kontron

» TRACe-TR Family «

Getting Started

SD.DT.G40-1e - April 2015

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Environmental Protection Statement

This product has been manufactured to satisfy environmental protection requirements where possible. Many of the components used (structural parts, printed circuit boards, connectors, batteries, etc.) are capable of being recycled.

Final disposition of this product after its service life must be accomplished in accordance with applicable country, state, or local laws or regulations.

Environmental protection is a high priority with Kontron.

Kontron follows the DEEE/WEEE directive.

You are encouraged to return our products for proper disposal.

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 they 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

Conventions

Note: this notice calls attention to important features or instructions.

Caution: this notice alert you to system damage, loss of data, or risk of personal injury.

ESD: This banner indicates an Electrostatic Sensitive Device.

This symbol indicates that product must be connected to earth ground prior making any other connections to the equipment.

This symbol Indicates on the rating plate that the equipment is suitable for direct current only (24 VDC-110 VDC nominal). Identify relevant terminals

The CE marking certifies that the product complies with the essential requirements of the Directive:

- 2011/65/EC of the European Parliament and of the Council of 8 June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment
- 2006/95/CE of the European Parliament and of the Council of 12 December 2006 on the harmonisation of the laws of Member States relating to electrical equipment designed for use within certain voltage limits.
- 2004/108/CE of the European Parliament and of the Council of 15 December 2004 on the approximation of the laws of the Member States relating to electromagnetic compatibility

All numbers are expressed in decimal, except addresses and memory or register data, which are expressed in hexadecimal. The prefix '0x' shows a hexadecimal number, following the 'C' programming language convention.

The multipliers 'k', 'M' and 'G' have their conventional scientific and engineering meanings of $*10^3$, $*10^6$ and $*10^9$ respectively. The only exception to this is in the description of the size of memory areas, when 'K', 'M' and 'G' mean $*2^{10}$, $*2^{20}$ and $*2^{30}$ respectively.

When describing transfer rates, 'k' 'M' and 'G' mean $*10^3$, $*10^6$ and $*10^9$ *not $*2^{10}$ $*2^{20}$ and $*2^{30}$.*

In PowerPC terminology, multiple bit fields are numbered from 0 to n, where 0 is the MSB and n is the LSB. PCI and CompactPCI terminology follows the more familiar convention that bit 0 is the LSB and n is the MSB.

Signal names ending with an asterisk (*) or a hash (#) denote active low signals; all other signals are active high.

Signal names follow the PICMG 2.0 R3.0 CompactPCI Specification and the PCI Local Bus 2.3 Specification.

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

Warning!
All operations on this device must be carried out by sufficiently skilled personnel only.

Caution, Electric Shock!
Before installing a not hot-swappable Kontron product into a system always ensure that your mains power is switched off. This applies also to the installation of piggybacks. Serious electrical shock hazards can exist during all installation, repair and maintenance operations with this product. Therefore, always unplug the power cable and any other cables which provide external voltages before performing work.
Earth ground connection to vehicle's chassis or a central grounding point shall remain connected. The earth ground cable shall be the last disconnected or the first connected during operations of cabling.

Special Handling and Unpacking Instructions

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 board 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 board.

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 device, which are not explicitly approved by Kontron and described in this manual or received from Kontron's Technical Support as a special handling instruction, will void your warranty.

This device should only be installed in or connected to systems that fulfill all necessary technical and specific environmental requirements. This applies also to the operational temperature range of the specific system version, which must not be exceeded.

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

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

Special care is necessary when handling or unpacking the product. Please consult the special handling and unpacking instruction.

Only TRACE-B304-TR variant of the TRACE-x304 TR family is supposed to be opened by qualified integrators for customization, following Kontron recommendations described in the specific "TRACe B304-TR Customization Guide - SD.DT.G46". Then, any modifications performed on the unit render the guarantee void.

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Chapter 1 - Introduction

Kontron TRACe-TR Family is an EN50155 certified fanless Operational Computer designed to ensure stable operation in harsh environments. The "B" version is specifically designed to ease customization thanks to MiniP-Cie slots and multiple configuration extentions to help integrators meet application-specific requirements. The B304-TR version is based on a CoM express© CPU module featuring Intel® Atom E3845 Bay Trail (quad core @ 1.91 GHz).

Kontron COMe Intel® Atom E3845 Bay Trail CPU: http://www.kontron.com/products/computeronmodules/com-express/com-express-mini/come-mbt10/specification

Kontron TRACe-TR Family website page : http://www.kontron.com/products/systems-and-platforms/transportation-systems-and-platforms/trace---intelligent-transportation-computer/

Figure 1: TRACe-TR Family Overview

1.1 Manual Overview

1.1.1 Objective

This guide provides general information, hardware instructions, operating instructions and functional description of the TRACe-TR Family systems. The onboard programming, onboard firmware and other software (e.g. drivers and BSPs) are described in detail in separate guides (see section A.1 "Associated Documentation").

This hardware technical documentation reflects the most recent version of the product. Functional changes that differ from previous version of the document are identified by a vertical bar in the margin.

1.1.2 Audience

This manual is written to cover, as far as possible the range of people who will handle or use the TRACe-TR system, from unpackers/inspectors, through system managers and installation technicians to hardware and software engineers. Most chapters assume a certain amount of knowledge on the subjects of single board computer architecture, interfaces, peripherals, system, cabling, grounding and communications.

1.1.3 Scope

This manual describes all variants of the TRACe-TR Family.

1.1.4 Structure

This manual is structured in a way that will reflect the sequence of operations from receipt of the system up to getting it working. Each topic is covered in a separate chapter and each chapter begins with brief introduction that tells you what the chapter contains. In this way, you can skip any chapters that are not applicable or with which you are already familiar.

The chapters are:

- Chapter 1 - Introduction (this chapter)
- Chapter 2 - Getting Started with TRACe-TR Family
- Appendix A - References
- Appendix B - List of Abbreviations

Chapter 2 - Getting Started with TRACe-TR Family

2.1 Receipt of the Equipment

2.1.1 Checking the Packages

Inspecting the packing cartons and verifying their condition is the responsability of the customer and should be carried out upon delivery.

> Inspect the packing and check its condition:
  - no broken corners,
  - general state of the case (no rips or holes),
  - condition of the bands and the clips.
> If you wish to report any damage in transit, you should make out a full report, and also note the damage on the packing list that accompanies the equipment. Ensure that the report and the packing list are signed by yourself and also by the transport agent, and send a copy of these documents to:
  - the transport company,
  - Kontron.

2.1.2 Unpacking

Unpacking the equipment must be carried out under the supervision of an authorized technician.

> Open the package and take out the items one by one.
> Inspect each item and make a note of any possible defects (scratches, marks or blemishes, damaged cables, etc.). If necessary, make a report of any damage or defects.
> Check the equipment against the packing list and report any missing items.

It is recommended that you keep the package and the anti-shock protection. This will be required if you decide to move your system to a different site.

2.2 System Identification

An identification label is available on the left side of the system.

Label data:

- Model : TRACE-B304-TR
- S/N : XXXX (4 digits chronologic Serial Number)
- ECL : 10000 (5 digits Engineering Change Level)

Figure 2: Identification Label Location

2.3 At a Glance

Processor

> Intel® Atom™ Bay Trail-I Platform E3845 quad cores @ 1.91 GHz

Memory

> 2 GB DDR3 with ECC

Storage

> EMMC 8 GB SLC Flash soldered

Connectivity

> Operational side :
- 2x M12 GbE (10/100/1000BASE-T)
- 2 x Serial SUBD9 for RS232/422/485
- 1x Audio SUBD9
- 1x GPIO SUBD25

> Maintenance side:
- 1x USB (high speed)
- 1x USB 3.0 (3.0 only) port [BIOS configurable]
- 1x RJ-45 GbE (10/100/1000BASE-T)
- 1x RJ-12 RS-232 for processor and HMU

Software

- Linux: Refer to TRACe-TR Family User's Manual (SD.DT.G45), section “Linux (Live CD)”.
- Windows: Refer to TRACe-TR Family User's Manual (SD.DT.G45), section “Windows (BSP”

Specific TRACe-TR tools package and live demo image will be made available on TRACe-TR Family Kontron Web Site (download section).

Management

- Operational side status LED: Power status LED
- Maintenance side Status an User LEDs:
  - L1: User1
  - L2: User0,
  - L3: Alarm/HMU,
  - L4: Sys/SATA,
  - L5: Power Status

Form Factor

> Dimensions:

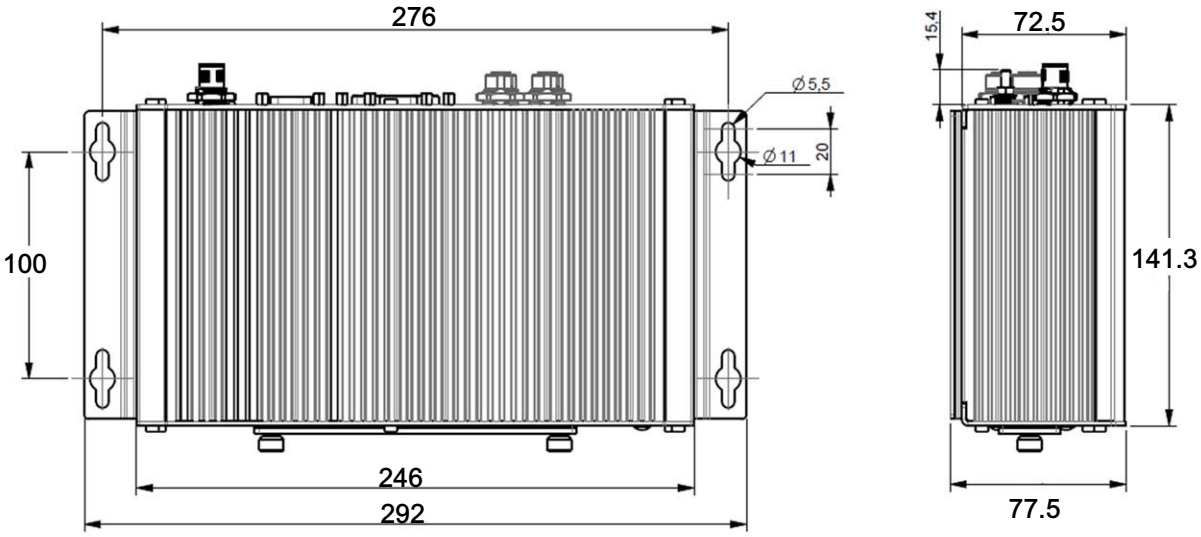


Figure 3: TRACe-TR Family Dimensions

> Weight: 2.5 kgs

Warranty

> 2 years

2.4 Operational Side: I/O Connectors Pinout

2.4.1 DC IN: External PSU M12 Connector, Male, 4 Pin, A coded.

Figure 4: DC IN Connector

Pin Configuration

Pin	Pin Name	Signal Name
1	VIN+	POWER IN + (+VDC)
2	VIN-	POWER IN- (GND)
3	IGN	Ignition (IGN)
4	NC	NC
Chassis	SHLD	Chassis ground (Shield)

Table 1: DC IN Pin Configuration

To power-on the system, you need a power cable with M12 Connector Female 4 Pin A-Coded in one end (see Appendix A “Accessories References Examples” pages 35 to find some references) to fit the DC IN connector.

The power cable is included in TRACE-KIT-CAB-EVAL cable kit to be purchased separately.

According to the above pinout, free ends of this cable must be wired as follows (refer to section 2.6.1 page 19):

- Brown: +VDC
- White: -VDC
- Blue: IGN (+VDC to Power On)

IGN can be directly connected to VDC to have the system always on when VDC is applied, or connected to VDC through a switch to power the system on/off with VDC kept applied.

A power off controlled by the IGN signal has the same impact than removing VDC: all PSUs are switched off including standby power supplies. However using IGN to power on/off is recommended because this enables some extra features such as an automatic system shutdown with a delayed power-off when the IGN signal is disabled, or a system wakeup from sleep by toggling the IGN signal.

Note Even if IGN is expected to be connected to VDC, it can be alternatively connected to another voltage source with same GND(POWER IN-) and a voltage in the same range than the one required for VDC.

VDC and IGN voltage range to GND: 24 VDC-110 VDC nominal (17 VDC min - 138 VDC max).

Current on VDC for VDC = 24 VDC, when idle under BIOS or Linux OS: around 800 mA.

Current on IGN for all IGN voltage range: around 4 mA

2.4.2 LAN B, LAN C: Ethernet M12 Connectors, Female, 8 Pin, X coded.

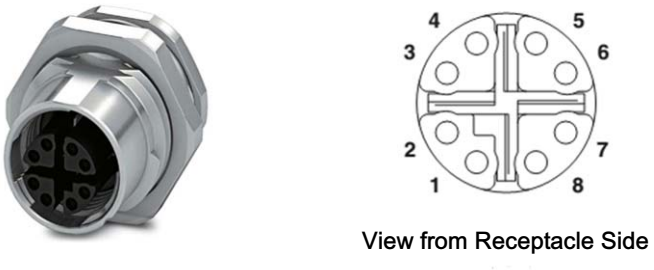


Figure 5: LAN B, LAN C Connectors

HMU 10/100 Ethernet interface can be routed to LAN-C (can be selected by the `trace_config` tool -refer to 2.7.2 “Play/TRACe Configuration” page 22-)

Pin Configuration

Pin	Pin Name
1	DA+
2	DA-
3	DB+
4	DB-
5	DD+
6	DD-
7	DC-
8	DC+

Table 2: LAN B, LAN C Connectors Pin Configuration

2.4.3 USB C: M12 Connector Female, 5 Pin, A coded.

Available on TRACe-B314-TR only.

Figure 6: USB C Connector

Pin Configuration

Pin	Pin Name
1	D+
2	5V
3	N.C.
4	D-
5	GND
Chassis	Shield

Table 3: USB C Connector Pin Configuration

2.4.4 COM B, COM C: Serial SUBD9 Connectors, Male, 9 Pin.

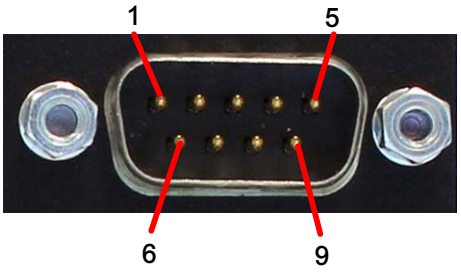


Figure 7: COM B, COM C Connectors

Pin Configuration

Pin	RS-232	RS-422/RS-485 Full Duplex	RS-422/RS-485 Half Duplex
1	N.C.	N.C.	N.C.
2	RX	RX+ (A)	N.C.
3	TX	TX- (Z)	TX-/RX- (Z/B)
4	N.C.	N.C.	N.C.
5	GND	N.C.	N.C.
6	N.C.	N.C.	N.C.
7	RTS	TX+ (Y)	TX+/RX+ (Y/A)
8	CTS	RX- (B)	N.C.
9	N.C.	N.C.	N.C.

Table 4: COM B, COM C Connectors Pin Configuration

Note Two naming conventions are used for RS-422/RS-485 differential signals, they match each other as follows : TX+ = Y, TX- = Z, RX+ = A, RX- = B

The serial mode and duplex can be set using the `trace_config` tool (refer to 2.7.2 “Play/TRACe Configuration” page 22).

When in 485 mode, the RTS signal from the UART is no more available on the connectors but is used as a "`TX enable`" (transmit enable): when RTS is high (logic 1 driven by UART), TX is enabled. TX is disabled by switching RTS low (under Linux OS, RTS can be managed by the `TIOCMGET/TIOCMSET IOCTL`, using the `TIOCM_RTS` flag)

COM-B is muxed between UART (default) and HMU (can be selected by the `trace_config` tool).

When in HMU mode, transmit is always enabled (RTS always at 1) so only RS-232 and RS-422 are supported.

See COM-A for HMU serial line routing to COM-A or COM-B

2.4.5 GPIO: SUBD25 Connector, Female, 25 Pin.

Figure 8: GPIO Connector

Pin Configuration

Pin	Signal Name	Pin Name	Signal Name
1	GND_GPIO_ISO	14	GPIO_IN[0]
2	GND_GPIO_ISO	15	GPIO_IN[1]
3	GND_GPIO_ISO	16	GPIO_IN[2]
4	GND_GPIO_ISO	17	GPIO_IN[3]
5	N.C.	18	N.C.
6	N.C.	19	N.C.
7	N.C.	20	N.C.
8	N.C.	21	24 VISO (external)
9	GND_GPIO_ISO	22	GPIO_OUT[0]
10	GND_GPIO_ISO	23	GPIO_OUT[1]
11	GND_GPIO_ISO	24	GPIO_OUT[2]
12	GND_GPIO_ISO	25	GPIO_OUT[3]
13	GND_GPIO_ISO	26, 27	Shield

Table 5: GPIO Connector Pin Configuration

24 VISO DC voltage (8 VDC min - 29 VDC max) must be applied to pin 21 to power the isolated GPIO logic.

GPIO_OUT[n] are open-collector outputs, enabled (driven low to GND_GPIO_ISO) when a logic 1 is written from software. Each output can sink up to 20 mA. Maximum voltage on GPIO_OUT[n] (to GND_GPIO_ISO) is 29 VDC.

GPIO_IN[n] are inputs that are read at 1 from software when at logic level high (24V logic).

Maximum voltage on GPIO_IN[n] (to GND_GPIO_ISO) is 29 VDC.

These inputs have an hysteresis (around 1V); level high is above 17V; level 0 under 16V.

GPIO_OUT[n] and GPIO_IN[n] can have a voltage greater than 24 VISO provided than this voltage does not exceed 29 VDC.

2.4.6 Audio: SUBD9 Connector, Female, 9 Pin.

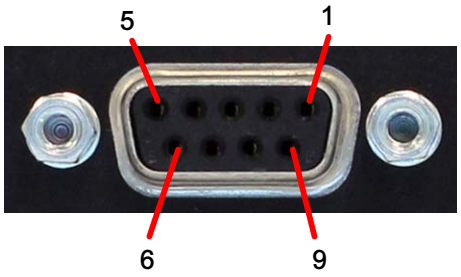


Figure 9: Audio Connector

Pin Configuration

Pin	Signal Name
1	LINE_OUT_L (Headphone)
2	GND_AUDIO
3	LINE_OUT_R (Headphone)
4	GND_AUDIO
5	AUDIO LINE MICBIAS
6	5V (internal)
7	LINE_IN_L (Microphone)
8	GND_AUDIO
9	LINE_IN_R (Microphone)

Table 6: Audio Connector Pin Configuration

2.5 Maintenance Side: I/Os Connector Pinout

2.5.1 COM A: RJ-12 Connector

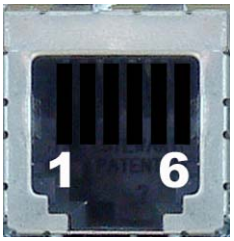


Figure 10: COM A Connector

Pin Configuration

Pin	Signal Name
1	HMU TX
2	GND
3	COMe TX
4	COMe RX
5	GND
6	HMU RX

Table 7: COM A Connector Pin Configuration

HMU serial line on COM-A (default) can be routed to COM-B instead (can be selected by the `trace_config` tool -refer to 2.7.2 “Play/TRACe Configuration” page 22-).

COM-B mode	COM-A	COM-B	Comments
UART	TX = HMU TX RX = HMU RX	TX = UART TX RX = UART RX RTS = UART RTS	 RTS is available on COM-B only in RS-232 mode
HMU	TX = HMU TX RX = --	TX = HMU TX RX = HMU RX RTS = 1	TX output of HMU is available on both connectors RTS is available on COM-B only in RS-232 mode

2.5.2 LAN A Gigabit Ethernet Port

The TRACe-TR have a Gigabit Ethernet port:

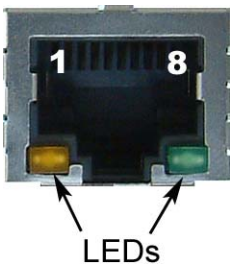


Figure 11: LAN A Gigabit Ethernet Connector

Pin Assignment

PIN	10BASE-T		100BASE-TX		1000BASE-T	
	I/O	SIGNAL	I/O	SIGNAL	I/O	SIGNAL
1	O	TX+	O	TX+	I/O	BI_DA+
2	O	TX-	O	TX-	I/O	BI_DA-
3	I	RX+	I	RX+	I/O	BI_DB+
4	-	-	-		I/O	BI_DC+
5	-	-	-		I/O	BI_DC-
6	I	RX-	I	RX-	I/O	BI_DB-
7	-	-	-		I/O	BI_DD+
8	-	-	-		I/O	BI_DD-
Shell	Chassis Ground					

Table 8: Gigabit Ethernet Connector Pin Assignment

The Ethernet transmission should operate using a CAT5 cable with a maximum length of 100 m.

The Ethernet connectors are available as RJ-45 connectors with tab down.

2.5.3 USB B: USB 3.0 Connector

The TRACe-TR have a USB3.0 compliant connector. It can work as a USB 2.0 connector or as a USB 3.0 connector.

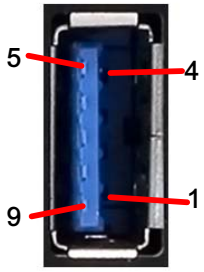


Figure 12: USB 3.0 Connector

Pin Assignment:

PIN	SIGNAL	DESCRIPTION	I/O
1	+5V protected	USB power	-
2	DATA-	Differential USB-	I/O
3	DATA+	Differential USB+	I/O
4	GND	Ground	-
5	USBSS_RX-	Differential USB Receive -	I
6	USBSS_RX+	Differential USB Receive +	I
7	GND	Ground	-
8	USBSS_TX	Differential USB Transmit -	O
9	USBSS_TX+	Differential USB Transmit +	O

Table 9: USB 3.0 Connector Pin Assignment

2.5.4 USB A: USB 2.0 Connector

The TRACe-TR have a USB 2.0 connector type A right angle

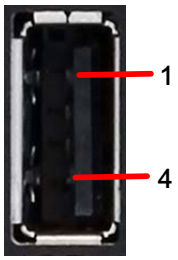


Figure 13: USB 2.0 Connector

Pin Assignment

PIN	SIGNAL	FUNCTION	I/O
1	VCC (+5V Protected)	VCC	--
2	USB_D-	Differential USB-	I/O
3	USB_D+	Differential USB+	I/O
4	GND	GND	--

Table 10: USB 2.0 Connector Pin Assignment

All the signal lines are EMI-filtered.

2.5.5 SIM CARDS: SIM Connectors

The TRACe-TR have two SIM connectors

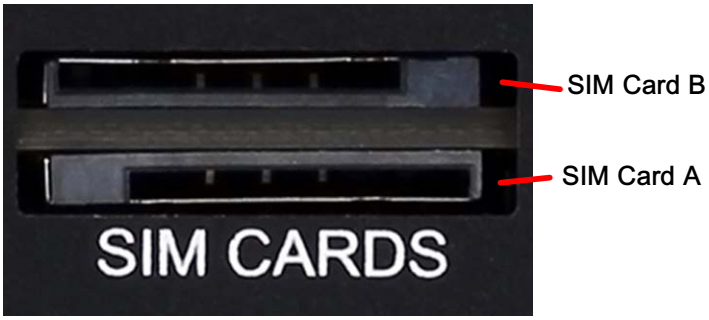


Figure 14: SIM Connector

Pin Assignment

PIN	NAME	SIGNAL DESCRIPTION
1	VCC	VCC
2	Reset	RST
3	Clock	CLK
4	SW1	SIM Detection
5	GND	GND
6	VPP	Not Connected
7	DATA	DATA
8	SW2	GND

Table 11: SIM Connector Pin Assignment

2.5.6 DP: DisplayPort Connector

The TRACe-TR have a DisplayPort Interface

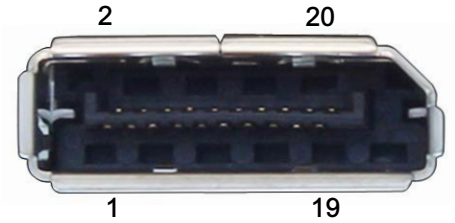


Figure 15: DisplayPort Connector

Pin Assignment

PIN	SIGNAL	FUNCTION
1	ML_Lane 0 (p)	Lane 0 (positive)
2	GND	Ground
3	ML_Lane 0 (n)	Lane 0 (negative)
4	ML_Lane 1 (p)	Lane 1 (positive)
5	GND	Ground
6	ML_Lane 1 (n)	Lane 1 (negative)
7	ML_Lane 2 (p)	Lane 2 (positive)
8	GND	Ground
9	ML_Lane 2 (n)	Lane 2 (negative)
10	ML_Lane 3 (p)	Lane 3 (positive)
11	GND	Ground
12	ML_Lane 3 (n)	Lane 3 (negative)
13	GND	Ground
14	GND	Ground
15	AUX CH (p)	Auxiliary Channel (positive)
16	GND	Ground
17	AUX CH (n)	Auxiliary Channel (negative)
18	Hot Plug	Hot Plug Detect
19	Return	Return for power
20	DP_PWR	Power for connector

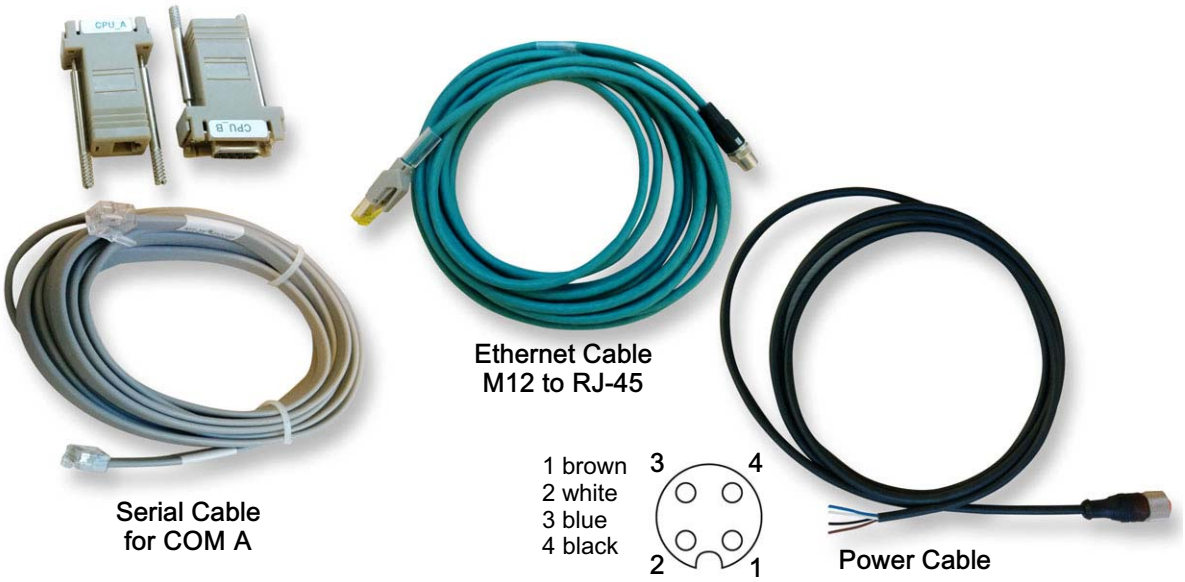
Table 12: DisplayPort Connector Pin Assignment

2.6 Optional Cables Kits

2.6.1 TRACE-KIT-CAB-EVAL

Set of Cables for TRACe-TR Family evaluation, consisting of:

- 1x CABLE ASSY: Power (M12-A coded to free end),
- 1x ETHERNET (M12-X coded to RJ45),
- 1x Serial (RJ-12 to dual DB9)



Serial Cable for COM A: CPU_A to connect to COMe CPU, CPU_B to connect to HMU

2.6.2 TRACE-KITSATA-1

Set of SATA cables to install one 2,5" SSD (for TRACe B304-TR only), consisting of:

- 1xSATA Power cable,
- 1x SATA Data cable,
- 4x screws and spacers

2.6.3 TRACE-STARTERKIT-1

Complete set of cables / accessories for TRACe evaluation, consisting of :

- 1x AC/DC converter cable assembly for DC IN
- 1x USB Key Fedora 21 TRACe Live Image
- 2x M12 to RJ45 Ethernet Cable
- 1x Display port to VGA adapter
- 1x Serial cable (RJ12 to dual DB9: CPU_A, CPU_B) : 1x KIT-2X-RJ12DB9
- 1x Wi-Fi antenna Dual Band 2,4GhZ-5GhZ , 1x 3G/LTE antenna 5dBi, 1x GPS antenna

2.7 Plug and Play with TRACe-TR Family

The following sections are valid for a Linux operating system with its TRACe BSP installed. A live CD Fedora image is available on the Kontron Web Site under TRACe B304-TR download section (http://www.kontron.com/products/systems-and-platforms/transportation-systems-and-platforms/trace---intelligent-transportation-computer/).

2.7.1 Plug

Earth ground connection to vehicle's chassis or a central grounding point shall remain connected. The earth ground cable shall be the last disconnected or the first connected during operations of cabling.

To power-on the TRACe-TR Operational Box Computer, you need to attach a Power Supply Cable (refer to section 2.6 page 19) to the DC IN connector (PSU wide range 24 VDC-110 VDC). On the other side, it has to be cabled to a DC power source (24 VDC minimum) following the pin-out description in the above section 2.4 "I/O Connectors Pinout" page 7.

Two methods:

1. Graphical session (recommended):
   - Connect a display for graphical session (display and cables not provided) to the DisplayPort on Maintenance side.
   - Plug a USB hub for keyboard and mouse in USB A connector on Maintenance side.
2. Serial console:
   - Connect to the TRACe-TR via RJ-12 serial connector on maintenance side using a cable KIT-2X-RJ12DB9 (included in TRACE-KIT-CAB-EVAL) and use a serial terminal emulator as putty or minicom for example.

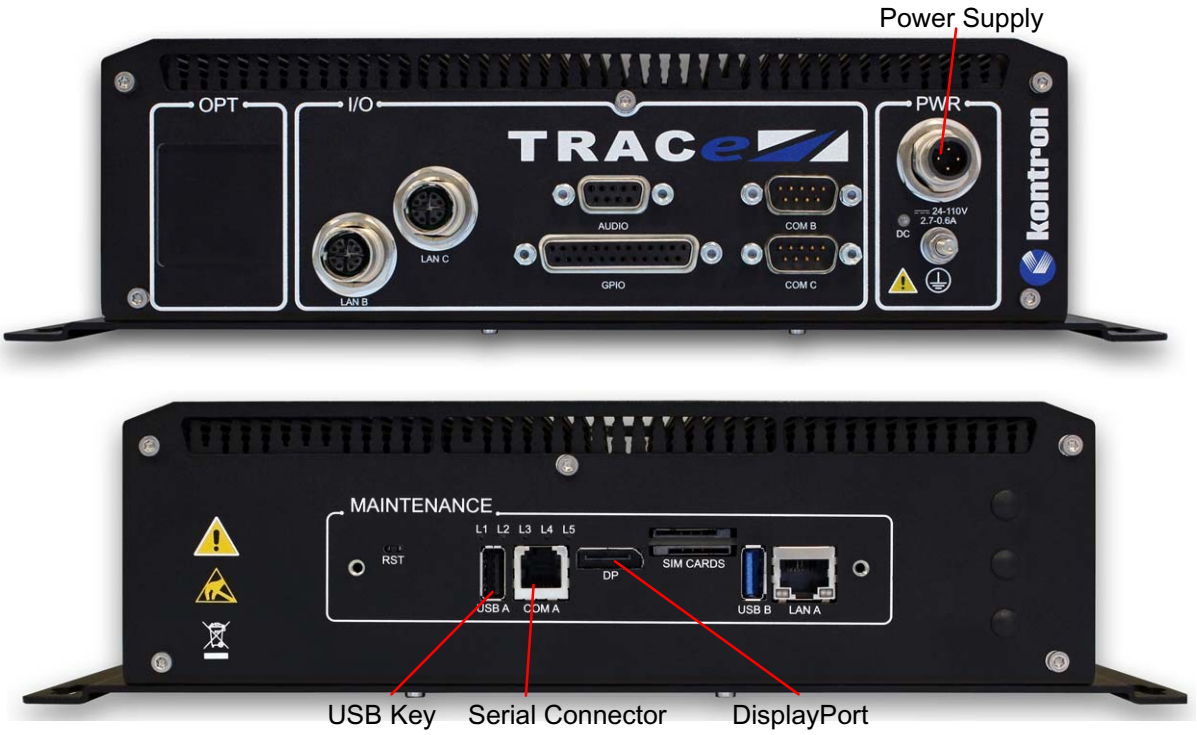


Figure 16: Connecting TRACe-TR Family

To start the system

> Power on the DC power supply module via DC IN connector (section 2.4 “I/O Connectors Pinout” page 7) and then turn on the ignition key. As long as the ignition signal is not connected to the +POWER IN (power supply connector pin 1) the system cannot start (refer to Figure 7 - Ignition Implementation page 10).

> A Linux login prompt should appear in a few seconds

The system can also be configured to stay off when ignition signal is switched on, and start on assertion of GPIO_IN[0] or GPIO_IN[1] (configurable using `trace_config` -refer to 2.7.2 “Play/TRACe Configuration” page 22-) or on HMU request

In this case, when waiting to start, the Power status LED is flashing twice every 2 seconds.

To stop the system

> **Manual method :**

Shutdown the OS: with shutdown menu in graphical session, or «halt» command in a Linux terminal for example.

When the Power status LED is flashing once every 2 seconds (shutdown completed), switch off the ignition signal.

You can also optionally remove power on “POWER IN”

> **Automatic method (default):**

This requires the `trace-poweroffd` daemon to be started when the OS is booting in a Linux console.

Just switch off the ignition signal: this automatically performs a shutdown, and once the shutdown is completed, a power-off

Suspend the system

Suspend the OS: with `suspend` menu in graphical session, or "`systemctl suspend`" in a Linux terminal (as root).

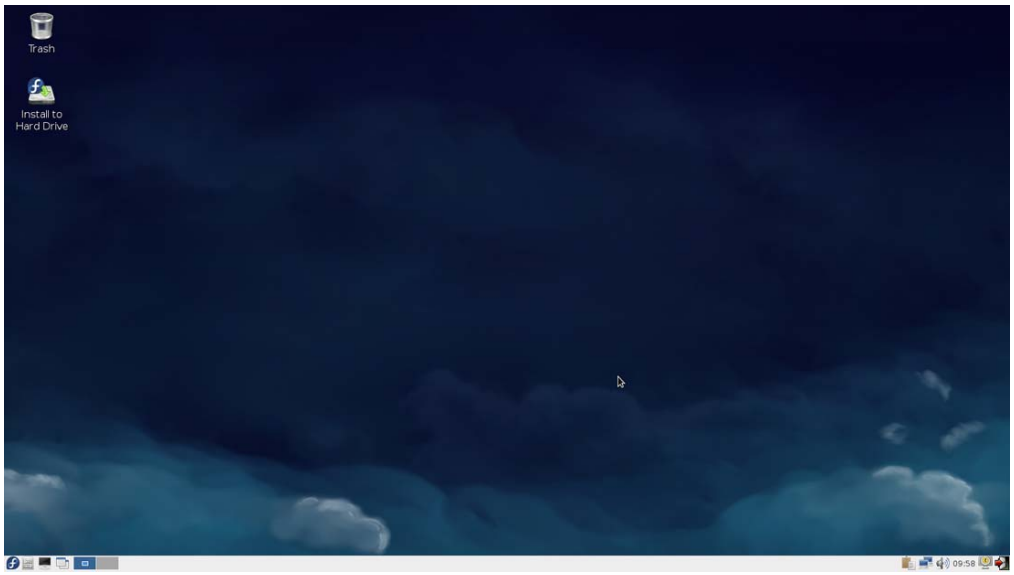
The Power status LED is flashing once every 2 second.

To resume, the following methods are supported :

- Switch the ignition signal off and on fastly (less than 750mS).
- Send a Wake-On-Lan Ethernet packet to the system on LAN-B or LAN-C interfaces
- Assertion of a GPIO_IN[0] or GPIO_IN[1] (configurable using trace_config)
- Reset switch on maintenance side
- HMU request

2.7.2 Play

> Plug the system for a graphical session as described in section 2.7.1 “Plug” page 20.
> Plug the live image support (DVD or USB) on the system.
> Power on the system then select the boot device by pressing **<F5>** on keyboard.
> A desktop workstation will appear in a few seconds:



» TRACe Configuration :

Some configuration settings are available under BIOS setup, however TRACe specific settings are managed by the OS tool `trace_config`

By default, this tool works on saved settings that are applied at power-on (ignition signal on).

It is also possible to work on the current settings, to temporarily change some settings (changes are lost at power-off).

This command must be run as root user.

To display saved settings:

```
[root@trace-board ~]# trace_config
Saved configuration :
  --serial     232      : RS232 mode on COM-B/COM-C serial lines
  --serial     full     : Full duplex on COM-B/COM-C serial lines
  --tpm        on       : Second TPM chip ON
  --poweron    start    : Start when ignition key is switched ON
  --dport      maint    : DisplayPort on maintenance plate connector
  --sata       mini1    : SATA interface to mini socket #1
  --sim        0a1b     : mini socket #0 to SIM-A + socket #1 to SIM-B
  --gpi1wake   off      : Wakeup from GPI1 NOT enabled
  --gpi0wake   off      : Wakeup from GPI0 NOT enabled
  --lanc       i210     : LAN-C connector for Intel i210 ethernet
  --comb       uart     : COM-B connector for PCIe UART
[root@trace-board ~]#
```

To display current settings:

```
[root@trace-board ~]# trace_config -c
Current configuration :
  --serial     232      : RS232 mode on COM-B/COM-C serial lines
  --serial     full     : Full duplex on COM-B/COM-C serial lines
  --tpm        on       : Second TPM chip ON
  --poweron    start    : Start when ignition key is switched ON
  --dport      maint    : DisplayPort on maintenance plate connector
  --sata       mini1    : SATA interface to mini socket #1
  --sim        0a1b     : mini socket #0 to SIM-A + socket #1 to SIM-B
  --gpi1wake   off      : Wakeup from GPI1 NOT enabled
  --gpi0wake   off      : Wakeup from GPI0 NOT enabled
  --lanc       i210     : LAN-C connector for Intel i210 ethernet
  --comb       uart     : COM-B connector for PCIe UART
  --offdelay   3        : Power off delay in units of 1/4 seconds (0 to 255)
  --mini0      absent   : Mini socket #0 PCIe device NOT present
  --mini1      absent   : Mini socket #1 device NOT present (mPCIe or mSATA)
  --mini1sata  absent   : Mini socket #1 SATA device NOT present
  --mini2      absent   : Mini socket #2 PCIe device NOT present
  --mode       normal   : System running in normal mode
  --ledsysr    off      : LED SYS red OFF
  --ledalarmr  off      : LED ALARM red OFF
  --ledusr1    off      : LED USER1 is OFF
  --ledusr0    off      : LED USER0 is OFF
  --sysstate   0        : Current system state code (0 to 15, updated by soft)
  --cpldrev    0x04     : cPLD revision/version on carrier board
[root@trace-board ~]#
```

The help gives the list of all possibles settings and their supported values:

```
[root@trace-board ~]# trace_config -h
```

To also see debug settings:

```
[root@trace-board ~]# trace_config -d -h
```

Some of them are read-only or/and only apply to the current or saved settings.

Refer to TRACe-TR Family User's Manual (SD.DT.G45), section “Linux Tools” for full command output.

> EXAMPLES :

- Switch LED L2 (User0) to red right now:

```
[root@trace-board ~]# trace_config -c --ledusr0 red
```

- Get current LED L2 (User0) state:

```
[root@trace-board ~]# trace_config -c --ledusr0
Current :
  --ledusr0    red      : LED USER0 is RED
[root@trace-board ~]#
```

- Set serial lines to 422/485 at next power-on (saved setting):

```
[root@trace-board ~]# trace_config --serial 485
```

- Set serial lines to 422/485 right now (current setting):

```
[root@trace-board ~]# trace_config -c --serial 485
```

- Get serial lines configuration for both saved and current settings:

```
[root@trace-board ~]# trace_config -c -s --serial
Saved :
  --serial     485      : RS422/485 mode on COM-B/COM-C serial lines
  --serial     full     : Full duplex on COM-B/COM-C serial lines
Current :
  --serial     485      : RS422/485 mode on COM-B/COM-C serial lines
  --serial     full     : Full duplex on COM-B/COM-C serial lines
[root@trace-board ~]#
```

2.8 Device Management

2.8.1 Power status LED

Figure 17: Power On LED

	State	Meaning
POWER	OFF	System power off (Ignition key OFF or forced to OFF by REG_POWER)
	GREEN	System running
	GREEN PULSE ONCE every 2 seconds	System in standby mode (S3,S4 or S5 state)
	GREEN PULSE TWICE every 2 seconds	System waiting for power-on event (GPI, uC command, ...)
	SLOW BLINKING GREEN with period 1 second	System about to power-off (power off delay)
	FAST BLINKING GREEN with period 0.5 second	In debug mode
	ORANGE (red+green)	System reset from COME (CB_RESET# asserted)
	RED	Power error Power supplies are switched off and an error code is reported on USER0/1 LEDs

2.8.2 Status and User LEDs

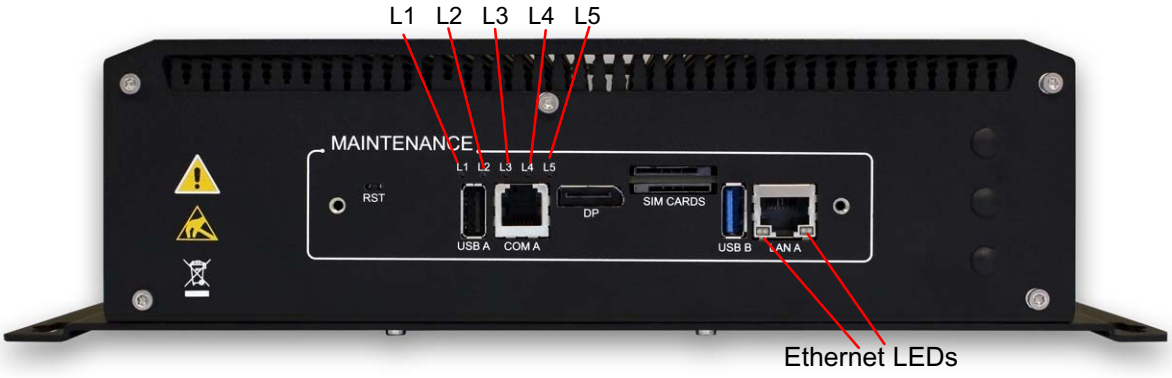


Figure 18: Status LEDs

> Five Status User LEDs: L1 (User1), L2 (User0), L3 (Alarm/HMU), L4 (Sys/SATA), L5 (Power)

These LEDs are bicolor (red and green), giving 4 possible states (off, red, green, orange)

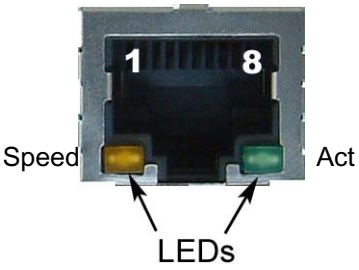
- L1 and L2 are controlled by the cPLD
- L3 and L4 are controlled by the cPLD for red color (Alarm, Sys) but not for green color (HMU, SATA)
- L5 (Power) has the same state than the Power status LED on operational side.

To control the LEDs through the cPLD, the `trace_config` tool can be used (`trace_config -c --ledXXXX YYYY`)

When L5 (Power) is red (power error), an error code is reported on L1 (User1) and L2 (User0) as follows:

Error number	Error name	L1 (User1)	L2 (User0)
0	ERR_NO_ERROR	N/A	N/A
1	ERR_STDBY_5V_3V3	OFF	GREEN
2	ERR_SUS_S3	OFF	RED
3	ERR_3V3_5V	OFF	ORANGE
4	ERR_12V	GREEN	OFF
5	ERR_2V5	GREEN	GREEN
6	ERR_1V0	GREEN	RED
7	ERR_1V5	GREEN	ORANGE
8	ERR_UART	RED	OFF
9	ERR_PCIESW_LOCK	RED	GREEN
10	ERR_SUS_STAT	RED	RED
11	ERR_EMERGENCY_OFF	RED	ORANGE

> Ethernet status LEDs



STATUS		SPEED LED yellow	ACT LED green
Ethernet link is not established		OFF	OFF
10/100 Mbps	Ethernet link establisehd	OFF	ON
	Ethernet Link Activity	OFF	BLINK
1000 Mbps	Ethernet link establisehd	ON	ON
	Ethernet Link Activity	ON	BLINK

Table 13: Ethernet LEDs Status Definition

2.8.3 Computer Reset

> RST button on Maintenance rear side

Figure 19: Computer Reset

2.9 Health Management Unit Use Cases

2.9.1 TRACe-TR as a Box PC

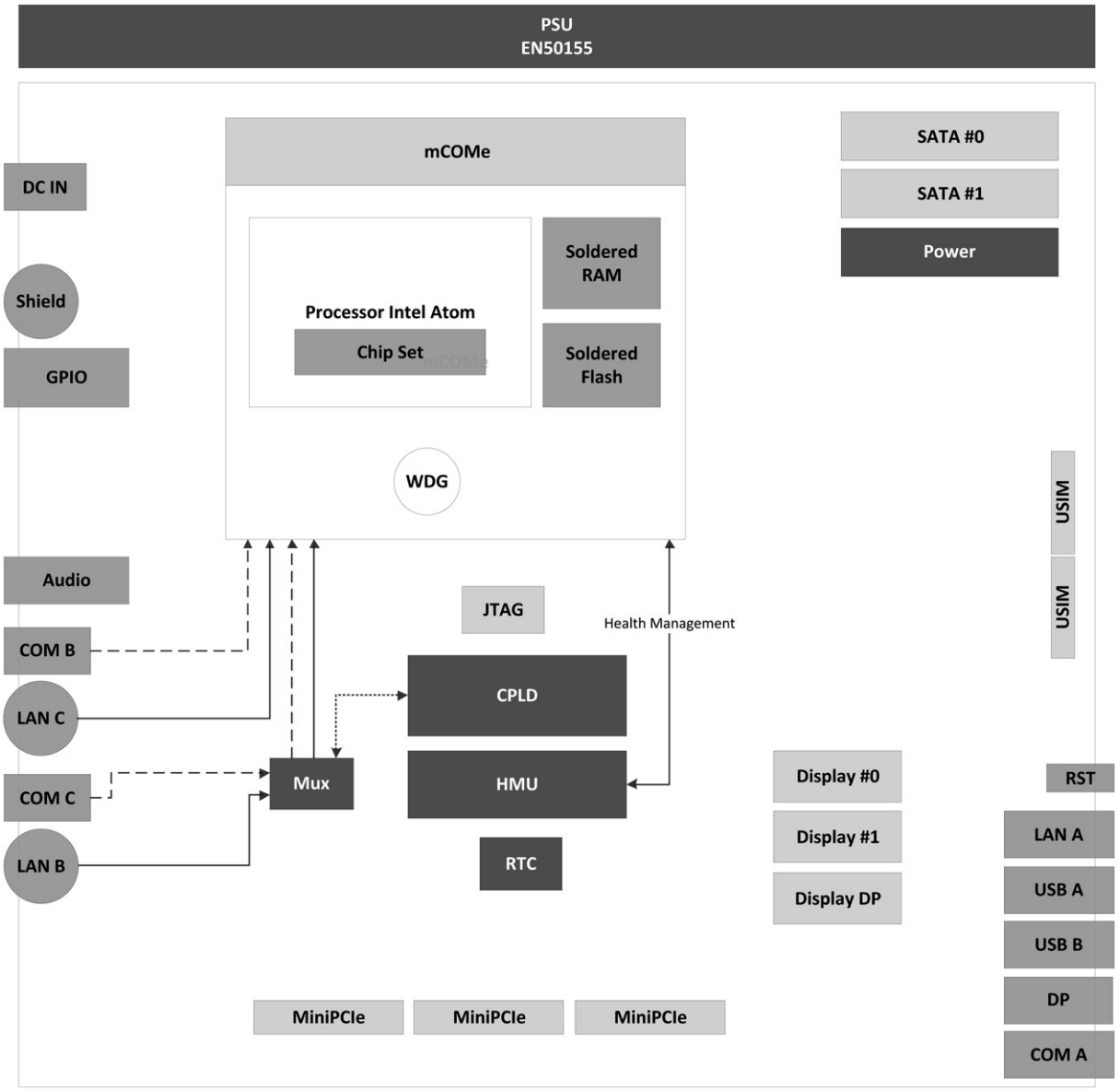


Figure 20: TRACe-TR as a Box PC

2.9.2 TRACe-TR as a monitored Operational Computer

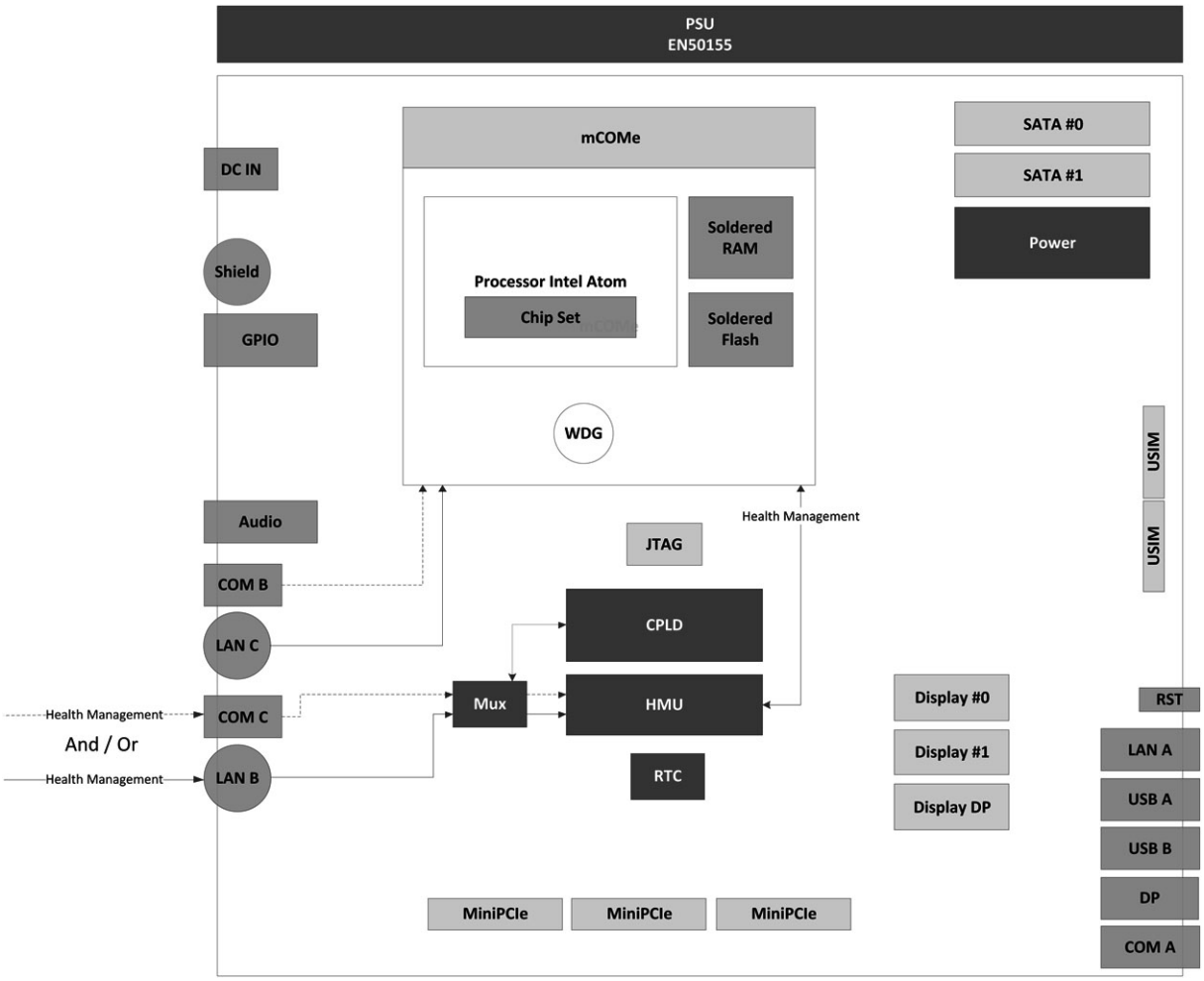


Figure 21: TRACe-TR as a monitored Operational Computer

Refer to TRACe-TR Family User's Manual (SD.DT.G45), section “Health Management Unit” for more detailed information about HMU.

2.10 Linux

The Linux BSP for TRACe-TR relies on two complementary BSP packages.

> First BSP comes from COMe-mBT10 module Kontron support. It provides a full COMe module support and can be downloaded on the Kontron COMe product website:

  http://www.kontron.com/products/computeronmodules/com-express/com-express-mini//come-mbt10.html

> Second Linux BSP is provided for TRACe-TR system support and can be downloaded on the Kontron TRACe website:

  http://www.kontron.com/products/systems-and-platforms/transportation-systems-and-platforms/trace---intelligent-transportation-computer/trace-b304-tr.html

OS Installation

This chapter will use Fedora 21 distribution as an example in order to describe a from scratch installation procedure to support the TRACe-TR system.

From TRACe-TR live CD, you can easily install a pre configured Fedora image on your system by clicking on the desktop shortcut "`Install to Hard Drive`".

1. Get the Fedora distribution : https://getfedora.org
2. Proceed to the OS installation from the Fedora media
3. Boot on your fresh installed system
4. Follow BSP installation instructions that follow

As both BSP have to be compiled on your system in order to install our drivers, you will need as mandatory packages "`kernel-devel`" and "`gcc`". These packages can be installed later with `rpm` or `yum` (recommended) commands.

Concerning the "`kernel-devel`" package, it has to be as the same version as the current kernel (run "`uname -r`" to get the current one). If you install the `kernel-devel` with `yum` from internet repository, it will download the last version which will be newer than the installed kernel. In that case, you can run "`yum update kernel`" to get the kernel packages at the same version.

MMC Boot Support

You can skip this section if it does not apply to your system.

Default `initramfs` that is installed by Fedora does not support the COMe MMC flash as a boot device. If you want to install your operating system on this MMC, it is recommended to get a live CD image to regenerate the `initramfs` after installation. Once booted on the live image, mount the whole installed device and add the MMC boot support to the `initramfs` with "`dracut`" command.

Example:

```
$ sudo vgscan
  Reading all physical volumes.  This may take a while...
  Found volume group ¿fedora¿ using metadata type lvm2
$ sudo vgchange -a y
  2 logical volume(s) in volume group ¿fedora¿ now active
$ sudo mount /dev/mapper/fedora-root /media/
$ sudo mount /dev/mmcblk0p2 /media/boot/
$ sudo chroot /media /sbin/dracut --add-drivers "sdhci sdhci-pci sdhci-acpi mmc_block mmc_core
usb-storage" /boot/initramfs-3.19.1-201.fc21.x86_64.img 3.19.1-201.fc21.x86_64 --force
$ sudo umount /media/boot
$ sudo umount /media
```

To permanently add the drivers to your system, create the following `dracut` configuration file :

```
# cat <<EOF > /etc/dracut.conf.d/mmc.conf
#add drivers for boot support on mmc device
add_drivers+=" sdhci sdhci-pci sdhci-acpi mmc_block mmc_core usb-storage "
EOF
```

It will add the specific drivers each times you will update your `initramfs` with `dracut` command.

COMe-mBT10 BSP Installation

Official supported Linux distribution for the COMe is Fedora 20. RPM packages are provided for this OS release. For other, sources files of the drivers are provided.

The COMe BSP is composed of three main drivers :

- kempld-drivers.12
- kontron-drivers.4
- nct-drivers.3

For each of them, extract the archive then go to the driver's directory. Open the INSTALL file and follow instructions which usually are:

```
$ cd XXX-modules
$ make
# make install
```

You may encounter a compilation error for kempld-drivers.12 module. Since kernel 3.18, `gpiochip_remove()` function in the `gpiolib` library returns a void value instead of the status. To workaround, this problem, you can patch the source code as described here :

```
# sed -i -e "s/ret = gpiochip_remove(/ret = 0;gpiochip_remove(/g" gpio-kempld.c
# sed -i -e "s/ret = gpiochip_remove(/ret = 0;gpiochip_remove(/g" gpio-kempld_now1.c
```

For nct-drivers.3 driver, copy the COMe configuration “`kontron-sensors3.conf`” provided in the “`misc`” directory of the COMe-mBT10 BSP. Note that “`lm_sensors`” package has to be installed on your system. Update the sensors configuration of your system :

```
# cat kontron-sensors3.conf >> /etc/sensors3.conf
# cat <<EOF >  /etc/sysconfig/lm_sensors
BUS_MODULES="trace_cpld_i2c"
HWMON_MODULES="coretemp lm73"
EOF
```

TRACe-TR BSP Installation

Extract the BSP archive then go to the driver's directory. Open the INSTALL file and follow instructions which usually are:

```
# make clean
# make
# make install
```

TRACe-TR System Configuration

BSP modules support

To automatically load the BSP modules during the boot process, create the following configuration file to your system:

```
# cat <<EOF > /etc/modules-load.d/trace.conf
i2c-dev
i2c-kempld
kempld-wdt
gpio-kempld
kontron-bootcounter
kontron-eeep
kontron-bl
coretemp
adt7475
nct7802
trace_cpld_i2c
trace_cpld
EOF
```

Update the blacklist for a correct modules order loading

```
# DRIVER="blacklist iTCO_wdt"
# BLACKLIST="/etc/modprobe.d/blacklist.conf"
# grep -q "$DRIVER" $BLACKLIST || echo -e "\n# kempld-wdt should be loaded first\n$DRIVER\n" >>
$BLACKLIST
```

> UARTS support

Append "`8250.nr_uarts=6`" to the boot arguments. This can be done by editing "`/etc/default/grub`" file then append this option to the `GRUB_CMDLINE_LINUX` variable. Run "`grub2-mkconfig -o /boot/grub2/grub.cfg`" to make the change effective.

Depending on your system installation the "grub.cfg" file location may differ. In this case, just give the correct location.

> Ethernet interfaces naming :

You may want to keep a standard ethernet interfaces naming such as eth0, eth1 and eth2. To disable the current naming that depends on the controller PCI address, append to the boot arguments these two options "`biosdevname=0 net.ifnames=0`"

> Serial port login activation

Create the service configuration file :

```
# cat <<EOF > /etc/systemd/system/serial-getty\@ttyS0.service
#  This file is part of systemd.
#
#  systemd is free software; you can redistribute it and/or modify it
#  under the terms of the GNU Lesser General Public License as published by
#  the Free Software Foundation; either version 2.1 of the License, or
#  (at your option) any later version.

[Unit]
Description=Serial Getty on %I
Documentation=man:agetty(8) man:systemd-getty-generator(8)
Documentation=http://0pointer.de/blog/projects/serial-console.html
BindsTo=dev-%i.device
After=dev-%i.device systemd-user-sessions.service plymouth-quit-wait.service
After=rc-local.service

# If additional gettys are spawned during boot then we should make
# sure that this is synchronized before getty.target, even though
# getty.target didn't actually pull it in.
Before=getty.target
IgnoreOnIsolate=yes

[Service]
ExecStart=-/sbin/agetty --autologin root --keep-baud %I 115200,38400,9600
Type=idle
Restart=always
RestartSec=0
UtmpIdentifier=%I
TTYPath=/dev/%I
TTYReset=yes
TTYVHangup=yes
KillMode=process
IgnoreSIGPIPE=no
SendSIGHUP=yes
EOF
```

Install the service :

```
# ln -s /etc/systemd/system/serial-getty\@ttyS0.service /etc/systemd/system/getty.target.wants/
```

2.11 Windows

In progress

Appendix A - References

A.1 Associated Documentation

The following documentation is available on the Kontron web site.

- Datasheet TRACe B304-TR . . . . . TRACe-B304-TR#20150427MB
- Datasheet TRACe G304-TR . . . . . TRACe-G304-TR#20150427MB
- Datasheet TRACe M304-TR . . . . . TRACe-M304-TR#20150427MB
- Datasheet TRACe V304-TR . . . . . TRACe-V304-TR#20150427MB
- TRACe B304-TR Customization / Integration Guide SD.DT.G46
- TRACe B304-TR User's Manual SD.DT.G45

Appendix B - List of Abbreviations

AC	Alternating Current
DC	Direct Current
COMe	Computer On Module Express
CPU	Central Processing Unit
DP	DisplayPort
ESD	Electrostatic Sensitive Device
GND	Ground
HMU	Health Management Unit
LAN	Local Area Network
LED	Light Emitting Diode
OS	Operating System
PCI	Peripheral Component Interconnect
S3	Suspend to RAM
S4	Suspend to Disk
S5	Soft Power-Off
SATA	Serial Advanced Technology Attachment
SIM	Subscriber Identity Module
USB	Universal Serial Bus
WEEE	Waste Electrical and Electronics Equipment

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