



KBox C-104-CFL-4



KBox C-104-CFL-2



KBox C-104-CFL-1



KBox C-104-CFL-0

KBox C-104-TGL-x

User Guide, Rev. 1.0

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 KBOX C-104-TGL-X - USER GUIDE

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CAUTION

Handling and operation of the product is permitted only for trained personnel within a work place that is access controlled. Please follow the "General Safety Instructions" supplied with the system.

NOTICE

You find the most recent version of the "General Safety Instructions" online in the download area of this product.

Revision History

Revision	Brief Description of Changes	Date of Issue	Author/Editor
1.0	Initial Issue	2023-Jun-05	MK

Terms and Conditions

Kontron warrants products in accordance with defined regional warranty periods. For more information about warranty compliance and conformity, and the warranty period in your region, visit <http://www.kontron.com/terms-and-conditions>.

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Find Kontron contacts by visiting: <https://www.kontron.de/support-and-services>.

Customer Service

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.

For more details on Kontron's service offerings such as: enhanced repair services, extended warranty, Kontron training academy, and more visit <https://www.kontron.de/support-and-services>.

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.



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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Figure 77: Dimensions: detail key hole (KBox C-104-TGL-2 with fan tray option)95

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Figure 81: Dimensions: detail key hole (KBox C-104-TGL-1)97

Figure 82: Dimensions: top side (KBox C-104-TGL-1)97

Figure 83: Dimensions: right side (KBox C-104-TGL-1 with fan tray option)98

Figure 84: Dimensions: front side with key holes (KBox C-104-TGL-1 with fan tray option).....98

Figure 85: Dimensions: detail key hole (KBox C-104-TGL-1 with fan tray option)98

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Figure 90: Dimensions: top side (KBox C-104-TGL-0)100

Figure 91: RS485 Echo mode configuration 110

1/ General Safety Instructions

⚠ 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.
- ▶ The product must be connected only to a certified mains power supply complying with the requirements of IEC 60950-1 or IEC 62368-1 standard or better.
- ▶ If a power supply comes with the product, only this power supply should be used to supply the product.
- ▶ If a power cable for your region comes with the product, only this cable should be used to supply the product.
- ▶ 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 that fulfill the safety requirements as stipulated by the applied safety standards 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:
 - ▶ 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 the applied safety standards.
- ▶ The product does not generally fulfill the requirements for "centralized DC power systems" as stipulated by the applied safety standards 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-104-TGL is equipped with an optional lithium battery. For the replacement of this battery please observe the instructions described in section 0 "

RTC Lithium Battery".

⚠ 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 (2014/30/EC), Class B limits for Information Technology Equipment according to European Standard EN 55032.

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-104-TGL (corresponding to the ordered system configuration)
- ▶ POWER-SUBCON PSC 1,5/ 3-F, 3-pin plug
- ▶ General Safety Instructions for Equipment

3.2.1. Optional Parts (System Expansion)

- ▶ Front accessible drive bays for 2.5" SATA HDD/SSDs
- ▶ M.2 cards
- ▶ PCIe cards
- ▶ USB Dongles

3.2.2. Optional System Extension

- ▶ RS232/RS422/RS485 Port: via internal factory mounted adapter module (X205 and X204)
- ▶ CAN Port: via internal factory mounted CAN adapter module (X204 and X205)
- ▶ DisplayPort (X203, X202; via corresponding internal factory mounted adapter modules)
- ▶ Optional fan tray or fan holder(not possible for KBox C-104-TGL-0)
- ▶ Profibus, Profinet or Ethercat Fieldbus support: via internal factory mounted adapter module (X201, X206)
- ▶ LTE or 5G: via internal factory mounted adapter module
- ▶ Wi-Fi: via corresponding internal factory mounted adapter module (X206)
- ▶ Optional second 24 VDC power input (X201)
- ▶ Optional GPIO module
- ▶ Optional PCIe cards like dual 10GB Ethernet
- ▶ Optional NVRAM
- ▶ Optional quad goldcap backup for RTC
- ▶ Optional automotive battery for RTC



Please observe the different configuration options for each system of the KBox C-104-TGL family.
Refer to chapter 13/ "Technical Specification " and the descriptions in this manual.

3.3. Spare Parts

Please contact your local Kontron sales representative or visit the product page on www.kontron.com.

3.4. Type Label and Product Identification

The type label (product name, serial number, part number, production date) of your KBox C-104-TGL system is located on the right side of the device (refer to Figure 1 and Figure 21, pos. 9).

Figure 1: Example of KBox C-104-TGL type label



Table 1: Product Identification Table

System Type	Product Designation	Product Identifikation
KBox C	KBox C-104-TGL	KBox C-104-TGL-4: corresponds for system configurations with four slot rows for optional removable DRIVES and/or PCIe expansion slots
		KBox C-104-TGL-2: corresponds for system configurations with two slot rows for optional removable DRIVES and/or PCIe expansion slots
		KBox C-104-TGL-1: corresponds for system configurations with one slot row for optional removable DRIVE and/or PCIe expansion slot
		KBox C-104-TGL-0: corresponds for system configuration without any slot row for optional removable DRIVE and PCIe expansion slot

4/ System Overview

The KBox C-104-TGL 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 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.

As base of the KBox C-104-TGL two COMe types are chosen, the COMe-bTL6 based on the 11th Gen Intel® Core™ processor (code name "Tiger Lake-H") providing outmost CPU performance and the COMe-cTL6 based on the 11th Gen Intel® Core™ processor (code name "Tiger Lake") for superior graphics performance.

The KBox C-104-TGL offers a maintenance free (wartungsfrei) operation as option. That means it is able to operate without battery, fans and rotating media (HDD).

The KBox C-104-TGL family comprises four different chassis versions if equipped with a basic COMe-bTL6:

- ▶ The KBox C-104-TGL-4 with four PCIe expansion slots and spaces for up to two 2.5" SATA SSDs/HDDs
- ▶ The KBox C-104-TGL-2 with two PCI/PCIe expansion slots and spaces for up to two 2.5" SATA SSDs/HDDs
- ▶ The KBox C-104-TGL-1 with one PCIe expansion slot and space for one 2.5" SATA SSD/HDD
- ▶ The KBox C-104-TGL-0 without PCIe expansion slot and space for one internal 2.5" SATA SSD/HDD

The KBox C-104-TGL family comprises two different chassis versions if equipped with a compact COMe-cTL6:

- ▶ The KBox C-104-TGL-1 with one PCIe expansion slot and space for one 2.5" SATA SSD/HDD
- ▶ The KBox C-104-TGL-0 without PCIe expansion slot and space for one internal 2.5" SATA SSD/HDD

Figure 2: KBox C-104-TGL Family



KBox C-104-TGL-4

KBox C-104-TGL-2

KBox C-104-TGL-1

KBox C-104-TGL-0

Standard Front Panel:

The following interfaces are available with the KBox C-104-TGL with both COMe-bTL6 and COMe-cTL6:

- ▶ 24VDC input power (X101, optional 2nd power input X201)
- ▶ 4x 2.5 Gigabit Ethernet with TSN support (X102, X105, X108, X111)
- ▶ 3x USB 3.0 (X103, X106, X109)
- ▶ 3x USB 2.0 (X104, X107, X110)
- ▶ 2x DisplayPort (X112, X113)
- ▶ RS232/422/485 serial port (X114)
- ▶ Buttons with corresponding LEDs:
 - ▶ RSQ (Rescue)
 - ▶ PWR (Power)
- ▶ LEDs:
 - ▶ GP1 to GP4 (general purpose LEDs)
 - ▶ THERM (thermal status)
 - ▶ DRIVE (SSD/HDD drive status)
 - ▶ M2 (M.2 card activity)
 - ▶ WD (Watchdog status)

Standard Baseboard - Onboard and System Expansion Capabilities with COMe-bTL6:

- ▶ up to 4x SATA and power connector (for internal or removable devices, depending on the configuration)
- ▶ 1x Mini PCIe x1 socket (J20, on the lower side of the baseboard)
- ▶ 3x M.2 (J13, J17 and J18; 2x B type, 1x M type)
- ▶ 1x PCIe x8 socket for expansion via riser cards
- ▶ 1x USB2.0 port for e.g. connection of USB dongles (J14)
- ▶ MicroSIM and MicroSD card connectors (J28)
- ▶ CR2032 coin battery (J29)

Standard Baseboard - Onboard and System Expansion Capabilities with COMe-cTL6:

- ▶ up to 2x SATA and power connector (for internal or removable devices, depending on the configuration)
- ▶ 1x Mini PCIe x1 socket (J20, on the lower side of the baseboard)
- ▶ 2x M.2 (J13 and J18 (SATA only); 2x B type)
- ▶ 1x PCIe x4 socket for expansion via riser card
- ▶ 1x USB2.0 port for e.g. connection of USB dongles (J14)
- ▶ MicroSIM and MicroSD card connectors (J28)
- ▶ CR2032 coin battery (J29)

Optional System Extension:

- ▶ RS232/RS422/RS485 Port: via internal factory mounted adapter module (X205 and X204)
- ▶ CAN Port: via internal factory mounted CAN adapter module (X204 and X205)
- ▶ DisplayPort (X203, X202; via corresponding internal factory mounted adapter modules)
- ▶ Optional fan tray or fan holder(not possible for KBox C-104-TGL-0)
- ▶ Profibus, Profinet or Ethercat Fieldbus support: via internal factory mounted adapter module (X201, X206)
- ▶ LTE or 5G: via internal factory mounted adapter module
- ▶ Wi-Fi: via corresponding internal factory mounted adapter module (X206)
- ▶ Optional second 24 VDC power input (X201)
- ▶ Optional GPIO module
- ▶ Optional PCIe cards like dual 10GB Ethernet
- ▶ Optional NVRAM
- ▶ Optional quad goldcap backup for RTC
- ▶ Optional automotive battery for RTC

The KBox C-104-TGL is a fanless system with a compact metal chassis with cooling fins, which can be optionally equipped with a fan tray or fan holder for active cooling (KBox C-104-TGL-1/-2/-4 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 21, pos. 9).

Table 2: Standard offered COMe CPUs:

CPU on COMe-bTL6
Intel® Celeron™ 6600HE
Intel® Core™ i3-11100HE
Intel® Core™ i5-11500HE
Intel® Core™ i7-11850HE
Intel® XEON™ W-11555MRE
Intel® XEON™ W-11865MRE
CPU on COMe-cTL6
Intel® Core™ i5-1145GRE
Intel® Core™ i7-1185GRE

NOTICE

The KBox C-104-TGL 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-104-TGL, make sure that the air exhaust openings on the top side (Figure 23, pos. 12), the air intake openings on the bottom side (Figure 24, pos. 11) and the cooling fins of the chassis (Figure 22, Figure 23 and Figure 24, 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-104-TGL. Do not place any objects on the device. When installing the system, please observe the clearance recommendation (keep out area) in the subsection 8.2 "Control Cabinet Mounting"; refer to the marked areas in Figure 47 to Figure 53.

4.1. RTC

The baseboard always provides a 1F Goldcap that supports the RTC for approx. 5 days while the system is powered off completely.

Additionally one of the 3x options can be chosen:

- ▶ Optional quad goldcap adapter for support of approx. 25 days
- ▶ Optional CR2032 coin cell battery for support of several (3-5) years
- ▶ Optional automotive battery module for support of up to 10 years



To get the maximum buffer time out of the goldcaps, 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.

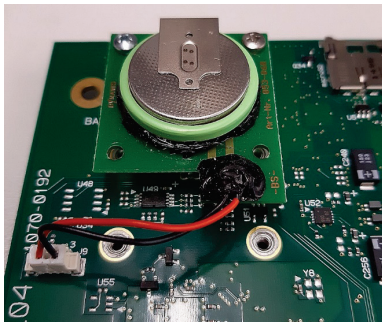
4.1.1. RTC Lithium Battery

Your KBox C-104-TGL can be equipped with an internally-accessible lithium battery (CMOS) (see Figure 56). The battery and the battery holder can be accessed after removing the topside access cover (see chapter 6.2 "Opening and Closing the KBox C-104-TGL").

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

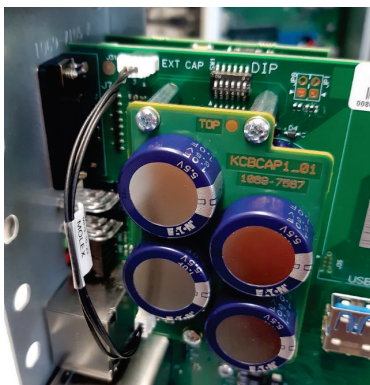
4.1.2. Automotive Battery

Your KBox C-104-TGL can be optionally equipped with an internally factory mounted automotive battery.



4.1.3. Goldcap Option

Your KBox C-104-TGL can be optionally equipped with an internally factory mounted quad goldcap module.



4.2. System Expansion Capabilities

4.2.1. M.2 Interfaces

The KBox C-104-TGL is equipped with three M.2 interfaces on the KBox C-104-TGL baseboard. The M.2 interface connectors are located on the top side of the baseboard and are accessible after removing the side access cover. There are two B type interfaces, one (J18) for 2280, 2260 and 2242 modules and one (J13) for 2252/3052, 2242/3042 and 2230/3030 modules. The M type M.2 interface (J17) supports 2280, 2260 and 2242 modules. Refer also to the subsection 6.3.7 "Installing/Removing an M.2 Module".

Refer to section 8.1 "Specifications of the internal M.2 Connectors" and the descriptions in this manual.

4.2.2. Mini PCI Express® Interface

The KBox C-104-TGL is equipped with a Mini PCIe interface on the KBox C-104-TGL baseboard. The Mini PCIe interface connector (J20) is located on the lower side of the baseboard and is not accessible in the field. This interface connector is intended to be used for Fieldbus, NVRAM or Wi-Fi 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 subsection 6.3.4 and to section 13/ "Technical Specification" and the descriptions in this manual.

4.2.3. Standard PCI Express® Interfaces

The baseboard of KBox C-104-TGL 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").



Please observe the different configuration options regarding the PCI/PCIe cards installation, for each system variant of the KBox C-104-TGL family.
Refer to chapter 13/ "Technical Specification" and the descriptions in this manual.

4.2.4. SATA Interfaces

Based on the COMe-bTL6, the baseboard of KBox C-104-TGL provides four SATA interfaces.

Based on the COMe-cTL6, the baseboard of KBox C-104-TGL 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 4.4.11 "Internal or Removable 2.5" SATA HDDs/SSDs").



Please observe the different configuration options, regarding the installation of 2.5" SATA HDD/SSD devices, for each system of the KBox C-104-TGL family (refer to the area marked "D" in the section 4.4).
Refer to chapter 13/ "Technical Specification" and the descriptions in this manual.

4.2.5. Internal USB 2.0 Interface

The baseboard of KBox C-104-TGL provides one USB2.0 interface (USB A header) and space for a USB A module. This connector can be used to install an internal USB device e.g. a USB Dongle or the optional GPIO module.

4.2.6. Internal microSD Card and microSIM Card Interface

The baseboard of KBox C-104-TGL provides a microSD and microSIM interface. This allows the installation of one microSD card and one microSIM card.

For installing/removing a micro SD or microSIM card, refer to chapter 6.3.8 "Installing/Removing a microSD or microSIM Car".

Figure 3 to Figure 9: Views of a KBox C-104-TGL-2

Figure 3: Bottom side view

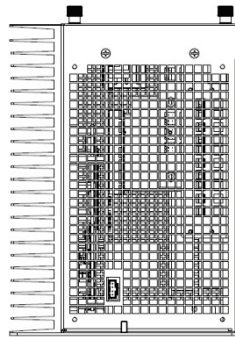


Figure 5: Front side view config. with removable drives



Figure 6: Front side view config. without removable drives



Figure 4: Right side view

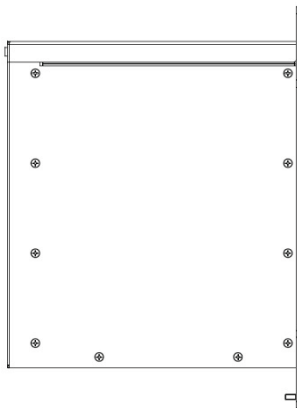


Figure 7: Left side view

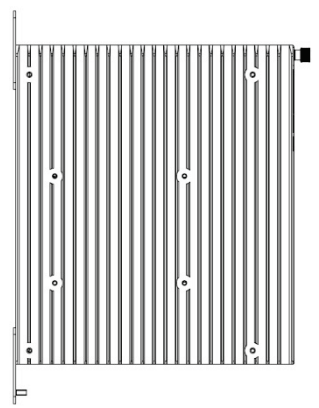


Figure 8: Top side view

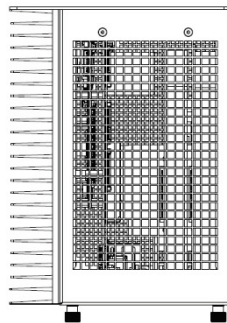
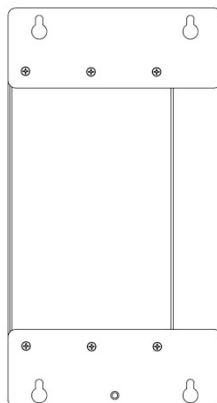
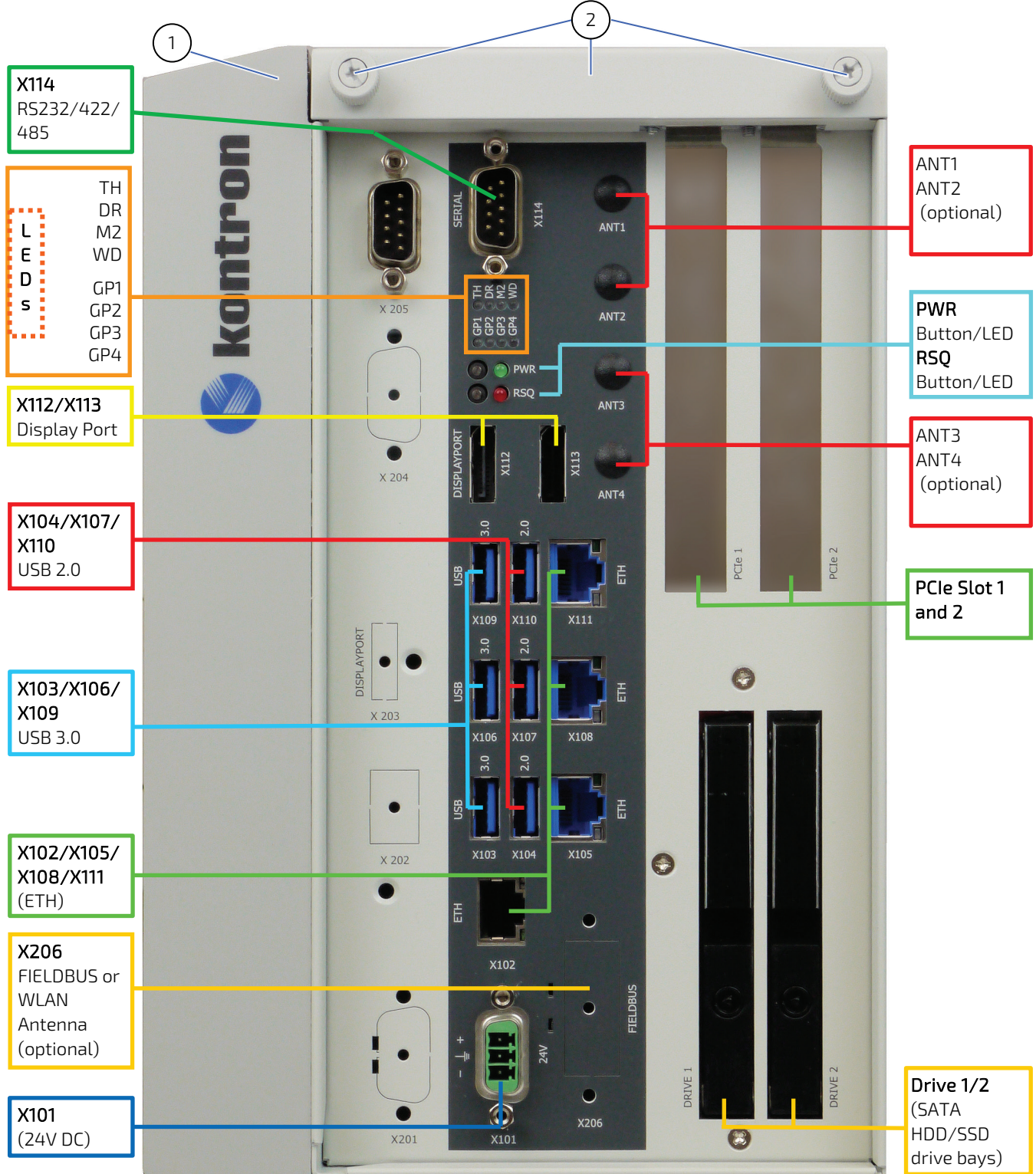


Figure 9: Rear side view



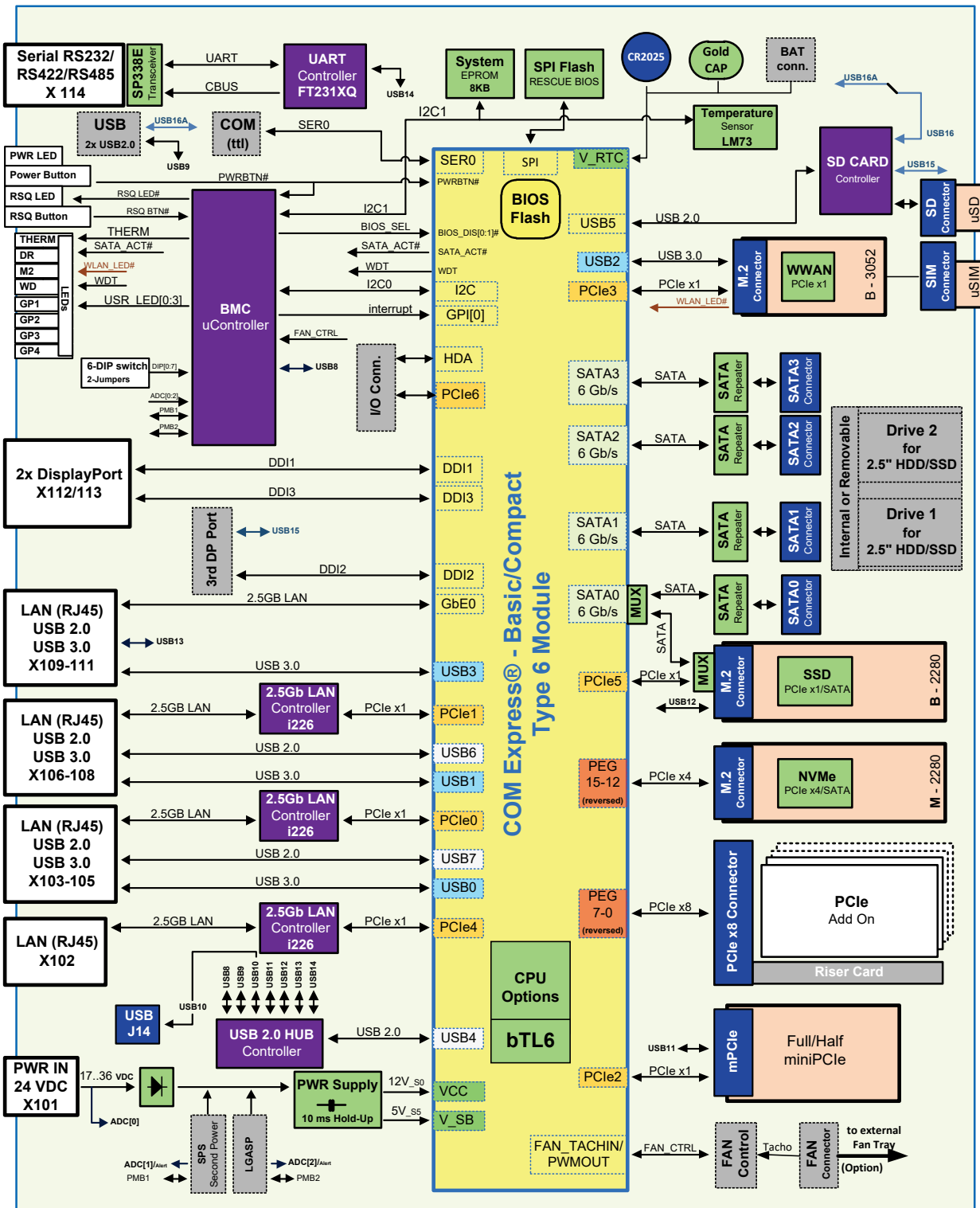
4.3. KBox C-104-TGL-2 Variant

Figure 10: KBox C-104-TGL-2 - front view (shown with removable drive bays and without mounting brackets)



1. Side of KBox C-104-TGL-2 with cooling fins
2. Top side cover with knurled screws

Figure 11: Block Diagram - KBox C-104-TGL-x with COMe-bTL6



KBOX C-104-TGL with bTL6 Rev. 1.0

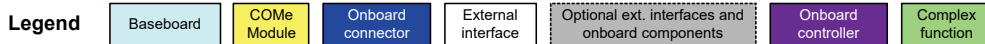
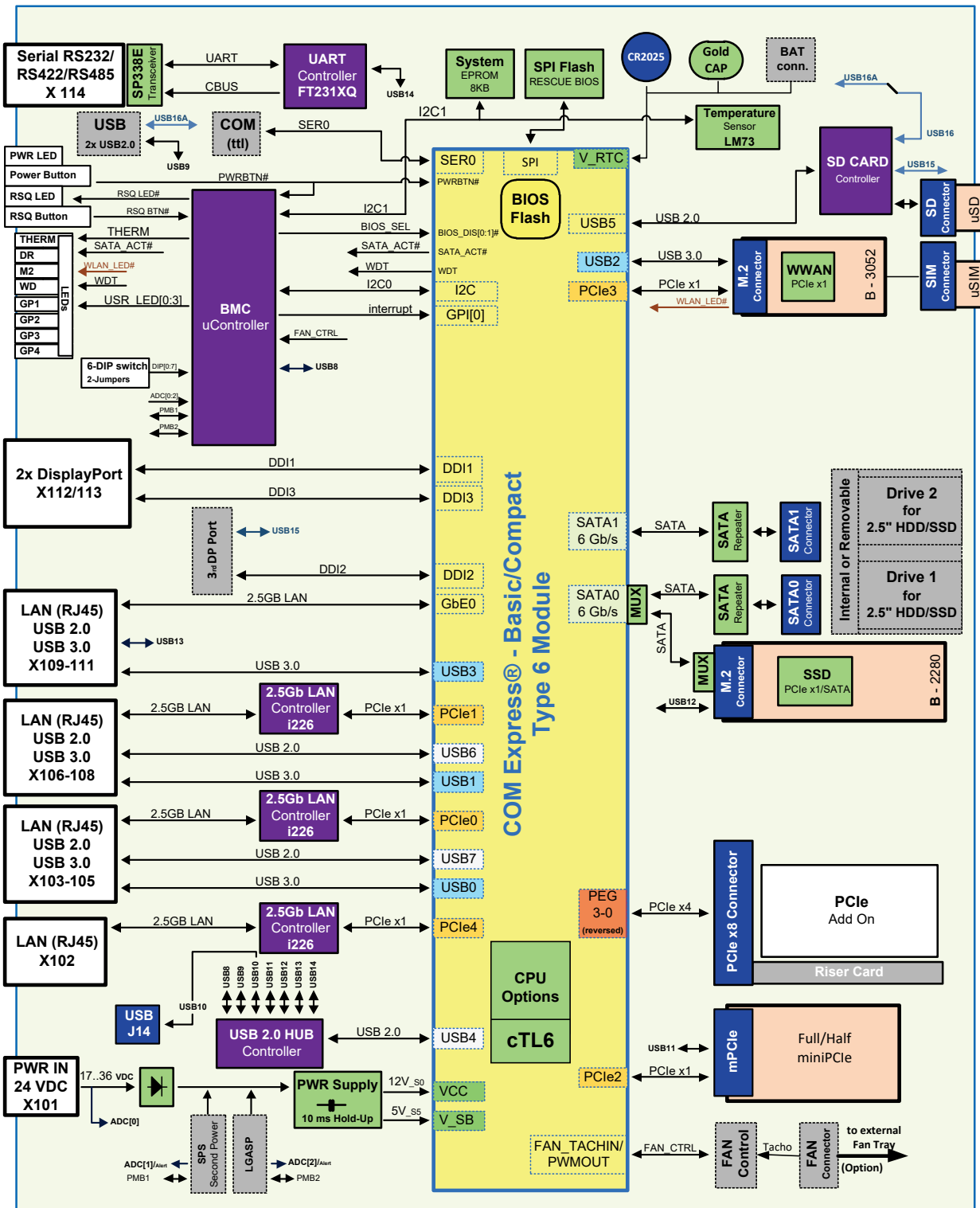
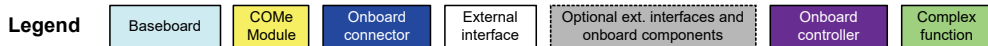


Figure 12: Block Diagram - KBox C-104-TGL-x with COMe-cTL6



KBOX C-104-TGL with cTL6 Rev. 1.0

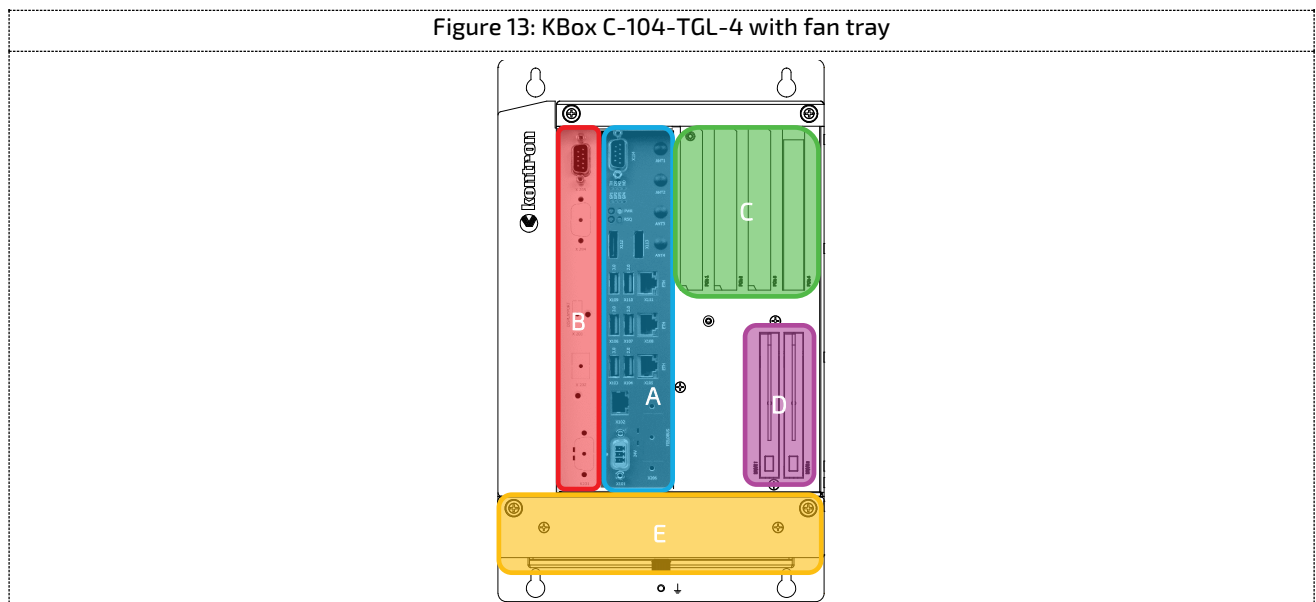


4.4. Front Side Configuration and Options - KBox C-104-TGL

Table 3: KBox C-104-TGL Front Side Configuration

A	Standard Interfaces	KBox C-104-TGL-4	KBox C-104-TGL-2	KBox C-104-TGL-1	KBox C-104-TGL-0	
	Power Input Connector (X101)	1x	1x	1x	1x	
	Ethernet (X102/X105/X108/X111)	4x	4x	4x	4x	
	USB 3.0 (X103/X106/X109)	3x	3x	3x	3x	
	USB 2.0 (X104/X107/X110)	3x	3x	3x	3x	
	DisplayPort (X112/X113)	2x	2x	2x	2x	
	RS232/422/485 (X114)	1x	1x	1x	1x	
B	Extension Capabilities (Options, factory-installed only)					
	FIELDBUS or Wi-Fi on mPCIe (X201 or X206)	1x	1x	1x	1x	
	CAN Port (X204) or 3rd RS232/RS422/RS485	1x	1x	1x	1x	
	2 nd RS232/RS422/RS485 Port (X205)	1x	1x	1x	1x	
	3 rd DisplayPort (X203)	1x	1x	1x	1x	
	2 nd Power Input Connector (X201)	1x	1x	1x	1x	
	LTE on M.2 3042 (ANT1/ANT2)	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	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 and M.2 SSD (Options)					
	<i>Either</i> Internal 2.5" SATA HDD/SSD	2x	2x	1x	1x	
	<i>OR</i> Removable Drive Bay for 2.5" SATA HDD/SSD	2x	2x	1x	-	
	M.2 2280 1x type M, 1x type B	2x	2x	2x	2x	
E	Fan (Option)					
	Fan Tray or Fan holder	1x	1x	1x	-	

Figure 13: KBox C-104-TGL-4 with fan tray



4.4.1. X101/X201 – Power Input Connectors

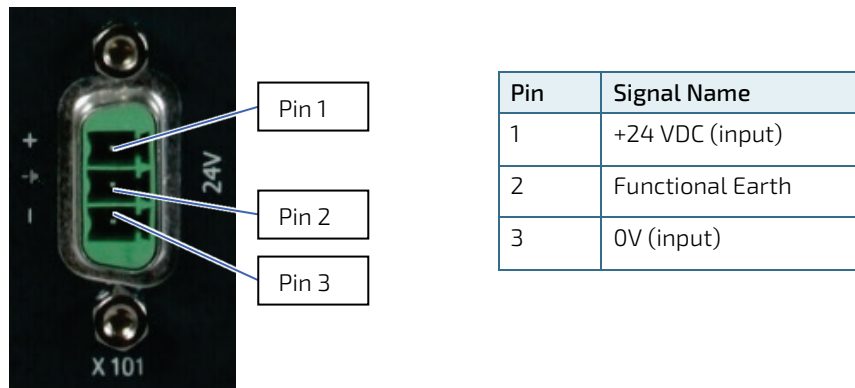
The 3-pin connector (X101) and the optional second power connector (X201) provide the power connection of the KBox C-104-TGL system to an appropriate DC main power supply (see Figure 14 and Figure 10). For pin assignment refer to the subsection 14.1.1.



If a second power supply is connected to the KBox C-104-TGL, only the particular power supply with the higher supply voltage will be used (no power sharing), the other power supply is redundant. Active and redundant power supply can change during operation without interruption.

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-104-TGL. 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



4.4.2. X102/X105/X108/X111 - Ethernet Connectors (ETH)

These connectors (X102/X105/X108/X111, Figure 10) are 2.5 Gigabit Ethernet 10/100/1000/2500 Mbit/s, IEEE 1588 and TSN 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 (10/100/1000/2500 Mbit/s).

For pin assignment refer to subsection 14.1.2.



The MAC Adress can't be changed to a user defined MAC.
On project base, a MAC address range defined by the customer can be programmed.
This security feature is valid for all Intel i225 and i226 based Ethernet controllers.

4.4.3. X103/X106/X109 - USB 3.0

The KBox C-104-TGL provides three USB 3.0/2.0 interfaces. These connectors (X103/X106/X109, Figure 10) allow connection of USB 3.0 or USB 2.0 compatible devices to the system. For pin assignment refer to subsection 14.1.3.

The current of each USB3.0 port is limited to the standard 900 mA

4.4.4. X104/X107/X110 - USB 2.0

The KBox C-104-TGL provides three USB 2.0/1.1 interfaces. These connectors (X104/X107/X110, Figure 10) allow connection of USB 2.0 or USB 1.1 compatible devices to the system. For pin assignment refer to subsection 14.1.4.

The current of each USB2.0 port is limited to the standard 500 mA

4.4.5. X112/X113/X203 - DisplayPorts

The KBox C-104-TGL provides DisplayPort compliant interfaces realised using two (optional: three) standard DisplayPort connectors. External (digital) displays can be connected to the DisplayPort connectors (X112/X113, optional: X203, Figure 10).

For pin assignment refer to subsection 14.1.5.

4.4.6. X114 - RS232/422/485 Port

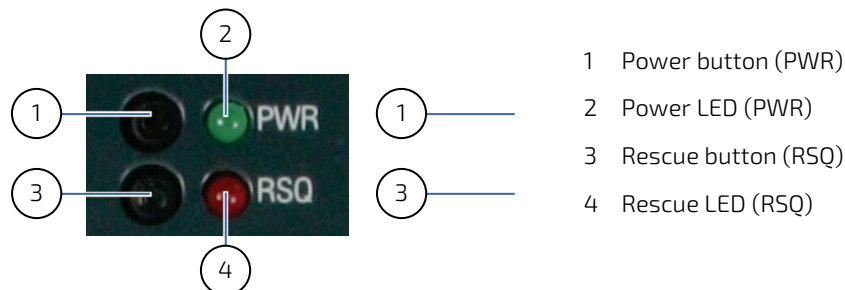
The RS232/422/485 interface (X114, Figure 10) is provided as a 9-pin D-SUB connector. It allows you to connect a serial device to the system.

The serial interface is realized with an USB to Serial controller (FT231X) and can be reconfigured by software for the different RS modes either with an Windows or Linux Tool. The serial controller needs an OS driver.

The default factory mode setting is RS232. For pin assignment refer to subsection 14.1.6.

4.4.7. POWER Button and PWR LED

Figure 15: Detail - Power button and PWR LED/Rescue button and RSQ LED



The power button (PWR, Figure 15, pos. 1, Figure 10) is used to power the KBox C-104-TGL 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 15, pos. 2, Figure 10) is on green steady when power is applied to the system.

Prerequisite:

The KBox C-104-TGL 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) or to the optional second power connector X201 (Figure 10), the KBox C-104-TGL 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 be restarted by pressing the PWR button (assuming that power is still applied to the main input power connector, X101).

4.4.8. RESCUE Button and RSQ LED



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.

The RESCUE button (marked RSQ, Figure 15, pos. 3, Figure 10) is used to force using the backup flash for system booting.

The RESCUE LED (RSQ, Figure 10, Figure 15, pos. 4) lights up 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.

4.4.9. Status and General Purpose LEDs

The following table provides information concerning these LEDs (Figure 10 and Figure 16).

Figure 16: Detail - Status and General Purpose LEDs

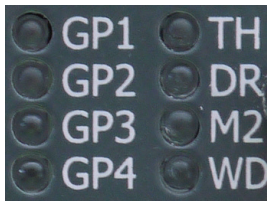


Table 4: Status and General Purpose LEDs

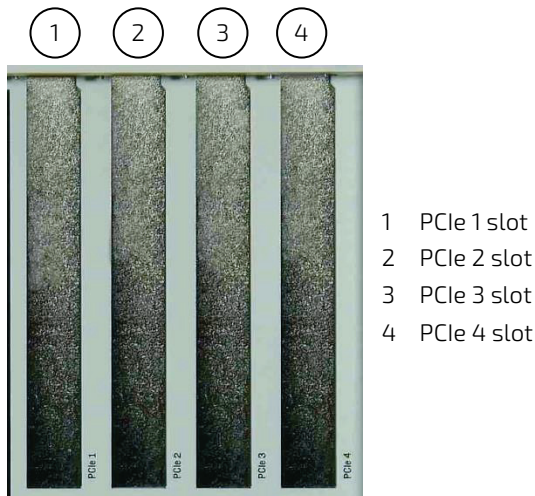
Designator	Function	Color	Description
TH	Thermal	Green	Normal operation
		Red blinking	The system turns off due to over temperature
		Red	FAN failure or DIP Switch position 6 wrong
DR	Drives (SSD/HDD)	Green	SSD/HDD active
M2	M.2 2242 Card	Green	M.2 card active
WD	Watchdog	Red blinking	Watchdog timeout 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

4.4.10. PCI/PCIe Expansion Slots

The KBox C-104-TGL provides on the front side up to four slots (see also Figure 10 for KBox C-104-TGL-2) 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 6.3.5 "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 also remove the right side access cover (Figure 23 and Figure 21, pos. 1 and pos. 3).

Figure 17: PCIe 1 to PCIe 4 slots (shown as detail of a KBox C-104-TGL-4)



Please observe that:

KBox C-104-TGL-4 supports up to:

- ▶ 2x PCIe x4 and 2x PCIe x1 expansion cards

KBox C-104-TGL-2 supports up to:

- ▶ 2x PCIe x4 expansion cards **or**
- ▶ 1x PCIe x8 expansion cards **or**
- ▶ 1x PCIe x4 and 1x PCI (32 bit) expansion cards.



KBox C-104-TGL-1 supports:

- ▶ 1x PCIe x4 expansion card **or**
- ▶ 1x PCIe x8 expansion card

KBox C-104-TGL-0:

- ▶ Can't be equipped with PCI/PCIe expansion cards.

For system configuration refer to the area marked "C" in the section 4.4. and for expansion card installation refer to the subsection 6.3.6 "Installing/Removing PCI/PCIe Expansion Cards".

4.4.11. Internal or Removable 2.5" SATA HDDs/SSDs

Depending on the ordered system configuration, your KBox C-104-TGL can be equipped with up to two drive bays for 2.5" removable SATA HDDs/SSDs (refer to Figure 10, Figure 11) 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 10) of the system (refer to Figure 18, Figure 19 and Figure 20).

The drives support following drive speeds:

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



If the KBox C-104-TGL 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 6). If the KBox C-104-TGL 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 18: Drive 1 and Drive 2 for removable 2.5" SATA HDD/SSD (option); closed drive bays



Figure 19: Drive bay 1 with opened drive bay cover

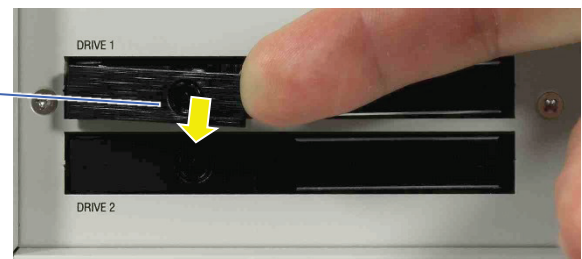
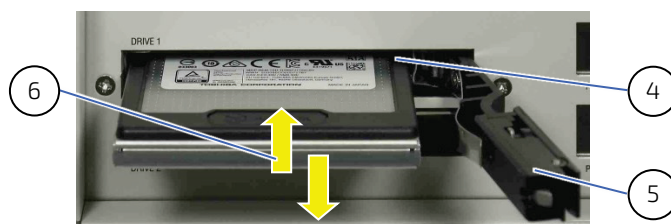


Figure 20: Inserting/removing a 2.5" removable SSD



This SATA interface supports hot-swapping. To prevent data loss, don't remove the HDD during read/write activity [while the "DRIVE LED" (Figure 16) is flashing green].

- | | |
|---|--|
| <ul style="list-style-type: none"> 1 Lockable lever to release the drive bay cover 2 Cover of the drive bay 3 Pulled-out lever | <ul style="list-style-type: none"> 4 Drive bay for 2.5" removable SATA HDD/SSD 5 Opened drive bay cover 6 Inserting or removing a 2.5" removable SATA HDD/SSD |
|---|--|



Please observe that the KBox C-104-TGL-1 system configuration can be equipped with only one internal or removable 2.5" SATA HDD/SSD. The KBox C-104-TGL-0 can be equipped with only one internal 2.5" SATA HDD/SSD. Refer also to the area marked "D" in the section 4.4.

4.4.11.1. Installing/Removing the removable HDD/SSD

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

1. Pull out the lever (Figure 19, pos. 3) of the drive cover (Figure 18, 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 21: Right side of the KBox C-104-TGL system

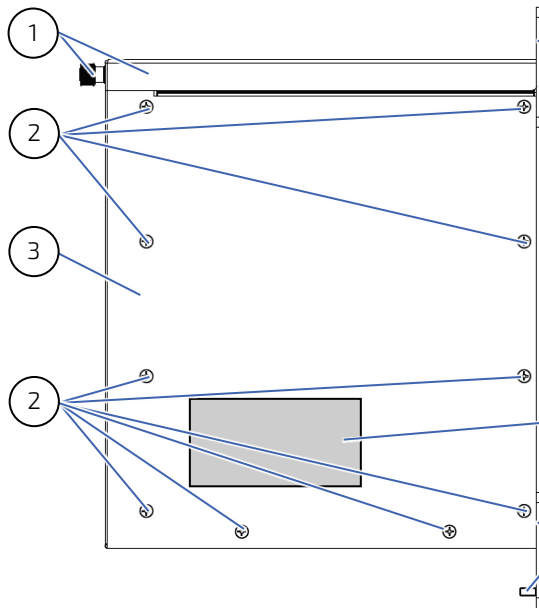
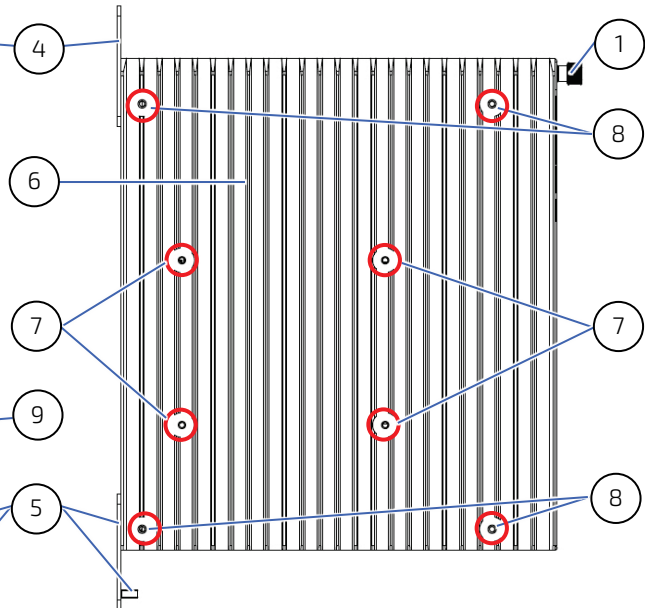


Figure 22: Left side of the KBox C-104-TGL system



- 1 Top side access cover with knurled screws
- 2 10x screws that secure the right side access cover
- 3 Right side access cover
- 4 Upper mounting bracket with key holes
- 5 Lower mounting bracket with M4 ground stud and key holes
- 6 Cooling fins of the chassis

- 7 Screws that secure the COMExpress® module
- 8 Screws that secure the cooling fins to the chassis
- 9 Type label
- 10 Hole for further system fan tray extension
- 11 Air intake openings on the bottom cover
- 12 Air exhaust openings on the top cover

NOTICE

Please do not remove the red marked screws (see Figure 22, pos. 7 and pos. 8).

4.6. Top and Bottom Side View

Figure 23: Top side of the KBox C-104-TGL system

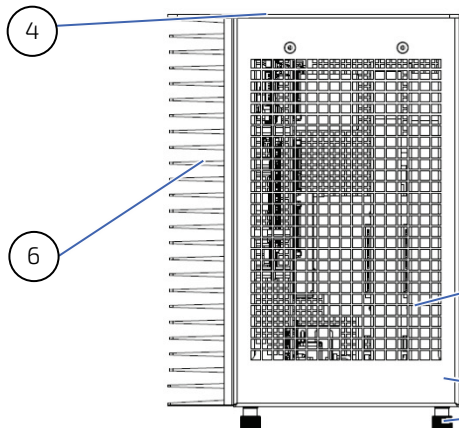
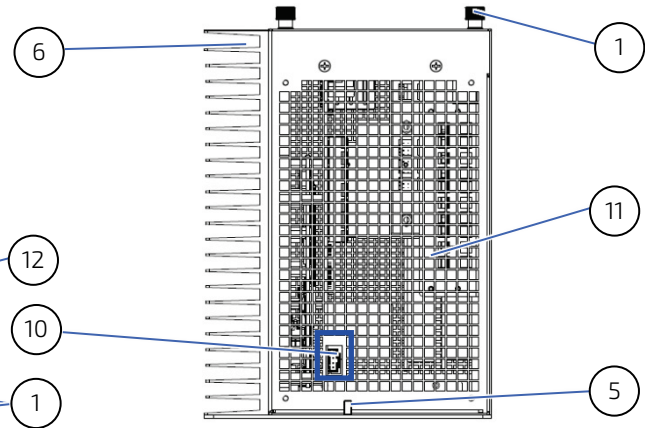


Figure 24: Bottom side of the KBox C-104-TGL system



NOTICE

When powering on the KBox C-104-TGL, make sure that the air intake and exhaust openings are not obstructed. To provide sufficient heat dissipation for the cooling of the KBox C-104-TGL system, never cover the cooling fins of the chassis. Do not place any objects onto the device.

4.7. Rear Side View

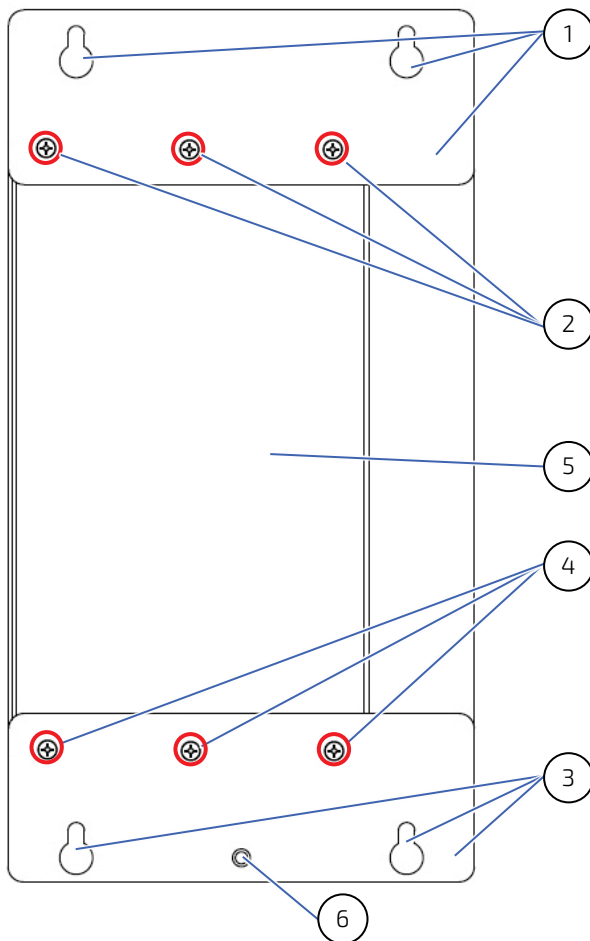
The KBox C-104-TGL is designed for wall mounting, in vertical position inside of a control cabinet.



Please do not remove the red marked screws (see Figure 25, pos. 2 and pos. 4).

Please observe the mounting instructions included in the chapter 8/ "Installation Instructions", and the outline dimensions in the subsection 13.1 "Mechanical Specifications of the KBox C-104-TGL".

Figure 25: Rear side of the KBox C-104-TGL-2 system



- 1 Key holes on the upper mounting bracket
- 2 Screws that secure the upper mounting bracket of the KBox C-104-CFL-2 and KBox C-104-CFL-1 (KBox C-104-CFL-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-104-CFL-2 and KBox C-104-CFL-1 (KBox C-104-CFL-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-104-TGL (Figure 25, pos. 6). This terminal may be connected as required.

NOTICE

The KBox C-104-TGL with the stud marked with a "Functional Earth" symbol (Figure 25) has to be grounded to an appropriate "common earth" connection point.

5/ System Extensions

Optionally your KBox C-104-TGL can be equipped by factory only, with following ports and additional components:

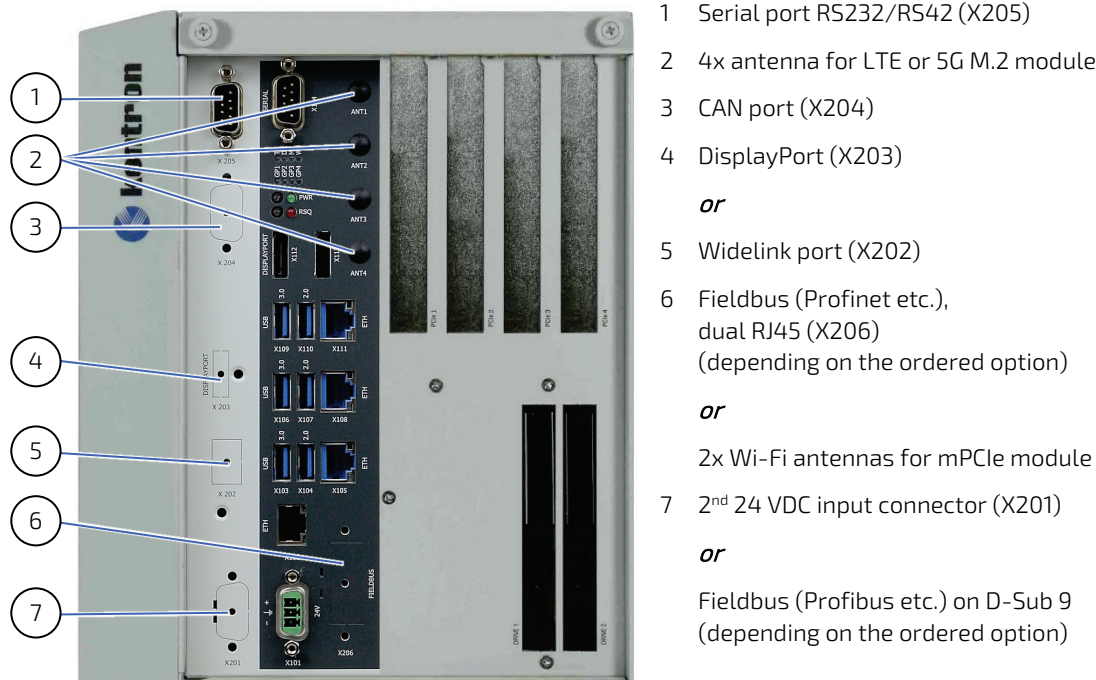
- ▶ Serial port RS232/RS485/RS422
- ▶ CAN port
- ▶ DisplayPort
- ▶ WideLink Port
- ▶ Fan Tray: an additional component connected to the KBox C-104-TGL-4, KBox C-104-TGL-2 and KBox C-104-TGL-1
- ▶ Fieldbus: (Profibus, Profinet or Ethercat)
- ▶ Second 24 VDC input (X201)
- ▶ GPIO module
- ▶ Wi-Fi module
- ▶ LTE or 5G module
- ▶ NVRAM
- ▶ PCIE cards like dual 10GB Ethernet

NOTICE

You have to order these components separately, in order to extend your KBox C-104-TGL at the factory.

Example of system configuration, see below:

Figure 26: KBox C-104-TGL-4 shown with optional interfaces and with removable drive bays



- 1 Serial port RS232/RS42 (X205)
- 2 4x antenna for LTE or 5G M.2 module
- 3 CAN port (X204)
- 4 DisplayPort (X203)
- or*
- 5 Widelink port (X202)
- 6 Fieldbus (Profinet etc.),
dual RJ45 (X206)
(depending on the ordered option)
- or*
- 2x Wi-Fi antennas for mPCIe module
- 7 2nd 24 VDC input connector (X201)
- or*
- Fieldbus (Profibus etc.) on D-Sub 9
(depending on the ordered option)

5.1. X201 to X206 - Possible Interface Combinations

The matrix below provides an overview of the possible interface combinations (X201 to X206).

Table 5: X201 to X206 Configuration Options

		2nd Power Input	Profibus	Wide Link	3rd DP port	CAN	3rd Serial	2nd Serial	Profinet Ethercat	Wi-Fi
		X201	X201	X202	X203	X204	X204	X205	X206	X206
2nd Power Input	X201	-	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Profibus	X201	No	-	Yes	Yes	Yes	Yes	Yes	No	No
WideLink	X202	Yes	Yes	-	No	Yes	Yes	Yes	Yes	Yes
3rd DP port	X203	Yes	Yes	No	-	Yes	Yes	Yes	Yes	Yes
CAN	X204	Yes	Yes	Yes	Yes	-	No	Yes	Yes	Yes
3rd Serial	X204	Yes	Yes	Yes	Yes	No	-	Yes	Yes	Yes
2nd Serial	X205	Yes	Yes	Yes	Yes	Yes	Yes	-	Yes	Yes
Profinet Ethercat	X206	Yes	No	Yes	Yes	Yes	Yes	Yes	-	No
Wi-Fi	X206	Yes	No	Yes	Yes	Yes	Yes	Yes	No	-

* Note: WideLink only on project base. Please contact your local Kontron sales for further information.

5.2. (X204, X205) - Serial Port RS232/RS422/485

The optional RS232/422/485 interface (X205, X204, Figure 10xx) is provided as a 9-pin D-SUB connector. It allows you to connect a serial device to the system.

The serial interface is realized on a module with an USB to Serial controller (FT231X) and can be reconfigured by software for the different RS modes either with Windows or Linux Tool. The serial controller needs an OS driver.

The module option is available in an isolated and a non-isolated version.

The factory default mode setting is RS232.

Optionally, X205 can be equipped with a serial debug module, which connects only RX and TX from the SER0 from the COMe to the front panel. This option is useful for console redirection of the BIOS/uEFI but also works with Windows or Linux as HS-UART RS232 interface.

Please contact your local Kontron sales for further information.

5.3. (X204) - CAN Port

Your KBox C-104-TGL can be extended via an adapter module with one CAN port, that allows layer 2 CAN communication. The optional CAN port (Figure 26, pos. 3) is implemented as a sub-D 9 pin connector (male). This port is galvanically isolated (1500V).

For pin assignment refer to the section 14.2.4.

5.4. (X203) - 3rd DisplayPort

Your KBox C-104-TGL can optionally be extended with a third DisplayPort (Figure 26, pos. 4).

The DP 3 port is a DisplayPort compliant interface realized using a standard DisplayPort connector. An external (digital) display can be connected to the DisplayPort connector (Figure 26, pos. 4).

For pin assignment refer to subsection 14.1.5.

5.5. (X202) - WideLink Port

WideLink is an extension for the KBox C-104-TGL which 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 14.2.2.



Only one of these two interfaces (WideLink and DP 3) can be ordered as optional extension of your C-104-TGL. The Widelink option can be supported on project request only! Therefore, please contact your local Kontron sales representative.

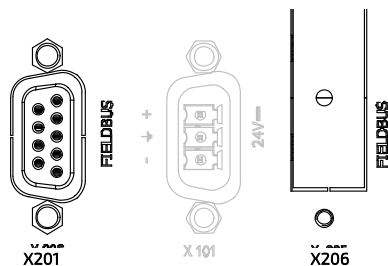
5.6. (X201 or X206) Fieldbus

Your KBox C-104-TGL can optionally be extended with a module for Fieldbus communication. Either a module for Profibus or Profinet/Ethercat communication will be integrated. Depending on the Fieldbus chosen, the DSUB brake-out (X201) for Profibus or the dual RJ45 brake-out (X206) for Profinet/Ethercat will be used.



Only one of these two Fieldbus interfaces (D-Sub or dual RJ45) can be ordered as optional extension of your KBox C-104-TGL system.

Figure 27: X201 or X206 – Locations for the optional FIELDBUS interface

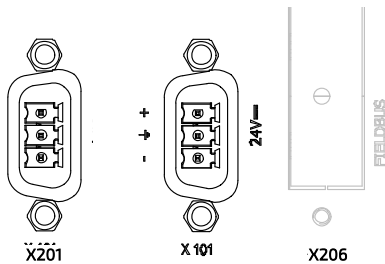


The optional interface (FIELDBUS) on the front side of the KBox C-104-TGL must be ordered separately either as D-Sub (X201) or as dual RJ45 (X206) connector. To add a FIELDBUS interface to the system, the mPCIe socket (on the lower side of the baseboard), will be used. This connection can be implemented at factory only.

5.7. (X201) 2nd 24 VDC Input

Your KBox C-104-TGL can optionally be extended with a second power input module (X201). Both power connectors have the same pinout. The power source with the highest input voltage will be used to power the system (hot standby).

Figure 28: Second power input (X201)



5.8. Wireless Expansion Options

When Wi-Fi, LTE (4G) or the 5G module is factory installed, the required corresponding antennas are included in the delivery.

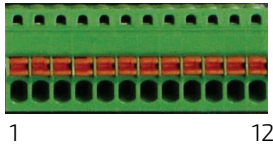
Table 6: Wireless Reference Options

Extension Socket	Interface	Function	Reference Modules
mPCIe	PCIe – Wi-Fi USB2.0 - BT	Wi-Fi/ Bluetooth	Dual band frequencies (2.4 GHz & 5 GHz) Bluetooth (BT) 4.1+HS IEEE802.11 ac/abgn Wi-Fi certified Speeds 300 Mbps max. on N & 867 Mbps on AC
M.2 Key B 2242 / 3042 / 2280	USB 2.0	LTE (4G)	Module: LTE Cat. 4 (150 Mbit/s Download; 50 Mbit/s Upload) Socket Type: M.2 Key B 3042 Freq. Bands: B1/B3/B7/B8/B20/B28/B38/B41 (Europe) Power consumption: 3.14 W MIMO Support: Yes Antenna: SMA male (hinged)
	PCIe 3.0 USB 3.1 Gen 2	5G	Module: 5G Sub-6G Module Socket type: M.2 Key B 3052 Freq. Bands: n1, n2, n3, n5, n75, n85, n125, n205, n255, n28, n385, n405, n41, n485, n66, n71, n77, n78, n79 Power Consumption: 31.6 mA (NR bands - standby current) MIMO Support: 2x2 DL MIMO (all bands) Interface: PCIe 3.0/USB 3.1 Gen 2 Antenna: SMA male (hinged)
SIM slot			SIM interface is required for cellular LTE (4G) and 5G modules.

5.9. 8-Channel GPIO/DIO Interface

The KBox C-104-TGL provides an optional 8-channel GPIO/DIO (Digital IO) interface. The GPIO module will be installed in one of the PCIe slots, without having electrical connection to the interface. Instead system internal the GPIO module will be connected to the onboard USB A header (J14).

Figure 29: GPIO connector (cable terminal side of mating connector)



This connector contains the eight GPIOs, the power supply for the GPIOs and GND.

Table 7: GPIO connector pinout

Pin	Signal Name	Direction	Remark
1	PWR_IN	Power	Power Input for the GPIO
2	PWR_IN	Power	
3	Not Connected	n.c.	-
4	GPIO1	In / Out	GPIO
5	GPIO2	In / Out	
6	GPIO3	In / Out	
7	GPIO4	In / Out	
8	GPIO5	In / Out	
9	GPIO6	In / Out	
10	GPIO7	In / Out	
11	GPIO8	In / Out	
12	GND	Ground	GND GND is direct connected to system chassis (Shield)

Table 8: GPIO misc. specifications

Interfaces	
Output Drivers	Texas instruments TPS4H000-Q1
USB	CDC Interface to CPU board
MISC	
Power Supply for GPIOs	Input voltage range: 10V* to 30V* *Note: Power input fused with 3A
Hot-Plug Support	NO

Eight GPIOs are implemented. Each GPIO can be select as an output or an input channel.

Table 9: GPIO output channel

Output Channel	
Output Type	High Side Switch
Output Voltage	Depends on External Connected Voltage. Allowed Range: 10VDC to 30VDC.
Output Current	250mA Continues Electrical limited to about 500mA.
Inductive load switch-off energy dissipation	40mJ
Output Protection	- Short-to-GND Protection by Current Limit - Thermal Shutdown with Output auto-retry - Inductive Load Negative Voltage Clamp

Figure 30: Output application connected to GPIO

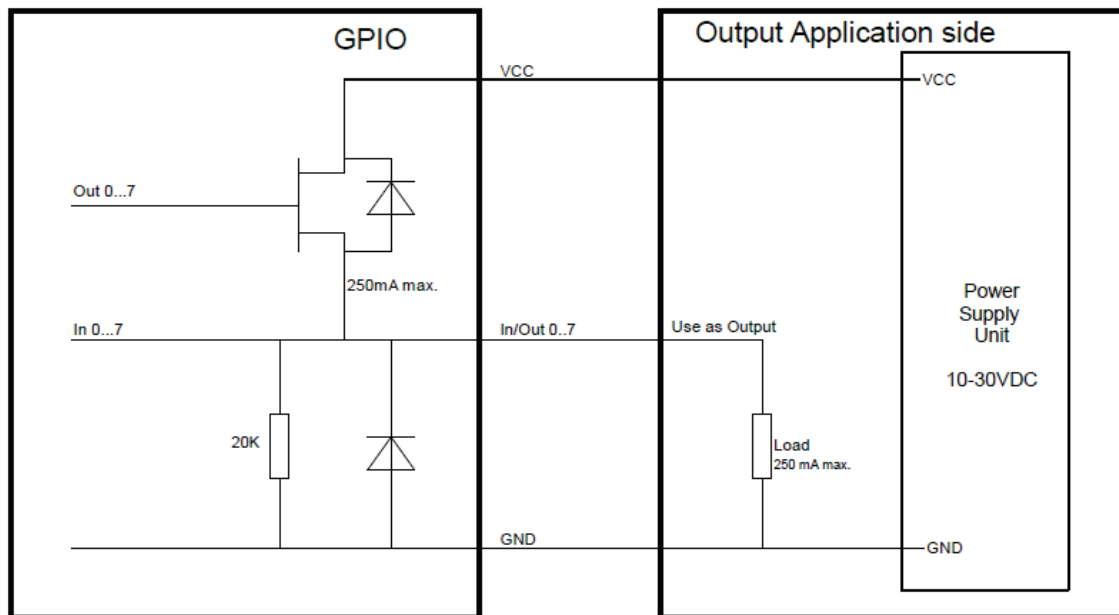


Table 10: GPIO input channel

Input Channel	
Input Type	Input with Integrated Pulldown
Max. Input Voltage	Maximum Allowed Input Voltage Depends on External Connected Voltage at PWR_IN. (GPIO _x ≤ PWR_IN) Allowed Range: 10 VDC to 30 VDC.
Input Pulldown Resistor	~ 20 kOhm
Input High Level	> 8.8 V
Input Low Level	< 4.2 V
Input Hysteresis	> 2.5 V

Figure 31: Input application connected to GPIO

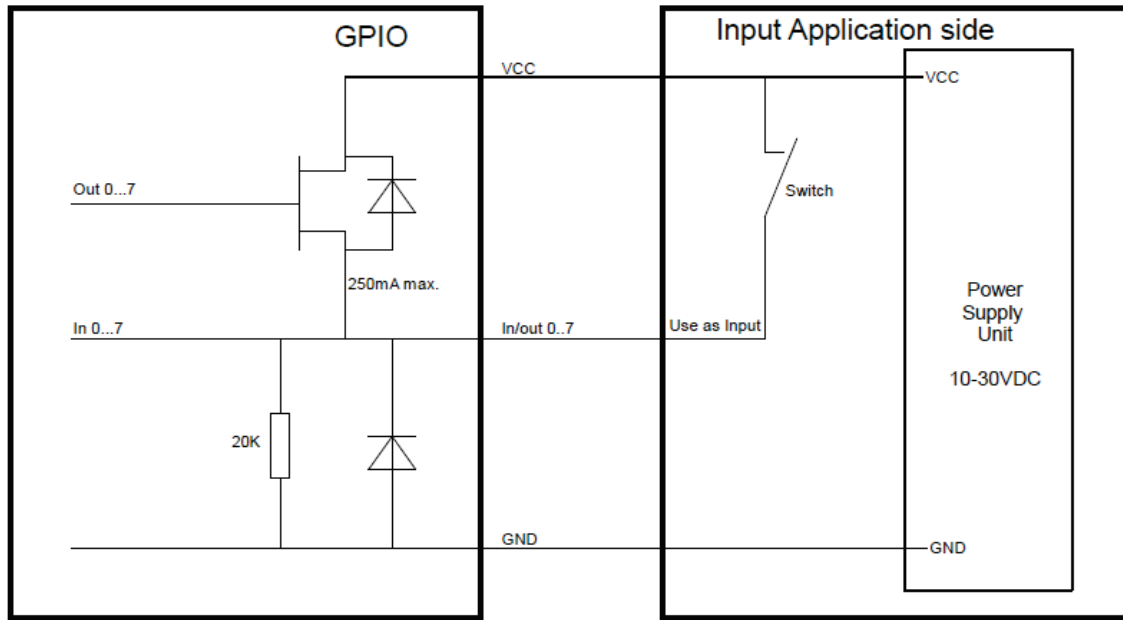


Table 11: GPIO connector and mating connector

	Manufacturer	P/N	Mating Cycles	Remark
Connector	Würth Elektronik or equivalent	691382040012 WR-TBL Serie 382 or equivalent	25	12-pin, 2.50 mm Horizontal PCB Header with Flanges Max. 12 A per pin
Mating Connector	Würth Elektronik or equivalent	691381030012 WR-TBL Serie 381 or equivalent	25	12-pin 2.50 mm Vertical CAB Entry Plug Screw less with Flanges (STRANDED WIRE: 24-16 AWG / 0.205-1.31 MM ²)

5.10. Optional Versions with Fan Tray or Fan Holder - KBox C-104-TGL-4/-2/-1

By using a fan tray (see also section 5.10.1) or fan holder (see also section 5.10.2), the KBox C-104-TGL-4/-2/-1 can be operated in a control cabinet with extended ambient temperature; refer to the specified values in the section 13.2 "Environmental Specifications and chapter 7/ "Power and Thermal Considerations". Furthermore the fan tray/holder chassis extension is designed to provide a better airflow through the system chassis, especially recommended if PCIe cards are installed.

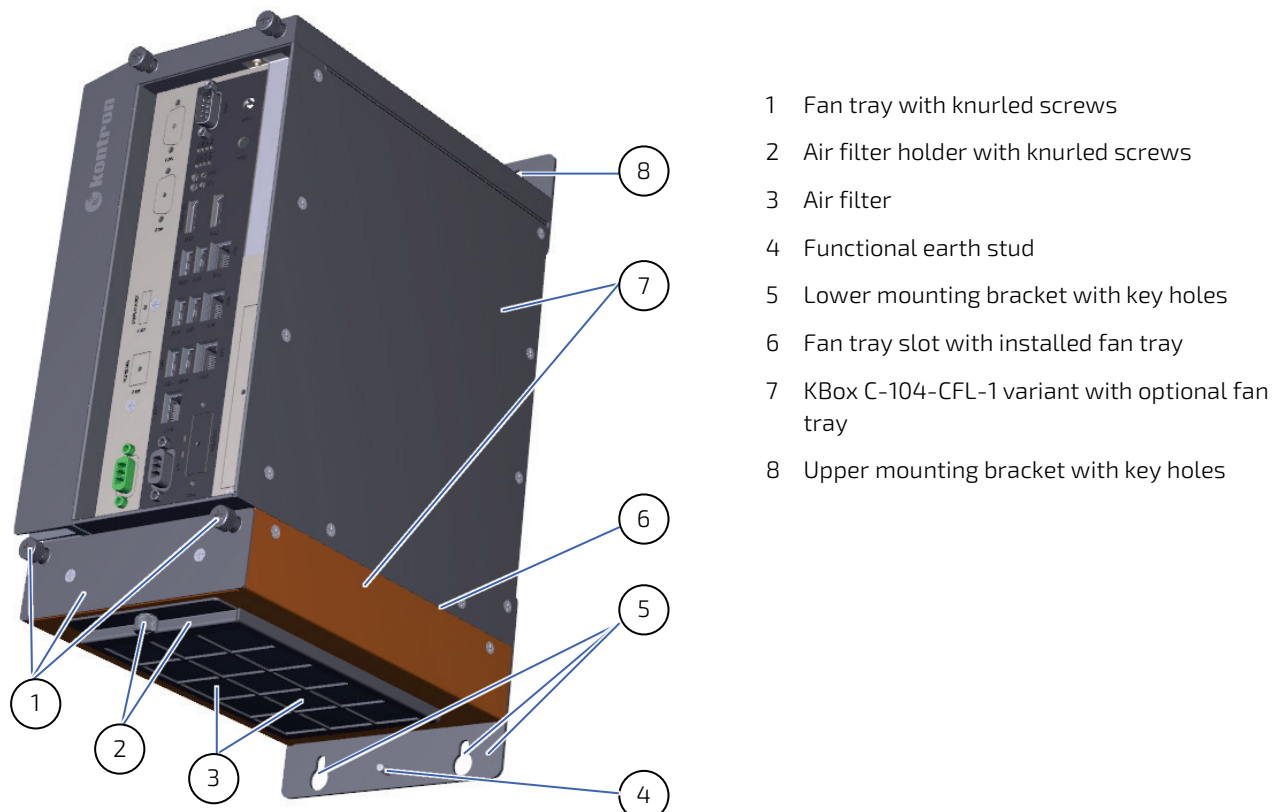


All chapters of this manual are valid for the KBox C-104-TGL-4, the KBox C-104-TGL-2 and KBox C-104-TGL-1 with fan tray/holder under consideration of the mechanical differences and the description in this section. Please refer also to the subsection 13.1.2 "Mechanical Specifications of the KBox C-104-TGL-4 with Fan Tray Option", subsection 13.1.4 "Mechanical Specifications of the KBox C-104-TGL-2 with Fan Tray Option", and subsection 13.1.6 "Mechanical Specifications of the KBox C-104-TGL-1 with Fan Tray Option".

5.10.1. Fan Tray (only for KBox C-104-TGL-4/-2/-1)

The KBox C-104-TGL-4/-2/-1 can be only factory equipped with the optional fan tray (Figure 32). The fan tray slot is externally mounted to the bottom side of the KBox C-104-TGL-4/-2/-1 chassis and comprises a fan tray (Figure 32, pos. 1) with one fan as well as the air filter.

Figure 32: KBox C-104-TGL-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-104-CFL-1 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) or fan holder. The fan tray is designed to be inserted into the fan tray slot (Figure 32, pos. 6) on the bottom side of the KBox C-104-TGL-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-104-TGL-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 32, pos. 3).

The optional air filter (fan tray only), 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".

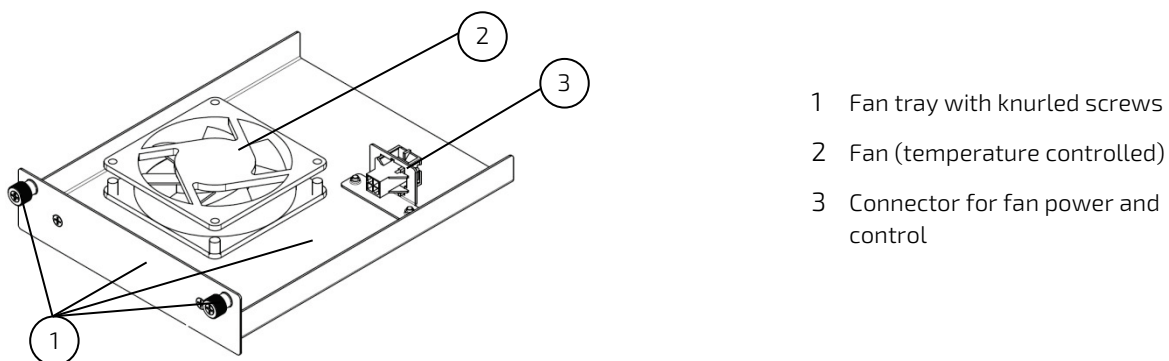
The fan tray provides tool-free replacement during operation and an optional filter mat.

⚠ CAUTION

The fan tray can be replaced and the filter mat can be cleaned/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" and 10.4 "Cleaning the Air Filter").

Figure 33: Fan tray components of the KBox C-104-TGL-4/-2/-1

Cable connections between fan and fan connector are included in this assembly.



5.10.2. Fan Holder (only for KBox C-104-TGL-4/-2/-1)

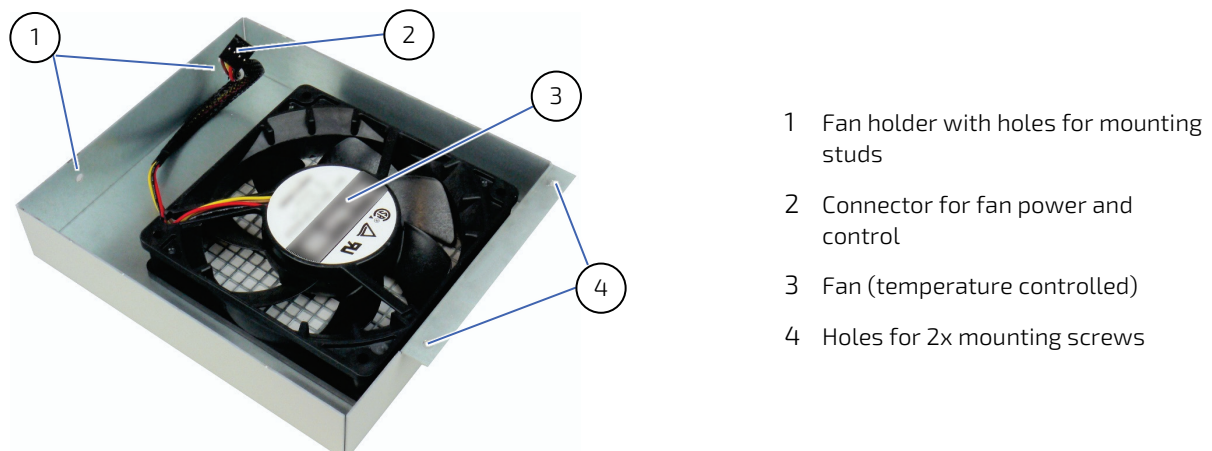
The fan holder provides a cost-efficient alternative without hot-swap feature and filter mat. It can be easily replaced by using a Philips screwdriver.

⚠ CAUTION

The fan holder cannot be replaced during operation.

Figure 34: Fan holder components of the KBox C-104-TGL-4/-2/-1

Cable connections between fan and fan connector are included in this assembly.



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/M.2 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-104-TGL 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-104-TGL 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-104-TGL with expansion cards, pay attention to the power specifications in chapter 13/ "Technical Specification" 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



The pictures in this section correspond to a KBox C-104-TGL-2 system.

The cover description can be applied to all system variants, under consideration of the different mechanical specifications of the KBox C-104-TGL; refer to the section 13.1 "Mechanical Specifications of the KBox C-104-TGL".

WARNING

When used as intended the KBox C-104-TGL is to be operated only in closed condition. Only when the right side cover is fixed with the screws (Figure 21, pos. 2) and top cover is properly installed and secured with the knurled screws (Figure 10, pos. 2) on the front side, it is ensured that the user doesn't have access to the internal components of the KBox C-104-TGL during operation.

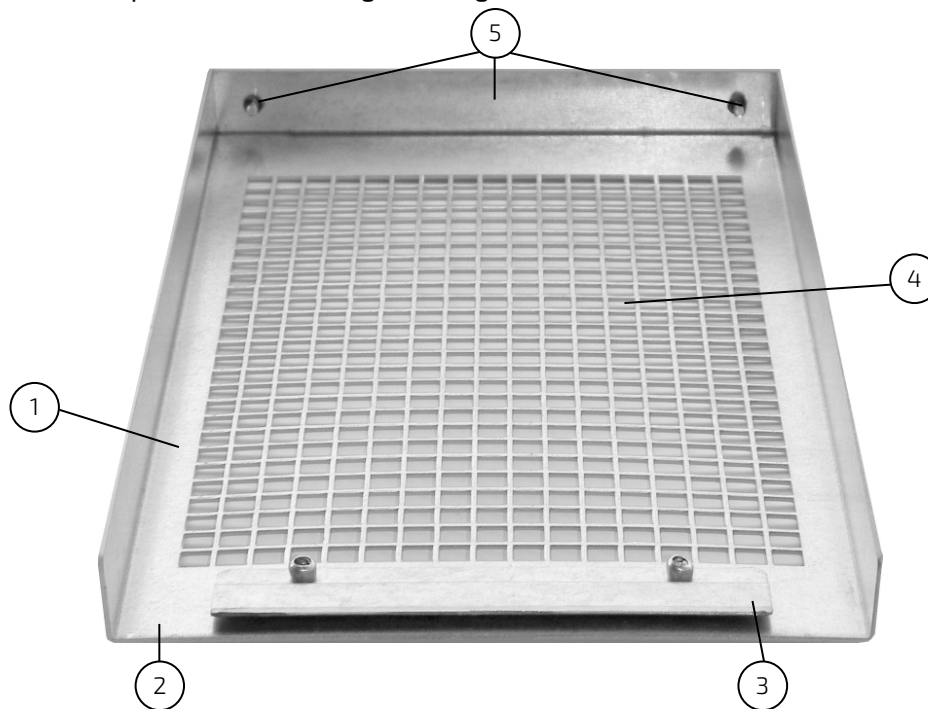
The cover will be fixed to the chassis using the centering bracket at the rear side of the cover (Figure 35, pos. 3) and the fixing bracket with captive knurled screws at the front side of the cover (Figure 35, pos. 5).

When inserting the cover, make sure that:

- ▶ At the rear: the centering bracket (Figure 35, pos. 3) is inserted properly into the corresponding cover retaining bracket of the chassis (Figure 40, pos. 13).
- ▶ At the front side: the fixing bracket with captive knurled screws of the cover (Figure 35, pos. 5), is matching properly over the cover retaining bracket on the front side (Figure 40, pos. 1).

The fixing bracket with captive knurled screws (Figure 35, pos. 5) secures the top cover on the front side (Figure 10, pos. 2).

Figure 35: 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-104-TGL



The pictures in this section correspond to a KBox C-104-TGL-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-104-TGL; refer to the section 13.1 "Mechanical Specifications of the KBox C-104-TGL".

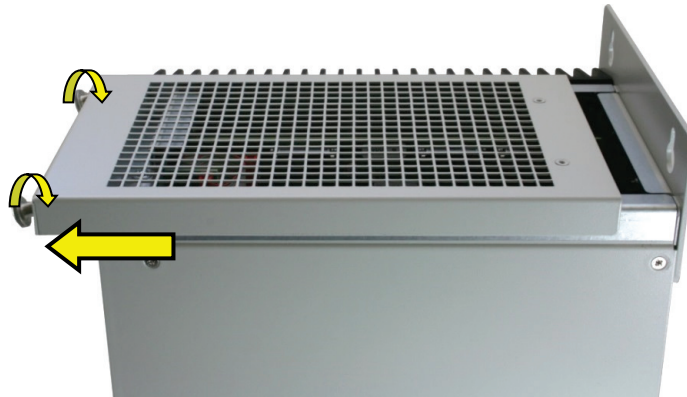
For opening/closing the KBox C-104-TGL, please perform the following steps:

WARNING

The system must be powered off and disconnected from the main power supply, before you attempt to open the KBox C-104-TGL. Ensure that you have a clean, flat and ESD-safe surface to work on. Also disconnect all peripheral devices from the KBox C-104-TGL. 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-104-TGL 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 10 and Figure 36).
4. Pull the cover out a little bit, as shown in Figure 36, to release the cover centering and fixing brackets.

Figure 36: Removing the centering and fixing bracket of the top cover (detail of the KBox C-104-TGL-2)

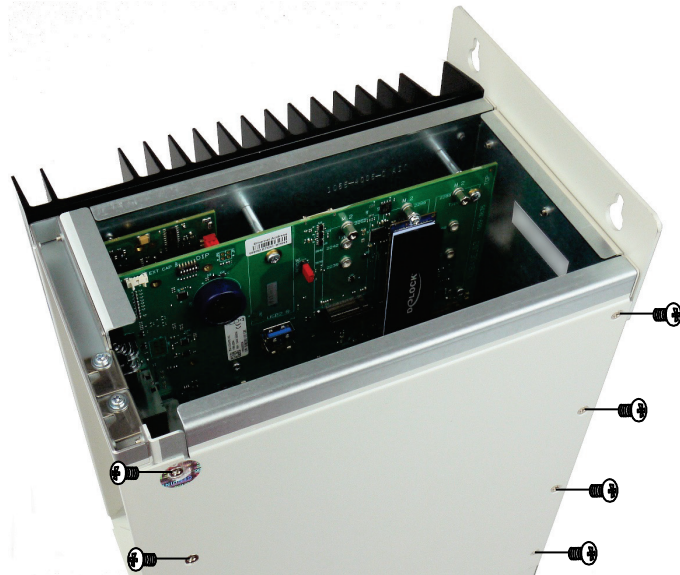


5. Lift the top cover up (on the front edge) and remove it (Figure 37). Now you have access to the internal sockets (PCI/PCIe/M.2) or to the corresponding cards/devices, in order to install or remove internal hardware components.

Figure 37: Removing the cover (detail of the KBox C-104-TGL-2)

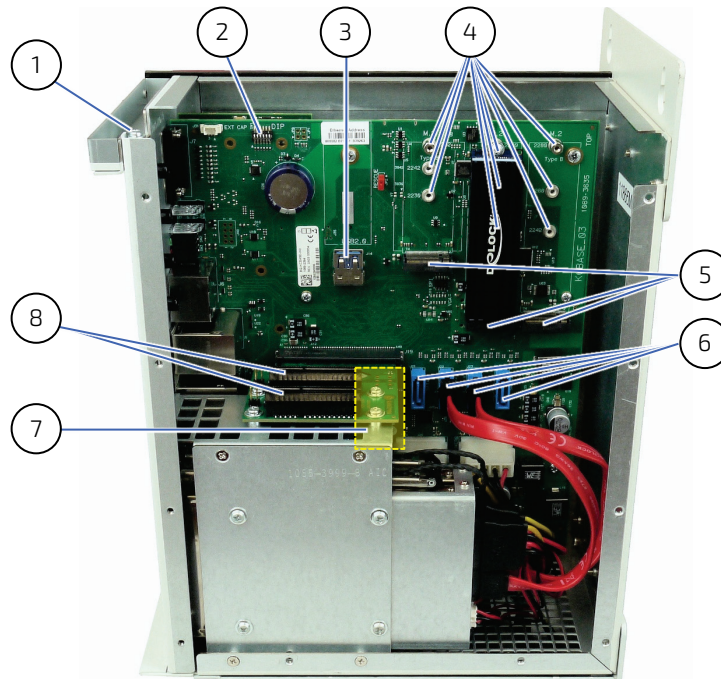


Figure 38: KBox C-104-TGL-2 - removing the right side cover



6. For a better accessibility of the internal sockets (PCI/PCIe and M.2 modules), you may also remove the right side cover of the KBox C-104-TGL (Figure 38). Loosen the externally accessible fastening screws (Figure 21, pos. 2) that secure the right side cover (Figure 38 and Figure 21, 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.

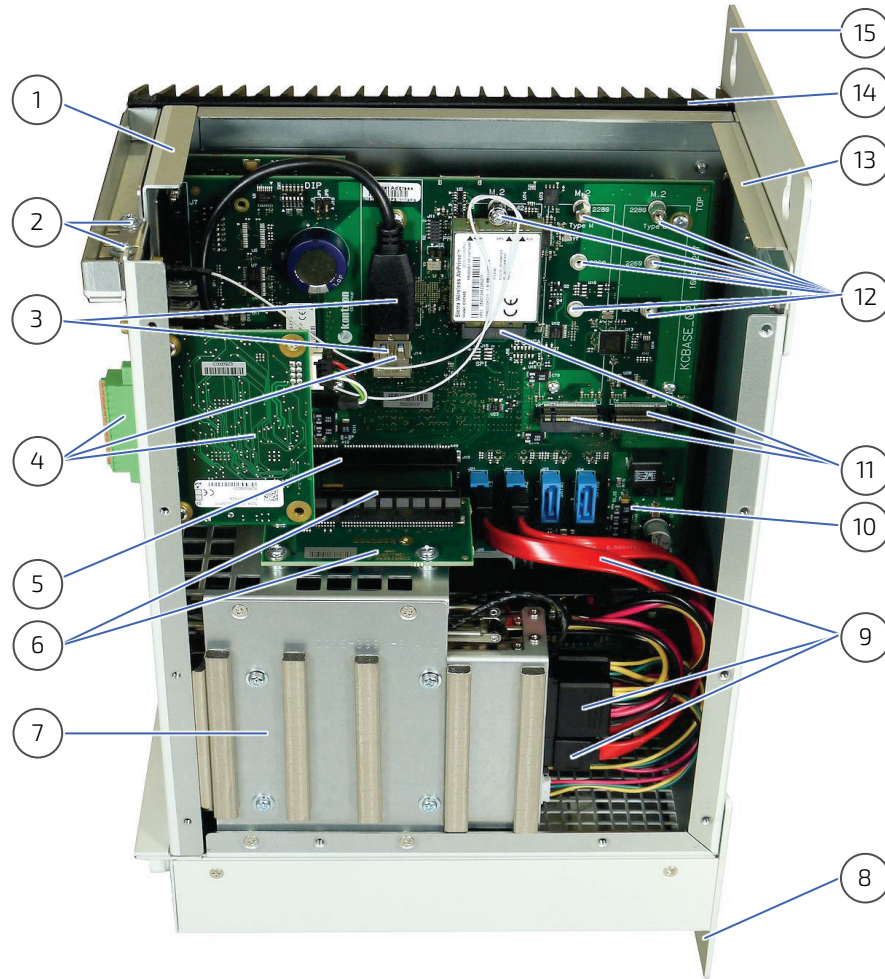
Figure 39: KBox C-104-TGL-2 without top and right side cover (shown with a PCIe riser card)



- | | |
|--|---|
| <ol style="list-style-type: none"> 1 Screws to fix the PCIe slot bracket or the I/O bracket of the PCIe card 2 DIP switch 3 Internal USB 2.0 port with space for module 4 Threaded holes/fixing bolts to secure the 3x M.2 modules | <ol style="list-style-type: none"> 5 3x M.2 sockets (2x Type B, 1x Type M; from left to right: J13, J17, J18) 6 4x SATA connectors 7 1x Mini PCIe socket for PCIe Mini card (J20) <i>(not visible; obstructed by riser card)</i> 8 Riser card with 2x PCIe x4 sockets |
|--|---|

6.3. Internal View

Figure 40: KBox C-104-TGL-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 Screws that secure the PCIe slot brackets | 10 Baseboard |
| 3 Internal USB 2.0 port with USB cable connected | 11 3x M.2 sockets (2x Type B, 1x Type M),
left socket (J13) with wireless module installed |
| 4 Optional GPIO module, connected to
internal USB 2.0 port via cable | 12 Threaded holes/fixing bolts to secure the 3x M.2
modules |
| 5 PCI x8 socket of the baseboard | 13 Cover retaining bracket on the rear side |
| 6 Riser card with 1x PCIe x8 socket | 14 Cooling fins |
| 7 Mounting frame for 2.5" drive bays of the
removable HDDs/SSDs | 15 Upper mounting bracket with key holes |
| 8 Lower mounting bracket with key holes | |



The Mini PCIe socket is on the lower 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-104-TGL accommodates a baseboard with a COMe-bTL6 or cTL6 module.

Figure 41: KBox C-104-TGL-2 - internal view with COMExpress® module and with PCIe riser card



- | | |
|--|--|
| 1 COM Express module | 6 Riser card with 1x PCIe x8 socket |
| 2 Baseboard | 7 Cover retaining plate on the rear side |
| 3 Internal USB 2.0 port with USB cable connected | 8 Threaded holes/fixing bolts to secure the 3x M.2 modules |
| 4 Screws that secure the PCIe slot brackets | 9 Upper mounting bracket with key holes |
| 5 Slot bracket with optional GPIO module (not connected to the riser card) | 10 microSD and microSIM connector |
| | 11 Cooling fins |



Refer to the information and technical data included in the user manual of the installed COMe-cTL6 respectively COMe-bTL6 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. M.2 Sockets

Depending on the system configuration ordered your KBox C-104-TGL can be extended with up to three M.2 modules. For installation/removing of the M.2 SSD refer to the subsection 6.3.7 "Installing/Removing an M.2 Module".

6.3.3. DIP Switch

The baseboard of the KBox C-104-CFL is equipped with an DIP switch (Figure 39, pos. 2). The particular DIP switches have the following functions:

- ▶ DIP switch 1-4: User defined
- ▶ DIP switch 5: For future use
- ▶ DIP switch 6: ON: Fan tray present (therm LED behavior change, green → red)

6.3.4. Expansion Socket for PCIe Mini Cards

Depending on the system configuration ordered, your KBox C-104-TGL can be extended with a PCIe Mini card.



The KBox C-104-TGL provides one internal Mini PCIe socket for PCIe Mini cards. The Mini PCIe socket is on the lower side of the baseboard and can be only at factory equipped with an expansion card.

6.3.5. Riser Cards Expansion Sockets for PCI/PCIe Cards

Depending on the system configuration ordered, your KBox C-104-TGL 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 43, pos. 5 and pos. 6, Figure 44, pos. 5 and pos. 8), please refer to the subsection 6.3.6 "Installing/Removing PCI/PCIe Expansion Cards".



To expand your system with expansion cards, please observe the power consumption specified in chapter 13/ "Technical Specification".
The power consumption of each expansion card does not exceed 15 W.

Please observe that:

KBox C-104-TGL-4 supports up to:

- ▶ 2x PCIe x4 and 2x PCIe x1 expansion cards

KBox C-104-TGL-2 supports up to:

- ▶ 2x PCIe x4 expansion cards **or**
- ▶ 1x PCIe x8 expansion cards **or**
- ▶ 1x PCIe x4 and 1x PCI (32 bit) expansion cards.



KBox C-104-TGL-1 supports:

- ▶ 1x PCIe x4 expansion card **or**
- ▶ 1x PCIe x8 expansion card

KBox C-104-TGL-0:

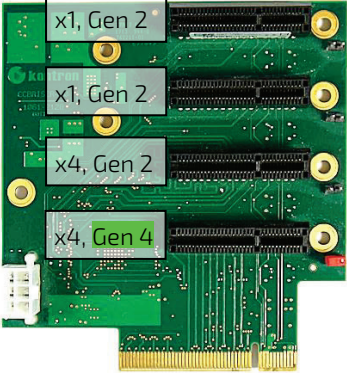
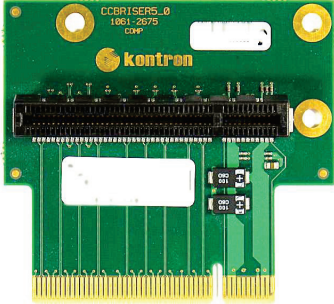
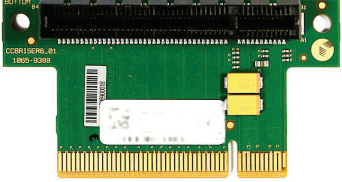

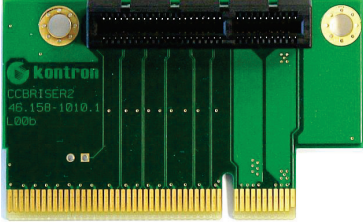
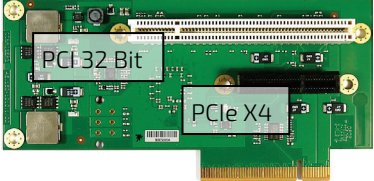
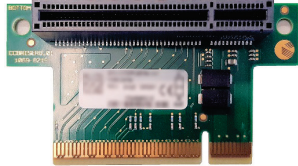
- ▶ Can't be equipped with PCI/PCIe expansion cards.

For system configuration refer to the area marked "C" in the section 4.4. and for expansion card installation refer to the subsection 6.3.6 "Installing/Removing PCI/PCIe Expansion Cards".

6.3.5.1. Riser Cards for KBox C-104-TGL-x

Depending on the variant and system configuration ordered, your KBox C-104-TGL-x can be equipped with different riser cards. The following table shows which riser card is available for which system.

Table 12: Available Riser Cards for the different KBox C-104-TGL variants

KBox C-104-TGL-4	KBox C-104-TGL-2	KBox C-104-TGL-1
<ul style="list-style-type: none"> ▶ 2x PCIe x4 (1x Gen 3, 1x Gen 2) ▶ 2x PCIe x1 (2x Gen 2) ▶ 4x "Card present" jumper ▶ Extra power connector 	<ul style="list-style-type: none"> ▶ 1x PCIe x8 	<ul style="list-style-type: none"> ▶ 1x PCIe x8 
or		For BTL6 only
	<ul style="list-style-type: none"> ▶ 2x PCIe x4 ▶ 2x "Card present" jumper 	<ul style="list-style-type: none"> ▶ 1x PCIe x4 
or		For cTL6 only
	<ul style="list-style-type: none"> ▶ 1x PCI 32 Bit ▶ 1x PCIe x4 	<ul style="list-style-type: none"> ▶ 1x PCIe x4 

NOTICE

Info on this PEG Port setting (see also UEFI BIOS manual, PEG Width Configuration):
 [1x8+2x4 rev] is used with 2 Slot and 4 Slot PCIe Riser cards
 [2x8 rev] is used with the 1 Slot X8 PCIe Riser cards.

6.3.5.2. Detail: Riser Card for KBox C-104-TGL-4

The KBox C-104-TGL-4 is equipped with a riser card that supports 2x PCIe x4 (1x Gen 4, 1x Gen 2) and 2x PCIe x1 (2x Gen2) expansion cards (full-height, half-length form factor). The riser card provides an extra power connector for add-on cards with high power consumption and a "card present" jumper for each slot. If an installed add-on card is not automatically detected by the system, set the corresponding jumper to switch the status to "card present".

Figure 42: Riser card with 2xPCIe x4 and 2x PCIe x1 slots for KBox C-104-4



6.3.6. Installing/Removing PCI/PCIe Expansion Cards (KBox C-104-TGL-4/-2/-1 only)

The PCI/PCIe expansion cards can be installed into the slots on the front side of the system (Figure 10). The slots are marked with "PCIe 1" to "PCIe 4". It is recommended to expand your KBox C-104-TGL 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-104-TGL-4/-2/-1 as described in the section 6.2 "Opening and Closing the KBox C-104-TGL" (step 1-6).
3. To remove/install an expansion card, you have to remove the corresponding card/slot bracket (refer to Figure 10 and Figure 43/Figure 44). 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 43/Figure 44, pos. 2).

Figure 43: Detail of the KBox C-104-TGL-2 with PCIe riser card with 2x PCIe x4 sockets

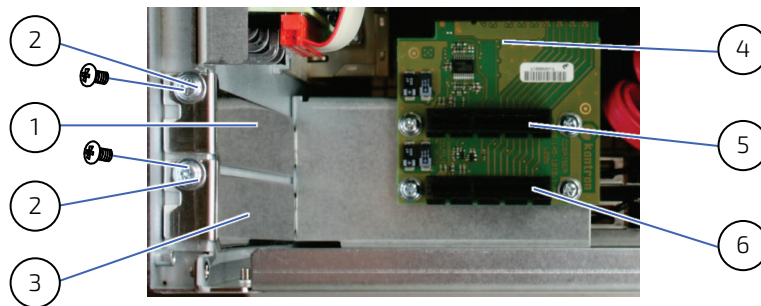


Figure 44: Detail of the KBox C-104-TGL-2 with PCI-PCIe riser card with 1x PCI (32 bit) and 1x PCIe x4 sockets

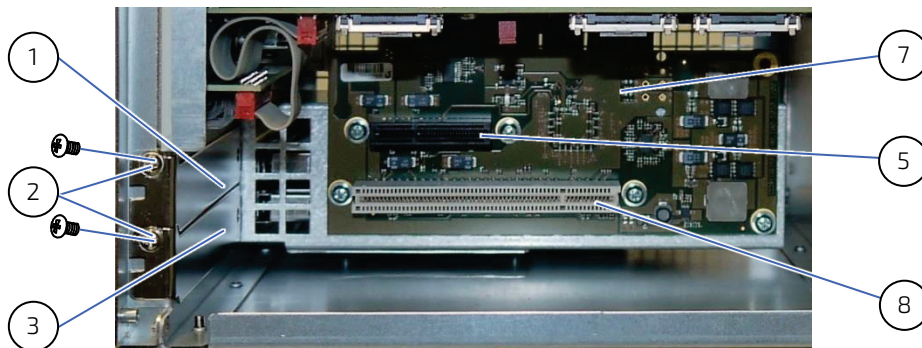
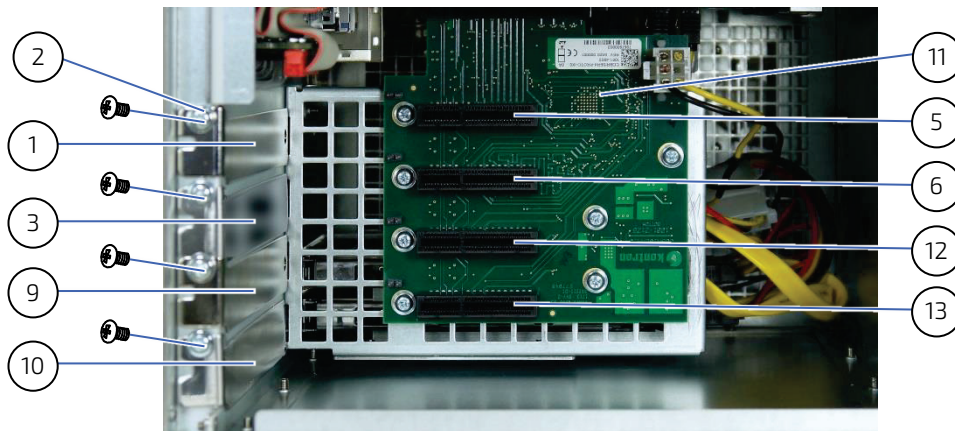


Figure 45: Detail of the KBox C-104-TGL-4 with PCIe riser card with 2x PCIe x4 and 2x PCIe x1 sockets



Legend for Figure 43, Figure 44 and Figure 45 :

- | | |
|---|--|
| 1 Slot bracket for the for the PCIe 1 expansion slot | 8 Free 1x PCI (32 bit) (for PCIe 2 slot) |
| 2 Screws to secure the expansion slot/cards brackets | 9 Slot bracket for the for the PCIe 3 expansion slot |
| 3 Slot bracket for the for the PCIe 2 expansion slot | 10 Slot bracket for the for the PCIe 4 expansion slot |
| 4 Riser card with 2x PCIe x4 expansion sockets | 11 Riser card with 2x PCIe x4 and 2x PCIe x1 expansion sockets |
| 5 Free PCIe x4 socket (for PCIe 1 slot) | 12 Free PCIe x1 socket (for PCIe 3 slot) |
| 6 Free PCIe x4 socket (for PCIe 2 slot) | 13 Free PCIe x1 socket (for PCIe 4 slot) |
| 7 Riser card with 1x PCI and 1x PCIe x4 expansion sockets | |
-
4. Insert/remove the expansion card into/from the corresponding PCI/PCIe socket of the corresponding riser card (Figure 43, pos. 5, pos. 6 or Figure 44, 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-104-TGL, proceed in reverse order (step 6 to 1 in the section 6.2 "Opening and Closing the KBox C-104-TGL").

6.3.7. Installing/Removing an M.2 Module

To install an M.2 module 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-104-TGL" (step 1-6).
3. Locate the M.2 sockets and the corresponding fixing bolts. (Figure 39, pos. 4 and 5).
4. Mount the fixing bolts at the correct position for the length of the M.2 card, using the threaded holes (Figure 39, pos. 4)
5. Insert the M.2 card into the corresponding socket (Figure 39, pos. 7) at an angle of approx. 45° and push it down until it lies on the the fixing clip.
6. Secure the M.2 on the fixing bolt with the corresponding fixing screw.
7. In order to close the KBox C-104-TGL, proceed in reverse order (step 6 to 1 of the section 6.2 "Opening and Closing the KBox C-104-TGL").

To remove an M.2 module, 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-104-TGL" (step 1-6).
3. Locate the M.2 card installed into your system.
4. Remove the fixing screw in order to release the M.2 card. It will spring up at an angle of approx. 45° on the fixing clips side.
5. Gently pull the M.2 card out.
6. In order to close the KBox C-104-TGL, proceed in reverse order (step 6 to 1 of the section 6.2 "Opening and Closing the KBox C-104-TGL").



Preventive Maintenance for M.2 SSDs:

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.

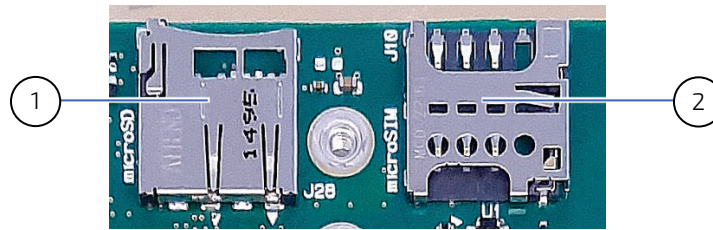
See also section 8.1 "Specifications of the internal M.2 Connectors".

6.3.8. Installing/Removing a microSD or microSIM Card

To install a microSD or a microSIM 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-104-TGL" (step 1-6).
3. Locate the microSD or microSIM connector at the rear side of the baseboard (see also Figure 41, pos. 10).

Figure 46: microSD and microSIM connector



1 microSD connector

2 micro SIM connector

4. Insert a microSIM card into the the microSIM connector or/and insert a microSD card int the microSD connector by gently pushing the card into the corresponding connector, card contacts facing down (see Figure 46).
5. In order to close the KBox C-104-TGL, proceed in reverse order (step 6 to 1 of the section 6.2 "Opening and Closing the KBox C-104-TGL").

To remove a microSD or a microSIM 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-104-TGL" (step 1-6).
3. Locate the microSD or microSIM connector at the rear side of the baseboard (see also Figure 41, pos. 10).
4. Gently pull the microSD or microSIM card out.
5. In order to close the KBox C-104-TGL, proceed in reverse order (step 6 to 1 of the section 6.2 "Opening and Closing the KBox C-104-TGL").

7/ Power and Thermal Considerations

7.1. System Power Portfolio

Below information gives more insight on the power portfolio of KBOX C-104-TGL:

- ▶ Overall Maximum Power Consumption: **140 Watt**
- ▶ Input Voltage Nominal 24 VDC / 6 A (+20% / -20%)
- ▶ Maximum range, not considered for safety approval: 17 - 36 VDC
- ▶ Holdup Time 10ms @ 100 Watt

Please find in below tables values to calculate the total needed power for the 24 Volt power supply depending on the application. Be aware that the DC power supply must be able to handle peak currents for several seconds.

Table 13: Power Consumption

Power Consumption	COMe	Carrier	USB 3.0	USB 2.0	M.2	MiniPCIe	Sata SSD	PCIe card
CPU	TDP		4 Conn.	3 Conn.	3 Slots	1 Slot	2 Pcs.	4 Slot
Intel® Celeron™ 6600HE	35W	5 W	0-20 W	0-7.5 W	0-17 W	0-4 W	0-10 W	0-50 W
Intel® Core™ i3-11100HE	45 W	5 W	0-20 W	0-7.5 W	0-17 W	0-4 W	0-10 W	0-50 W
Intel® Core™ i5-11500HE	45 W	5 W	0-20 W	0-7.5 W	0-17 W	0-4 W	0-10 W	0-50 W
Intel® Core™ i7-11850HE	45 W	5 W	0-20 W	0-7.5 W	0-17 W	0-4 W	0-10 W	0-50 W
Intel® XEON™ W-11555MRE (i5)	45 W	5 W	0-20 W	0-7.5 W	0-17 W	0-4 W	0-10 W	0-50 W
Intel® XEON™ W-11865MRE (i7)	45 W	5 W	0-20 W	0-7.5 W	0-17 W	0-4 W	0-10 W	0-50 W
Intel® Core™ * i5-1145GRE	15 W	5 W	0-20 W	0-7.5 W	0-17 W	0-4 W	0-10 W	0-50 W
Intel® Core™ * i7-1185GRE	15 W	5 W	0-20 W	0-7.5 W	0-17 W	0-4 W	0-10 W	0-50 W

*realized on COMe-cTL6 version

Table 14: Current and voltage provided in the KBOX C-104-TGL per port

	USB 3.0	USB 2.0	M.2	MiniPCIe	Sata SSD
Maximum defined Power per Port	5 W	2.5 W	5.6 W	4 W	5 W
Max current (Voltage) per Port	1 A (5 V)	0.5 A (5 V)	1.7 A (3.3 V)	1 A (3.3 V)	1 A (5 V)
				375 mA (1.5 V)	1 A (12 V)

Table 15: Maximum Power supplied on the PCIe Slots (depending on the installed PCIe expansion card)

PCIe Expansioncard	Slot1	Slot 2	Slot 3	Slot 4		12 Volt	3.3 Volt
1 Slot PCIe X8	25 W	-	-	-		2 A	3 A
1 Slot PCIe X4	25 W	-	-	-		2 A	3 A
2 Slot PCIe X4	15 W	15 W	-	-		2 A total	3 A total
4 Slot PCIe X4	15 W	15 W	10 W	10 W		4 A total	7 A total

For more information about available riser cards see also Table 12.

7.2. Tuning CPU Power and Performance

There are BIOS settings that can help to limit the power consumption, peak current and thermal heat dissipation.

NOTICE

Changing these settings will influence the performance of the application.

- ▶ Turbo Mode: Will limit the CPU to the nominal TDP
Advanced/Power & Performance /CPU- Power Management Control/Turbo Mode
- ▶ Power Limits: PL1, PL2 and Tau can be set in
Advanced/Power & Performance/CPU-Power Management Control/Config TDP Configurations

Table 16: Default values in BIOS for KBOX C-104-TGL

CPU	Nominal TDP PL1 (Base)	Maximum TDP PL2 (up)	Tau Sec.	cTDP (down)
Intel® Celeron™ 6600HE	35 W	55 W	-	-
Intel® Core™ i3-11100HE	45W	60 W	28	35 W
Intel® Core™ i5-11500HE	45 W	78 W	28	35 W
Intel® Core™ i7-11850HE	45 W	90 W	28	35 W
Intel® XEON™ W-11555MRE	45 W	87 W	28	35 W
Intel® XEON™ W-11865MRE	45 W	109 W	28	35 W
Intel® Core™ i5-1145GRE	15 W	28 W	28	12 W
Intel® Core™ i7-1185GRE	15 W	28 W	28	12 W

7.3. Available Processors

Table 17: Overview of some of the features of the used CPU versions in KBOX C-104-TGL

CPU	Core/Thread	Nom. Freq	Turbo Freq.	Graphics GPU
Intel® Celeron™ 6600HE	2/2	2.6 GHz	-	UHD
Intel® Core™ i3-11100HE	4/8	2.4 GHz	4.4 GHz	UHD
Intel® Core™ i5-11500HE	6/12	2.6 GHz	4.5 GHz	UHD
Intel® Core™ i7-11850HE	8/16	2.6 GHz	4.7 GHz	UHD
Intel® XEON™ W-11555MRE	6/12	2.6 GHz	4.5 GHz	UHD
Intel® XEON™ W-11865MRE	8/16	2.6GHz	4.7GHz	UHD
Intel® Core™ i5-1145GRE	4/8	1.5 GHz	4.1 GHz	IRIS Xe
Intel® Core™ i7-1185GRE	4/8	1.8 GHz	4.4 GHz	IRIS Xe

7.4. Convection Cooling

The KBox C-104-TGL 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-104-TGL including optionally installed devices prior implementing the unit in the intended application.

7.5. Active Cooling via the optional Fan Tray/Fan Holder

For applications where convection cooling is not sufficient, there is the possibility to use the optional fan tray or fan holder (externally mounted to the KBox C-104-TGL-4/-2/-1). The optional fan tray/holder 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 and improving the overall MTBF.

7.6. 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 8.2 "Control Cabinet Mounting" and Figure 47 to Figure 53).

7.7. Maximum Temperatures

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

Table 18: Maximum Temperatures without Fan Tray

Processor (Maximum Power Consumption)	KBox C-104-TGL without Fan Tray		
	Max. Ambient Temperature [°C] w/o CPU throttling	Max. Ambient Temperature [°C] with CPU throttling	Approx. System Internal Temperature Rise [°C] (Depending on Configuration)
Intel® Celeron™ 6600HE	55	65	10-20
Intel® Core™ i3-11100HE	55	65	10-20
Intel® Core™ i5-11500HE	55	65	10-20
Intel® Core™ i7-11850HE	55	65	10-20
Intel® XEON™ W-11555MRE	55	65	10-20
Intel® XEON™ W-11865MRE	50	60	10-20
Intel® Core™ i5-1145GRE	65	70	10-20
Intel® Core™ i7-1185GRE	65	70	10-20

Table 19: Maximum Temperatures with Fan Tray

Processor (Maximum Power Consumption)	KBox C-104-TGL with Fan Tray		
	Max. Ambient Temperature [°C] w/o CPU throttling	Max. Ambient Temperature [°C] with CPU throttling	Approx. System Internal Temperature Rise [°C] (Depending on Configuration)
Intel® Celeron™ 6600HE	60	65	5 - 10
Intel® Core™ i3-11100HE	60	65	5 - 10
Intel® Core™ i5-11500HE	60	65	5 - 10
Intel® Core™ i7-11850HE	60	65	5 - 10
Intel® XEON™ W-11555MRE	60	65	5 - 10
Intel® XEON™ W-11865MRE	60	65	5 - 10
Intel® Core™ i5-1145GRE	70	70	5 - 10
Intel® Core™ i7-1185GRE	70	70	5 - 10



The maximum system ambient temperature depends mostly on the power consumption of the processor, chipset and third party components:

- ▶ Configurations with HDDs are limited to 50°C maximum ambient temperature.
 - ▶ Configurations with wireless components (LTE, Wi-Fi) are limited to 60°C ambient temperature.
-

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 70% 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.



For save operation (UL Approval) it is mandatory that all third party components are certified for at least 8 °C above maximum ambient temperature.

7.8. Third Party Components

When the KBox C-104-TGL is extended and configured with third party components like PCIe extension cards and 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.

7.9. Processor Thermal Monitoring

The processor used with the KBox C-104-TGL 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.

7.10. Processor Thermal Trip Feature

The Processor Thermal Trip feature protects the processor from catastrophic overheating. The Thermal Trip 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-104-TGL comes with attached wall mount brackets. The available mounting key holes (Figure 25, pos. 1 and pos. 3) of the wall mounting brackets allow the unit attaching to a wall of a fire resistant enclosure.

Please observe the following safety and installation instructions:

- ▶ 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-104-TGL 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-104-TGL has to be installed and operated only by trained and qualified personnel.
- ▶ The KBox C-104-TGL 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-104-TGL.
- ▶ This device shall only be installed in or connected to systems that fulfill all necessary technical and specific environmental requirements.
- ▶ The KBox C-104-TGL system is designed to be operated in vertical position with attached mounting brackets as shown in Figure 5 and Figure 6. It is not allowed to install the KBox C-104-TGL 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 47 to Figure 53 section 13.1 "Mechanical Specifications".
- ▶ It must be observed that all ventilation openings are not covered/obstructed by objects.
- ▶ The KBox C-104-TGL 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-104-TGL 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 8.3 "DC Power Plug Terminal" and chapter 9/ "Starting Up".
- ▶ The unit is to be connected only to internal Ethernet networks without exiting a facility and being subjected to TNVs.
- ▶ External circuits connected to the device shall be SELV/PELV (galvanic separated from mains by double or reinforce insulation).
- ▶ Use copper conductors according to the specification of the field wiring terminal.
- ▶ Minimum temperature rating of the cables connected to the field wiring terminals is 77° C.

8.1. Specifications of the internal M.2 Connectors

Table 20: Specifications of the internal M.2 Connectors

M.2 Connector No.	J13	J17	J18
M.2 Connector type	B-Type	M-Type	B-Type
PCIe lanes/ Gen	X1 / G3	X4 /G4 ³	X1 / G3 ³
SATA	no	no	yes ¹
USB	3.0	no	2.0
MicroSIM	yes	no	no
Mech. Format			
2230	yes	no	no
3030	yes	no	no
2242	yes	yes	yes
3042	yes	no ²	no ²
2252	yes	no	no
3052	yes	no	no
2260	no	yes	yes
2280	no	yes	yes

yes¹: muxed with SATA0/J24

no²: possible if neighbouring slot is not occupied

PCIe³: only with COMe-bTL6

8.2. Control Cabinet Mounting



Expansion card installation should be performed before installing the KBox C-104-TGL into the control cabinet.

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-104-TGL is supplied with assembled mounting brackets. The key holes of the upper and lower mounting brackets (Figure 25, pos. 1 and pos. 3) allow you to mount the KBox C-104-TGL to a mounting side of the control cabinet in vertical position. This is the only permitted operating position.



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-104-TGL must be observed; refer to the marked areas in Figure 47 to Figure 53.

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 13.1, "Mechanical Specifications of the KBox C-104-TGL", and the subsections 13.1.1 / 13.1.4 / 13.1.5 / 13.1.6 and 13.1.7, or refer to the drawings for KBox C-104-TGL on our web site. The drawings can be downloaded from our web site www.kontron.com by selecting the product.

Figure 47: Keep out area for mounting around KBox C-104-TGL-4 (front side view without fan tray)

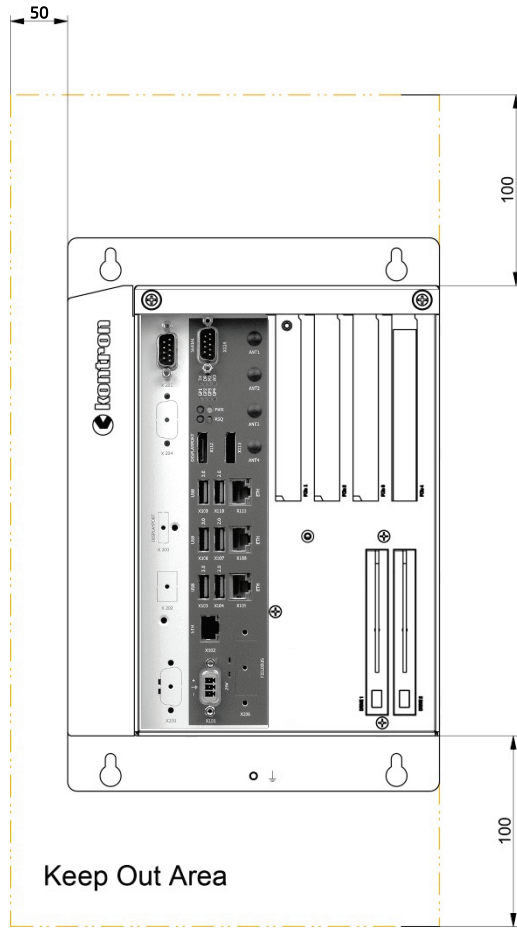


Figure 48: Keep out area for mounting around KBox C-104-TGL-4 (front side view with optional fan tray)

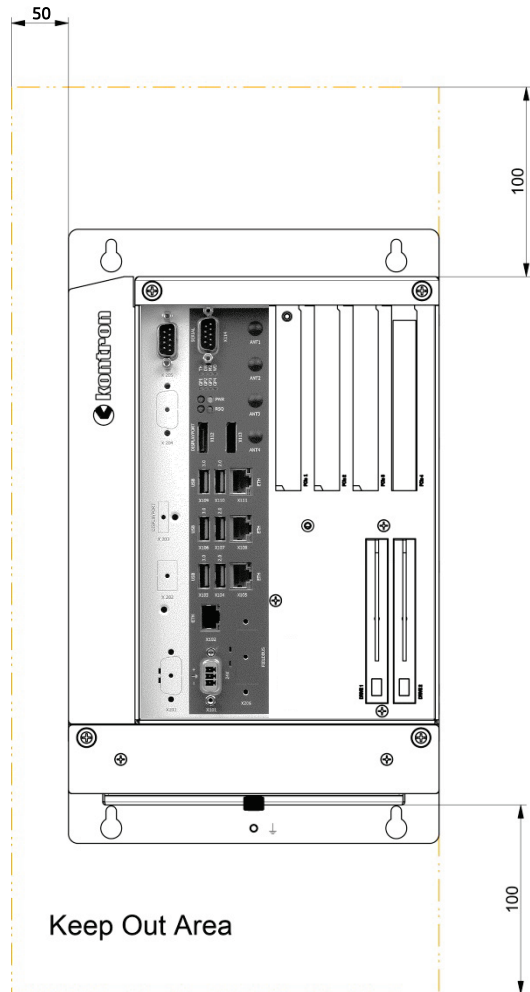


Figure 49: Keep out area for mounting around KBox C-104-TGL-2 (front side view without fan tray)

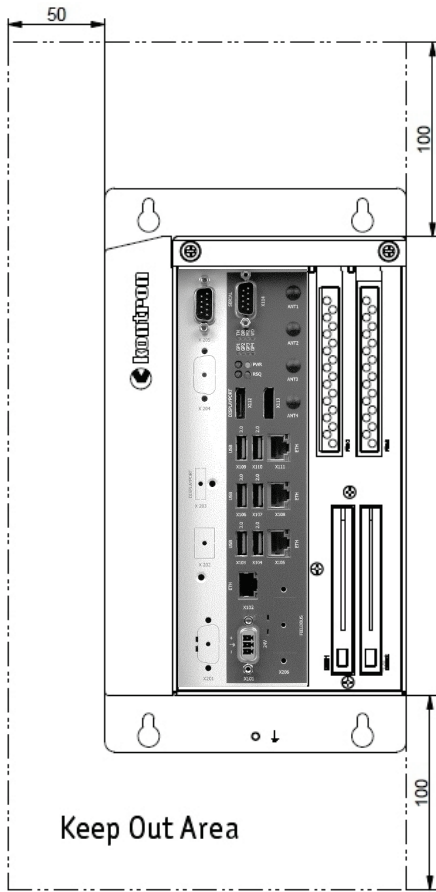


Figure 50: Keep out area for mounting around KBox C-104-TGL-2 (front side view with optional fan tray)

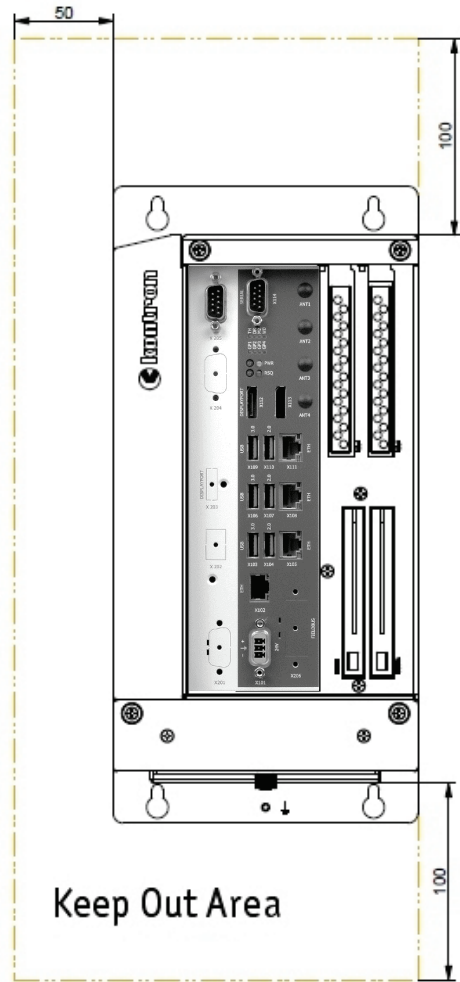


Figure 51: Keep out area for mounting around KBox C-104-TGL-1 (front side view without fan tray)

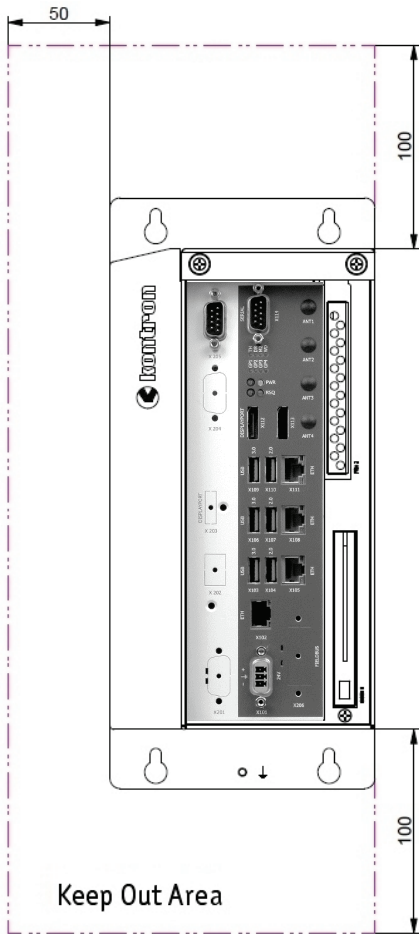


Figure 52: Keep out area for mounting around KBox C-104-TGL-1 (front side view with optional fan tray)

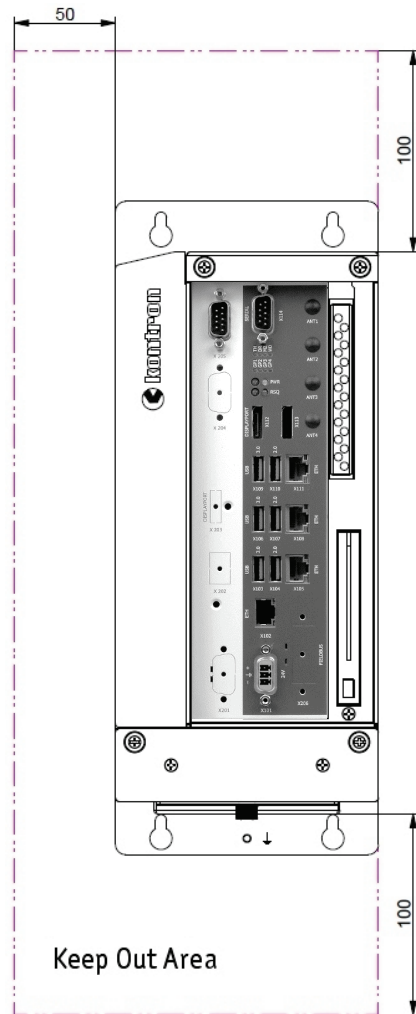
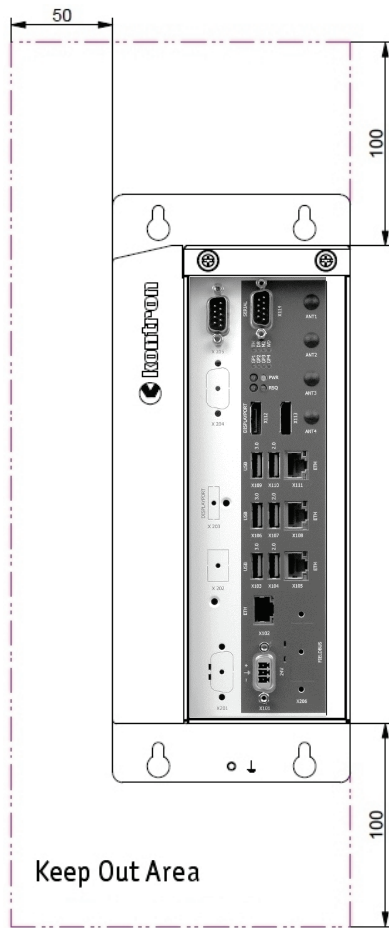


Figure 53: Keep out area for mounting around KBox C-104-TGL-0

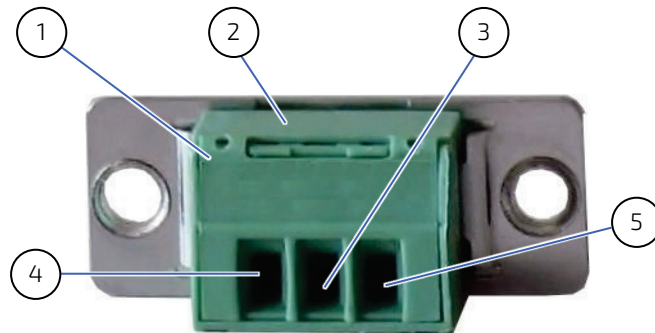


8.3. DC Power Plug Terminal

The KBox C-104-TGL 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-104-TGL 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 54: 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 | | |

8.3.1. Cabling

For the pin assignment Phoenix power plug terminal refer to the subsection 4.4.1 "X101/X201 – Power Input Connectors".

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 54, 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 54, Figure 14 or subsection 14.1.1, "(X101) Power Input Connector "].
6. Fasten the screws to secure the wires into the clamps of the plug terminal.
7. Close the cover (Figure 54, pos. 2).

8.4. Side Wall Mounting (Option)

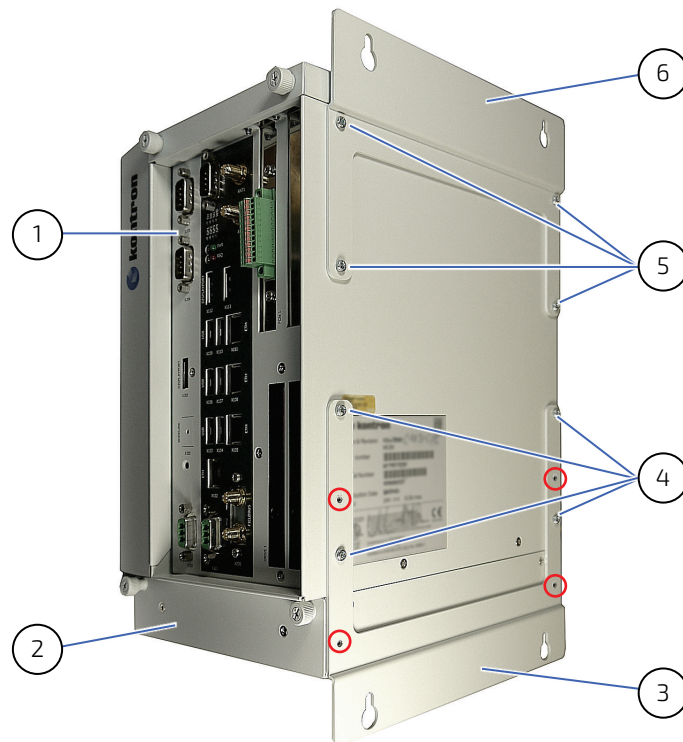
Your KBox C-104-TGL can be mounted with optionally available side wall mounting brackets. The key holes of the upper and lower mounting brackets (Figure 55, pos. 3 and pos. 6) allow you to mount the KBox C-104-TGL to a mounting side of the control cabinet in vertical position. This is the only permitted operating position. The lower side wall mounting bracket has different holes for mounting with and without fan tray (Figure 55, pos. 3 and pos. 4).



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-104-TGL must be observed; refer to the marked areas in Figure 47 to Figure 53. (This applies to the standard brackets as well as to the side wall mounting brackets.)

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 13.1, "Mechanical Specifications of the KBox C-104-TGL", and the subsections 13.1.1 / 13.1.4 / 13.1.5 / 13.1.6 and 13.1.7, or refer to the drawings for KBox C-104-TGL on our web site. The drawings can be downloaded from our [EMD Customer Section](#) by selecting the product.

Figure 55: KBox C-104-TGL-2 with fan tray and side wall mounting brackets



- | | |
|--|---|
| <ul style="list-style-type: none"> 1 KBox C-104-TGL-2 2 Fan tray (optional) 3 Lower side wall mounting bracket with key holes, mounted in the "with fan tray" position. | <ul style="list-style-type: none"> 4 Mounting screws of the lower side wall mounting bracket, using the holes for mounting with fan tray present 5 Mounting screws of the upper side wall mounting bracket 6 Upper side wall mounting bracket with key holes |
|--|---|

Red circles: Mounting holes for the lower side wall mounting bracket if no fan tray is present

9/ Starting Up



The KBox C-104-TGL must be operated only with the nominal voltage of 24V DC of type SELV. For details refer to the chapter 13/ "Technical Specification".

9.1. Connecting to DC Main Power Supply

The DC input connector (Figure 10 and Figure 14 marked X101) is located on the front side of the KBox C-104-TGL. The KBox C-104-TGL will be connected to a DC main power supply via the supplied Phoenix power plug terminal (see Figure 54) and corresponding power wires (prepared as described in the subsection 8.3.1 "Cabling").

NOTICE

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-104-TGL must be connected to a DC mains power supply complying with the requirements of IEC 61010-1 and IEC 60950-1 standard or better. 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-104-TGL. Even when the system is turned off via the power button (Figure 10 and Figure 15, marked PWR) parts of the system are still energized.

The disconnecting device (fuse/circuit breaker) rating must be in accordance with the wire cross-section and the rated current of the KBox C-104-TGL.

NOTICE

The wires used for power connections must be clearly marked (+/-/functional earth) to ensure that they will be properly connected to the DC IN connector of the KBox C-104-TGL and to the main power source, corresponding to signals marked; refer to Figure 14 and Figure 54. In addition, the cables must have some form of support so as to minimize the strain on the unit's connectors.

NOTICE

Only connect to an external power supply delivering the specified input rating and complying with the requirements of Safety Extra Low Voltage (SELV) and Limited Power Source (L.P.S.) of UL/IEC 60950-1 or (PS2) of UL/IEC 62368-1.

To connect the KBox C-104-TGL 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 25, pos. 6) to an appropriate "common earth" connection point.
3. Connect the Phoenix power terminal prepared as described in the subsection 8.3.1 "Cabling" to the DC input connector (Figure 10 and Figure 14 marked X101) of the KBox C-104-TGL. 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-104-TGL 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-104-TGL 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 15, pos. 2) stops blinking.
4. Reapply power.

Refer also to the subsection 4.4.7 "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-104-TGL 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-104-TGL 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 [EMD Customer Section](#) 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-104-TGL 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

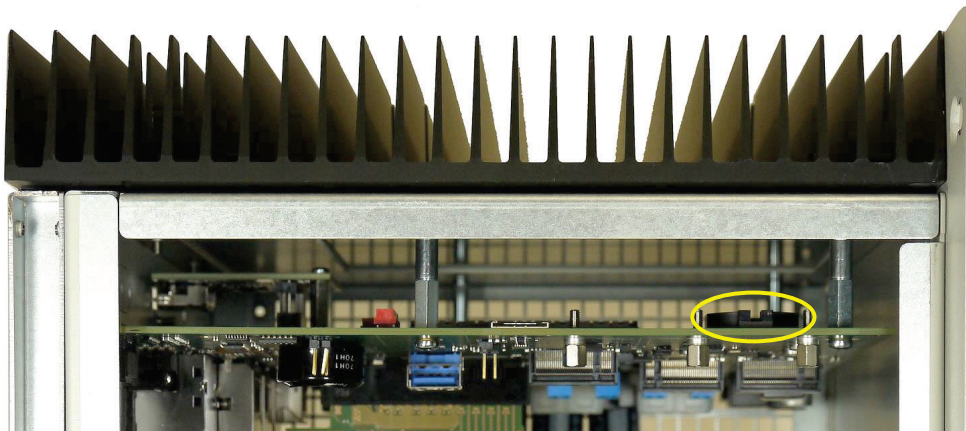
Do not use steel wool, metallic threads or solvents like abrasives, alcohol, acetone or benzene for cleaning the KBox C-104-TGL.

10.1. Replacing the Lithium Battery

If your KBox C-104-TGL is equipped with the optional lithium battery (CR 2032, 3V, internally accessible), and you have to replace it, please proceed as follows:

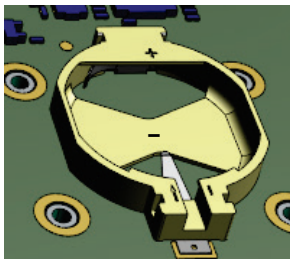
1. Open the topside access cover as describes in chapter 6.2 "Opening and Closing the KBox C-104-TGL"
2. The battery is located on the side of the baseboard that faces to the cooling fins (see Figure 56).

Figure 56: Location of the optional Lithium battery



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: the plus pole must face to the top side, the minus pole to the bottom side of the battery holder (see Figure 57).

Figure 57: Lithium battery polarity



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. Close the top access cover.

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 M.2 and SSD devices installed into the KBox C-104-TGL system.



Because of the limited predetermined lifespan of the M.2/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: 4.4.11 and 6.3.7.

10.3. Replacing the Fan Tray

NOTICE

The operation of the KBox C-104-TGL versions with fan tray extension is permitted only with a functional fan tray!

Defective components may only be replaced by Kontron original spare parts:

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.

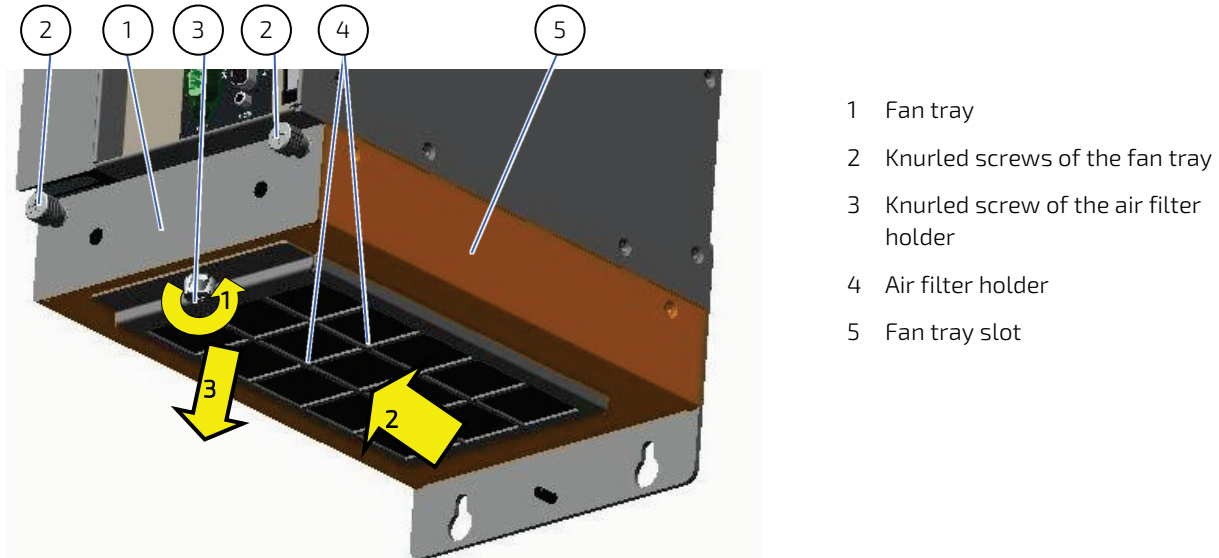
To replace fan tray, proceed as follows:

1. Ensure to have access to the bottom side of the KBox C-104-TGL-4/-2/-1. The fan tray (Figure 58, pos. 1 and Figure 59, pos. 2) may be replaced without removing the air filter holder (Figure 58, pos. 4).
2. Loosen the two knurled screws (Figure 58, pos. 2) of the fan tray.
3. Pull the fan tray (Figure 59, pos. 2) out from the fan tray slot (Figure 59, pos. 3) in order to disconnect the connector for fan power and control (Figure 33, pos. 3) from the internal fan control socket (Figure 59, pos. 10).
4. Pull the fan tray completely out from the fan tray slot (Figure 59, pos. 3).
5. Replace the defective fan tray with a new one.
6. Insert the functional fan tray (Figure 59, pos. 2) into the fan tray slot (Figure 59, pos. 3).
7. Secure the fan tray by fastening the knurled screws (Figure 58, pos. 2). By fastening of the knurled screws the proper insertion of the fan tray into the internal socket (Figure 59, pos. 10) is ensured.

10.4. Cleaning the Air Filter

The air filter is inserted in the holder (Figure 32, pos. 2) at the bottom side of the fan tray slot (Figure 32, pos. 6). The soiling of the air filter (Figure 32, 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 58: Fan tray extension (detail: shown as KBox C-104-TGL-1)



To replace the air filter, proceed as follows:

1. Ensure to have access to the bottom side of the KBox C-104-TGL-4/-2/-1. The air filter may be replaced without removing the fan tray (Figure 58, pos. 1).
2. Loosen the knurled screw (Figure 58, pos. 3) that secures the air filter holder (Figure 58, pos. 4) to the fan tray slot (Figure 58, pos. 5); refer to step 1 in Figure 58.
3. Pull the air filter holder out of the positioning holes, (Figure 59, pos. 9) into the marked direction (see Figure 58) and pull it down. Put the air filter holder aside for later reassembly; refer to step 2 and 3 in Figure 58.
4. Remove the soiled air filter (Figure 58, pos. 3 and Figure 59, 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 59, pos. 8) into the positioning holes (Figure 59, pos. 9).
11. Secure the air filter holder by tightening the knurled screw to the tapped hole (Figure 59, pos. 4) of the fan tray slot (Figure 58, pos. 5 or Figure 59, pos. 3).

NOTICE

Defective components may only be replaced by Kontron original spare parts.



The pictures in this section correspond to a KBox C-104-TGL-2 system.
 The description of the procedure for cleaning the air filter can be applied to all KBox C-104-CFL-4/-2/-1 variants, under consideration of the different mechanical specifications.

Figure 59: KBox C-104-TGL-2 with removed fan tray and removed air filter

Figure 60: Filter mat Holder without air filter

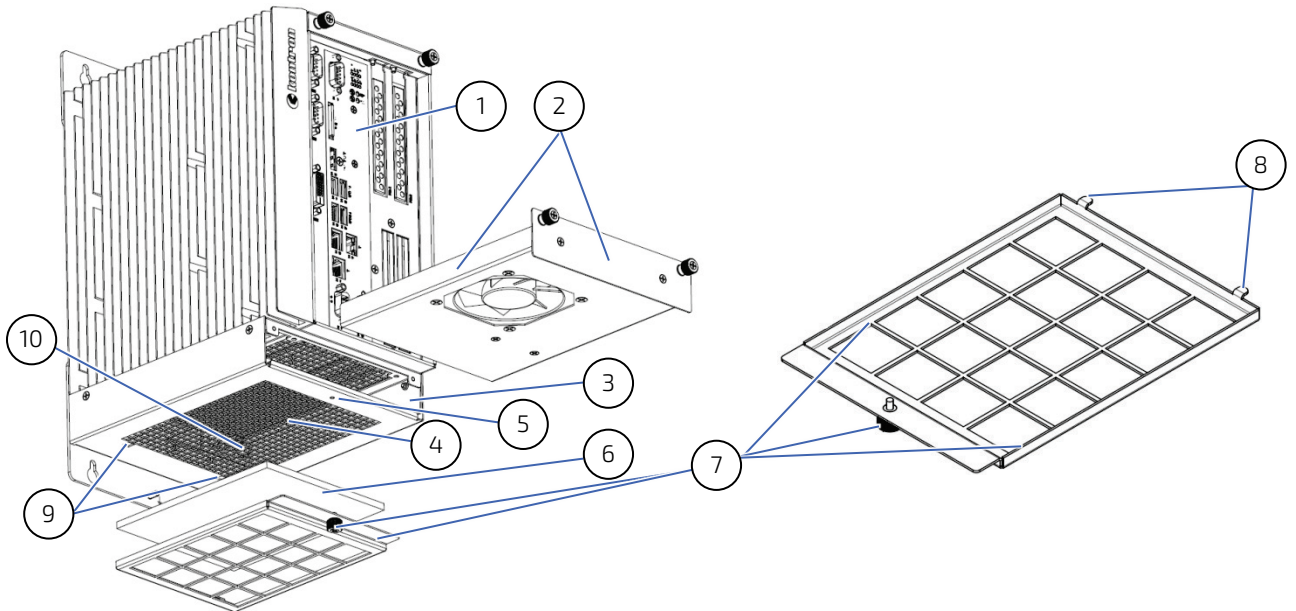
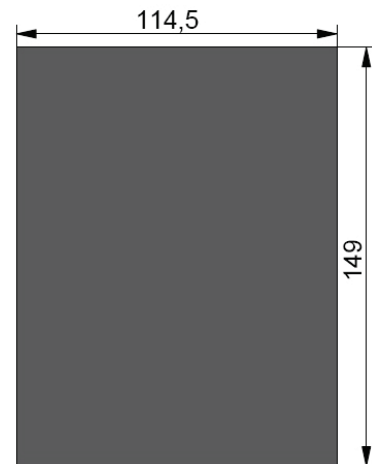
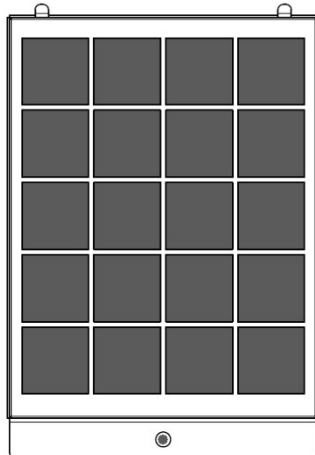


Figure 61: Holder (shown for KBox C-104-TGL-2) with air filter

Figure 62: Air filter (shown for KBox C-104-TGL-2)



- | | |
|--|---|
| <ul style="list-style-type: none"> 1 KBox C-104-TGL 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 | <ul style="list-style-type: none"> 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/ uEFI BIOS

11.1. Starting the uEFI BIOS

The KBox C-104-TGL-x is provided with a Kontron-customized, pre-installed and configured version of AMI Aptio® V uEFI BIOS based on the Unified Extensible Firmware Interface (uEFI) specification and the Intel® Platform Innovation Framework for EFI.



The KBox C-104-TGL-x provides two different COMe modules, COMe-bTL6 and COMe-cTL6. Please refer to the BIOS chapters in the corresponding manuals from our web site <https://customersection.kontron.com> by selecting the product.



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

11.2. The uEFI Shell

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 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/>).



Kontron uEFI BIOS does not provide all shell commands described in the EFI Shell Command Manual.

11.2.1. Basic Operation of the uEFI Shell

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

11.2.1.1. Entering the uEFI Shell

To enter the uEFI Shell, follow the steps below:

1. Power on the board.
2. Press the <F7> key (instead of) to display a choice of boot devices.
3. Choose 'UEFI: Built-in EFI shell'.

```

UEFI Interactive Shell v2.2
EDKII / Kontron add-on v0.1
UEFI v2.70 (American Megatrends, 0x0005000D)
Mapping table:
  FS0:      Alias(s):HD0f0b:;BLK1:
           PciRoot(0x0)/Pci(0x14,0x0)/USB(0x5,0x0)/HD(1,MBR,0x0008131B,0x1,0x6C7ff)
  BLK0:     Alias(s):
           PciRoot(0x0)/Pci(0x14,0x0)/USB(0x5,0x0)

```

4. Press the ESC key within 5 seconds to skip startup.nsh, and any other key to continue.
5. The output produced by the device-mapping table can vary depending on the board's configuration.
6. If the ESC key is pressed before the 5 second timeout elapses, the shell prompt is shown:

```
Shell>
```

11.2.1.2. Exiting the uEFI Shell

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

1. Use 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.

11.3. uEFI Shell Scripting

11.3.1. Startup Scripting

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

1. Initially searches for Kontron flash-stored startup script.
2. If there is no Kontron flash-stored startup script present then 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.
3. If none of the startup scripts are present or the startup script terminates then the default boot order is continued.

11.3.2. 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.

11.3.3. Examples of Startup Scripts

11.3.3.1. Execute Shell Script on Other Harddrive

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
```

11.4. Updating the uEFI BIOS

The KBox C-104-TGL has two SPI boot flashes programmed with the uEFI BIOS, a standard SPI boot flash and a recovery SPI boot flash. The basic idea behind that is to always have at least one working uEFI BIOS flash available regardless if there have been any flashing errors or not.

11.4.1. Updating Procedure

For the BIOS update the customer should follow the instructions in the Readme.txt BIOS package.

11.4.2. uEFI BIOS Recovery

In case of the standard SPI boot flash being corrupted and therefore the KBox C-104-TGL-x not starting up, it can be booted from the recovery SPI boot flash via RESCUE button on the front panel. For further information, refer to the section 4.4.8 "RESCUE Button and RSQ LED".

NOTICE

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.

12/ The Board Management Controller (BMC) on the KBox C-104

12.1. Tasks and Features of the BMC

The Board Management Controller (BMC) performs the following tasks and features:

- ▶ Controlling the power sequence of the CPU module during startup
- ▶ Measuring the board voltages
- ▶ Measuring the board temperature
- ▶ Control of the system LEDs and the General Purpose LEDs
- ▶ Reading of the DIP Switch
- ▶ Monitoring of the optional assembled fans
- ▶ Providing an Operating Time Counter (OTC)
- ▶ Access to a non-volatile memory (EEPROM) with 7936 bytes for general purpose
- ▶ Controlling the EFI firmware bank via the RSQ button
- ▶ Providing a power fail interrupt to the OS.
- ▶ Download and flashing of new firmware versions

12.2. BMC Bootloader

The BMC consists of two parts, which work hand in hand:

- ▶ BMC bootloader
- ▶ BMC firmware application

First, when booting the KBox, the controller starts the BMC bootloader. This bootloader is responsible for verifying, whether a firmware application is available at a certain memory location in the controller. If yes, the bootloader hands over to the firmware application, which will do its startup and control the board. If no firmware application is available, the BMC bootloader stays active and handles further actions as for example the power sequencing of the CPU module and waiting for a firmware application download.

12.2.1. BMC Bootloader LED

Four LEDs (GP1 to GP4) indicate the various states of the bootloader. These four LEDs are controlled like one single LED during boot and will be called "Bootloader LED" in the following.

Table 21: States of the Bootloader LED

Status of Bootloader LED	Description
Permanent red	Bootloader started, FW application not available or not valid
Blinking red	Bootloader started in "Forced Bootloader Mode"
Permanent green	Bootloader started, FW application is valid and so the bootloader will jump into FW application. This happens so fast, that this Bootloader LED state is hardly visible.

12.2.2. Forced Bootloader Mode

In case, a Firmware Application is not responsive or a previously update of the FW was not successful, the Bootloader can be forced to remain in the bootloader mode by pressing the power button during the power-on in a power cycle.

A power cycle is defined as switch off the power supply voltage, wait for about 10 seconds and then switch on again.

In "forced bootloader mode", the bootloader can download a new firmware application at any time.

NOTICE

If the firmware application is running, a download of a new firmware is also possible. The forced bootloader mode is then not necessary. In fact, this mode is only for unexpected occurrences with the firmware application.

12.2.3. Download of a Firmware Application

The download of a new firmware application can be done by the bootloader or under the currently running firmware application and is in both variants the same.

A detailed and latest description for the download is also available in the README text file of the provided firmware package.

Procedure for the firmware update:

- a) Start the Windows Commandline "cmd.exe" (type "cmd" in the Windows Search Textbox) or alternatively the Windows Powershell.
- b) Type following command: (<path> is the folder path to the file)

```
<path>\Bootloader_Console.exe -c=COMx -f=<path>\KBox-C104-FW-App_<version>.hex
```

- c) The FW should now be downloaded to the Controller Flash. After the download and verification, the KBox must perform a power cycle, in order to run the new downloaded Firmware version.

12.3. BMC Firmware Application

The firmware application performs various duties when started automatically by the bootloader. Most of them are done automatically and others can be controlled by the KEAPI, the embedded API by Kontron.

12.3.1. The Power-On LED (PWR)

When the KBox started successfully, the FW application performs a power sequencing to provide all the needed voltages to the CPU module. When all state machines of the sequencing were successful, the CPU will work in S0 state and indicates this with the PWR LED, which will be permanent green.

When going to a sleep state, the PWR LED will blink green in a low frequency.

When being in shutdown, the PWR LED blinks green shortly. A restart is possible by pressing the PWR button or a power cycle.

12.3.2. The Rescue LED (RSQ)

Normally the EFI will be started from the CPU module. The KBox also provides a secondary rescue flash for the EFI on the baseboard, which can be controlled via the RSQ button.

When the RSQ button has been pressed, the RSQ LED will be permanent red and indicates the start of the EFI from the baseboard.

NOTICE

Pressing the RSQ button will perform an immediate reset of the system.

12.3.3. Access to the Firmware Application

Part of the Board Support Package (BSP) for the KBox is the so-called "Kontron Embedded Application Programming Interface", short KEAPI. This API can be used to interact with the FW application of the BMC. It is possible to obtain the current temperature value of the system, the voltages applied to the KBox or reading the current state of the DIP-Switch. It is further possible to switch the GP LEDs in different colors or reading and writing data to the internal EEPROM, connected on the BMC.

The KEAPI comes with a tool named "ktool", which demonstrates the usage of the KEAPI. The source code is provided. A documentation is also available in the KEAPI package.

12.4. Special Considerations with the FW Application

12.4.1. Fan monitoring and the "TH" LED

The KBox can be equipped with a cooling fan. If such a fan is installed, the DIP switch #6 must be in "on" state. In this case, the FW application will control, whether the connected fan is running with the desired rotation frequency, provided from the module's CPLD.

If the FW application detects a non-rotating fan, the Thermal LED "TH" will be red, otherwise green.

The FW application also monitors all the time the TH trip point signal from the CPU module. If the module signals a CPU overheating, the FW application immediately performs a power-off and signals this catastrophic state with a blinking "TH" LED in red.

12.4.2. Watchdog and the "WD" LED

When watchdog is active on the CPU module (via EFI or Application) and a timeout occurred, the FW application reads the watchdog signal from the module and indicates its state via the WD LED. For this, the EFI setting must be set accordingly.

12.4.3. Power Fail Interrupt

For using a power fail interrupt by the FW application, the EFI setting for GPIO Interrupt must be set to GPI-0. When an error occurs with the power supply voltage (< 18V) then an interrupt will be generated to the CPU module via the GPI-0. This power fail interrupt can be delayed between 0ms and 25ms (default is 10ms) to avoid a false alarm by a short glitch with power voltage. This delay value can be configured with KEAPI.

12.4.4. The Operating Time Counter (OTC)

The FW application sets a counter every 10 minutes and saves this in the internal EEPROM, which is not accessible by the user. This value can be read (but not written) via the KEAPI.

For example, a counter value of 360 means, the KBox is running since 3600 minutes.

12.4.5. Access to the USER Partition of the EEPROM

The BMC controller provides an area of 7936 Bytes for any user data to store in a non-volatile memory. Data can be send and retrieved by the usage of KEAPI.

NOTICE

A read or write cycle can only handle a maximum of 32 Bytes due to the page size of the EEPROM. If more data must be read or written, the API call must be split to several calls. However, the user need not to care about page aligning, as this is handled by the firmware.

13/ Technical Specifications

Table 22: Technical Specifications

KBox C-104-TGL Family	
Installed COM Express Module and Baseboard	Baseboard with COMe-bTL6 6600HE or Baseboard with COMe-bTL6 i3-11100HE or Baseboard with COMe-bTL6 i5-11500HE or Baseboard with COMe-bTL6 i7-11850HE or Baseboard with COMe-bTL6 W-11555MRE or Baseboard with COMe-bTL6 W-11865MRE or Baseboard with COMe-cTL6 i5-1145GRE or Baseboard with COMe-cTL6 i7-1185GRE
Processor	Intel® Celeron™ 6600HE, 2x 2.6 GHz, 35W max. power consumption Intel® Core™ i3-11100HE, 4x 2.4 GHz, 45W max. power consumption Intel® Core™ i5-11500HE, 6x 2.6 GHz, 45W max. power consumption Intel® Core™ i7-11850HE, 8x 2.6 GHz, 45W max. power consumption Intel® XEON™ W-11555MRE, 6x 2.6 GHz, 45W max. power consumption, TCC & TSN Intel® XEON™ W-11865MRE, 8x 2.6 GHz, 45W max. power consumption, TCC & TSN Intel® Core™ i5-1145GRE, 4x 1.5 GHz, 15W max. power consumption, TCC & TSN, Iris Xe graphics Intel® Core™ i7-1185GRE, 4x 1.8 GHz, 15W max. power consumption, TCC & TSN, Iris Xe graphics
RAM	Up to 64 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) TH (Thermal LED) DR (HDD/SSD status LED) M2 (M.2 Card status LED) WD (Watchdog status LED) GP1-4 (General purpose LEDs)
Interfaces (front side accessible)	4x Ethernet (10/100/1000/2500 Mbit/s) 3x USB 3.0 3x USB 2.0 2x DisplayPort 1x Serial port (RS232/RS422/RS485)
DC IN Connector (at the front side)	3-pin DC input connector
Protection Class	IP20
Lithium Battery (internally accessible)	CR 2032, 3 V
Rated Voltage (tolerance)	24 VDC/6 A (+20% / - 20%), up to 20ms hold-up (depending on configuration)

13.1. Mechanical Specifications of the KBox C-104-TGL

13.1.1. Mechanical Specifications of the KBox C-104-TGL-4

Figure 63: Dimensions: right side (KBox C-104-TGL-4)

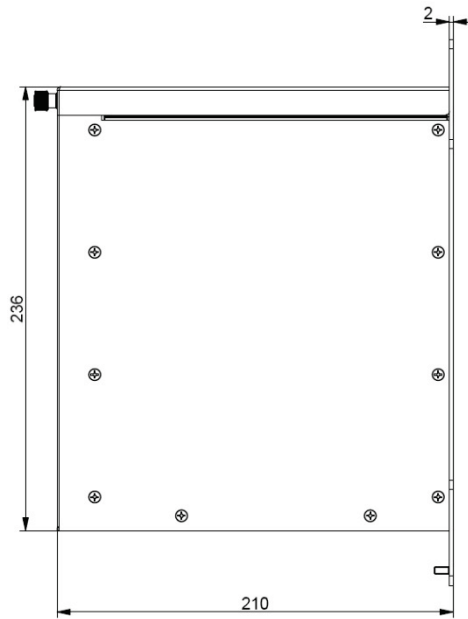


Figure 64: Dimensions: front side with key holes (KBox C-104-TGL-4)

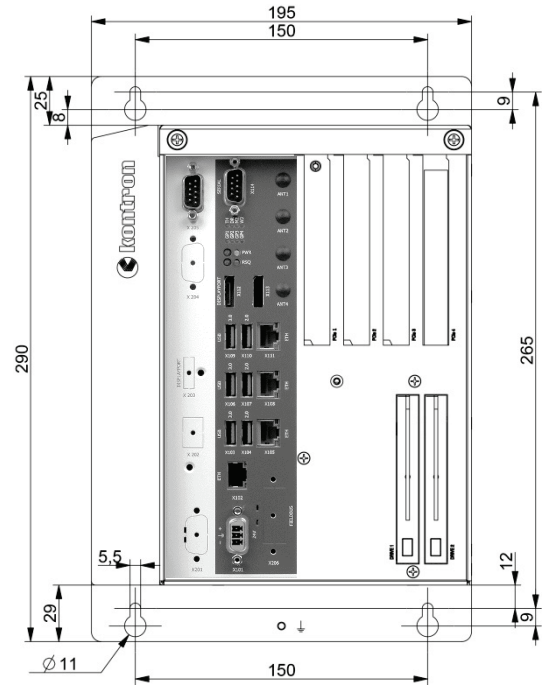


Figure 65: Dimensions: detail key hole (KBox C-104-TGL-4)

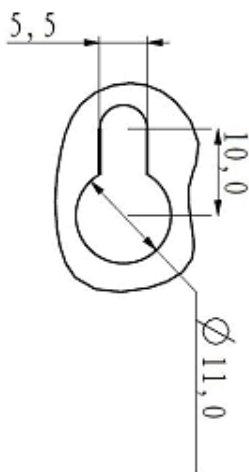
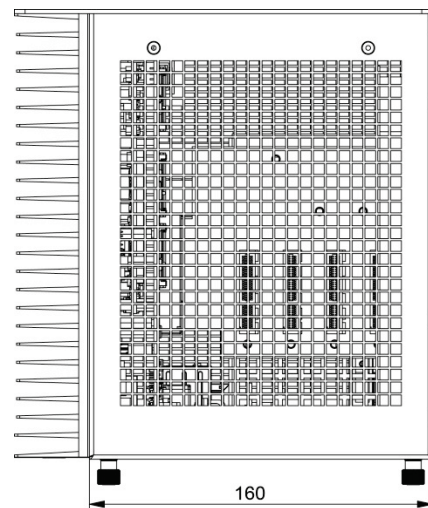


Figure 66: Dimensions: top side (KBox C-104-TGL-4)



13.1.2. Mechanical Specifications of the KBox C-104-TGL-4 with Fan Tray Option

Figure 67: Dimensions: right side
(KBox C-104-TGL-4 with fan tray option)

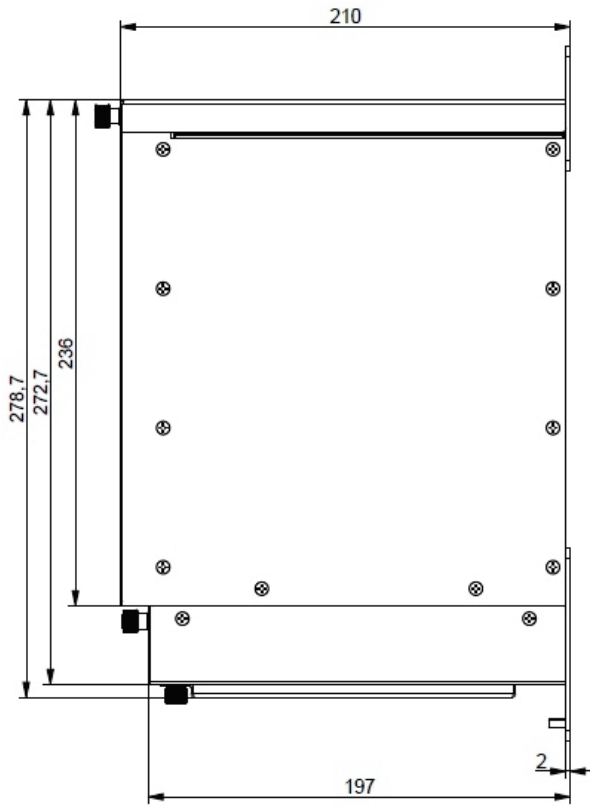


Figure 69: Dimensions: detail key hole
(KBox C-104-TGL-4 with fan tray option)

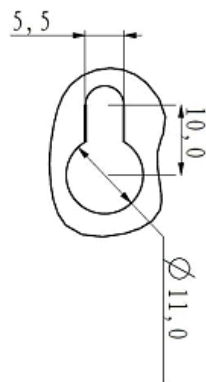


Figure 68: Dimensions: front side with key holes
(KBox C-104-TGL-4 with fan tray option)

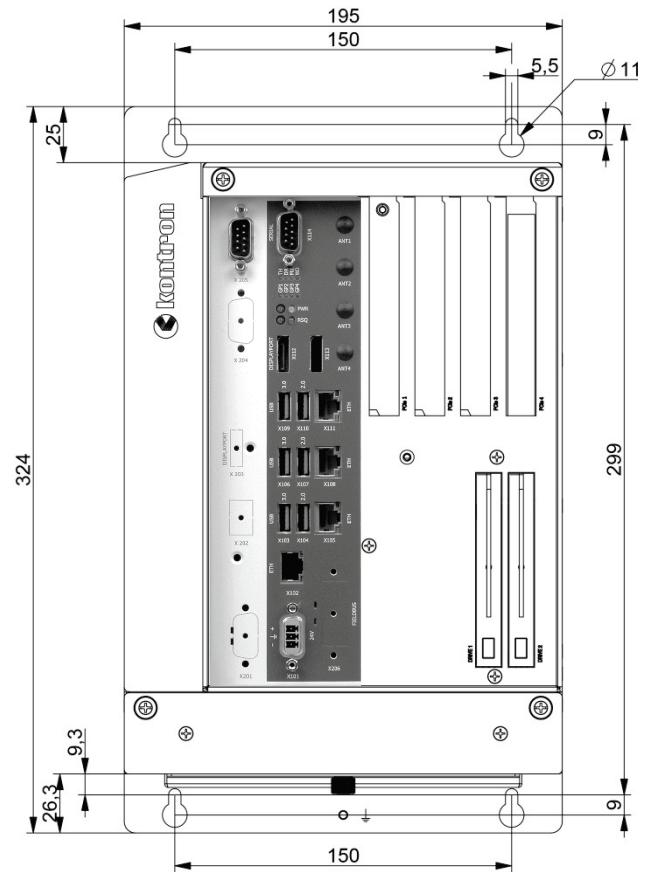


Figure 70: Dimensions: top side
(KBox C-104-TGL-4 with fan tray option)

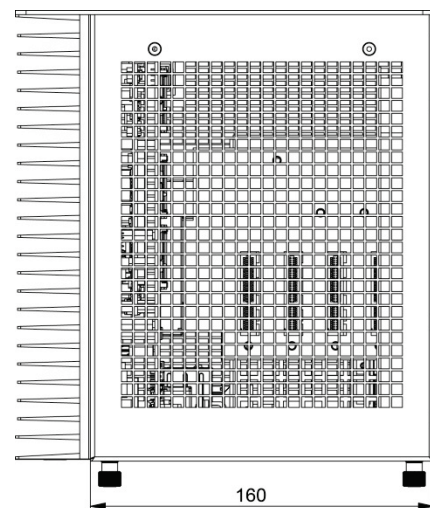


Table 24: Mechanical Specifications of the KBox C-104-TGL-4

Dimensions	KBox C-104-TGL-4 (Standard Version)	KBox C-104-TGL-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. 5.2 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)	

13.1.3. Mechanical Specifications of the KBox C-104-TGL-2

Figure 71: Dimensions: right side (KBox C-104-TGL-2)

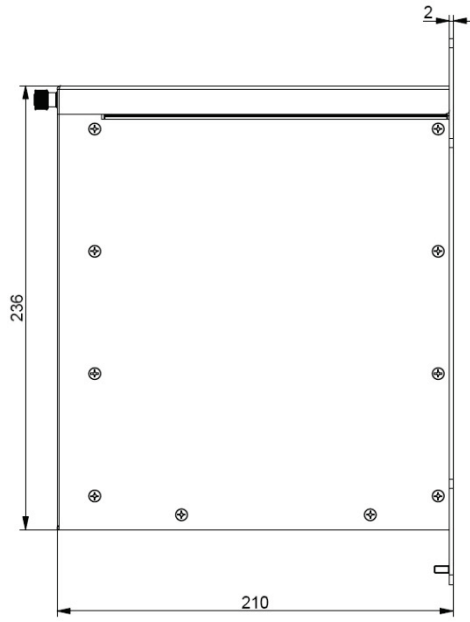


Figure 72: Dimensions: front side with key holes (KBox C-104-TGL-2)

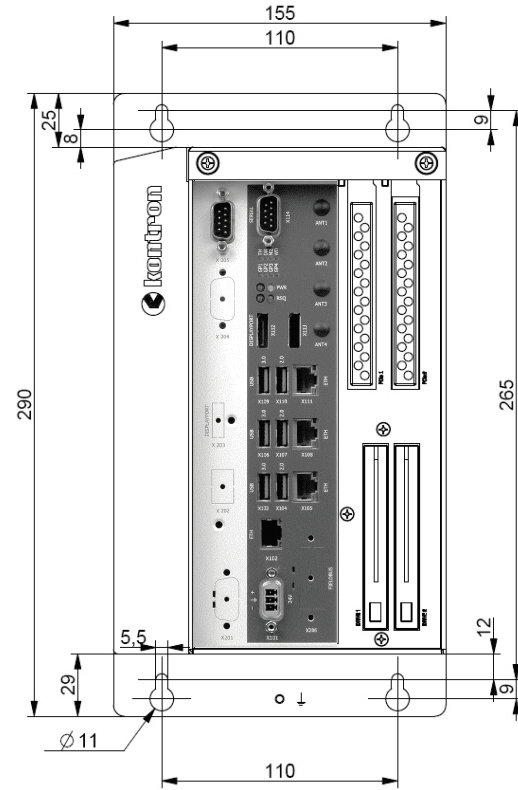


Figure 73: Dimensions: detail key hole (KBox C-104-TGL-2)

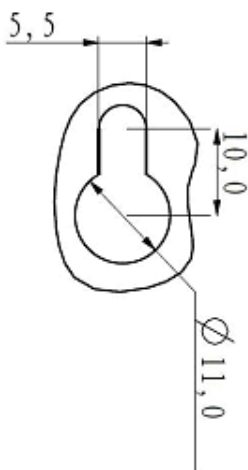
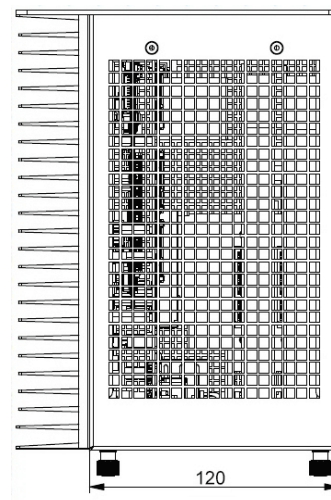


Figure 74: Dimensions: top side (KBox C-104-TGL-2)



13.1.4. Mechanical Specifications of the KBox C-104-TGL-2 with Fan Tray Option

Figure 75: Dimensions: right side
(KBox C-104-TGL-2 with fan tray option)

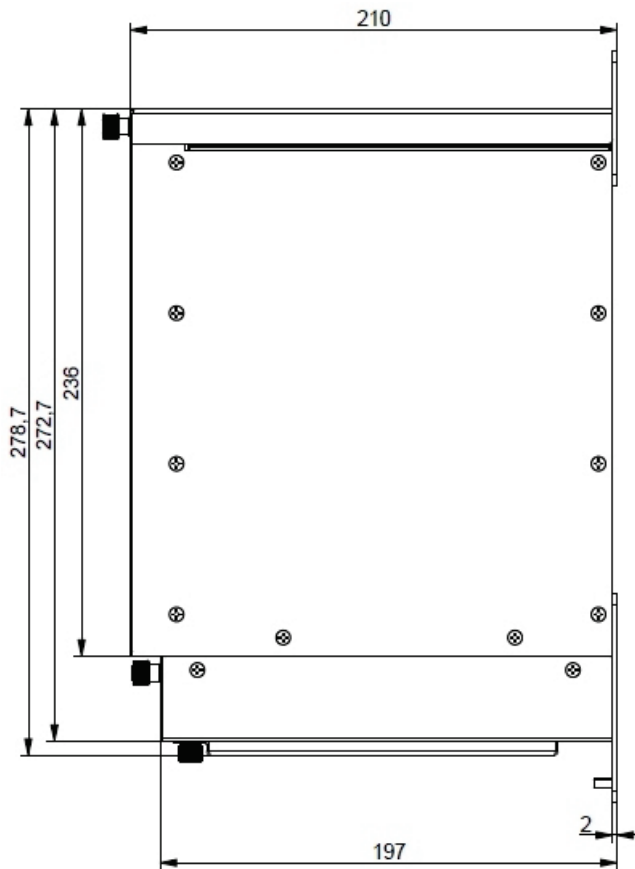


Figure 77: Dimensions: detail key hole
(KBox C-104-TGL-2 with fan tray option)

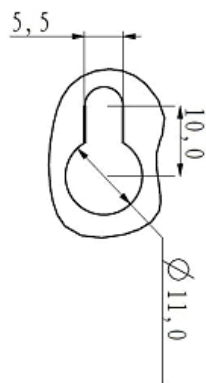


Figure 76: Dimensions: front side with key holes
(KBox C-104-TGL-2 with fan tray option)

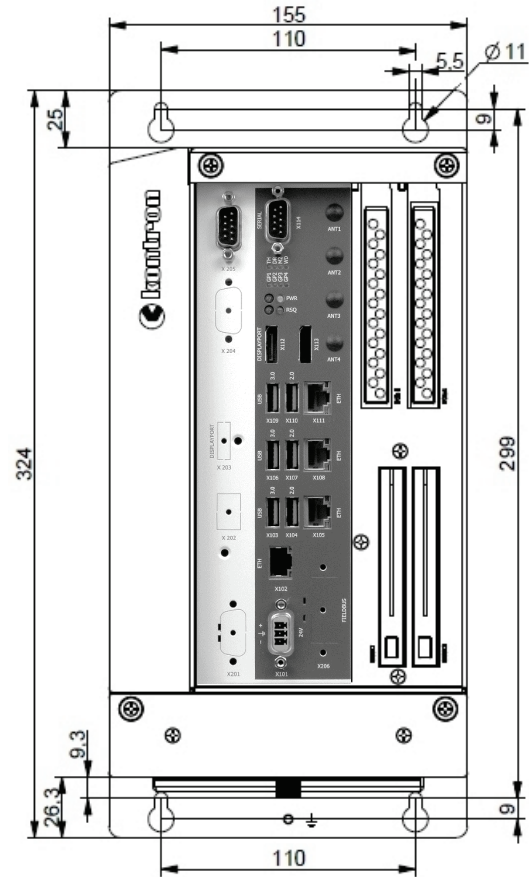


Figure 78: Dimensions: top side
(KBox C-104-TGL-2 with fan tray option)

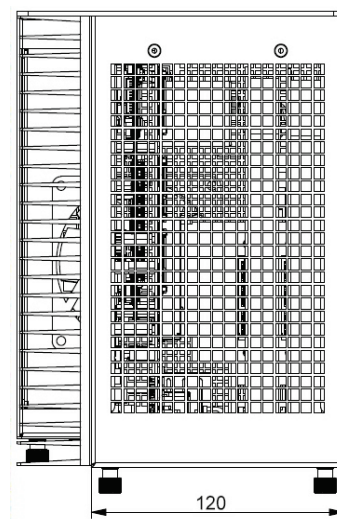


Table 25: Mechanical Specifications of the KBox C-104-TGL-2

Dimensions	KBox C-104-TGL-2 (Standard Version)	KBox C-104-TGL-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)	

13.1.5. Mechanical Specifications of the KBox C-104-TGL-1

Figure 79: Dimensions: right side (KBox C-104-TGL-1)

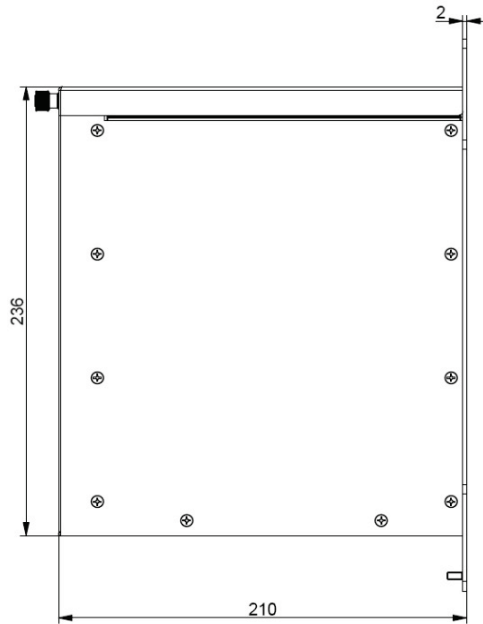


Figure 80: Dimensions: front side with key holes (KBox C-104-TGL-1)

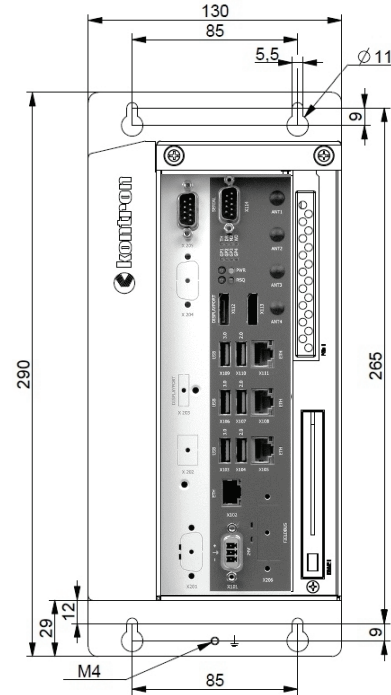


Figure 81: Dimensions: detail key hole (KBox C-104-TGL-1)

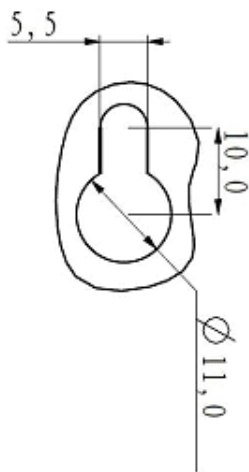
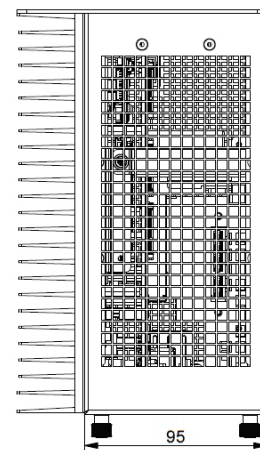


Figure 82: Dimensions: top side (KBox C-104-TGL-1)



13.1.6. Mechanical Specifications of the KBox C-104-TGL-1 with Fan Tray Option

Figure 83: Dimensions: right side
(KBox C-104-TGL-1 with fan tray option)

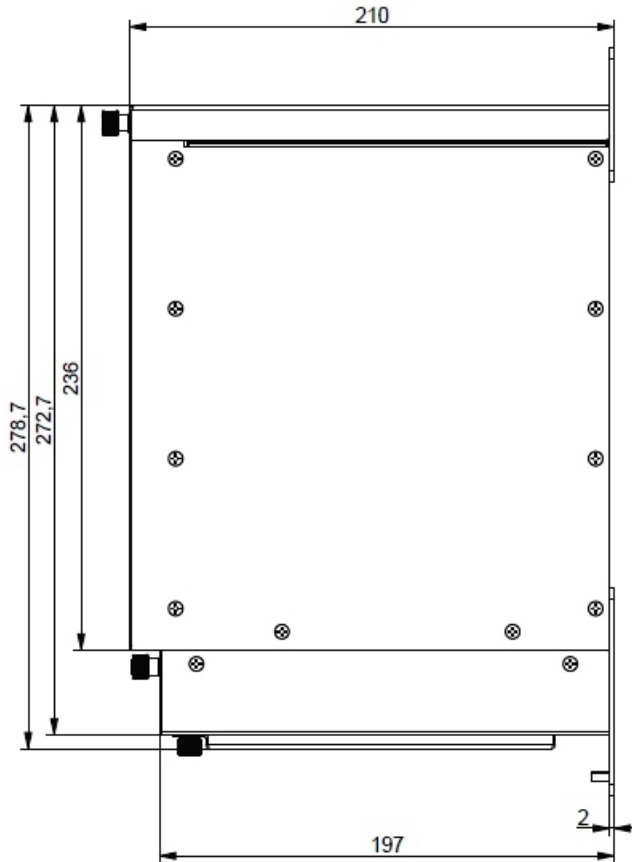


Figure 84: Dimensions: front side with key holes
(KBox C-104-TGL-1 with fan tray option)

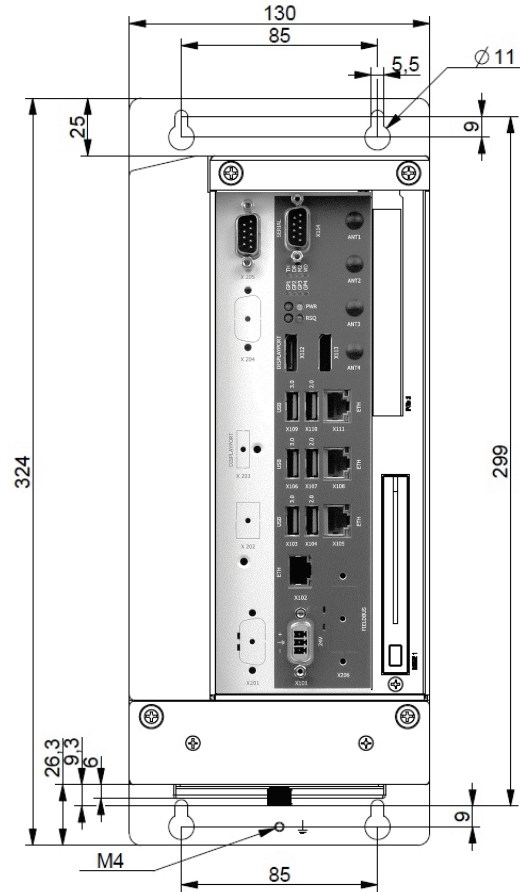


Figure 85: Dimensions: detail key hole
(KBox C-104-TGL-1 with fan tray option)

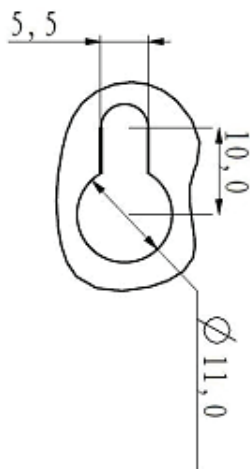


Figure 86: Dimensions: top side
(KBox C-104-TGL-1 with fan tray option)

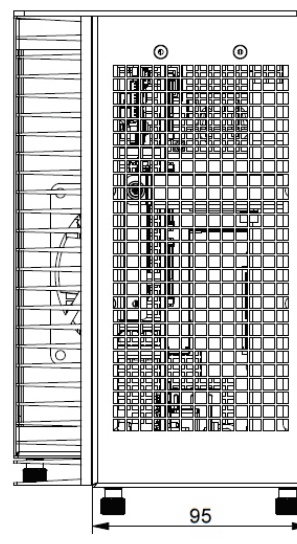


Table 26: Mechanical Specifications of the KBox C-104-TGL-1

Dimensions	KBox C-104-TGL-1 (Standard Version)	KBox C-104-TGL-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)	

13.1.7. Mechanical Specifications of the KBox C-104-TGL-0

Figure 87: Dimensions: right side (KBox C-104-TGL-0)

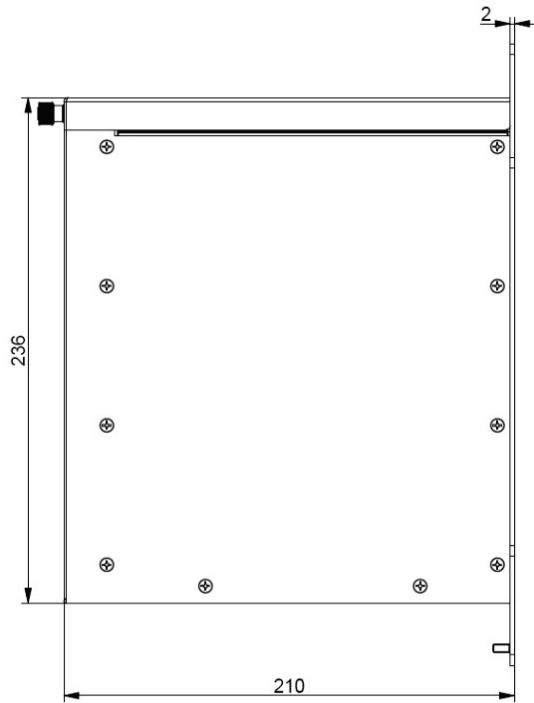


Figure 88: Dimensions: front side with key holes (KBox C-104-TGL-0)

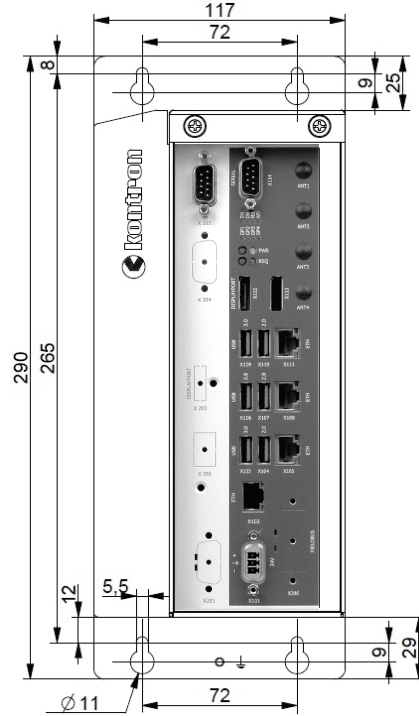


Figure 89: Dimensions: detail key hole (KBox C-104-TGL-0)

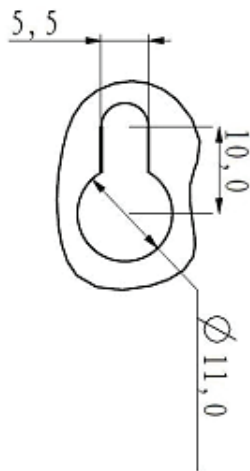


Figure 90: Dimensions: top side (KBox C-104-TGL-0)

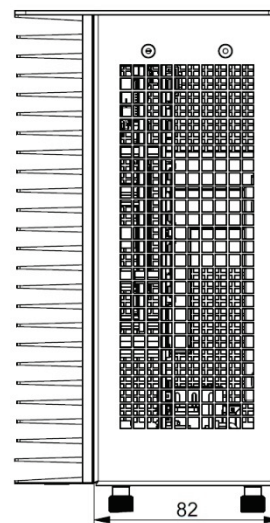


Table 27: Mechanical Specifications of the KBox C-104-TGL-0

Dimensions	KBox C-104-TGL-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)

13.2. Environmental Specifications

Table 28: Environmental Specifications

	KBox C-104-TGL
Thermal Management	Convection cooling/with fan
Operating Temperature (with Fan Tray)	Intel® Celeron™ 6600HE 0°C to +65°C (32°F to 149°F) Intel® Core™ i3-11100HE 0°C to +65°C (32°F to 149°F) Intel® Core™ i5-11500HE 0°C to +65°C (32°F to 149°F) Intel® Core™ i7-11850HE: 0°C to +65°C (32°F to 149°F) Intel® XEON™ W-11555MRE -40°C to +65°C (-40°F to 149°F) Intel® XEON™ W-11865MRE -40°C to +65°C (-40°F to 140°F) Intel® Core™ i5-1145GRE -40°C to +70°C (-40°F to 158°F) Intel® Core™ i7-1185GRE -40°C to +70°C (-40°F to 158°F)
Operating Temperature (w/o Fan Tray)	Intel® Celeron™ 6600HE 0°C to +65°C (32°F to 149°F) Intel® Core™ i3-11100HE 0°C to +65°C (32°F to 149°F) Intel® Core™ i5-11500HE 0°C to +65°C (32°F to 149°F) Intel® Core™ i7-11850HE: 0°C to +65°C (32°F to 149°F) Intel® XEON™ W-11555MRE -40°C to +65°C (-40°F to 149°F) Intel® XEON™ W-11865MRE -40°C to +60°C (32°F to 140°F) Intel® Core™ i5-1145GRE -40°C to +70°C (-40°F to 158°F) Intel® Core™ i7-1185GRE -40°C to +70°C (-40°F to 158°F)
Storage / Transit Temperature	-40°C ... +75°C (-40°F to 167°F)
Relative Humidity (Operating)	93 % @ 40 °C (non condensing) acc. to IEC 60068-2-78
Max. Operation Altitude	2,000 m
Max. Storage / Transit Altitude	10,000 m
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	10 Hz - 150 Hz, 2 G, acc. to IEC 60068-2-6
Operating Vibration	10 Hz - 150 Hz, 1 G, acc. to IEC 60068-2-6
Pollution Degree	2

13.3. Standards, Certifications and Directives Compliance

Table 29: Standards, Certifications and Directives Compliance

CE-Mark Compliant with EU Directives	Electromagnetic Compatibility	Directive 2014/30/EU
	Low Voltage	Directive 2014/35/EU
	Radio Equipment Directive (RED)	Directive 2014/53/EU
	RoHS II	Directive 2011/65/EU
EMC 2014/30/EU Emission	CISPR 11 EN 55011	Industrial, scientific and medical equipment - Radio-frequency disturbance characteristics - Limits and methods of measurement
EMC 2014/30/EU Immunity	EN 61000-6-2	Electromagnetic compatibility (EMC), part 6-2: Generic standards- Immunity for industrial environment
RED 2014/53/EU <i>Article 3.1(b)</i>	EN 301 489-1 V2.2.0	ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 1: Common technical requirements; Harmonised Standard covering the essential requirements of article 3.1(b) of Directive 2014/53/EU and the essential requirements of article 6 of Directive 2014/30/EU
	<i>EN 301 489-17 V3.1.1</i>	ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 17: Specific conditions for Broadband Data Transmission Systems; Harmonised Standard covering the essential requirements of article 3.1(b) of Directive 2014/53/EU
	<i>EN 301 893 V2.1.1</i>	5 GHz RLAN; Harmonised Standard covering the essential requirements of article 3.2 of Directive 2014/53/EU
RF Spectrum Efficiency & Spurious Emission 2014/53/EU <i>Article 3.2</i>	EN 300 328 V2.1.1	Wideband transmission systems; Data transmission equipment operating in the 2,4 GHz ISM band and using wide band modulation techniques; Harmonised Standard covering the essential requirements of article 3.2 of Directive 2014/53/EU
	<i>EN 301 511 V12.5.1</i>	<i>Global System for Mobile communications (GSM); Mobile Stations (MS) equipment; Harmonised Standard covering the essential requirements of article 3.2 of Directive 2014/53/EU</i>
	EN 301 908-1 V11.1.1	<i>IMT cellular networks; Harmonised Standard covering the essential requirements of article 3.2 of the Directive 2014/53/EU; Part 1: Introduction and common requirements</i>
	<i>EN 301 908-2 V11.1.2</i>	<i>IMT cellular networks; Harmonised Standard covering the essential requirements of article 3.2 of Directive 2014/53/EU; Part 2: CDMA Direct Spread (UTRA FDD) User Equipment (UE)</i>
	<i>EN 301 908-13 V11.1.2</i>	<i>IMT cellular networks; Harmonised Standard covering the essential requirements of article 3.2 of Directive 2014/53/EU; Part 13: Evolved Universal Terrestrial Radio Access (E-UTRA) User Equipment (UE)</i>
FCC CFR 47 Part 15, Subpart B	ANSI C63.4 CISPR 16 ICES-003	The American National Standards Institute standard ANSI C63.4 is the key standard for measuring electrical and electronic equipment for showing compliance to FCC and Industry Canada regulations.

Safety 2014/35/EU	IEC 61010-1 EN 61010-1 UL 61010-1	Safety requirements for electrical equipment for measurement, control and laboratory use - Part 1: General requirements
	IEC 61010-2-201 EN 61010-2-201 UL 61010-2-201	Safety requirements for electrical equipment for measurement, control and laboratory use - Part 2-201: Particular requirements for control equipment
Safety and Health 2014/35/EU 2014/53/EU <i>Article 3.1(a)</i>	EN 62311	Assessment of the compliance of low power electronic and electrical equipment with the basic restrictions related to human exposure to electromagnetic fields (10 MHz to 300 GHz)
WEEE 2002/96/EC	The Waste Electrical and Electronic Equipment Directive (WEEE Directive)	Compliant with the Waste Electrical and Electronic Equipment (WEEE) directive to reduce waste of electrical and electronic equipment, encourage recycling and environmental disposal and increase the environmental awareness of producers

Table 30: Electrical Safety

Electrical Safety	Harmonized Standards
EUROPE	EN 61010-2-201
U.S.A. / CANADA	Conform UL 61010-1, UL 61010-2-201 Certified to CAN/CSA-C22.2 No. 61010-1-12, CSA C22.2 No. 61010-2-201:18
CB Report	IEC 61010-1:2010/AMD1:2016/COR1:2019 IEC 61010-2-201:2017
Listed Mark	UL

Table 31: 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)

NOTICE

For save operation (UL approval) it is mandatory that all PCIe extension boards are UL certified/recognized. The PCIe slots do not have limited energy approval.

13.4. Power Supply Specification

Before connecting the product to a mains power supply, ensure that the power supply meets the required electrical specification for the product and that protection and supply limitation have been taken into consideration. The power supply used must also automatically recover from AC power loss and start up under peak loading.

Connect the product only to a power supply designed to achieve NEC Class-2 and Limited Power Source (LPS).

Table 32: KBox C-104-TGL-x Electrical Specification

Nominal Input Voltage	24 VDC
Input Voltage Range	17 VDC to 36 VDC
Input Current	6.0 A max.
Inrush Current	10 A max. (at 17 VDC)
Power	140 W (max.)

⚠ CAUTION

Observed that wiring and short-circuit/overcurrent protection is performed according to the applicable standards, regulations and in respect to the product's electrical specification. The disconnecting device (fuse/circuit breaker) rating must be in accordance with the product's wire cross-section

NOTICE

Only connect to an external power supply delivering the specified input rating and complying with the requirements of Safety Extra Low Voltage (SELV) and Limited Power Source (L.P.S.) of UL/IEC 60950-1 or (PS2) of UL/IEC 62368-1.

NOTICE

Ensure that the power supply is used according to the manufacturer's instructions.

NOTICE

Ensure the power supply has been fully tested to at least meet the minimum immunity of AC inputs requirements, as stipulated in IEC 55024. Including power supplies marketed with a separate AC/DC power converter.

13.4.1. Power Supply Protection Requirements

The used external power supply is required to incorporate protection and supply features such as over current protection, inrush current protection, over voltage protection and undervoltage (brownout) protection, to protect the product against fluctuations and interruptions in the delivered DC power supply.

NOTICE

If an under voltage (brownout) condition occurs, the used power supply must remain in the "off state" long enough to allow internal voltages to discharge sufficiently. Failure to observe this "off state" may mean that parts of the product or peripherals work incorrectly or suffer a reduction of MTBF. The minimum "off state", to allow internal voltages to discharge sufficiently, is dependent on the power supply and additional electrical factors. To determine the required "off state", each case must be considered individually. For more information, contact Kontron Support.

13.4.2. Power Consumption

The used external power supply must be capable of delivering the product with the required power when configured with all components. The total power consumption depends on factors such as the CPU, interfaces, and system/memory expansion.



The external power supply must supply power to all configured components.

13.4.3. Protective Earth Stud Bolt

The protective earth stud bolt connects to the internal chassis GND. The protective earth stud bolt is located at the bottom of the System.

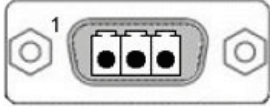
When installing cables to the product the first cable connection must be to the protective earth stud bolt and when disconnecting the last cable to be disconnected must be from the protective earth stud bolt

14/ Standard Interfaces – Pin Assignments

Low-active signals are indicated by a minus sign.

14.1.1. (X101) Power Input Connector

Table 33: (X101) Power Input Connector

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

14.1.2. (X102, X105, X108, X111) Ethernet Connectors

Table 34: (X105, X108, X111) Ethernet Connectors

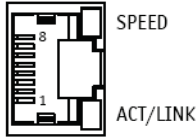
Pin	Signal Name	X105, X108, X111 Ethernet (RJ45)
1	MDI0+	
2	MDI0-	
3	MDI1+	
4	MDI2+	
5	MDI2-	
6	MDI1-	
7	MDI3+	
8	MDI3-	

Table 35: (X102) Ethernet Connector

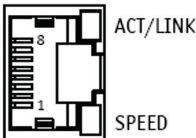
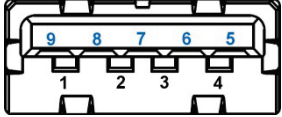
Pin	Signal Name	X102 Ethernet (RJ45)
1	MDI0+	
2	MDI0-	
3	MDI1+	
4	MDI2+	
5	MDI2-	
6	MDI1-	
7	MDI3+	
8	MDI3-	

Table 36: Ethernet Status LEDs

Speed (Mbps)		LINK/ACT	
		LINK	ACTIVE
10	off	Green on	Green off (blinking)
100	green	Green on	Green off (blinking)
1000	orange	Green on	Green off (blinking)
2500	orange	Green on	Green off (blinking)


14.1.3. (X103, X106, X109) USB 3.0 Ports

Table 37: (X103, X106, X109) USB 3.0 Ports

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+	

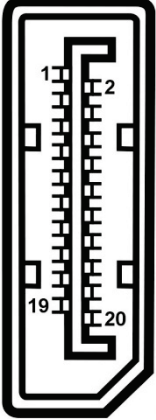
14.1.4. (X104, X107, X110) USB 2.0 Ports

Table 38: (X104, X107, X110) USB 2.0 Ports

Pin	Signal Name	4-pin USB Connector Typ A Version 2.0
1	VCC fused (500 mA max.)	
2	Data-	
3	Data+	
4	GND	

14.1.5. (X112, X113, X203) DisplayPorts

Table 39: (X112, X113, X203) DisplayPorts

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

14.1.6. (X114 and optional X205, X204) Serial Interface (RS232, RS422, RS485)

Default factory setting of the serial port is RS232 mode.

The mode can be reconfigured by software under Windows or Linux.

Reprogram FT230x with FTDI software FT-PROG.

For Windows download from FTDI Website https://ftdichip.com/wp-content/uploads/2021/01/FT_PROG.zip

For Linux there is a utility on Github: <https://github.com/richardeoin/ftx-prog>

To reprogram the FT230 RS mode set the CBUS signals to following parameters and perform a power cycle after succesfull programming:

Table 40: RS Mode Configuration

CBUS signal	RS232	RS485	RS422
C0 (Direction)	TXDEN	TXDEN	TXDEN
C1 (Mode0)	Drive_1	Drive_0	Drive_1
C2 (Mode1)	Drive_0	Drive_1	Drive_1
C3 (Termination*)	Drive_0	Drive_*	Drive_*

*: 0=off / 1=on

NOTICE

It is advised to use external termination resistor of 120 Ohm for RS422 and RS485 if needed and set CBUS C3 to Drive_0. In case the system is powered off the resistance on the RS422 or RS485 bus is still needed.

Table 41: (X114, X205, X204) Serial Interface, configured as RS232

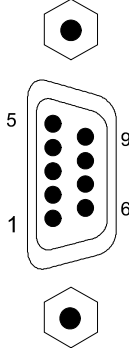
Pin	Signal Name	9-pin D-SUB Connector (male)
1	DCD (Data Carrier Detect)	
2	RXD (Receive Data)	
3	TXD (Transmit Data)	
4	DTR (Data Terminal Ready)	
5	GND (Signal Ground)	
6	DSR (Data Set Ready)	
7	RTS (Request to Send)	
8	CTS (Clear to Send)	
9	RI (Ring Indicator)	

Table 42: (X114, X205, X204) Serial Interface, configured as RS485

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

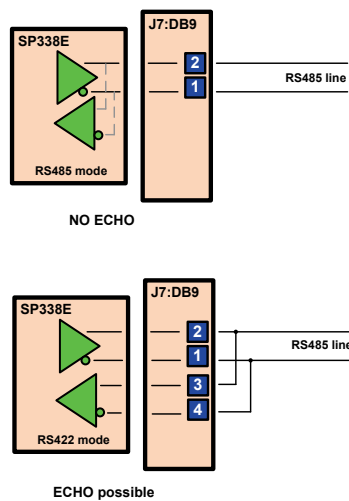
Table 43: (X114, X205, X204) Serial Interface, configured as RS422

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



If RS485 is needed in Echo mode, the RS422 mode must be selected and the lines must be connected according below picture.

Figure 91: RS485 Echo mode configuration



14.2. Optional Interfaces via Adapter Modules

14.2.1. (X201) 2nd Power Input Connector

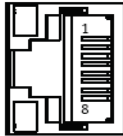
For pin assignment, refer to 14.1.1.

14.2.2. (X 202) WideLink



This port must be factory installed and configured only.
 Your KBox C-104 can either be equipped with a 3rd DisplayPort or a WideLink port.
 Only one of these two interfaces (WideLink and DP 3) can be ordered as optional extension of your system.

Table 44: (X201) WideLink

Pin #	Signal Name	WideLink (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

14.2.3. (X203) 3rd DisplayPort

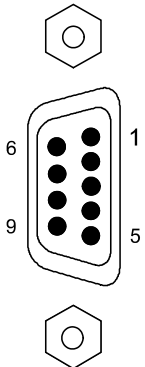
For pin assignment, refer to 14.1.5.



This port must be factory installed and configured only.
 Your KBox C-104 can either be equipped with a 3rd DisplayPort or a WideLink port.
 Only one of these two interfaces (WideLink and DP 3) can be ordered as optional extension of your system.

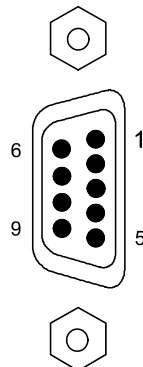
14.2.3.1. Serial Debug Port RS232 (X205)

Table 45: Serial Debug Port RS232

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

14.2.4. (X 204) CAN Bus Port

Table 46: (X204) CAN Bus Port

Pin	Signal Name	9-pin D-SUB Connector (male)
1	NC (not connected)	
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	NC (not connected)	
9	NC (not connected)	



About Kontron

Kontron is a global leader in IoT/Embedded Computing Technology (ECT). Kontron offers individual solutions in the areas of Internet of Things (IoT) and Industry 4.0 through a combined portfolio of hardware, software and services. With its standard and customized products based on highly reliable state-of-the-art technologies, Kontron provides secure and innovative applications for a wide variety of industries. As a result, customers benefit from accelerated time-to-market, lower total cost of ownership, extended product lifecycles and the best fully integrated applications.

For more information, please visit: www.kontron.com



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