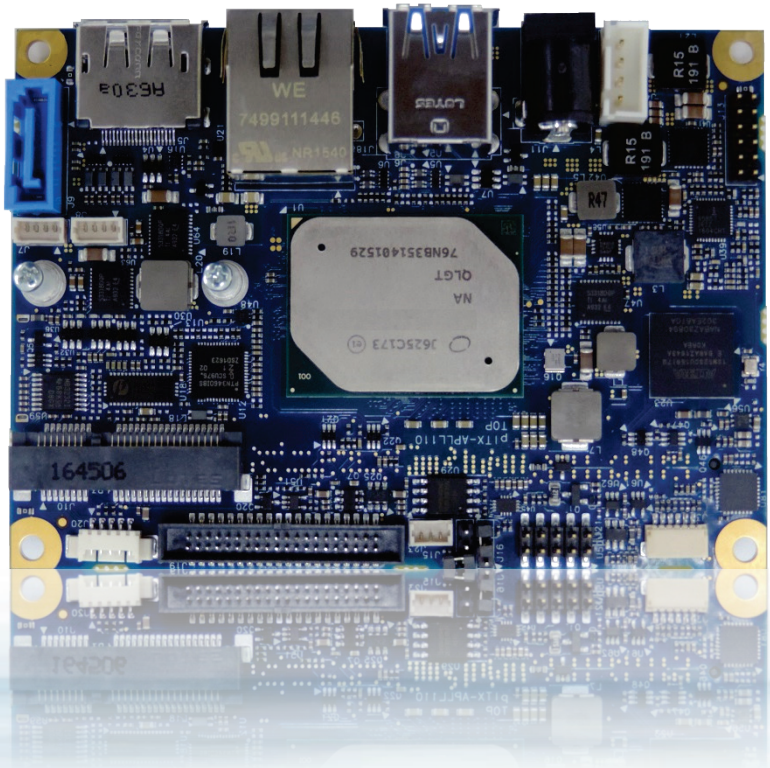
USER GUIDE





pITX-APL

User Guide Rev. 1.91

Doc-ID: 1061-1199

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PITX-APL - 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
1.0	Initial Issue	2018-Mar-08	hjs
1.1	added information in chapter 5	2018-Jul-12	hjs
1.2	added chapter 6.17	2018-Jul-24	hjs
1.3	added note power plug	2018-Oct-01	hjs
1.4	added chapter 6.19 (Serial COM)	2018-Nov-13	hjs
1.5	added chapter 6.20 (Audio Connector)	2018-Dec-04	hjs
1.6	Block diagram added, redesign specifications added	2018-Dec-17	hjs
1.7	GPIO chapter 6.12 and Front Panel 6.9	2019-Oct-14	hjs
1.8	memory updated	2019-Dec-03	hjs
1.9	Block diagram, Power LED, DP updated	2019-Dec-12	hjs
1.91	Word2016 issues	2021-Mar-25	hjs

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Kontron sells products worldwide and declares regional General Terms & Conditions of Sale, and Purchase Order Terms & Conditions. Visit http://www.kontron.com/terms-and-conditions.

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Symbols

The following symbols may be used in this manual

⚠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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1/ Introduction

This manual describes the pico-ITX board with Intel CPU. This board will also be denoted pITX-APL within this Users Guide.

The use of this Users Guide implies a basic knowledge of PC hard- and software. This manual is focussed on describing the pITX-APL board's special features and is not intended to be a standard PC textbook.

New users are recommended to study the short installation procedure stated in the following chapter before switching-on the power.

All configuration and setup of the CPU board is either done automatically or manually by the user via the BIOS setup menus.

Latest revision of this manual, datasheet, BIOS, drivers, BSPs (Board Support Packages) can be downloaded from Kontron Web Page.

2/ Description

The board is based on the Intel System on Chip (SoC) and is mechanically compliant to the Pico-ITX (pITX) specification. Board key features are:

- 1x DDR3L SO-DIMM, support maximum memory size up to 8Gbyte
- 1x DisplayPort Rear Connector
- 1x 24-bit Dual-Channel LVDS Converter for External Display with 5V Backlight power output support
- 1x 10/100/1000 Gigabit LAN Rear Port
- 1x Dual-Stacked USB 3.0 Rear Port
- 2x Internal USB 2.0 headers
- 1x mPCIe/mSATA connector
- 1x SATA Gen3 (up to 6 GB/s) connector
- 1x 2-wire RS-232 Serial Port internal header
- 1x Internal SPI Interface for external device
- 1 x USB3.0/2.0 Type C and Display Port Interface
- HD Audio with Microphone, Stereo Line-in & Stereo Line-out internal header, SPDIF
- 1x Internal Front Panel Header for LEDs, Power Buttons and PC Speaker
- WIBU Secure Element (optional)
- TPM 2.0
- 1x Internal Header for up to 8 configurable GPIOs
- 1x Fan connector for CPU
- Temperature Sensor
- +5V DC Input via locking barrel-type connector or Internal Power Header
- pITX form factor and cooling solution
- 1 x Pigtail RTC battery

Built with these functions, pITX-APL Mother Board is ideal for ATM, Automation, Kiosk applications, medical equipment, industrial automation, financial automation, process control, semiconductor equipment and network security markets.

2.1. Configurations

Kontron offers the pITX-APL in different configurations. The products can be ordered in four different flavors.

Table 1: Component Main Data

Product Number	Description	MTBF (hours)
44010-0000-23-2	Intel® Mobile Celeron® N3350 2C 2.3 GHz, 6W, Commercial temp, Entry	1,571,585
44010-0000-20-4	Intel® Atom™ x7 E3950 4C 2.0 GHz, 13W, Industrial temp, High	1,577,287
44010-0000-18-4	Intel® Atom™ x5 E3940 4C 1.8 GHz, 9,5W, Industrial temp, Intermediate	1,577,287
44010-0000-18-2	Intel® Atom™ x5 E3930 2C 1.8 GHz, 6,5W, Industrial temp, Entry	1,577,287

⚠WARNING

Warning: If changing the premounted cooling system, then the system might get overheated resulting in instable system or defects if the cooling system is insufficient.

Figure 1: Premounted System with Battery Modul



2.2. Accessories List

Table 2: List of Accessories

Connector (RefDes)	On-Board Connectors		Mating Connectors/Cables	
	Manufacturer	Part No.	Manufacturer	Part No.
Fan (J23)	Molex	53047-0310	Molex	51021-0300
			Kontron	1060-9200
SATA (J9)	Lotes	ABA-SAT-010-K08	Kontron	96079-0000-00-1
Audio (J22)	Molex	53261-0671	Molex	51021-0600
			Kontron	96063-0000-00-1
DC Jack (J11)	Kycon	KLDHCX-0202-A-LT	Kycon	KLDX-PA-0202-A-LT
Internal Power (J4)	Leoco	2521P04VW00	Leoco	2520S040000

Connector (RefDes)	On-Board Connectors		Mating Connectors/Cables	
	Manufacturer	Part No.	Manufacturer	Part No.
LVDS (J19)	Samtec	SHF-120-01-F-D-SM-K-TR	Don Connex	A32-40-C-G-B-1
	Pinrex	53C-90-40GBE0	Pinrex	977-31-403204
			Kontron	821515
Serial COM (J20)	Molex	53261-0571	Molex	51021-0500
			Kontron	1055-8059
SPI (J12)	Molex	53261-0971	Molex	51021-0900
GPIO (Battery Module)	Molex	53261-1071	Molex	51021-1000
			Kontron	1055-8063
GPIO/RTC (J13)	Molex	87758-1216	Molex	79107-7205
			Kontron	1055-7645
Front Panel (J21)	Molex	87759-1014	Molex	51110-1050
	Amphenol-FCI	57202-F52-06LF	Kontron	1055-8065
USB2.0 (J7, J8)	Molex	53047-0410	Molex	51021-0400
			Kontron	96054-0000-00-2

3/ Installation procedure

3.1. Installing the Board



ESD Sensitive Device!

Electrostatic discharge (ESD) can damage equipment and impair electrical circuitry.

- Wear ESD-protective clothing and shoes
- Wear an ESD-preventive wrist strap attached to a good earth ground
- Check the resistance value of the wrist strap periodically (OK: 1 MΩ to 10 MΩ)
- Transport and store the board in its antistatic bag
- Handle the board at an approved ESD workstation
- Handle the board only by the edges

To get the board running follow these steps. If the board shipped from Kontron has already components like RAM and CPU cooler mounted, then relevant steps below can be skipped.

1. Turn off the PSU (Power Supply Unit)

NOTICE

Turn off PSU (Power Supply Unit) completely (no mains power connected to the PSU) or leave the Power Connectors unconnected while configuring the board. Otherwise components (RAM, LAN cards etc.) might get damaged. Make sure to use +5V single supply only. Alternatively use a standard ATX PSU with suitable cable kit and PS_ON# active.

2. Insert the memory module
   Be careful to push it in the slot(s) before locking the tabs. For a list of approved memory modules contact your Distributor or FAE. See also chapter "System Memory Support". Use memory modules with the same density in all sockets!
3. Cooler Installation
   Normally the cooler is premounted, but in case not, then make sure that the heat paste etc. on the cooler is intact and cover the full area of the SoC. Connect cooler fan electrically to the FAN_CPU connector.
4. Connecting Interfaces
   Insert all external cables for hard disk, keyboard etc. A monitor must be connected in order to change BIOS settings.
5. Connect and turn on PSU
   Connect PSU to the board by the ATX+5 V-4pin connector or alternatively connect an external 5 V DC power adapter to the rear DC jack.
6. BIOS Setup
   Enter the BIOS setup by pressing the <DEL> key during boot up.

   Enter "Exit Menu" and load Setup Defaults.

   Refer to the "BIOS Configuration / Setup" section of this manual for details on BIOS setup.



To clear all BIOS settings, including Password protection, activate "Load Default BIOS Settings" Jumper for > 10 sec (without power connected).

7. Mounting the board in chassis

NOTICE

When mounting the board to chassis etc. please notice that the board contains components on both sides of the PCB which can easily be damaged if board is handled without reasonable care. A damaged component can result in malfunction or no function at all.

When fixing the Motherboard on a chassis it is recommended to use screws with integrated washer and a diameter of > 7 mm. Do not use washers with teeth, as they can damage the PCB and cause short circuits.

3.2. Requirements IEC60950-1

Take care when designing chassis interface connectors in order to fulfil the IEC60950-1 standard. Users of pITX-APL must evaluate the end product to ensure compliance the requirements of the IEC60950-1 safety standard are met:

- The motherboard must be installed in a suitable mechanical, electrical and fire enclosure.
- The system in its enclosure must be evaluated for temperature and air flow considerations.
- The motherboard must be powered by a CSA or UL approved power supply that limits the maximum input current to 6 A to an external 5 V locking barrel-type DC jack or to an internal 5 V 4-pin DC power connector.
- For interfaces having a power pin such as external power or fan, ensure that the connectors and wires are suitably rated. All connections from/to the product shall be with SELV circuits only.
- Wires have suitable rating to withstand the maximum available power.
- The enclosure of the peripheral device fulfils the fire protecting requirements of IEC60950-1.

3.3. Lithium battery precautions

⚠CAUTION

Danger of explosion if the lithium battery is incorrectly replaced.

- Replace only with the same or equivalent type recommended by the manufacturer
- Dispose of used batteries according to the manufacturer's instructions

VORSICHT! Explosionsgefahr bei unsachgemäßem Austausch der Batterie.

- Ersatz nur durch denselben oder einen vom Hersteller empfohlenen Typ
- Entsorgung gebrauchter Batterien nach Angaben des Herstellers

ATTENTION! Risque d'explosion avec l'échange inadéquat de la batterie.

- Remplacement seulement par le même ou un type équivalent recommandé par le producteur
- L'évacuation des batteries usagées conformément à des indications du fabricant

PRECAUCION! Peligro de explosión si la batería se sustituye incorrectamente.

- Sustituya solamente por el mismo o tipo equivalente recomendado por el fabricante
- Disponga las baterías usadas según las instrucciones del fabricante

ADVARSEL! Lithiumbatteri – Eksplosionsfare ved fejlagtig håndtering.

- Udskiftning må kun ske med batteri af samme fabrikat og type
- Levér det brugte batteri tilbage til leverandøren.

ADVARSEL! Eksplosjonsfare ved feilaktig skifte av batteri.

- Benytt samme batteritype eller en tilsvarende type anbefalt av apparatfabrikanten.
- Brukte batterier kasseres i henhold til fabrikantens instruksjoner

VARNING! Explosionsfara vid felaktigt batteribyte.

- Använd samma batterityp eller en ekvivalent typ som rekommenderas av apparattillverkaren.
- Kassera använt batteri enligt fabrikantens instruktion.

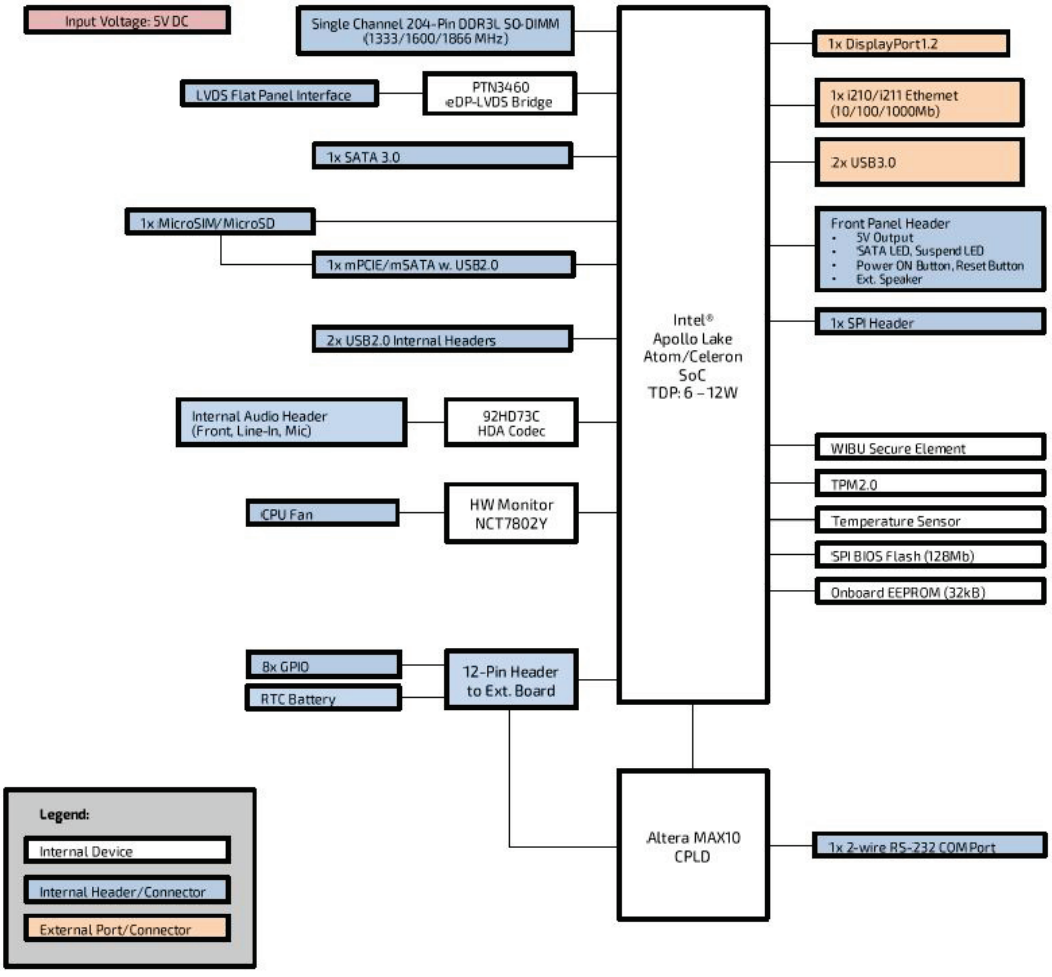
VAROITUS! Paristo voi räjähtää, jos se on virheellisesti asennettu.

- Vaihda paristo ainoastaan lalteval- mistajan suosittelemaan tyyppiln
- Hävitä käytetty paristo valmistajan ohjeiden mukaisesti

4/ System specifications

4.1. Block Diagram

Figure 2: Block Diagram



4.2. Component Main Data

The table below summarizes the features of the pITX-APL embedded motherboard.

Table 3: Component Main Data

Motherboard pITX-APL	
Form factor	Pico-ITX (100 mm by 72 mm by 1.6 mm/Length x Width x Thickness)
Mechanical Dimensions with cooling	100 mm x 72 mm x 41 mm (Length x Width x Height)
Processor	Onboard CPU variants Intel® Processor line, 14 nm SoC ▶ Intel® Atom™ x7 E3950 4C 2.0 GHz, 13 W ▶ Intel® Atom™ x5 E3940 4C 1.8 GHz, 9.5 W ▶ Intel® Atom™ x5 E3930 2C 1.8 GHz, 6.5 W ▶ Intel® Mobile Celeron® N3350 2C 2.3 GHz, 6 W
BIOS	Winbond W25Q128FVSIG or Micron N25Q128A13ESE40F (128Mb) for System BIOS
EEPROM	Atmel AT24C32 for board information
Memory	1x DDR3L SO-DIMM, support maximum memory size up to 8 Gbyte
Flash Memory	The pITX-APL board supports microSD cards via onboard microSD/microSIM combo connector. The microSD card interface is sharing a combo connector with the micro SIM card.
Storage	The pITX-APL supports one SATA Gen 3 port.
Wake On	Wake on LAN, USB, Power button (S3 to S5)
Hardware Status Monitor	The hardware monitoring chip NCT7802Y is connected via SMBus and incorporates the following features: ▶ CPU Temperature Monitoring ▶ Voltages Level ▶ Fan Control
TPM	Infineon SLB9665XQ2.0
Power management	ACPI 5.0 support: ▶ Processor Core C-States (CC0, CC1, CC6) ▶ Processor Core/Package States support (C0, C1, C1E, C6, C6L, C7, C8, C9, C10) ▶ Processor Module States (MC0-CC0, MC0-CC6, MC7) ▶ Display States support (D0, D1, D2, D3, D4, D5, D9) ▶ Graphics States (RC0, RC1, RC6) ▶ System Sleep States (S0, S0ix, S3, S4, S5) ▶ Dynamic I/O power reduction (disabling sense amps on input buffers, tri-stating output buffers) ▶ Active power-down of Display links
Battery	BR2032 See Safety Instructions below this table!
Expansion	1x mPCIe (PCIe Rev 2.0)/mSATA (SATA Gen 3.0) with USB 2.0 and microSIM interface

Operating System Support	Six different Board Support Packages are offered: ▶ BSP1: Windows 10 IOT Enterprise 64 bit, eMMC Boot ▶ BSP2: Windows 10 IOT Core, Redstone 64 bit ▶ BSP3: Windows 7, 64 bit, eMMC boot (optional) ▶ BSP4: Windows ES 7, 64 bit, eMMC boot (optional) ▶ BSP5: Linux 64 bit, Yocto ▶ BSP6: VxWorks 7.x or newer (optional) ▶ API: KEAPI 3 for all OS (except for VxWorks)
External I/O	
LAN, USB3.0	1x RJ-45 LAN Ports and dual USB3.0
Display Port (DP)	1x DisplayPort Rear Connector
Power	5 V DC-IN Power Jack
Internal I/O	
SATA	1x SATA Gen 3 Straight with Locking Latch
USB	2x USB 2.0 4-pin header
Serial Peripheral Interface (SPI)	internal 9-pin header
LVDS	1x 24-bit Dual-Channel LVDS Converter for External Display with 5 V Backlight power output support
mPCIe/mSATA Connector	1x 1 mPCIe/mSATA connector
Audio	HD Audio with Microphone, Stereo Line-in & Stereo Line-out internal header, SPDIF
Serial	1x RS232
Internal Header	
Power	one Locking barrel-type DC Power Jack one internal 4-pin Power connector one 1 x 3-pin power connector for CPU Fan
CMOS Clear/Autostart	two (1 x 3) 2 mm pin-header
Front Panel	one 2 x 5-pin connector
MicroSD/microSIM	one microSD & microSIM combo socket adapter

Display	
Graphics Controller	The pITX-APL board onboard graphics support two simultaneous displays via two Digital Display Interface (DDI) and one eDP output. First DDI output is connected directly to a rear DisplayPort connector. Second DDI is unused. eDP output is converted to LVDS by NXP PTN3460BS DisplayPort to dual-channel 24-bit LVDS converter. The LVDS interface is provided on a standard 40-pin connector.
eDP to LVDS Controller	NXP PTN3460BS
Display Interface	one Display Port and LVDS internal Note: Two independent Displays Max.
Resolution	DP/LVDS 4096x2304 @ 60 Hz, 24 bpp (One panel display)
Ethernet	
Controller	Intel i210/i211
Interface	IEEE 802.3 10BASE-T / 100BASE-TX / 1000BASE-T compliant
Audio	
Universal Audio Architecture (UAA)	The onboard audio codec supports High Definition Audio with UAA (Universal Audio Architecture). The following connections are available via an internal header: ▶ Stereo Line-Out ▶ Stereo Line-in ▶ Mono Microphone-in
Power	
External Power Supply	The pITX-APL is operated by a single 5 V DC supply via a locking Barrel-type jack or through an internal 4-pin header.

⚠CAUTION

Danger of explosion if the lithium battery is incorrectly replaced.

- Replace only with the same or equivalent type recommended by the manufacturer
- Dispose of used batteries according to the manufacturer's instructions

Table 4: Environmental Conditions

Operating	It is the customer's responsibility to provide sufficient airflow around each of the components to keep them within allowed temperature range. The board has two temperature ranges: ▶ commercial grade: 0°C to +60°C (32°F~140°F) operating temperature (forced cooling). ▶ extended grade: -25°C to +75°C (-13°F~167°F) operating temperature (SKU Dependent and with standard cooler running at maximum speed) ▶ DC Voltage Limits: ±7 % of nominal voltage. 10 % to 95 % relative humidity non-condensing at temperature of 25°C to 30°C
Storage	-40°C to 85°C (-40°F to 185°F); lower limit of storage temperature is defined by specification restriction of on-board BR2032 battery. Up to 95 % relative humidity (temperature 25°C to 30°C) ▶ Thermal ramps: 4 cycles between limits at a rate of ≤ 20°C per hour ▶ Temperature extremes: 36 nonconsecutive hours at high limit ▶ 24 nonconsecutive hours at low limit
Radiated Emissions (EMI)	All Peripheral interfaces intended for connection to external equipment are EMI protected. Compliant to the requirements of: ▶ EN55022 Class B radiated and conducted ▶ EN 61000-6-4:2007 (EMC) Generic emission standard Part 6-4: Emission standard for industrial environments ▶ EN 61000-6-2:2005 (EMC) – Generic standard – Immunity for industrial environmental
Immunity	Includes following tests accordingly: ▶ IEC 61000 PT4-2, (EN 61000-4-2) Electrostatic discharge immunity ESD ▶ IEC 61000 PT4-3, (EN 61000-4-3 and ENV 50204) Radiated Field ▶ IEC 61000 PT4-4, (EN 61000-4-4) Electrical fast transient/burst (EFT) BURST ▶ IEC 61000 PT4-5, (EN 61000-4-5) Surge immunity test ▶ IEC 61000 PT4-6, (EN 61000-4-6) Immunity to conducted disturbances ▶ IEC 61000 PT4-8, (EN 61000-4-8) Immunity to magnetic fields (LOW) ▶ IEC 61000 PT4-11, (EN 61000-4-11) Testing and measuring techniques-voltage dips, short interruption, and voltage variations immunity tests
Safety	EN 60950-1:2006 +A11:2009 +A1:2010 +A12:2011: Safety for information technology equipment including electrical business equipment
Shock	Conducted in standard available ATX chassis. Test is following Standard IEC 60068-2-27, half-sine wave, Acceleration 2 g, Pulse duration 11 ms. Number of shocks: 600 shocks (100 shocks for each face.)
Bump	IEC 60068-2-27: Half Sine Waveform Acceleration 2 g; Pulse Duration 11 ms. Number of shocks: 600 shocks (100 shocks for each face.)
Vibration	AW IEC 60068-2-64, test Fh, Random Vibration, 90 min per axis, 3 axes at 1.9 grms, with PSD: 10-20Hz: 0.05 g^2/Hz and 20-500Hz:- 3dB/octave.
MTBF	1,571,585 to 1,577,287 hours depending on processor type and according to Telcordia standard SR-332 Issue 3 at 30°C
Restriction of Hazardous Substances (RoHS II)	The product will comply to the European Council Directive on the approximation of the laws of the member states relating to Directive 20011/65/EU or the last status thereof.
Altitude	2000 m max., optionally 3000 m

Cooler	The Cooler heatspreader is active on the mITX-APL, so the cooler has integrated fan (UL-approved) with the following specifications: Supply Voltage: 4.5 V to 5.5 V Startup Voltage: 4.0 V Rotation Speed, rated: 5000 RPM Noise level, maximum: 27.0 dB(A) MTBF: 70000 Hours @ 40°C Operating Temperature: -25°C to +90°C

5/ Jumpers and Connectors

5.1. Hardware Configuration Setting

This chapter gives the definitions and shows the positions of jumpers, headers and connectors. All of the configuration jumpers on the board are in the proper position. The default settings shipped from factory are marked with an asterisk (*).

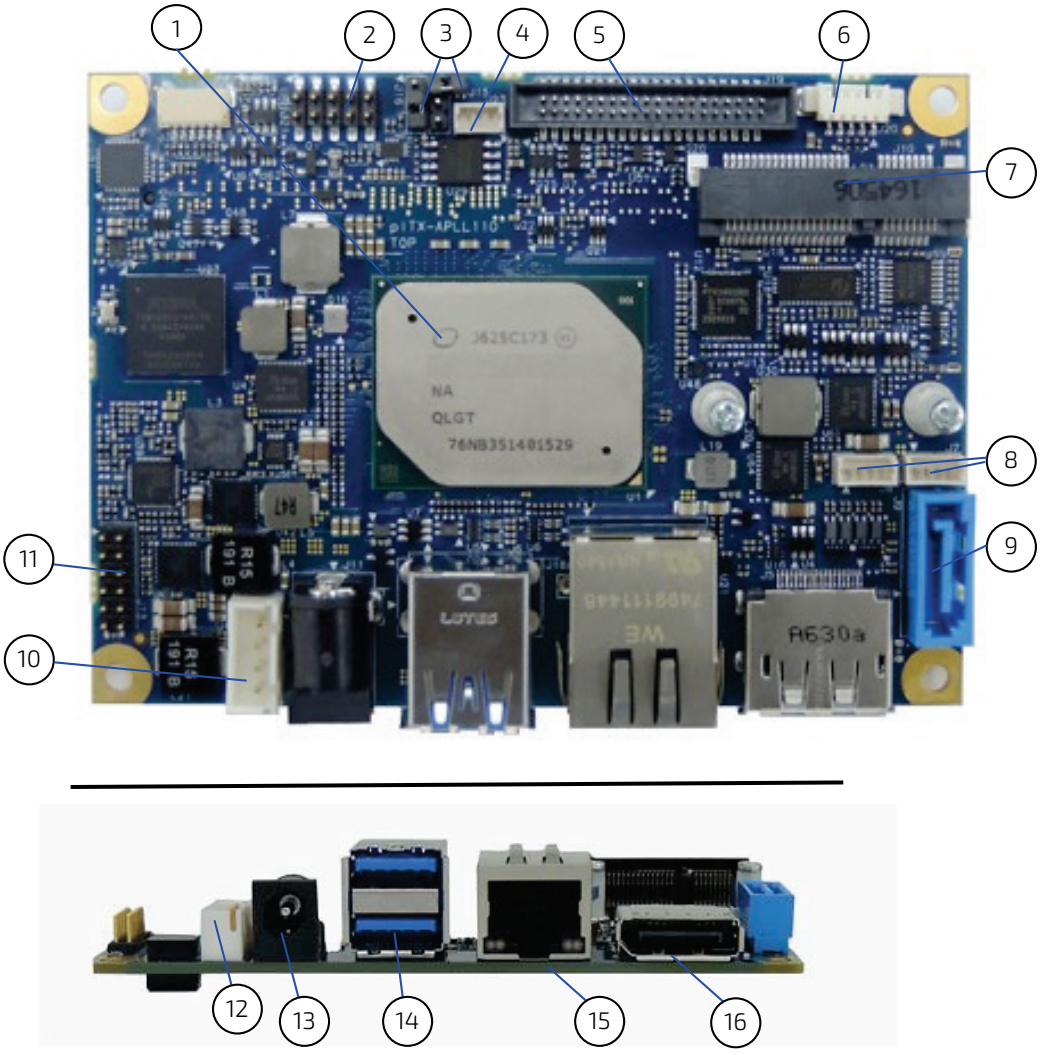
In general, jumpers on the board are used to select options for certain features. Some of the jumpers are designed to be user-configurable, allowing for system enhancement. The others are for testing purpose only and should not be altered. To select any option, cover the jumper cap over (SHORT) or remove (NC) it from the jumper pins according to the following instructions. Here, NC stands for “Not Connect”.

5.1.1. Jumpers and Connectors

Jumper	Function	Remark
CLR_CMOS (J15)	Clear CMOS	1 x 3 header
AUTOSTART (J16)	Always on	1 x 3 header
Connector	**Function**	**Remark**
CPU_FAN1 (J23)	CPU FAN Connector	1 x 3 wafer
FP (J21)	Front Panel Connector	2 x 5 header
LVDS (J27)	LVDS Connector	2 x 20 connector
ATX 4-pin (J4)	ATX Power Connector	1 x 4 connector
DC Jack (J11)	Power Connector	Jack
MINI-PCIE (J29)	Mini PCIe Connector	2 x 26 connector
SATA	SATA3.0 Connector	Standard
BAT	Battery Socket	BR2032 compatible
SODIMM	Memory Socket	Slot
GPIO (J13)	GPIO connector	1 x 10 wafer
USB 2.0 internal	USB internal	2x 4-pin connector
Front Panel Audio (J22)	Audio connector	1x 6-pin Header

5.2. Mainboard Placement and Rear I/O locations

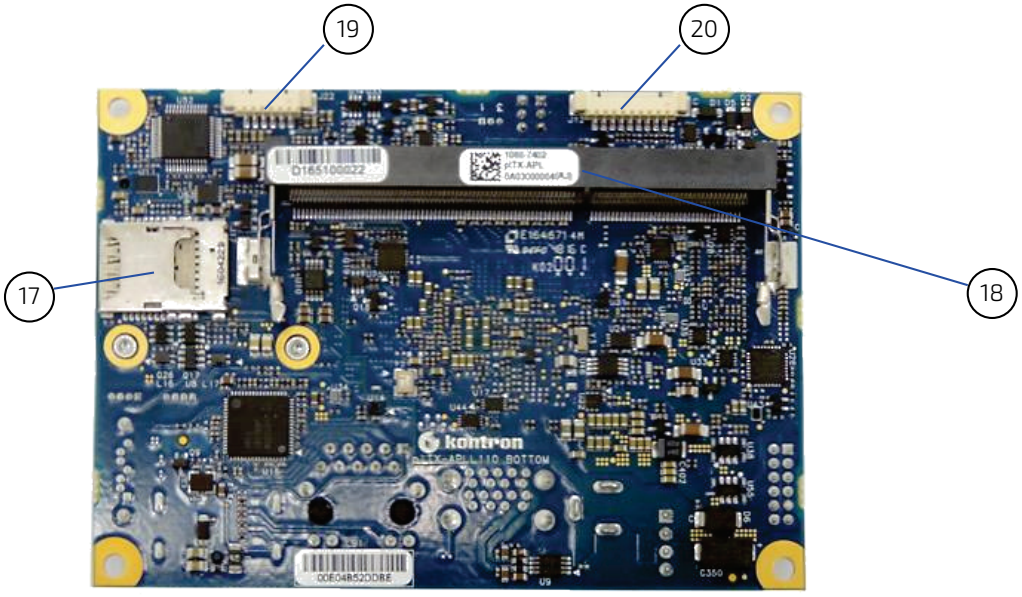
Figure 3: Front Side and Interfaces



1 CPU
2 Front Panel header (J21)
3 Load BIOS Default Jumper (right)
Autostart Jumper (left)
4 CPU fan (J23)
5 LVDS connector (J19)
6 RS232 connector (J20)
7 mPCIe/mSATA connector
8 2x USB 2.0 connector
9 SATA connector (J9)
10 Four-Pin Power connector (J4)
11 SBC Connector (eight GPIOs and RTC battery via SBC Battery Module) (J13)
12 Power connector (J4)
13 DC Power Jack (J11)
14 Dual USB 3.0
15 Ethernet
16 Display Port

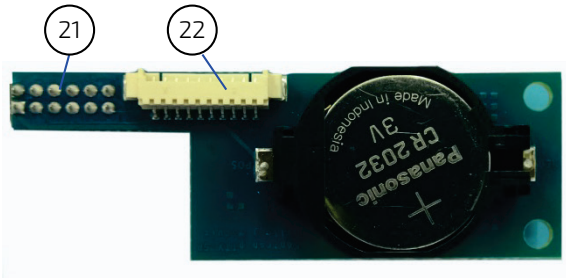
5.2.1. Rear Side

Figure 4: Rear Side



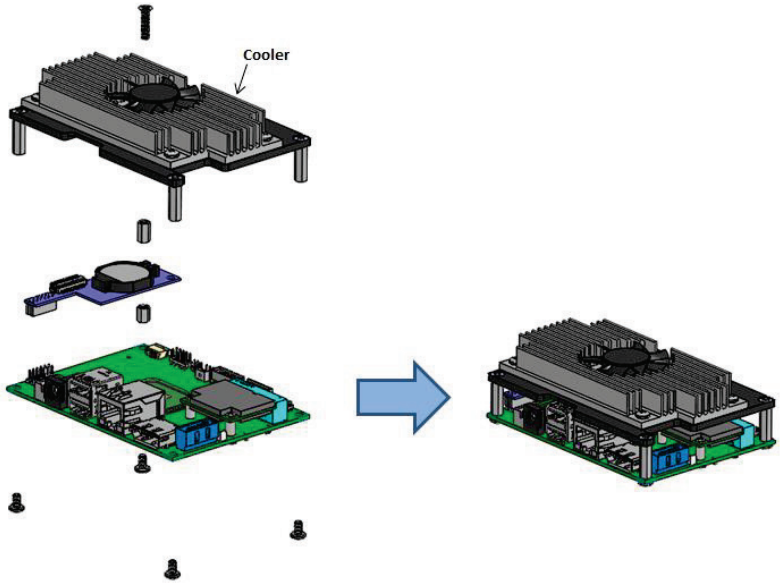
17 MicroSIM/MicroSD Combo adapter
18 Memory slot
19 Front Panel Audio connector (J22)
20 BIOS recovery (J12)

Figure 5: Battery Module



21 SBC Header to board
22 GPIO Header

Figure 6: System parts with integrated premounted cooler



6/ Pin Definitions

The following sections provide pin definitions and detailed description of all on-board connectors.
The connector definitions follow the following notation:

Table 5: Connector Definitions

Column Name	Description
Pin	Shows the pin-numbers in the connector. The graphical layout of the connector definition tables is made similar to the physical connectors.
Signal	The mnemonic name of the signal at the current pin. The notation "XX#" states that the signal "XX" is active low.
Type	AI: Analog Input. AO: Analog Output. I: Input, TTL compatible if nothing else stated. IO: Input / Output. TTL compatible if nothing else stated. IOT: Bi-directional tristate IO pin. IS: Schmitt-trigger input, TTL compatible. IOC: Input / open-collector Output, TTL compatible. IOD: Input / Output, CMOS level Schmitt-triggered. (Open drain output) NC: Pin not connected. O: Output, TTL compatible. OC: Output, open-collector or open-drain, TTL compatible. OT: Output with tri-state capability, TTL compatible. LVDS: Low Voltage Differential Signal. PWR: Power supply or ground reference pins.
	Ioh: Typical current in mA flowing out of an output pin through a grounded load, while the output voltage is > 2.4 V DC (if nothing else stated). Iol: Typical current in mA flowing into an output pin from a VCC connected load, while the output voltage is < 0.4 V DC (if nothing else stated).
Pull U/D	On-board pull-up or pull-down resistors on input pins or open-collector output pins.
Note	Special remarks concerning the signal.
Designation	Type and number of item described
see Section	Number of section in this manual containing detailed description

6.1. Processor Support

The Intel BGA1296 14 nm is a SoC architecture with integrated Memory and Graphics Controller. The system supports the following embedded Stockkeeping Units (SKUs):

- Intel® Atom™ x7 E3950 4C 2.0 GHz, 12 W
- Intel® Atom™ x5 E3940 4C 1.8 GHz, 9.5 W
- Intel® Atom™ x5 E3930 2C 1.8 GHz, 6.5 W
- Intel® Mobile Celeron® N3350 2C 2.3 GHz, 6 W

Kontron has defined the board versions as listed in the following table, so far all based on Embedded CPUs.

Table 6: Processor Support

Name	Product number	Speed	Embed.	Cache	TDP / Tj
Atom x7 E3950 4C	44010-0000-20-4	2.0 GHz	Yes	2 MB	12 W/110°C
Atom x5 E3940 4C	44010-0000-18-4	1.8 GHz	Yes	2 MB	9.5 W/85°C
Atom x5 E3930 4C	44010-0000-18-2	1.8 GHz	Yes	2 MB	6.5 W/110°C
Mobile Celeron N3350 2C	44010-0000-23-2	2.3 GHz	Yes	2 MB	6 W/105°C

6.2. System Memory Support

The pITX-APL board supports a DDR3L SO-DIMM memory interface. The integrated memory controller can support memory speeds of 1866 MHz. Maximum memory supported is 8 GB.



If using 32 Bit OS, less than 4 GB are displayed in the system (Shared Video Memory/PCI resources are subtracted).

Kontron offers the following memory module:

Table 7: Memory Support

Memory Module Description
DDR3L SO-DIMM, support maximum memory size up to 8 Gbyte

6.3. MicroSD and MicroSIM

Figure 7: Combo Connector for MicroSD and MicroSIM

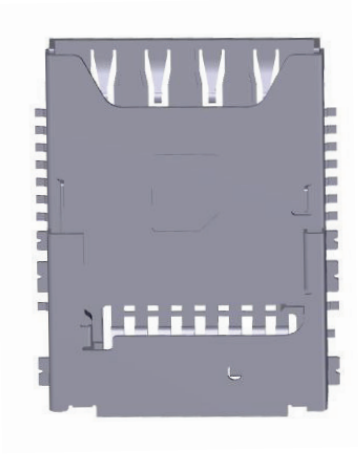


Table 8: Pin Assignment MicroSIM

Pin	Type
1	V_VCC
2	RST
3	CLK_S3
4	RSVD_S4
5	GND_S5
6	V_VPP
7	I/O
8	RSVD_S8

Table 9: Pin Assignment MicroSD

Pin	Type
1	DAT2
2	CD/DAT3
3	CMD
4	V_VDD
5	CLK_T5
6	VSS/GND
7	DAT0
8	DAT8
SW	CARD_DETECT

6.4. Ethernet Connectors (I/O area)

The pITX-APL supports one channel of 10/100/1000 Mbit/s Ethernet (LAN1 to LAN3).

In order to achieve the specified performance of the Ethernet port, Category 5 twisted pair cables must be used with 10/100 MBit/s and Category 5E, 6 or 6E with 1 GBit/s LAN networks.

Figure 8: Ethernet Connector

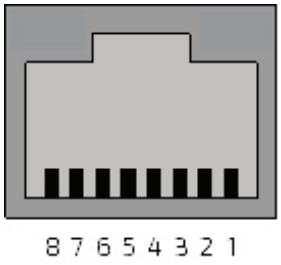


Table 10: Pin Assignment

Pin	Signal	Ethernet 10 BaseT/100BaseT	Gigabit-Ethernet
1	MDI0+	TX+	D1+
2	MDI0-	TX-	D1-
3	MDI1+	RX+	D2+
4	MDI1-		D3+
5	MDI2+		D3-
6	MDI2-	RX-	D2-
7	MDI3+		D4+
8	MDI3-		D4-

Table 11: Signal Description

Signal	Description
MDI[0]+ / MDI[0]-	In MDI mode, this is the first pair in 1000Base-T, i.e. the BI_DA+/- pair, and is the transmit pair in 10Base-T and 100Base-TX. In MDI crossover mode, this pair acts as the BI_DB+/- pair, and is the receive pair in 10Base-T and 100Base-TX.
MDI[1]+ / MDI[1]-	In MDI mode, this is the second pair in 1000Base-T, i.e. the BI_DB+/- pair, and is the receive pair in 10Base-T and 100Base-TX. In MDI crossover mode, this pair acts as the BI_DA+/- pair, and is the transmit pair in 10Base-T and 100Base-TX.
MDI[2]+ / MDI[2]-	In MDI mode, this is the third pair in 1000Base-T, i.e. the BI_DC+/- pair. In MDI crossover mode, this pair acts as the BI_DD+/- pair.
MDI[3]+ / MDI[3]-	In MDI mode, this is the fourth pair in 1000Base-T, i.e. the BI_DD+/- pair. In MDI crossover mode, this pair acts as the BI_DC+/- pair.

6.5. USB Connectors (I/O area)

The pITX-APL board contains support for two USB3.0/2.0 in the IO area. Two internal USB2.0 ports are available via internal 4-pin connectors. USB 2.0 ports allowing data transfers up to 480 Mb/s. The USB 3.0 port allowing data transfers up to 5 Gb/s.

Figure 9: USB 2.0/3.0 socket

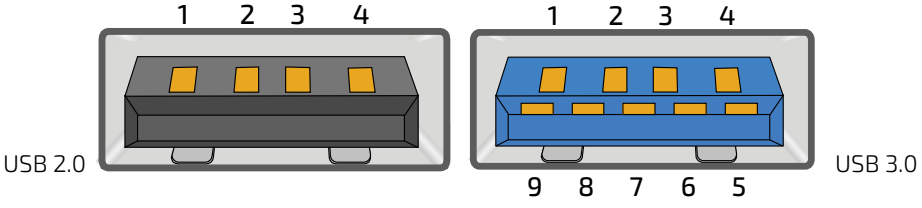


Table 12: Pin Assignment

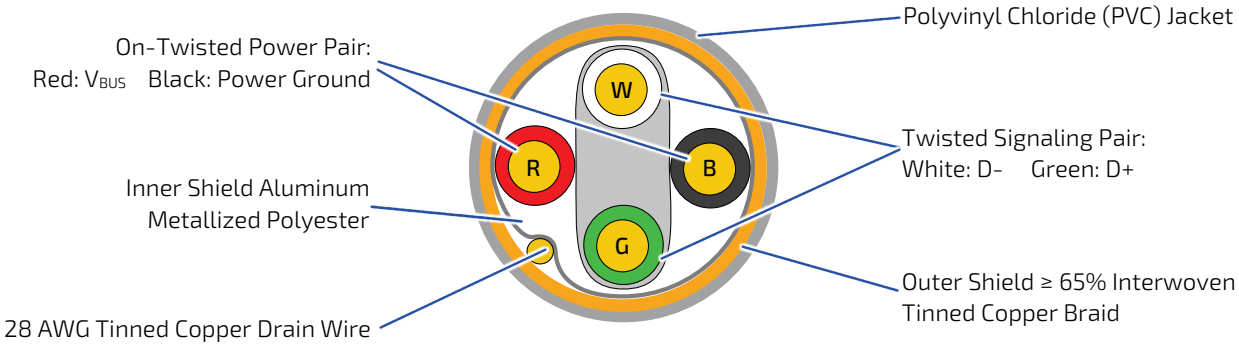
Pin	Type	Signal	Note
1	PWR	GND	USB2.0 / 3.0
2	IO	USB n+	USB2.0 / 3.0
3	IO	USB n-	USB2.0 / 3.0
4	PWR	5 V / SB 5 V	USB2.0 / 3.0
5	IO	TXn+	USB3.0
6	IO	TXn-	USB3.0
7	PWR	GND	USB3.0
8	IO	RXn+	USB3.0
9	IO	RXn-	USB3.0

Table 13: Signal Description

Signal	Description
USBn+ USBn- RXn+ RXn- TXn+ TXn-	Differential pair works as serial differential receive/transmit data lines. Change to: USB2.0 (n=0,1,2,3), USB3.0 (n=0,1)
5 V / SB5 V	5 V supply for external devices. SB5 V is supplied during power-down to allow wakeup on USB device activity. Protected by a 2A current limiting IC (1A for each port).

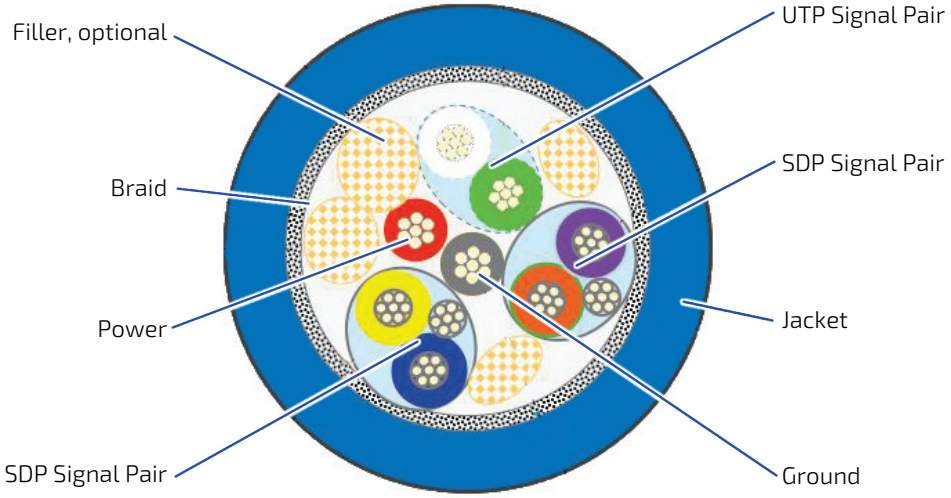
For USB2.0 cabling it is required to use only HiSpeed USB cable, specified in USB2.0 standard:

Figure 10: USB 2.0 High Speed Cable



For USB3.0 cabling it is required to use only HiSpeed USB cable, specified in USB3.0 standard:

Figure 11: USB 3.0 High Speed Cable



6.6. Fan Connector (internal, J23)

The Fan can be used to actively cool the heatsink mounted on the board. The fan rotation speed can be monitored and the fan speed controlled by the temperature of the PCB (near SoC).

Figure 12: 3-pin Fan Connector

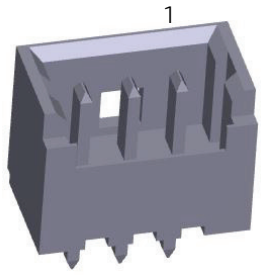


Table 14: 3-pin Mode

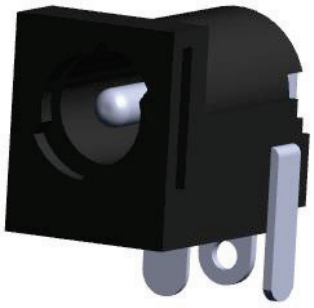
Pin	Signal	Description	Type
1	TACHO	Rotation speed	I
2	PWM	PWM output	0-5V
3	GND	Ground	PWR

Table 15: Signal Description

Signal	Description
GND	Power Supply GND signal
TACHO	Tacho input signal from the fan, for rotation speed supervision RPM (Rotations Per Minute).
PWM	Output signal for FAN speed control.

6.7. DC Power Jack Connector (5 Vin Ext., J11)

Figure 13: Power Jack Connector



Either the DC Power Jack Connector (5 Vin Ext.) or the "5 Vin Int." connector must be used to supply the board with +5V +/-5 %.

The 5 Vin Ext. power connector has Vin to the center pin and mates with Ø 6.3 mm DC Power jack with Ø 2.0 mm pin hole. (DC Connector RA 2 mm locking type). Maximum allowed current is 5 A.

⚠CAUTION

The board can be supplied via the AC/DC adapter plugged into the power jack. Such adapters have usually no connection to protective earth. Consequently, the potential of the conductive parts on the board may drift. If a human touches such a part, this may lead to an electric shock. The board must be grounded separately, if the unit is supplied via power jack.

⚠WARNING

Hot Plugging power supply is not supported.
Hot plugging might damage the board.

NOTICE

To protect the external power lines of peripheral devices make sure that

- the wires have the right diameter to withstand the maximum available current.
- to enclosure of the peripheral device fulfills the fire-protecting conditions of IEC/EN 60950.

6.8. Internal Power Connector (Vin Int., J4)

Figure 14: Internal Power Connector

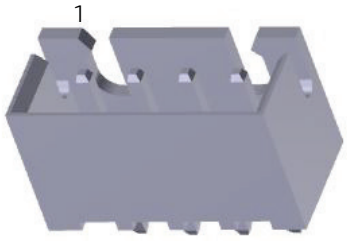


Table 16: Internal Power Connector

Header	Pin	Signal	Description
1	+5V	+5V power input	PWR
2	+5V	+5V power input	PWR
3	GND	Power Ground	PWR
4	GND	Power Ground	PWR

Maximum allowed current on each pin is 3A.

6.9. Front Panel (FP) internal (J21)

Figure 15: FP Connector



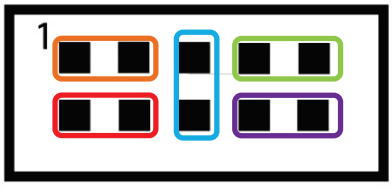


Table 17: FP Connection

Pin	Description	Pin	Description
1	Ext_Reset	2	Ext_PWRBTN
3	GND	4	GND
5	Ext_SPKR	6	Ext_V_5V0_S0
7	Ext_3V3_S5_P7	8	Ext_V_3V3_S5_P8
9	Ext_SATA_LED#	10	Ext_SUS_LED

6.10. USB internal (J7, J8)

Figure 16: USB Internal Connector

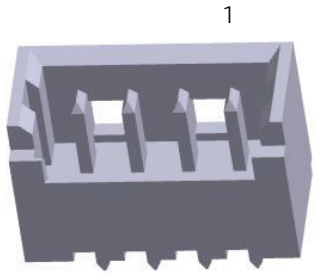


Table 18: USB Internal Connection

Pin	Description	Pin	Description
1	GND	2	USBn+
3	USBn-	4	5 V/SB 5 V

6.11. SBC Connector (GPIO and Ext. Battery) (internal, J13))

Figure 17: SBC Connector



Table 19: SPI Internal Connection

Pin	Description	Pin	Description
1	V_3V3_S5	2	FGPIO0
3	FGPIO1	4	FGPIO2
5	FGPIO3	6	FGPIO4
7	FGPIO5	8	FGPIO6
9	FGPIO7	10	GND
11	GND	12	EXT_BAT

6.12. GPIO Connector (J13)

Figure 18: GPIO Connector

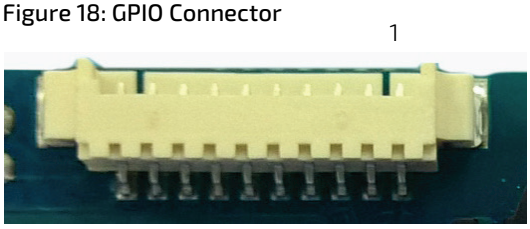


Table 20: GPIO Pinout

Pin	Description	Pin	Description
1	V_3V3_S5	2	FGPIO0
3	FGPIO1	4	FGPIO2
5	FGPIO3	6	FGPIO4
7	FGPIO5	8	FGPIO6
9	FGPIO7	10	GND

6.13. Jumper Load BIOS Default and Clear CMOS (J15)

Figure 19: CMOS Internal Connector

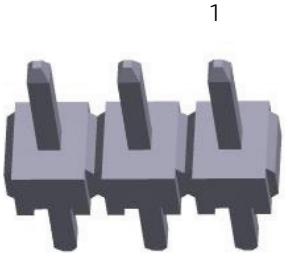


Table 21: CMOS Internal Connection

Pin	Description
1	RTC_TEST#
2	GND
3	DIS_SECCMOS

Function:

Pin 1-2: Clear CMOS

Pin 1-X: Default

Pin 2-3: Load BIOS Default

6.14. Jumper Always ON (J16)

Figure 20: Always ON

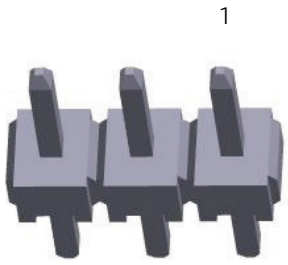


Table 22: Always ON Internal Connection

Pin	Description
1	GND
2	AUTOSTART#
3	NC

Function:

Pin1-2: Always ON

Pin2-3: Default Position

6.15. LVDS (internal, J19)

Figure 21: LVDS Connector

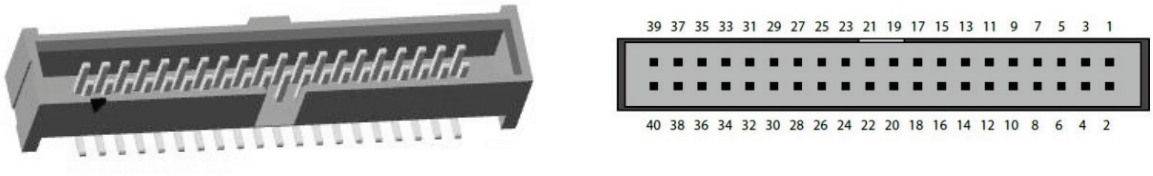


Table 23: LVDS Pin Assignment

Pin	Description	Pin	Description
1	5 V	2	5 V
3	5 V	4	5 V
5	5 V	6	GND
7	5 V	8	GND
9	V_LVDS	10	V_LVDS
11	LVDS_DDC_CLK	12	LVDS_DDC_DATA
13	LVDS_EDP_BKLTCTL	14	LVDS_EDP_VDD_EN
15	LVDS_BKLT_EN_OUT	16	GND

Pin	Description	Pin	Description
17	LVDS_A_DATA0-	18	LVDS_A_DATA_A0+
19	LVDS_A_DATA1-	20	LVDS_A_DATA_A1+
21	LVDS_A_DATA2-	22	LVDS_A_DATA_A2+
23	LVDS_A_CLK-	24	LVDS_A_CLK+
25	LVDS_A_DATA3-	26	LVDS_A_DATA3+
27	GND	28	GND
29	LVDS_B_DATA0-	30	LVDS_B_DATA_A0+
31	LVDS_B_DATA1-	32	LVDS_B_DATA1+
33	LVDS_B_DATA2-	34	LVDS_B_DATA2+
35	LVDS_B_CLK-	36	LVDS_B_CLK+
37	LVDS_B_DATA3-	38	LVDS_B_DATA3+
39	GND	40	GND

6.16. SATA (Serial ATA) Disk Interfaces (internal, J9)

Figure 22: SATA Connector

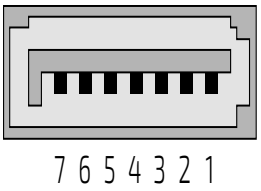


Table 24: Pin Assignment

Pin	Signal	Type
1	GND	PWR
2	SATA* TX+	
3	SATA* TX-	
4	GND	PWR
5	SATA* RX-	
6	SATA* RX+	
7	GND	PWR

Table 25: Signal Description

Signal	Description
SATA0 RX+ / RX-	Host transmitter differential signal pair
SATA0 TX+ / TX-	Host receiver differential signal pair

Figure 23: Available Cable Kit



6.17. Display Port

The external DisplayPort 1.2 at rear I/O space is supporting Active/Passive HDMI 1.4a and DVI adapter.

Figure 24: Display Port

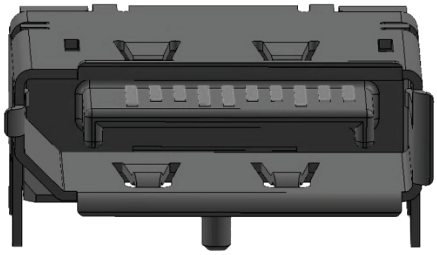


Table 26: Display Port

Pin	Signal	Description
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	CONFIG1	connected to Ground[1)]
14	CONFIG2	Connected to Ground[1)]
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 (3.3 V 500 mA)

6.18. mPCIe/mSATA connector (J10)

NOTICE

The Slot connector has two functions: mSATA or miniPCIe. The Slot connector detects the mounted card technology with autosensing. So there is no need for further configuration.

Figure 25: Slot Connector (mPCIe)

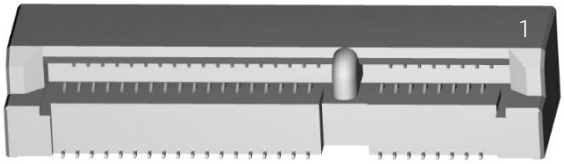


Table 27: Pin Assignment mPCIe

Pin	Signal	Type
1	WAKE#	
2	+3V3	PWR
3	NC	NC
4	GND	PWR
5	NC	NC
6	+1.5V	PWR
7	CLKREQ#	
8	UIM_PWR	PWR
9	GND	PWR
10	UIM_DATA	NC
11	PCIE_mini CLK#	
12	UIM_CLK	NC
13	PCIE_mini CLK	
14	UIM_RESET	NC
15	GND	PWR
16	UIM_VPP	NC
17	UIM_IC_DM	NC
18	GND	PWR
19	UIM_IC_DP	
20	W_Disable#	
21	GND	PWR
22	RST#	
23	PCIE_RX-/SATA_RX-	
24	+3V3	PWR
25	PCIE_RX+/SATA_RX+	
26	GND	PWR

Pin	Signal	Type
27	GND	PWR
28	+1.5 V	PWR
29	GND	PWR
30	SMB_CLK	
31	PCIE_TX-/SATA_TX-	
32	SMB_DATA	
33	PCIE_TX+/SATA_TX+	
34	GND	PWR
35	GND	PWR
36	USBhub_D1_N	IO
37	GND	PWR
38	USBhub_D1_P	IO
39	+3V3	PWR
40	GND	PWR
41	+3V3	PWR
42	NC	NC
43	SATA_DET5#	
44	NC	NC
45	NC	NC
46	NC	NC
47	NC	NC
48	+1.5 V	PWR
49	NC	NC
50	GND	PWR
51	NC	NC
52	+3V3	PWR

6.19. Serial COM (J20)

Figure 26: Serial COM

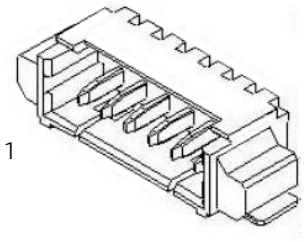


Table 28: Pin Assignment Serial COM

Pin	Signal
1	RS232_TXD
2	RS232_RXD
3	RS232_RTS#
4	RS232_CTS#
5	GND

6.20. Front Panel Audio Connector (J22)

Figure 27: Audio Connector

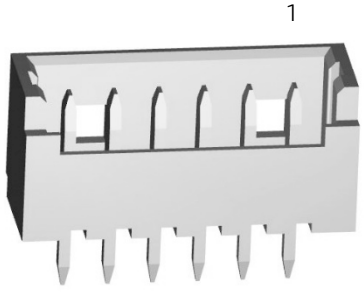


Table 29: Pin Assignment Audio Connector

Pin	Signal
1	LINE_OUT_R_HEADER
2	GND
3	LINE_OUT_L_HEADER
4	LINE_IN_R_HEADER
5	MIC_IN_HEADER
6	LINE_IN_L_HEADER

7/ Installation and Power Considerations

7.1. Hardware Monitor

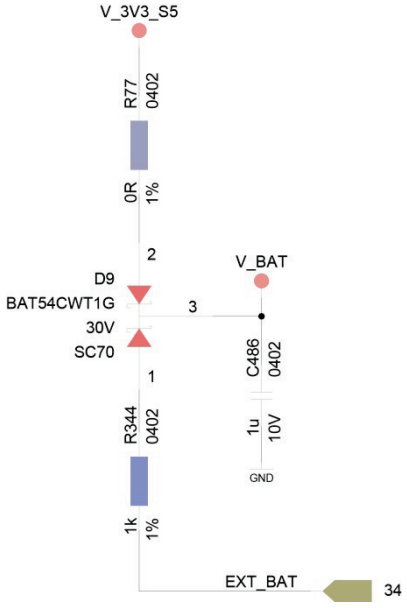
The hardware monitoring chip NCT7802Y is connected via SMBus and incorporates the following features:

- CPU Temperature Monitoring
- Voltages Level
- Fan Control

7.2. Real-Time Clock

A battery maintains power to the real time clock (RTC) when in a mechanical off state. A BR2032 battery is connected using Pigtail battery.

Figure 28: Real-Time Clock



7.3. Onboard Power Supply

All used power rails are generated internal by a highly integrated DC/DC power unit.

- Voltage Ripple specification max ±5 % peak to peak 0-20 MHz
- Rise Time specification 2 to 20ms from input voltage <10 % to nominal VCC

7.4. External Power Supply

The pITX-APL is operated by a single 5V DC supply via a locking Barrel-type jack or through an internal 4-pin header.

7.5. Power Management

ACPI 5.0 support:

- Processor Core C-States (CC0, CC1, CC6)
- Processor Core/Package States support (C0, C1, C1E, C6, C6L, C7, C8, C9, C10)
- Processor Module States (MC0-CC0, MC0-CC6, MC7)
- Display States support (D0, D1, D2, D3, D4, D5, D9)
- Graphics States (RC0, RC1, RC6)
- System Sleep States (S0, S0ix, S3, S4, S5)
- Dynamic I/O power reduction (disabling sense amps on input buffers, tri-stating output buffers)
- Active power-down of Display links

Table 30: Power Management

State	Description
G0/S0/C0	**FULL ON:** Processor operating. Individual devices may be shut down to save power. The different processor operating levels are defined by Cx states.
G0/S0/Cx	**Cx State**: Processor manages C-State itself.
G1/S3*	**Suspend-To-RAM (STR):** The system context is maintained in system DRAM, but power is shut off to non-critical circuits. Memory is retained and refreshes continue. All external clocks stop except RTC.
G1/S4	**Suspend-To-Disk (STD):** The context of the system is maintained on the disk. All of the power is shut down except power for the logic to resume. The S4 and S5 states are treated the same.
G2/S5	**Soft-Off:** System context is not maintained. All of the power is shut down except power for the logic to restart. A full boot is required to restart. A full boot is required when waking. The S4 and S5 states are treated the same.
G3	**Mechanical OFF**: System content is not maintained. All power shutdown except for the RTC. No "Wake" events are possible, because the system does not have any power. When system power returns, transition will depend on the state just prior to the entry to G3.

*G1/S3 is only supported in Non-Connected Standby mode.

Power features:

- Reset Button behavior : Board will reset but do not keep reset state as long as reset button is pressed
- Automatic Power On Features: Board can power on automatically in single supply operation with VCC connected if Auto Start is activated.

8/ uEFI BIOS

8.1. Starting the uEFI BIOS

The pITX-APL is provided with a Kontron-customized, pre-installed and configured version of American Megatrends, Inc. (AMI). It is based on the Unified Extensible Firmware Interface (uEFI) specification and the Intel® Platform Innovation Framework for EFI. This uEFI BIOS provides a variety of new and enhanced functions specifically tailored to the hardware features of the pITX-APL.

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

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

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

1. Power on the board.
2. Wait until the first characters appear on the screen (POST messages or splash screen).
3. Press the <DEL> key.
4. If the uEFI BIOS is password-protected, a request for password will appear. Enter either the User Password or the Supervisor Password (see Security menu), press <RETURN>, and proceed with step 5.
5. A Setup menu will appear.

The pITX-APL uEFI BIOS Setup program uses a hot key-based navigation system. A hot key legend bar is located on the bottom of the Setup screens.

The following table provides information concerning the usage of these hot keys.

Table 31: Navigation Hot Keys Available in the Legend Bar

Hotkeys	Description
<F1>	The <F1> key is used to invoke the General Help window.
<->	The<Minus> key is used to select the next lower value within a field.
<+>	The <Plus> key is used to select the next higher value within a field.
<F4>	The <F4> key is used to Exit saving Changes.
<F3>	The <F3> key is used to load Optimized Defaults.
<→> or <←>	The <Left/Right> arrows are used to select major Setup menus on the menu bar. For example: Main screen, Advanced screen, Security screen, etc.
<↑> or <↓>	The <Up/Down> arrows are used to select fields in the current menu. For example a Setup function or a sub-screen.
<ESC>	The <ESC> key is used to exit a Setup menu.
<ENTER>	The <ENTER> key is used to execute a command or select a submenu.

8.2. Setup Menus

The Setup utility features a selection bar at the top of the screen that lists the available menus:

1. Main
2. Advanced
3. Chipset
4. Security
5. Boot
6. Save & Exit

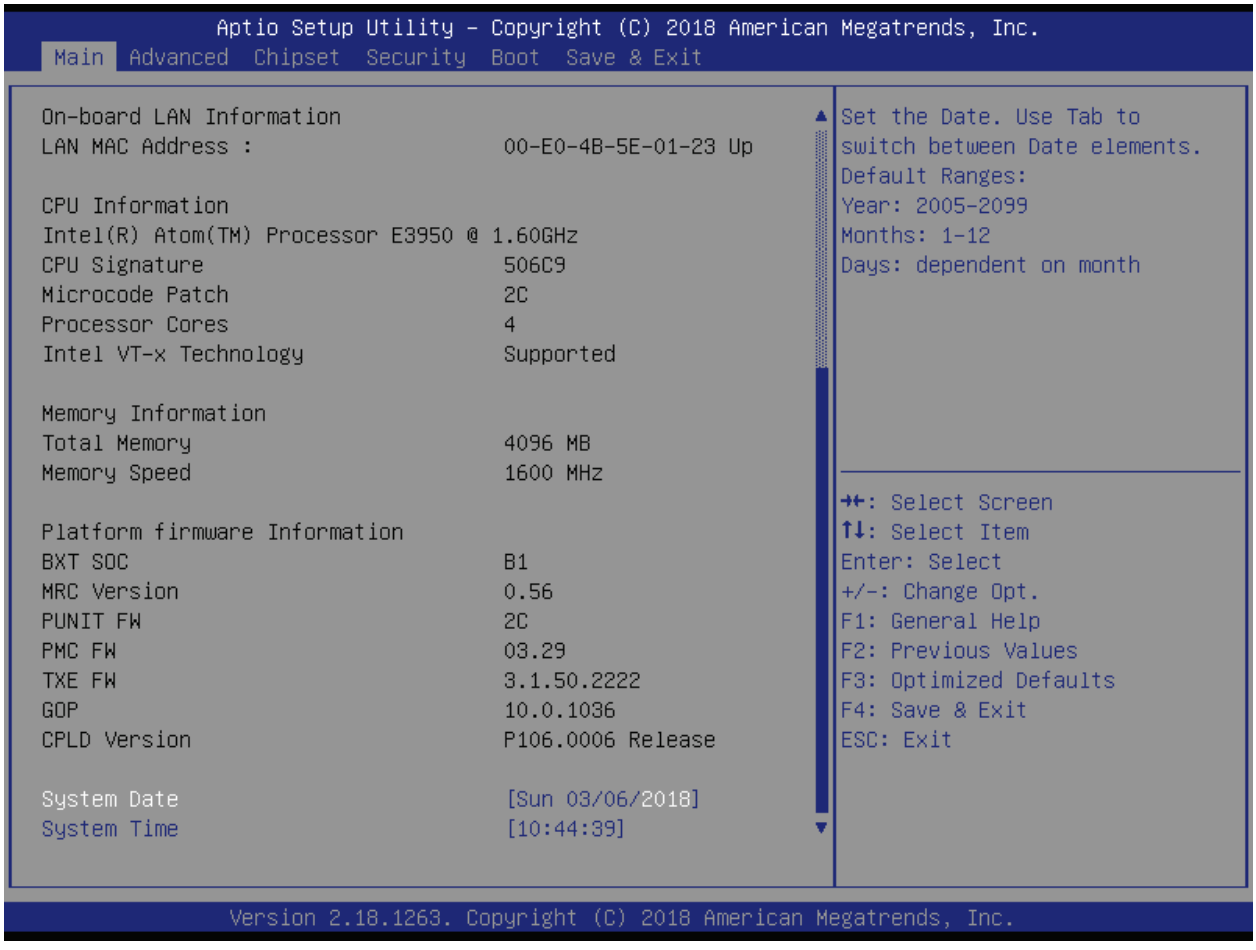
The currently active menu and the currently active uEFI BIOS Setup item are highlighted in white. Use the left and right arrow keys to select the Setup menus.

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

8.2.1. Main Setup Menu

On entering the uEFI BIOS, the Setup program displays the Main Setup menu. This screen lists basic system and board information.

Figure 29: Main Setup Menu Initial Screen



The following table shows Main sub-screens and functions, and describes the content. Default settings are in **bold**.

Table 32: Main Setup Menu Sub-screens

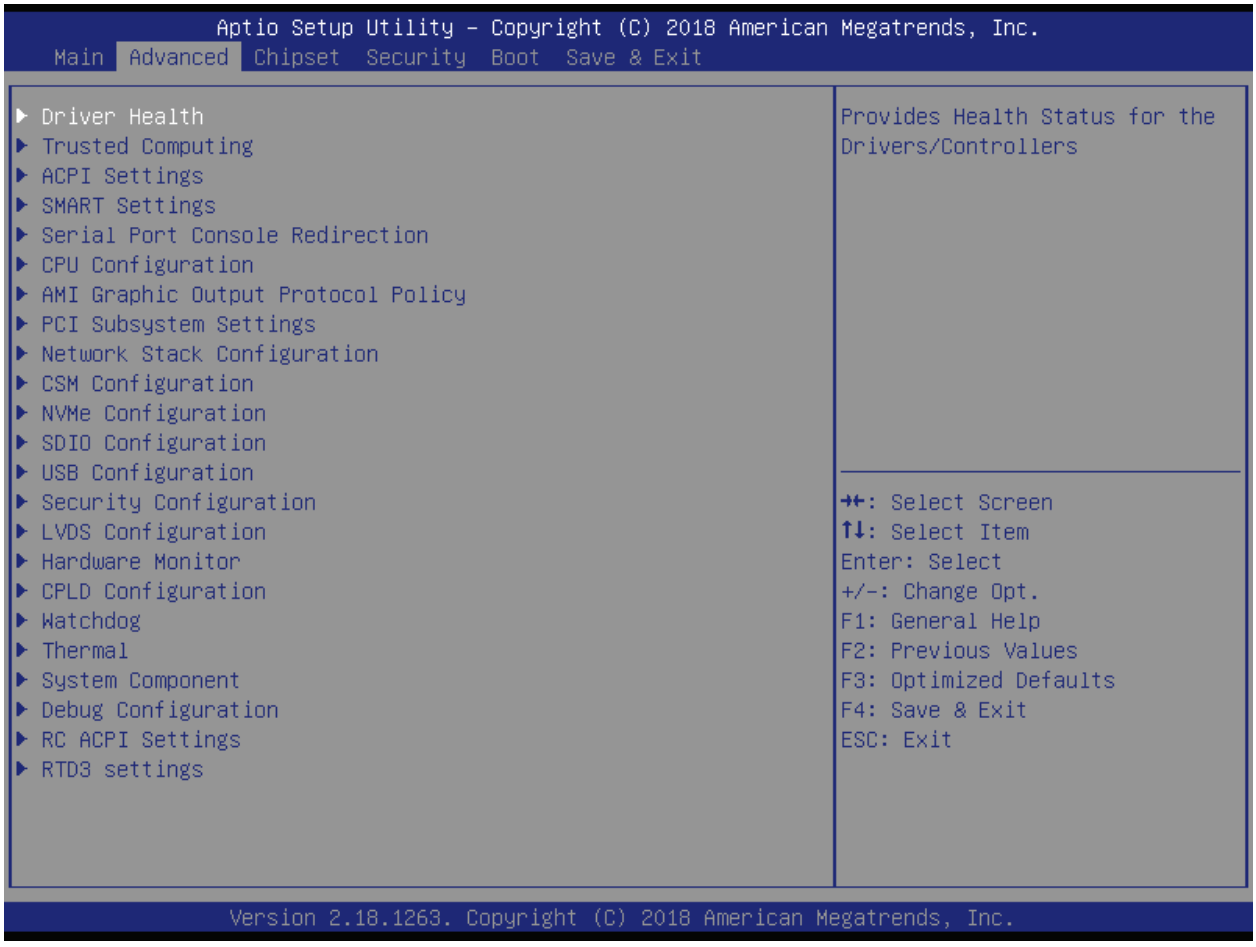
Sub-Screen	Function	Second level Sub-Screen / Description
BIOS Information	Read only field	
	Displays BIOS Information	
	Board Vendor, BIOS Version, Build Date and Time, Access Level	
Board Information	Read only field	
	Displays Board Information	
	Manufacturer, Product Name, PCB Version, Serial Number, Part Number, Boot Count	
On-board LAN Information	Read only field	
	Displays LAN MAC Address	
CPU Information	Read only field	
	Displays CPU Information	
Memory Information	Read only field	
	Displays Memory Information	
Platform firmware Information	Read only field	
	Displays Platform firmware Information	
System Date>	Sets the system date	
	[mm/dd/yyyy]	
System Time>	Sets the system time	
	[hh:mm:ss]	

8.2.2. Advanced Setup Menu

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

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

Figure 30: Advanced Setup Menu Initial Screen



The following table shows the Advanced sub-screens and functions and describes the content. Default settings are in **bold** and some functions include additional information. The function / submenu in *italic* indicate either status display or submenu string that cannot be selected. The underlined statement indicates the condition for the availability of the second-level submenu in reference to submenu.

Table 33: Advanced Setup menu Sub-screens and Functions

Sub-Screen	Function	Second level Sub-Screen / Description
Driver Health	*Intel® PRO/1000 7.0.06 PCI-E*	
Trusted Computing	*TPM20 Device Status, Vendor and Firmware Version.* Security Device Support **[Enable]**	<u>When set to Enable:</u> *Active PCR banks* *Available PCR banks*
		SHA-1 PCR Bank **[Enabled]**
		SHA256 PCR Bank **[Enabled]**
		Pending operation **[None]**
		Platform Hierarchy **[Enabled]**
		Storage Hierarchy **[Enabled]**
		Endorsement Hierarchy **[Enabled]**
		TPM2.0 UEFI Spec Version **[TCG_2]**
		Physical Presence Spec Version **[1.3]**
		TPM 20 InterfaceType [TIS]
		Device Select **[Auto]**
ACPI Settings	Enable ACPI Auto Configuration **(Disabled)**	<u>When set to Disable:</u> Enable Hibernation **[Enabled]** ACPI Sleep State **[S3 (Suspend to RAM)]** Lock Legacy Resources **[Disabled]**
SMART Settings	SMART Self Test **[Disabled]**	
Serial Port Console Redirection	Console Redirection (COM0) > **[Disabled]**	<u>When set to Enabled:</u> COM# Console Redirection Settings **[ANSI]** Bits per second **[115200]** Data Bits **[None]** Stop Bits **[1]** Flow Control **[None]** VT-UTF8 Combo Key Support **[Enabled]** Recorder Mode **[Disabled]** Resolution 100x31 **[Disabled]** Legacy OS Redirection Resolution **[80x24]** Putty KeyPad **[VT100]** Redirection After BIOS POST **[Always Enable]**
	Legacy Console Redirection Settings >	Legacy Serial Redirection Port [COM0]
	Serial Port for Out-of-Band Management / Windows Emergency Management Services (EMS) Console Redirection > **[Disabled]**	<u>When set to Enabled:</u> Console Redirection Settings > Out-of-Band Mgmt Port [COM0] Terminal Type **[VT-UTF8]** Bits per second **[115200]** Flow Control **[None]** Data Bits **[8]**

Sub-Screen	Function	Second level Sub-Screen / Description
		Parity **[None]** Stop Bits **[1]**
CPU Configuration	Turbo Mode **[Enabled]**	
	Intel Virtualization Technology **[Enabled]**	
	VT-d **[Disabled]**	
	Monitor Mwait **[Disabled]**	
AMI Graphic Output Control Policy	*Intel ® Graphics Controller* *Intel ® GOP Driver* Output select **[DP1]**	
PCI Subsystem Settings	*AMI PCI Driver Version* Above 4G Decoding **[Disabled]**	
	Hot-Plug Support **[Enabled]**	
Network Stack Configuration	Network Stack **[Disabled]**	
CSM Configuration	CSM Support **[Enabled]**	When set to Enabled: *CSM16 Module Version 07.79* GateA20 Active **[Upon Request]** INT19 Trap Response **[Immediate]** Boot option filter **[UEFI and Legacy]** *Option ROM execution* Network **[UEFI]** Storage **[UEFI]** Video **[UEFI]** Other PCI devices **[UEFI]**
NVMe Configuration	*NVME controller and Drive information*	
SDIO Configuration	SDIO Access Mode **[Auto]** *Mass Storage Devices:*	
USB Configuration	Legacy USB Support **[Enabled]**	
	XHCI Hand-off **[Enabled]**	
	USB Mass Storage Driver Support **[Enabled]**	
	USB transfer time-out **[20 sec]**	
	Device reset time-out **[20 sec]**	
	Device power-up delay **[Auto]**	
	TXE HMRFPO **[Disabled]**	

Sub-Screen	Function	Second level Sub-Screen / Description
Security Configuration	TXE EOP Message **[Enabled]**	
LVDS Configuration	LVDS Flat Panel Display Support **[Disabled]**	When set to Enabled: Panel Type **[Standard]** Resolution **[1024 x 768]** Panel Color Depth **[24-Bit VESA]** Panel Voltage **[3.3V]** Channel **[Dual]** Bus Swapping **[Normal]** Clock Frequency Center Spread **[Disabled]** Differential Output Swing Level **[300 mV]** Backlight **[Enable]** Backlight Signal Inversion **[Disable]** Backlight PWM Frequency **[200 Hz]** Brightness Level **[80%]**
Hardware Monitor	*Hardware Monitoring:* *CPU DTS Temperature (CPU MSR)* *PCB Temperature (TD1)* *NCT7802Y Temperature (LTD)* *LM75B Temperature (I2C0)* *NCT7802Y Voltage (VCC)* *RTC Voltage (VCORE)* *DDR Voltage (VSENS2)* *Input Voltage (VSENS3)*	
	CPU Fan: CPU Fan Pulse CPU Fan Control Mode **[SMART FAN IV]** Fan Trip Point Trip Point Speed	
CPLD Configuration	Serial Port 0 **[Enabled]**	When set to Enabled: Base Address **[3E8]** IRQ **[10]**
	GPIO IRQ **[Disabled]** I2C IRQ **[Disabled]**	
Watchdog	Auto-reload **[Disabled]**	
	Global Lock **[Disabled]**	
	Stage 1 mode **[Disabled]**	
Thermal	Automatic Thermal Reporting **[Disabled]**	When set to Disabled: Critical Trip Point **[125 C]** Passive Trip Point **[95 C]** Passive TC1 value 1 Passive TC2 value 5 Passive TSP value 10
System Component	OS Reset Select **[Cold Reset]**	

Sub-Screen	Function	Second level Sub-Screen / Description
	Spread Spectrum Clocking Configuration	
	DDR SSC **[Enable]**	When set to Enable: DDR SSC Selection Table **[-0.5%]**
	DDR SSC Bending Selection Table **[0% (No Clock Bending)]**	
	HighSpeed SerialIO SSC **[Enable]**	When set to Enable: HighSpeed SerialIO SSC Selection Table **[-0.5%]**
Debug Configuration	*Kernel Debugger Configuration* Kernel Debugger Enable **[Disabled]**	
	APEI BERT Configuration APEI BERT **[Enable]**	
	ACPI Memory Debug Switch ACPI Memory Debug **[Disable]**	
	TXE Debug Option End of Post **[Disable]** Lock Directory **[Disable]**	
	PTT Debug Option Suppress PTT Commands **[Disable]**	
	TDO GPIO Pin Switch TDO GPIO Pin **[Enable]** Max Memory 2G **[Disable]** Persistent RAM Size **[Disable]**	
	OS DnX OS DnX focus entry **[Disable]**	
	Processor Trace Configuration Processor Trace memory allocation **[Disable]**	
	CSE Data Clear Option CSE Data Clear (Yes / No)	
	Option to clear Data region during IFWI Update Capsule Data Clear **[Enable]**	
	NPK Debug Configuration >	North Peak Enable **[Auto]** FW Trace Enable **[Enable]** FW Trace Destination **[PTI]** NPK Recovery Dump **[Disable]** Memory Region 0 Buffer Size **[None]** Memory Region 0 Buffer WrapAround **[Wrap]**

Sub-Screen	Function	Second level Sub-Screen / Description
		Memory Region 1 Buffer Size **[None]** Memory Region 1 Buffer WrapAround **[Wrap]** PTI Mode **[X4]** PTI Training **[Off]** PTI Speed **[Quarter Speed]** Punit Message Level **[LEVEL LOW]** PMC Message Level **[LEVEL LOW]**
RC ACPI Settings	Native PCIE Enable **[Enable]**	
	Native ASPM **[Enable]**	
RTD3 Settings	RTD3 Support **[Disable]**	

8.2.3. Chipset Setup Menu

The Chipset Setup menu provides sub-screens, second level and third level sub-screens with functions, for Intel Chipset configurations.

Figure 31: Chipset Setup Menu Initial Screen

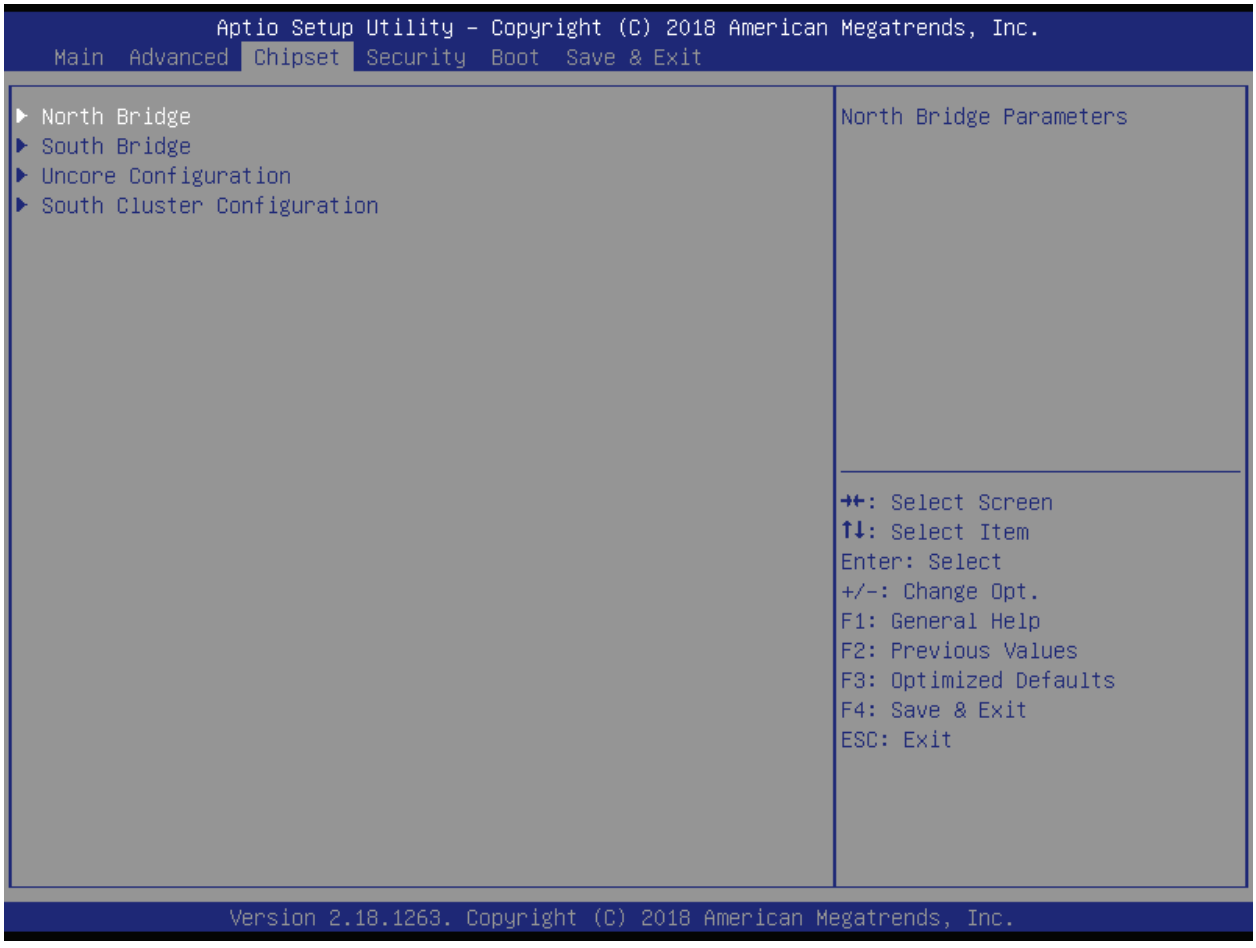


Table 34: Chipset Setup menu Sub-screens and Functions

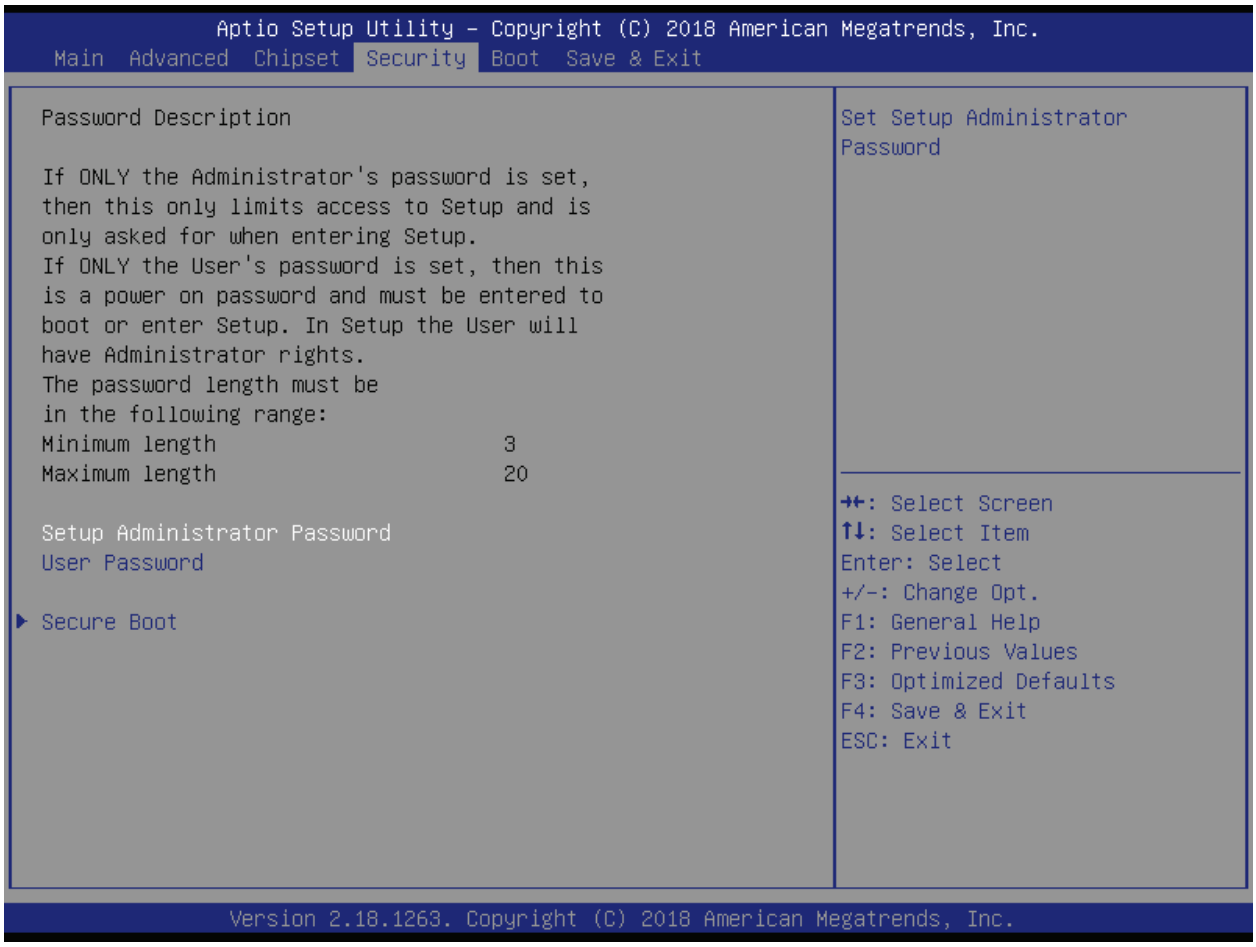
Sub-Screen	Function	Second level Sub-Screen / Description
North Bridge	Max TOLUD **[2 GB]** PCIE VGA Workaround **[Disable]**	
South Bridge	Serial IRQ Mode **[Continuous]**	
	SMBus Support **[Enabled]**	
	OS Selection **[Windows 10 (Ver>=167)]**	
	PCI Clock Run **[Enable]**	
	Real Time Option **[RT Disable]**	
Uncore Configuration	GOP Configuration GOP Driver **[Enable]** Intel Graphics Pei Display PEIM **[Disable]** GOP Brightness Level **[140]**	
	IGD Configuration Integrated Graphics Device **[Enable]** Primary Display **[IGD]** RC6 (Render Standby) **[Disable]** GTT Size **[8MB]** Aperture Size **[256MB]** DVMT Pre-Allocated **[64M]** DVMT Total Gfx Mem **[256M]** Cd Clock Frequency **[624 MHz]** GT PM Support **[Enable]** PAVP Enable **[Enable]**	
	IGD – LCD Control BIA **[Auto]** ALS Support **[Enable]** IGD Flat Panel **[Auto]** IGD Boot Type **[Auto]** Panel scaling **[Auto]** GMCH BLC Control **[PWM-Inverted]**	
South Cluster Configuration	HD-Audio Configuration >	HD-Audio Support **[Enable]**
	LPSS Configuration >	*Low Power Sub System* LPSS HSUART #3 Support (D24:F2) **[Enable]** LPSS SPI #1 Support (D25:F0) **[Enable]** LPSS IOSF PMCTL SOix Enable **[Enable]**
	PCI Express Configuration >	*PCI Express Configuration* PCI Express Clock Gating **[Enable]** Port8xh Decode **[Disable]** Peer Memory Write Enable **[Disable]** Compliance Mode **[Disable]** > PCIe #0 BDF[00:13:00] LAN 1 > PCIe #1 BDF[00:13:01] mPCIe <u>When PCIE #X is enabled:</u> PCIe #X BDF[XX:XX:XX] **[Auto]** ASPM **[Disable]** L1 Substates **[L1.1 & L1.2]**

Sub-Screen	Function	Second level Sub-Screen / Description
		ACS **[Enable]** URR **[Disable]** FER **[Disable]** NFER **[Disable]** CER **[Disable]** CTO **[Default Setting]** SEFE **[Disable]** SENFE **[Disable]** SECE **[Disable]** PME SCI **[Enable]** Hot Plug **[Disable]** PCIE Speed **[Auto]** Transmitter Half Swing **[Disable]** *Extra Bus Reserved 0* *Reserved Memory 10* *Reserved I/O 4* PCH PCIE LTR **[Enable]** Snoop Latency Override **[Auto]** Non Snoop Latency Override **[Auto]** PCIE LTR Lock **[Disable]** PCIE Selectable De-emphasis **[Enable]**
	SATA Drives >	SATA Drives Chipset-SATA Controller Configuration SATA Port 0 Port 0 **[Enable]** SATA Port 0 Hot Plug Capability **[Disable]** SATA Port 1 (mSATA) Port 0 **[Enable]** SATA Port 0 Hot Plug Capability **[Disable]**
	SCC Configuration >	SCC SD Card Support (D27:F0) **[Enable]**
	USB Configuration >	USB Port Disable Override **[Disable]** XHCI Disable Compliance Mode **[FALSE]**
	Miscellaneous Configuration >	State After G3 **[S0 State]** Power Button Debounce Mode **[Enable]** Wake on LAN **[Disable]** BIOS Lock **[Disable]** RTC Lock **[Enable]** TCO Lock **[Disable]** DCI Enable (HDCIEN) **[Disable]** DCI Auto Detect Enable **[Enable]** GPIO Lock **[Disable]**

8.2.4. Security Setup Menu

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

Figure 32: Security Setup Menu Initial Screen



The following table shows Security sub-screens and functions.

Table 35: Security Setup Menu Functions

Function	Description
Setup Administrator Password User Password	Create / change password to enter Setup
HDD Security Configuration	Create / change password to allow access to Set, Modify and Clear HardDisk User and Master Passwords for Enabling Security.
Attempt Secure Boot **[Disable]**	Enable or Disable the Secure Boot support. Please also set Secure Boot Mode to "Standard" to install standard Microsoft Platform Key (PK).
Secure Boot Mode	Set Secure Boot Mode to "Standard" to boot standard Windows or Linux boot loader signed with Microsoft's platform key. Select "Customized" mode only if you have a custom OS with OS boot loader signed with your own platform key. Kontron provide services for Customized Secure Boot, visit Kontron SEC-Line home page

Function	Description
	https://www.kontron.com/products/solutions/security/sec-line.html for more information.
Key Management	Enables expert users to modify Secure Boot Policy Variables without full authentication.

If only the administrator's password is set, then only access to the setup is limited and is requested when entering the setup.
If the user's password is set, then the password is a power on password and must be entered to boot or enter setup. In the setup the user has restricted rights.

8.2.4.1. Remember the Password

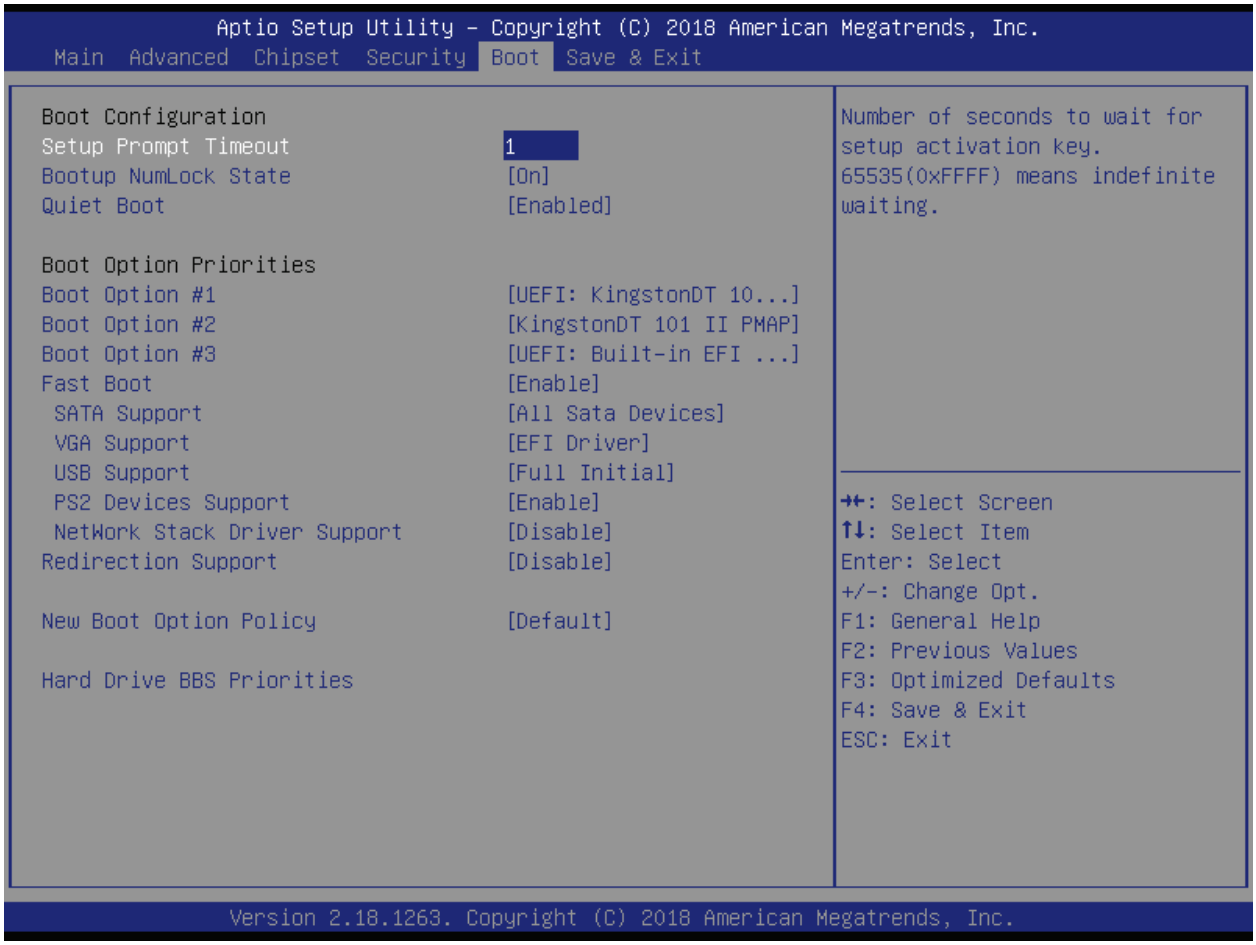
It is highly recommended to keep a record of all passwords in a safe place. Forgotten passwords result in the user being locked out of the system.

If the system cannot be booted because the User Password or the Supervisor Password are not known, contact Kontron Support for further assistance.

8.2.5. Boot Setup Menu

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

Figure 33: Boot Setup Menu Initial Screen



The following table shows Boot sub-screens and functions, and describes the content. Default settings are in **bold**.

Table 36: Boot Setup Menu Functions

Function	Description
Boot Configuration Setup Prompt Timeout **1** Bootup NumLock State **[On]** Quiet Boot **[Enabled]**	
Boot Option Priorities Boot Option #1 Boot Option #2 Boot Option #3 Boot Option #4 Fast Boot **[Enable]** SATA Support VGA Support USB Support	To set the system boot order. Use +/- keys to change option. When Fast Boot is Enabled, SATA, VGA, USB, PS2 support, devices initialization, Network Stack driver can be customized.

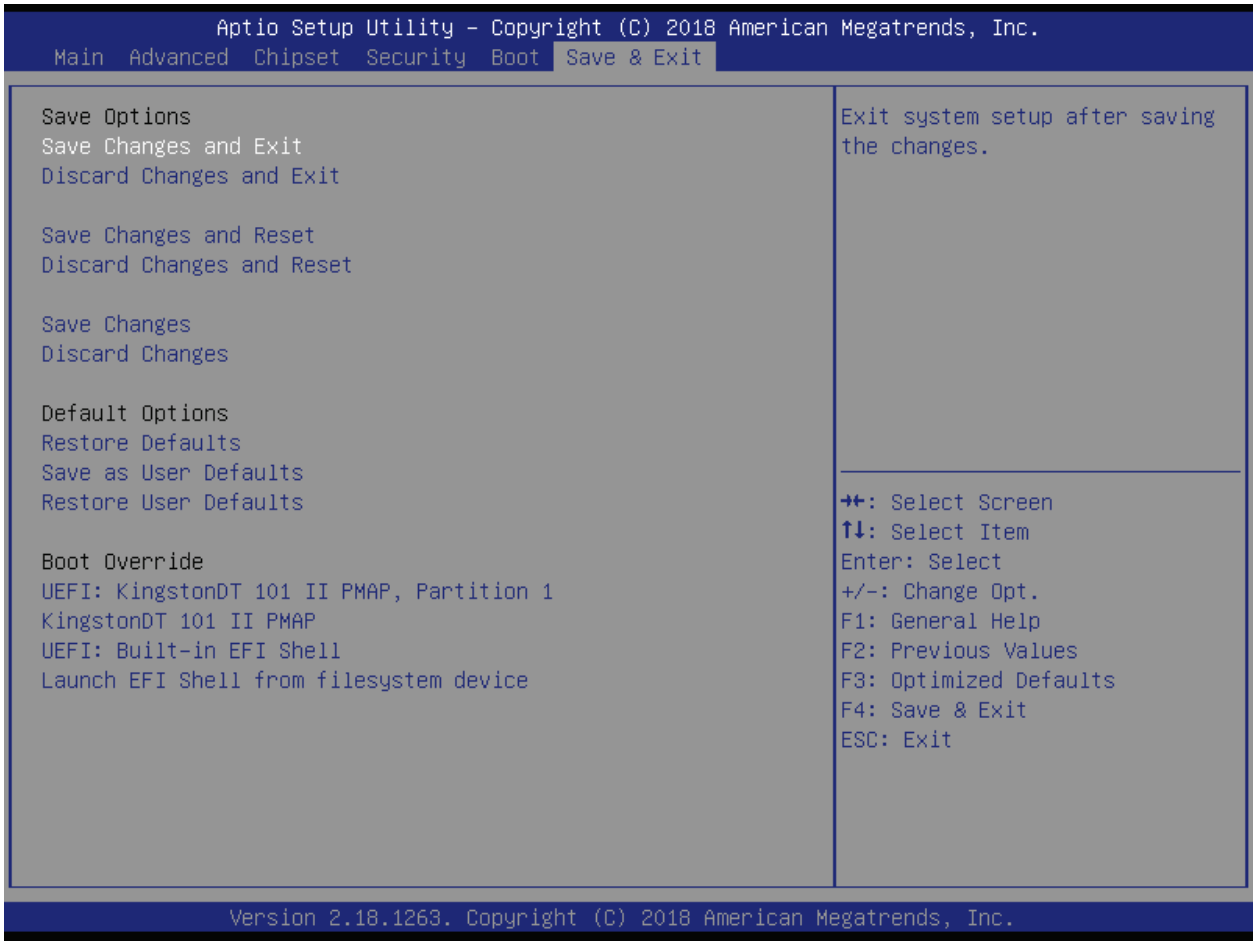
Function	Description
PS2 Support Network Stack Driver Support Redirection Support	
New Boot Option Policy	Controls the placement of newly detected UEFI boot options
Hard Drive BBS Priotities	Sets the placement of legacy boot options

8.2.6. Exit Setup Menu

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

If system cannot boot or work properly due to incorrect setting, shorting Pin-1 and Pin-2 on J15 jumper will load the default setting of BIOS upon power cycle. Once safely booted with default setting, you may undo the jumper setting to save new changes on BIOS Setup Menu.

Figure 34: Save and Exit Setup Menu Initial Screen



The following table shows the Exit menu sub-screens and functions, and describes the content.

Table 37: Save and Exit Setup Menu Functions

Function	Description
Save Options	
Save Changes and Exit	
Discard Changes and Exit	
Save Changes and Reset	
Discard Changes and Reset	
Default Options	
Restore Defaults	
Save as User Defaults	

Function	Description
Restore User Defaults	
Boot Override UEFI: Built-in EFI Shell Launce EFI Shell from filesystem device	

8.3. 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. If Secure Boot is enabled, the UEFI shell may not be able to be entered.

8.3.1. Basic Operation of the uEFI Shell

8.3.1.1. 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 <DEL>) to display a choice of boot devices.
3. Choose 'UEFI: Built-in EFI Shell'.

```
EFI Shell version 2.50 [5.12]
Current running mode 1.1.2
Device mapping table
fs0        :Removable HardDisk - Alias hd18c0b blk0
        PciRoot(0x0)/Pci(0x15,0x0)/USB(0x2,0x0)/HD(1,MBR,0x0002B27D,0x3F,0x785BEC)
blk0    :Removable HardDisk - Alias hd18c0b fs0
        PciRoot(0x0)/Pci(0x15,0x0)/USB(0x2,0x0)/HD(1,MBR,0x0002B27D,0x3F,0x785BEC)
blk1    :Removable BlockDevice - Alias (null)
        PciRoot(0x0)/Pci(0x15,0x0)/USB(0x2,0x0)
```

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

4. The output produced by the device-mapping table can vary depending on the board's configuration.
5. If the ESC key is pressed before the 5 second timeout elapses, the shell prompt is shown:

```
Shell>
```

8.3.1.2. 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, that the OS will boot from.
2. Reset the board using the **reset** uEFI Shell command.

8.4. uEFI Shell Scripting

8.4.1. 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.

8.4.2. 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.

8.4.3. Examples of Startup Scripts

8.4.3.1. Execute Shell Script on other Harddrive

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

```
fs0:
bootme.nsh
```

8.5. Firmware Update

Firmware updates are typically delivered as a ZIP archive containing only the firmware images. The content of the archive with the directory structure must be copied onto a data storage device with FAT partition.

8.5.1. Updating Procedure

BIOS can be updated with the Intel tool fpt64.efi using the procedure below:

1. Copy these files to an USB stick.
   - flash.nsh or flash_with_fpt.nsh (if available)
   - fpt.efi
   - fparts.txt
   - pITX_APL_BIOS_Ver_<xxx>……bin (where xxx stands for the version #)
2. Start the system into the uEFI shell (see chapter 8.3.1.1 "Entering the uEFI Shell").
3. Change to the drive representing the USB stick.

   ```
   fsx:   (x = 0,1,2,etc. represents the USB stick)
   ```

   Change to the directory where you copied the flash tool.

   ```
   cd <your_directory>
   ```

4. Start flash.nsh or flash_with_fpt.nsh (if available)

OR type

```
fpt -y -f pITX_APL_BIOS_Ver_<xxx>……bin
```

5. Wait until flashing is successful and then power cycle the board.



Do not switch off the power during the flash process!

List of Acronyms

DP	Display Port
DVI	Digital Video Interface
EDP	Embedded DisplayPort
EMI	Electromagnetic Interference
ESD	Electrostatic Discharge
FCBGA	Flip Chip Ball Grid Array
FWH	Firmware Hub
HDMI	High Definition Multimedia Interface
LPC	Low Pin Count
LVDS	Low Voltage Differential Signaling
MPCIE	Mini PCI Express
MSATA	Mini Serial ATA
PCBA	Printed Circuit Board Assembly
PEG	PCI Express Graphics
RTC	Real Time Clock
SATA	Serial ATA
SDVO	Serial Digital Video Out
SMBUS	System Management Bus
SOC	System on Chip
SPI	Serial Peripheral Interface
TPM	Trusted Platform Module
ULV	Ultra-low Voltage
USB	Universal Serial Bus

About Kontron – Member of the S&T Group

Kontron is a global leader in Embedded Computing Technology (ECT). As a part of technology group S&T, Kontron offers a combined portfolio of secure hardware, middleware and services for Internet of Things (IoT) and Industry 4.0 applications. With its standard products and tailor-made solutions based on highly reliable state-of-the-art embedded technologies, Kontron provides secure and innovative applications for a variety of industries. As a result, customers benefit from accelerated time-to-market, reduced total cost of ownership, product longevity and the best fully integrated applications overall.

For more information, please visit: **http://www.kontron.com/**

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