


3.5"-SBC-VR1000

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 3.5"-SBC-VR1000 - USER GUIDE

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Revision History

Revision	Brief Description of Changes	Date of Issue	Author/ Editor
1.0	Initial Issue	2020-Apr-17	YS
1.1	Add mating connector info	2020-Oct-28	YS
1.2	Modify USB 3.1 to USB 3.2 Gen 2 per new naming	2021-Sep-13	YS
1.3	Add max. current value	2021-Dec-06	YS
1.4	Update audio codec	2022-Feb-25	YS
1.5	Add extended temperature, certification standards	2022-Mar-18	YS
1.6	Add cTDP	2022-Jul-21	YS
1.7	Add new variant R1305G	2022-Jul-29	YS

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Symbols

The following symbols may be used in this user guide

⚠ DANGER

DANGER indicates a hazardous situation which, if not avoided, will result in death or serious injury.

⚠ WARNING

WARNING indicates a hazardous situation which, if not avoided, could result in death or serious injury.

NOTICE

NOTICE indicates a property damage message.

⚠ CAUTION

CAUTION indicates a hazardous situation which, if not avoided, may result in minor or moderate injury.



Electric Shock!

This symbol and title warn of hazards due to electrical shocks (> 60 V) when touching products or parts of products. Failure to observe the precautions indicated and/or prescribed by the law may endanger your life/health and/or result in damage to your material.



ESD Sensitive Device!

This symbol and title inform that the electronic boards and their components are sensitive to static electricity. Care must therefore be taken during all handling operations and inspections of this product in order to ensure product integrity at all times.



HOT Surface!

Do NOT touch! Allow to cool before servicing.



Laser!

This symbol inform of the risk of exposure to laser beam and light emitting devices (LEDs) from an electrical device. Eye protection per manufacturer notice shall review before servicing.



This symbol indicates general information about the product and the user guide.

This symbol also indicates detail information about the specific product configuration.



This symbol precedes helpful hints and tips for daily use.

For Your Safety

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

High Voltage Safety Instructions

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

CAUTION

Warning

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

CAUTION



Electric Shock!

Before installing a non hot-swappable Kontron product into a system always ensure that your mains power is switched off. This also applies to the installation of piggybacks. Serious electrical shock hazards can exist during all installation, repair, and maintenance operations on this product. Therefore, always unplug the power cable and any other cables which provide external voltages before performing any work on this product.

Earth ground connection to vehicle's chassis or a central grounding point shall remain connected. The earth ground cable shall be the last cable to be disconnected or the first cable to be connected when performing installation or removal procedures on this product.

Special Handling and Unpacking Instruction

NOTICE



ESD Sensitive Device!

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

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

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

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

Lithium Battery Precautions

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

CAUTION

Danger of explosion if the battery is replaced incorrectly.

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

General Instructions on Usage

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

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

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

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

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

Quality and Environmental Management

Kontron aims to deliver reliable high-end products designed and built for quality, and aims to complying with environmental laws, regulations, and other environmentally oriented requirements. For more information regarding Kontron's quality and environmental responsibilities, visit <https://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 user guide describes the 3.5"-SBC-VR1000 board made by Kontron. This board will also be denoted 3.5"-SBC-VR1000 within this user guide.

Use of this user guide implies a basic knowledge of PC-AT hardware and software. This user guide focuses on describing the 3.5"-SBC-VR1000 board's special features and is not intended to be a standard PC-AT 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 carried out automatically or manually by the user via the BIOS setup menus.

Latest revision of this user guide, datasheet, thermal simulations, BIOS, drivers, BSP's (Board Support Packages), mechanical drawings (2D and 3D) can be downloaded from Kontron's Web Page.

2/ Installation Procedures

2.1. Installing the Board

NOTICE



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 (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 already has components like RAM and CPU cooler mounted, then skip the relevant steps below.

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 +12 V DC single supply only with suitable cable kit and PS-ON# active.

NOTICE

The power supply unit shall comply with the requirements as defined in IEC 62368-1 according Clause 6.2.2 to power source category PS2 "Limited Power Source".

2. Insert the DDR4 2400 module(s)

Be careful to push the memory module(s) in the slot(s) before locking the tabs.

3. Connecting interfaces

Insert all external cables for hard disk, keyboard etc. A monitor must be connected in order to change BIOS settings.

4. Connect and turn on PSU

Connect PSU to the board by the +12 V 3.0 mm pitch 1x4-pin wafer connector.

5. BIOS setup

Enter the BIOS setup by pressing the key during boot up.

Enter "Exit Menu" and Load Setup Defaults.



To clear all BIOS setting, including Password protection, activate "Clear CMOS Jumper" for 10 sec (without power connected).

6. Mounting the board in chassis

NOTICE

When mounting the board to chassis etc. please note that the board contains components on both sides of the PCB that 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 board on a chassis, it is recommended to use screws with an integrated washer and a diameter of > 7 mm. Do not use washers with teeth, as they can damage the PCB and cause short circuits.

2.2. Chassis Safety Standards

Before installing the 3.5"-SBC-VR1000 in the chassis, users must evaluate the end product to ensure compliance with the requirements of the IEC60950-1 safety standard:

- ▶ The board must be installed in a suitable mechanical, electrical and fire enclosure.
- ▶ The system, in its enclosure, must be evaluated for temperature and airflow considerations.
- ▶ The board must be powered by a CSA or UL approved power supply that limits the maximum input current.
- ▶ For interfaces having a power pin such as external power or fan, ensure that the connectors and wires are suitably rated. All connections from and to the product shall be with SELV circuits only.
- ▶ Wires have suitable rating to withstand the maximum available power.
- ▶ The peripheral device enclosure fulfils the IEC60950-1 fire protecting requirements.

2.3. Lithium Battery Replacement

If replacing the lithium battery follow the replacement precautions stated in the notification below:

⚠ 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 gleichwertigen 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 explosi3n si la bater3a se sustituye incorrectamente.

- ▶ Sustituya solamente por el mismo o tipo equivalente recomendado por el fabricante
- ▶ Disponga las bater3as usadas seg3n las instrucciones del fabricante

ADVARSEL! Lithiumbatteri – Eksplosjonsfare ved feilagtig h3ndtering.

- ▶ Udkiftning m3 kun ske med batteri af samme fabrikat og type
- ▶ Lev3r det brugte batteri tilbage til leverand3ren

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

WARNING! Explosionsfara vid felaktigt batteribyte.

- ▶ Anv3nd samma batterityp eller en ekvivalent typ som rekommenderas av apparattillverkaren
- ▶ Kassera anv3nt batteri enligt fabrikantens instruktion

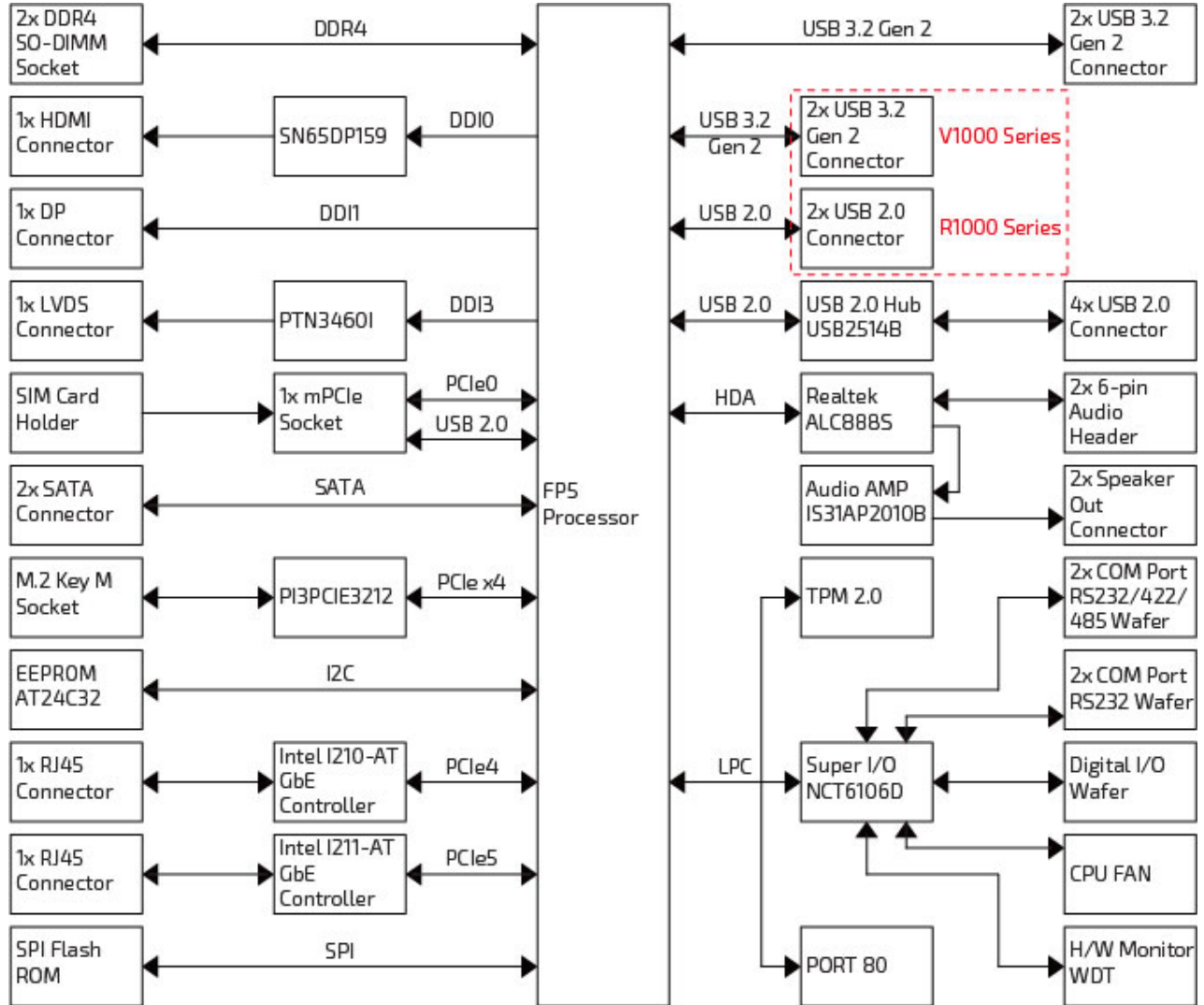
VAROITUS! Paristo voi r3j3ht33, jos se on virheellisesti asennettu.

- ▶ Vaihda paristo ainoastaan lalteil- mistajan suositteluun tyypill3n
 - ▶ H3vit3 k3ytetty paristo valmistajan ohjeiden mukaisesti
-

3/ System Specifications

3.1. System Block Diagram

Figure 1: System Block Diagram 3.5"-SBC-VR1000



3.2. Component Main Data

The table below summarizes the features of the 3.5"-SBC-VR1000 single board computer.

Table 1: Component Main Data

System	
Processor	<ul style="list-style-type: none"> ▶ AMD Ryzen™ V1000 Series Processors ▶ AMD Ryzen™ R1000 Series Processors
Memory	▶ 2x DDR4 SO-DIMM memory socket
Video	
Display Interface	<ul style="list-style-type: none"> ▶ 1x LVDS ▶ 1x DP (on rear) ▶ 1x HDMI 2.0 (on rear)
Multiple Display	▶ Triple
Network Connection	
Ethernet	▶ 2x GbE LAN (RJ45 on rear, 1x Intel® I210-AT, 1x Intel® I211-AT)
Peripheral Connection	
USB	<ul style="list-style-type: none"> ▶ 4x USB 3.2 Gen 2 (Type A on rear, V1000 model) ▶ 2x USB 3.2 Gen 2 (Type A on rear, R1000 model) ▶ 4x USB 2.0 (by header, V1000 model) ▶ 6x USB 2.0 (2x Type A on rear, 4x by header, R1000 model)
Serial Port	<ul style="list-style-type: none"> ▶ 2x RS232/422/485 (by header) ▶ 2x RS232 (by header)
Other I/Os	▶ 8x DIO (by header)
Storage & Expansion	
Storage & Expansion	<ul style="list-style-type: none"> ▶ 2x SATA 3.0 ▶ 1x mPCIe (half size, mixed w/ PCIe x1 / USB 2.0) ▶ 1x M.2 Key M (Type 2280, mixed w/ PCIe x4, NVMe support) ▶ 1x SIM Cage (Micro type, connected to mPCIe)
Power	
Input Voltage	▶ DC 12 V
Connector	▶ 1x4-pin pitch 3.0 mm Wafer
Firmware	
BIOS	▶ AMI uEFI BIOS w/ 64 Mb SPI Flash
Watchdog	▶ Programmable WDT to generate system reset event
H/W Monitor	<ul style="list-style-type: none"> ▶ Voltages ▶ Temperatures
Real Time Clock	▶ Processor integrated RTC
Security	▶ TPM 2.0 support (Infineon SLB 9665)
System Control & Monitoring	

System	
Front Panel Header	<ul style="list-style-type: none"> ▶ 1x Header Reset Button, HDD LED & External Speaker ▶ 1x Header for Power Button, Power LED & SM bus ▶ 1x Header for mPCIe activity LED ▶ 1x Header for M.2 Key M activity LED
Cooling	
Fan	▶ 1x Wafer for CPU System Fan
Software	
OS Support	▶ Windows 10
Mechanical	
Dimension (L x W)	▶ ECX (146 mm x 105 mm / 5.75" x 4.13")

3.3. Environmental Conditions

The 3.5"-SBC-VR1000 is compliant with the following environmental conditions. It is the customer's responsibility to provide sufficient airflow around each of the components to keep them within the allowed temperature range.

Table 2: Environmental Conditions

Operating Temperature	<ul style="list-style-type: none"> ▶ 0 °C ~ 60 °C / 32 °F ~ 140 °F (Standard) ▶ -20 °C ~ 70 °C / -4 °F ~ 158 °F (Extended)
Storage Temperature	<ul style="list-style-type: none"> ▶ -20 °C ~ 80 °C / -4 °F ~ 176 °F (Standard) ▶ -40 °C ~ 85 °C / -40 °F ~ 185 °F (Standard)
Humidity	▶ 0 % ~ 95 %

3.4. Standards and Certifications

The 3.5"-SBC-VR1000 meets the following standards and certification tests.

Table 3: Standards and Certifications

CE Class B	<ul style="list-style-type: none"> ▶ EN 55032: 2015 + AC: 2016 ▶ CISPR 32: 2015 ▶ EN 61000-3-2: 2014 ▶ EN 61000-3-3: 2013 ▶ EN 55024: 2010 + A1: 2015 ▶ IEC 61000-4-2: 2008 ▶ IEC 61000-4-3: 2006 + A1: 2007 + A2: 2010 ▶ IEC 61000-4-4: 2012 ▶ IEC 61000-4-5: 2014 + A1: 2017 ▶ IEC 61000-4-6: 2013 ▶ IEC 61000-4-8: 2009 ▶ IEC 61000-4-11: 2004 + A1: 2017
FCC Class B	▶ 47 CFR FCC Part 15, Subpart B

	<ul style="list-style-type: none"><li data-bbox="496 163 790 195">▶ ICES-003: 2016 Issue 6<li data-bbox="496 202 724 234">▶ ANSI C63.4: 2014
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3.5. Processor Support

The 3.5"-SBC-VR1000 is designed to support AMD Ryzen™ V1000 / R1000 Series Processors. The BGA CPU is remounted from factory. Kontron has defined the board versions as listed in the following table, so far all based on Embedded CPUs. Other versions are expected at a later date.

Table 4: Processor Support

Name	Core #	Speed (GHz)	Turbo (GHz)	Embedded	Cache	Socket	TDP (W)	TDP-up (W)	TDP-down (W)	Tj (°C)
Ryzen™ V1605B	4	2.00	3.60	Yes	4M	FP5	15	25	12	105
Ryzen™ V1202B	2	2.30	3.20	Yes	4M	FP5	15	25	12	105
Ryzen™ R1606G	2	2.60	3.50	Yes	4M	FP5	15	25	12	105
Ryzen™ R1505G	2	2.40	3.30	Yes	4M	FP5	15	25	12	105
Ryzen™ R1305G	2	1.50	2.80	Yes	4M	FP5	8	10	-	105

Sufficient cooling must be applied to the CPU in order to remove the effect as listed as TDP (Thermal Design Power) in above table. The sufficient cooling is also depending on the worst case maximum ambient operating temperature and the actual worst case load of processor.

3.6. System Memory Support

The 3.5"-SBC-VR1000 has two DDR4 SO-DIMM sockets. The sockets support the following memory features:

- ▶ 2x DDR4 SO-DIMM 260-pin
- ▶ Dual channel, 2400 MT/s
- ▶ Up to 32 GB (2x 16 GB)
- ▶ SPD timing supported
- ▶ ECC supported

The installed DDR4 SO-DIMM should support the Serial Presence Detect (SPD) data structure. This allows the BIOS to read and configure the memory controller for optimal performance. If non-SPD memory is used, the BIOS will attempt to configure the memory settings, but performance and reliability may be impacted, or the board may not be able to boot totally.

3.6.1. Memory Operating Frequencies

In all modes, the frequency of system memory is the lowest frequency of all the memory modules placed in the system. Each memory module's frequency can be determined through the SPD registers on the memory modules.

The table below lists the resulting operating memory frequencies based on the combination of SO-DIMMs and processor.

Table 5: Memory Operating Frequencies

SO-DIMM Type	Module Name	Memory Data Transfer (MT/s)	Processor System Bus Frequency (MHz)	Resulting Memory Clock Frequency (MHz)	Peak Transfer Rate (MB/s)
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SO-DIMM Type	Module Name	Memory Data Transfer (MT/s)	Processor System Bus Frequency (MHz)	Resulting Memory Clock Frequency (MHz)	Peak Transfer Rate (MB/s)
DDR4 2400	PC4-19200	2400	1200	300	19200

Memory modules have in general a much lower longevity than embedded motherboards, and therefore EOL of modules can be expected several times during lifetime of the motherboard.

As a minimum it is recommend using Kontron memory modules for prototype system(s) in order to prove stability of the system and as for reference.

For volume production you might request to test and qualify other types of RAM. In order to qualify RAM it is recommend configuring 3 systems running RAM Stress Test program in heat chamber at 60° C for a minimum of 24 hours.

3.7. On-board Graphics Subsystem

The 3.5"-SBC-VR1000 supports AMD Radeon™ Vega technology for high quality graphics capabilities. All 3.5"-SBC-VR1000 versions support triple displays pipes.

Triple displays can be used simultaneously and be used to implement independent or cloned display configuration.

Table 6: Three-displays Configurations

Display 1	Display 2	Display 3	Max. Resolution (Px) at 60 Hz		
			Display 1	Display 2	Display 3
LVDS	DP	HDMI 2.0	1920 x 1200	4096 x 2160	3840 x 2160

3.8. Power Consumption

In order to ensure safe operation of the board, the input power supply must monitor the supply voltage and shut down if the supply is out of range – refer to the actual power supply specification. Please note, in order to keep the power consumption to a minimal level, boards do not implement a guaranteed minimum load. The 3.5"-SBC-VR1000 board must be powered through the 3.0 mm pitch 1x4-pin wafer connector from a DC 12 V power supply.

NOTICE

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

The requirements to the supply voltages are as follows:

Table 7: Supply Voltages

Supply	Min.	Max.	Note
+12 V	11.4 V	12.6 V	Should be ±5 % tolerance

The power consumption is measured under the following software and hardware condition.

- ▶ ADM Ryzen™ R1606G with Radeon™ Vega Gfx @ 2600 Mhz
- ▶ 2x 4 GByte DDR4-2400 memory

- ▶ Phison ESMP256GTB3C2-E12 M.2 PCIe 256 GByte SSD
- ▶ Windows 10 Enterprise LTSC 1809 (17763.107)

Table 8: Power Consumption Test Result

State	Maximum Current Draw
Boot Into Idle	1.55 A
Full Loading	3.83 A
Into S3 Mode	43 mA
Into S4 Mode	42 mA

4/ Connector Locations

4.1. Top Side

Figure 2: Top Side

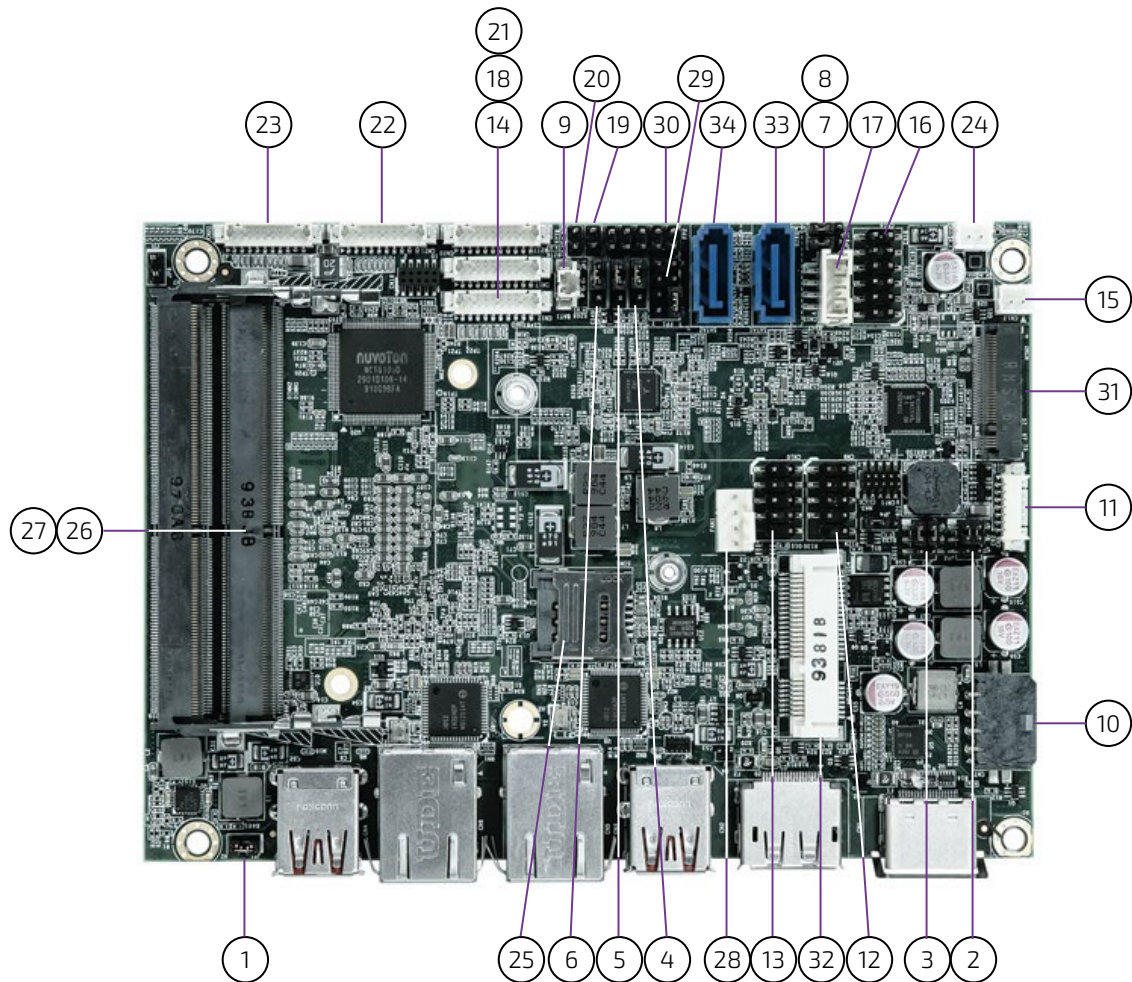


Table 9: Jumper List

Item	Designation	Description	See Chapter
1	JP1	EEPROM WP Selection	7.17.1
2	JP2	Backlight Enable Selection	7.17.2
3	JP3	Panel & Backlight Power Selection	7.17.3
4	JP5	AT / ATX Power Mode Selection	7.17.4
5	JP6	USB Power Selection	7.17.5
6	JP7	Clear CMOS Selection	7.17.6
7	JP9	Backlight Adjustment Selection	7.17.7
8	JP10	LVDS EDID Selection	7.17.8

Table 10: Top Side Internal Connector Pin Assignment

Item	Designation	Description	See Chapter
9	BAT1	CR2032 Battery Power Input Wafer	7.1.2
10	CN7	DC 12 V Power Input Wafer	7.1.1
11	CN8	Backlight Power Output Wafer	7.11
12	CN9	USB 2.0 Port DN 3, 4 Pin Header	7.5
13	CN10	USB 2.0 Port DN 1, 2 Pin Header	7.5
14	CN12	COM1 RS232/422/485 Port Wafer	7.9
15	CN13	Right Channel 3 W Audio AMP Output Wafer	7.6
16	CN14	Audio Input / Output Pin Header	7.7
17	CN15	HDD / SSD Power Output Wafer	7.4
18	CN17	COM2 RS232/422/485 Port Wafer	7.9
19	CN18	M.2 Key M Activity LED Pin Header	7.16
20	CN19	mPCIe Activity LED Pin Header	7.16
21	CN20	Digital Input / Output Wafer	7.12
22	CN21	RS232 Port 3 Wafer	7.9
23	CN22	RS232 Port 4 Wafer	7.9
24	CN23	Left Channel 3 W Audio AMP Output Wafer	7.6
25	SIM1	Micro SIM Card Cage	7.15
26	DIMM1	DDR4 Memory SO-DIMM Socket	3.6
27	DIMM2	DDR4 Memory SO-DIMM Socket	3.6
28	FAN1	DC 12 V Fan Wafer	7.2
29	FP1	Front Panel 1 Pin Header	7.8
30	FP2	Front Panel 2 Pin Header	7.8
31	M2M2	NGFF M.2 Key M Socket	7.14
32	MPCIE1	Mini-PCI Express V1.2 Socket	7.13
33	SATA1	Serial ATA Port 0 Connector	7.3
34	SATA2	Serial ATA Port 1 Connector	7.3

4.2. Rear Side

Figure 3: Rear Side

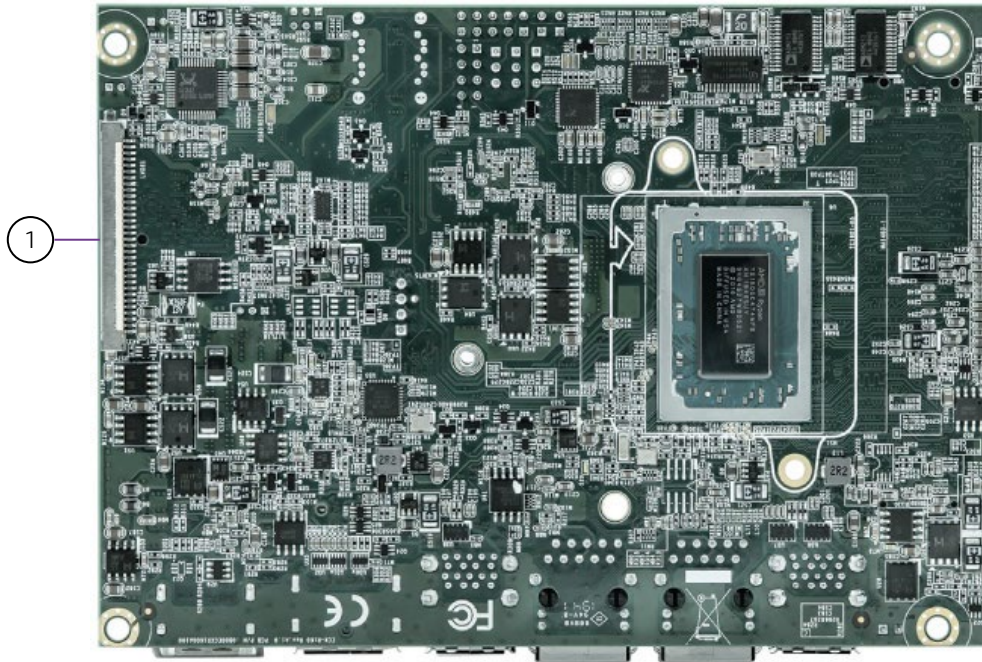


Table 11: Rear Side Internal Connector Pin Assignment

Item	Designation	Description	See Chapter
1	LVDS1	18/24-bit, 2-channel LVDS Panel Connector	7.10

4.3. Connector Panel Side

Figure 4: Connector Panel Side

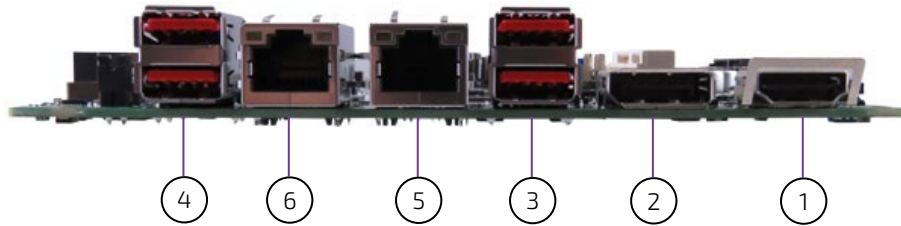


Table 12: Connector Panel Side Connector List

Item	Designation	Description	See Chapter
1	CN1	HDMI 2.0 Connector	6.1
2	CN2	DP Connector	6.2
3	CN3	USB 3.2 Gen 2 Port 1, 2 Type A Connector (V1000 Model) USB 2.0 Port 1, 2 Type A Connector (R1000 Model)	6.4
4	CN4	USB 3.2 Gen 2 Port 3, 4 Type A Connector	6.4
5	CN5	GbE LAN1 RJ45 Connector	6.3
6	CN6	GbE LAN2 RJ45 Connector	6.3

5/ Connector Definitions

The following defined terms are used within this user guide to give more information concerning the pin assignment and to describe the connector's signals.

Defined Term	Description
Pin	Shows the pin numbers in the connector
Signal	The abbreviated name of the signal at the current pin The notation "XX#" states that the signal "XX" is active low
Note	Special remarks concerning the signal
Designation	Type and number of item described
See Chapter	Number of the chapter within this user guide containing a detailed description

The abbreviation TBD is used for specifications that are not available yet or which are not sufficiently specified by the component vendors.

6/ I/O-Area Connectors

6.1. HDMI Connector (CN1)

The HDMI connector is based on standard HDMI type A and compliant with HDMI 2.0.

Figure 5: HDMI Connector CN1

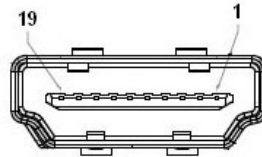


Table 13: Pin Assignment HDMI Connector CN1

Pin	Signal	Description	Note
1	TMDS Data2+	HDMI Lane 2 differential pair (+)	
2	Ground		
3	TMDS Data2-	HDMI Lane 2 differential pair (-)	
4	TMDS Data1+	HDMI Lane 1 differential pair (+)	
5	Ground		
6	TMDS Data1-	HDMI Lane 1 differential pair (-)	
7	TMDS Data0+	HDMI Lane 0 differential pair (+)	
8	Ground		
9	TMDS Data0-	HDMI Lane 0 differential pair (-)	
10	TMDS Clock+	HDMI Clock differential pair (+)	
11	Ground		
12	TMDS Clock-	HDMI Clock differential pair (-)	
13	Reserved		
14	Reserved		
15	DDC_CLK	DDC based control signal (clock)	
16	DDC_DATA	DDC based control signal (data)	
17	Ground		
18	+5 V Power	+5 V power supply	
19	Hot Plug Detect		

6.2. DP Connector (CN2)

The DP (DisplayPort) connectors are based on standard DP female port.

Figure 6: DP Connector CN2

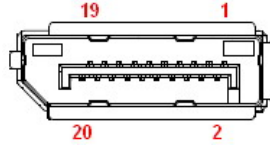


Table 14: Pin Assignment DP Connector CN2

Pin	Signal	Description	Note
1	TX0+	DisplayPort Lane 0 transmitter differential pair (+)	
2	GND	Ground	
3	TX0-	DisplayPort Lane 0 transmitter differential pair (-)	
4	TX1+	DisplayPort Lane 1 transmitter differential pair (+)	
5	GND	Ground	
6	TX1-	DisplayPort Lane 1 transmitter differential pair (-)	
7	TX2+	DisplayPort Lane 2 transmitter differential pair (+)	
8	GND	Ground	
9	TX2-	DisplayPort Lane 2 transmitter differential pair (-)	
10	TX3+	DisplayPort Lane 3 transmitter differential pair (+)	
11	GND	Ground	
12	TX3-	DisplayPort Lane 3 transmitter differential pair (-)	
13	GND	Ground	
14	GND	Ground	
15	AUX+	DisplayPort Auxiliary channel differential pair (+)	
16	GND	Ground	
17	AUX-	DisplayPort Auxiliary channel differential pair (-)	
18	HPD	DisplayPort hot plug detect	
19	GND	Ground	
20	PWR	Power for connector	

6.3. Ethernet Connectors (CN5 & CN6)

The 3.5"-SBC-VR1000 supports two channels of 10/100/1000 Mbit Ethernet, which are based Intel® I210-AT and Intel® I211-AT controller respectively.

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

The signals for the Ethernet ports are as follows:

Figure 7: Ethernet Connectors CN5, CN6

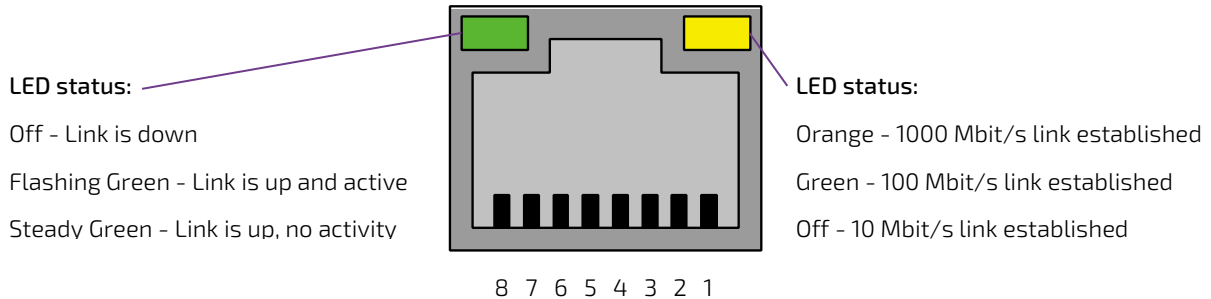


Table 15: Pin Assignment Ethernet Connector CN5, CN6

Pin	Signal	Note
1	TX1+	
2	TX1-	
3	TX2+	
4	TX3+	
5	TX3-	
6	TX2-	
7	TX4+	
8	TX4-	

Signal Description

Signal	Description
TX1+ / TX1-	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.
TX2+ / TX2-	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.
TX3+ / TX3-	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.
TX4+ / TX4-	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.

'MDI' – media dependent Interface

6.4. USB Connectors (I/O Area)

The external I/O connector panel supports two dual USB 3.2 Gen 2 connectors for models with AMD Ryzen™ V1000 Series processors; and one dual USB 3.2 Gen 2 connector and one dual USB 2.0 connector for models with AMD Ryzen™ R1000 Series processors.



USB 3.2 Gen 2 ports are backward compatible with USB 2.0.

Figure 8: USB 3.2 Gen 2 Connectors CN3 - Top & Bottom (V1000 model), CN4 - Top & Bottom



Table 16: Pin Assignment USB 3.2 Gen 2 / USB 2.0 Connectors CN3 - Top & Bottom (V1000 model), CN4 - Top & Bottom

Pin	Signal	Description	Note
1	+USB_VCC*	+5 V power supply for USB device	
2	USB_D-	USB 2.0 differential pair (-)	
3	USB_D+	USB 2.0 differential pair (+)	
4	GND	Ground	
5	USB_RX-	USB 3.2 Gen 2 receiver differential pair (-)	
6	USB_RX+	USB 3.2 Gen 2 receiver differential pair (+)	
7	GND	Ground	
8	USB_TX-	USB 3.2 Gen 2 transmitter differential pair (-)	
9	USB_TX+	USB 3.2 Gen 2 transmitter differential pair (+)	

Figure 9: USB 2.0 Connectors CN3 - Top & Bottom (R1000 model)

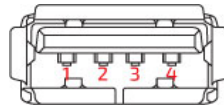


Table 17: Pin Assignment USB 2.0 Connectors CN3 - Top & Bottom (V1000 model)

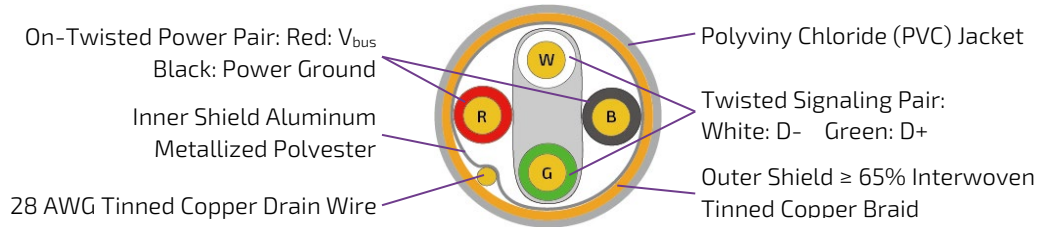
Pin	Signal	Description	Note
1	+USB_VCC*	+5 V power supply for USB device	
2	USB_D-	USB 2.0 differential pair (-)	
3	USB_D+	USB 2.0 differential pair (+)	
4	GND	Ground	



* The power source of +USB_VCC can be selected by JP6.

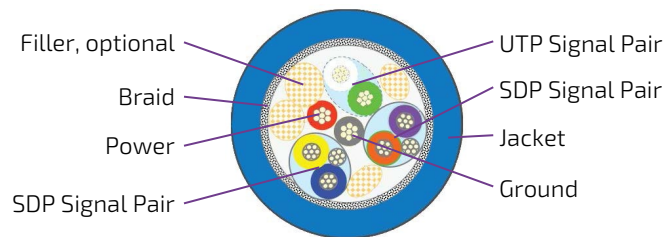
For HiSpeed rates it is required to use a USB cable, which is specified in USB 2.0 standard:

Figure 10: USB 2.0 High Speed Cable



For USB 3.2 Gen 2 cabling it is required to use only HiSpeed USB cable, specified in USB 3.2 standard:

Figure 11: USB 3.2 High Speed Cable



7/ Internal Connectors

7.1. Power Connector

Power connector must be used to supply the board with +12 VDC ($\pm 5\%$).

NOTICE

Hot plugging any of the power connector is not allowed.

Hot plugging might damage the board. In other words, turn off main supply etc. to make sure all the power lines are turned off when connecting to the motherboard.

7.1.1. Power Input Wafer (CN7)

The 1x4-pin 3.0 mm pitch power input wafer provides +12 V DC to the board.

Figure 12: Power Input Wafer CN7

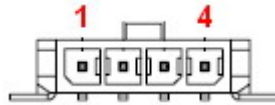


Table 18: Pin Assignment CN7

Pin	Signal	Description	Note
1	+12Vin	Power +12 V	
2	GND	Ground	
3	GND	Ground	
4	+12Vin	Power +12 V	
Connector Type			
B2W, 1x4-pin, 3.0 mm pitch			
Mating Connector			
Vendor	PINREX		
Housing Model No.	733-75-M104B6		
Terminal Model No.	733-70-FT0006		

7.1.2. CR2032 Battery Power Input Wafer (BAT1)

The 1x2-pin 1.25 mm pitch CR2032 battery power input wafer is intended to be connected to the battery. The battery provides power to the system clock to retain the time when power is turn off.

Figure 13: CR2032 Battery Power Input Wafer BAT1



Table 19: Pin Assignment BAT1

Pin	Signal	Description	Note
1	Battery+	Real-time clock backup battery input	
2	Battery-	Ground reference	
Connector Type			
B2W, 1x2-pin, 1.25 mm pitch			
Mating Connector			
Vendor	PINREX		
Housing Model No.	712-75-02W001		
Terminal Model No.	712-70-T00001		

7.2. Fan Wafer (FAN1)

The 1x4-pin 2.54 mm pitch CPU fan wafer (FAN1) is used for the connection of the fan for the processor.

Figure 14: Fan Wafer FAN1

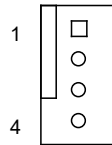


Table 20: Pin Assignment FAN1

Pin	Signal	Description	Note
1	GND	Power supply ground signal	
2	+12V	+12 V power supply for fan	1 A max.
3	SENSE	Sense input signal from the fan, for rotation speed supervision RPM (Rotations Per Minute).	
4	PWM	PWM output signal for FAN speed control	
Connector Type			
B2W, 1x4-pin, 2.54 mm pitch			

7.3. SATA (Serial ATA) Port 0 & 1 Connector (SATA1 & SATA2)

The SATA connectors supply the data connection for the SATA hard disks and are SATA 3.0 compatible.

Figure 15: SATA Port 0, 1 Connector SATA1, SATA2

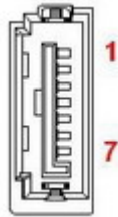


Table 21: Pin Assignment SATA1, SATA2

Pin	Signal	Description	Note
1	GND	Ground	
2	TX+	Host transmitter differential signal pair (+)	
3	TX-	Host transmitter differential signal pair (-)	
4	GND	Ground	
5	RX-	Host receiver differential signal pair (-)	
6	RX+	Host receiver differential signal pair (+)	
7	GND	Ground	
Connector Type			
B2W, 1x7-pin, 1.27 mm pitch			
Mating Connector			
Vendor	WINWIN		
Model No.	WATC-07DLPO2U		

7.4. HDD / SSD Power Output Wafer (CN15)

The 1x4-pin 2.0 mm pitch HDD / SSD power output wafer provides power to the SATA hard disk.

Figure 16: HDD / SSD Power Output Wafer CN15



Table 22: Pin Assignment CN15

Pin	Signal	Description	Note
1	+12V	+12 V power supply for HDD / SSD	1 A max.
2	GND	Ground	
3	GND	Ground	
4	+5V	+5 V power supply for HDD / SSD	1 A max.
Connector Type			
B2W, 1x4-pin, 2.0 mm pitch			
Mating Connector			
Vendor	PINREX		
Housing Model No.	721-75-04W009		
Terminal Model No.	721-70-T00009		

7.5. USB Connectors (Internal) (CN9 & CN10)

The 10-pin 2.54 mm pitch USB port pin header CN9 & CN10 supports two USB 2.0 ports each.

Figure 17: USB 2.0 Port 3, 4 Pin Header CN9, Port 1, 2 Pin Header CN10

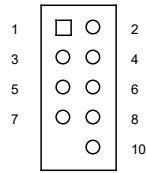


Table 23: Pin Assignment CN9, CN10

Pin	Signal	Description	Note
1	+USBVCC*	5 V supply. SB5V is supplied during power down to allow wakeup.	1 A max.
2	+USBVCC*	5 V supply. SB5V is supplied during power down to allow wakeup.	1 A max.
3	USB_A-	USB 2.0 differential pair (-) for channel A	
4	USB_B-	USB 2.0 differential pair (-) for channel B	
5	USB_A+	USB 2.0 differential pair (+) for channel A	
6	USB_B+	USB 2.0 differential pair (+) for channel B	
7	GND	Ground	
8	GND	Ground	
9	KEY		
10	GND	Ground	
Connector Type			
B2W, 2x5-pin, 2.54 mm pitch			
Mating Connector			
Vendor	PINREX		
Housing Model No.	741-75-205B01		
Terminal Model No.	741-70-FT0001		



* The power source of +USBVCC for CN9 and CN10 can be selected by JP6.

7.6. Audio AMP Output Wafer (CN13 & CN23)

The 3 W Speaker audio-out interface is available through the 2-pin 2.0 mm pitch wafers CN13 and CN23. These outputs are shared with the audio output (Line-out) signals of the audio pin header CN14.

Figure 18: Audio AMP Output Wafer CN13 (Right Channel), CN23 (Left Channel)

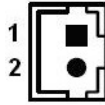


Table 24: Pin Assignment CN13, CN23

Pin	Signal	Description	Note
1	Speaker+	Speaker output (+)	
2	Speaker-	Speaker output (-)	
Connector Type			
B2W, 1x2-pin, 2.0 mm pitch			
Mating Connector			
Vendor	PINREX		
Housing Model No.	721-75-02W009		
Terminal Model No.	721-70-T00009		

7.7. Audio Input / Output Pin Header (CN14)

The audio input / output pin header provides audio output (Line-Out), audio input (Line-In) and microphone (Mic-In) signals through the 12-pin 2.54 mm pitch wafer CN14. The audio output signals are shared with those of the speaker connectors CN13 & CN23.

Figure 19: Audio Input / Output Pin Header CN14

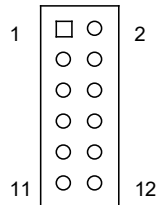


Table 25: Pin Assignment CN14

Pin	Signal	Description	Note
1	MIC-In_L	Microphone input left channel signal	
2	MIC-In_R	Microphone input right channel signal	
3	MIC-In_JD#	Microphone jack detection	
4	GND	Ground	
5	Line-In_L	Audio input left channel signal	
6	Line-In_R	Audio input right channel signal	
7	Line-In_JD#	Audio input jack detection	
8	GND	Ground	
9	Line-Out_L	Audio output left channel signal	
10	Line-Out_R	Audio output right channel signal	
11	Line-Out_JD#	Audio output jack detection	
12	GND	Ground	
Connector Type			
B2W, 2x6-pin, 2.54 mm pitch			
Mating Connector			
Vendor	PINREX		
Housing Model No.	741-75-206B01		
Terminal Model No.	741-70-FT0001		

7.8. Front Panel Pin Header (FP1 & FP2)

The 8-pin 2.54 mm pitch front panel pin header FP1 supplies signals for the reset button, storage LED and system warning speaker.

The 10-pin 2.54 mm pitch front panel pin header FP2 supplies signals for the power button, power LED, and SM Bus.

Figure 20: Front Panel 1 Pin Header FP1

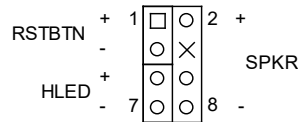


Table 26: Pin Assignment FP1

Pin	Signal	Description	Note
1	Reset Button +	System reset button (+)	
2	Speaker +	External system warning speaker (+)	
3	Reset Button -	System reset button (-)	
4	NC	No connection	
5	HDD LED +	HDD activity LED (+). The LED lights up or flashes when data is ready from or written to the HDD.	
6	Internal Speaker -	Internal system warning speaker (-)	
7	HDD LED -	HDD activity LED (-).	
8	Speaker -	External system warning speaker (-)	
Connector Type			
B2W, 2x4-pin, 2.54 mm pitch			
Mating Connector			
Vendor	PINREX		
Housing Model No.	741-75-204B01		
Terminal Model No.	741-70-FT0001		



Internal Buzzer is enabled when Pin6-8 is shorted.

Figure 21: Front Panel 2 Pin Header FP2

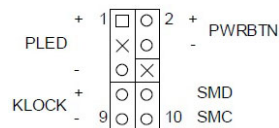


Table 27: Pin Assignment FP2

Pin	Signal	Description	Note
1	Power LED +	System Power LED (+). The LED lights up when users turn on the	

Pin	Signal	Description	Note
		system power, and blinks when the system is in sleep mode.	
2	Power Button +	System power button (+). Pressing the power button turns the system on or puts the system in sleep or soft-off mode depending on the operating system settings. Pressing the power switch for more than four seconds while the system turns from ON to OFF.	
3	NC	No connection	
4	Power Button -	System power button (-).	
5	Power LED -	System Power LED (-).	
6	SMB_ALERT#	System Management Bus Alert	
7	BATLOW#	Battery low input. This signal may be driven low by external circuitry to signal that the system battery is low. It also can be used to signal some other external power management event.	
8	SMBus Data	System management bus bidirectional data line	
9	GND	Ground	
10	SMBus Clock	System management bus bidirectional clock line	
Connector Type			
B2W, 2x5-pin, 2.54 mm pitch			
Mating Connector			
Vendor	PINREX		
Housing Model No.	741-75-205B01		
Terminal Model No.	741-70-FT0001		

7.9. Serial COM1, COM2, COM3 & COM4 Ports (CN12, CN17, CN21 & CN22)

The 10-pin 1.25 mm pitch serial COM wafer CN12 and CN17 provide RS232/422/485 connections.

The 10-pin 1.25 mm pitch serial COM wafer CN21 and CN22 provide RS232 connections.

Figure 22: Serial COM CN12, CN17, CN21, CN22

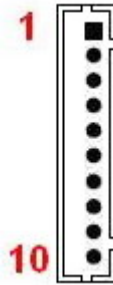


Table 28: Pin Assignment CN12, CN17

Pin	RS232 Signal	RS422 Signal	Half Duplex RS485 Signal	Full Duplex RS485 Signal	Note
1	DCD	TX-	DATA-	TX-	
2	DSR	N/A	N/A	N/A	
3	RXD	TX+	DATA+	TX+	
4	RTS	N/A	N/A	N/A	
5	TXD	RX+	N/A	RX+	
6	CTS	N/A	N/A	N/A	
7	DTR	RX-	N/A	RX-	
8	RI	N/A	N/A	N/A	
9	GND	GND	GND	GND	
10	+5V	+5V	+5V	+5V	500 mA max.
Connector Type					
B2W, 1x10-pin, 1.25 mm pitch					
Mating Connector					
Vendor	PINREX				
Housing Model No.	712-75-10W001				
Terminal Model No.	712-70-T00001				

Table 29: Pin Assignment CN21, CN22

Pin	RS232 Signal	Note
1	DCD	
2	DSR	
3	RXD	
4	RTS	
5	TXD	
6	CTS	

Pin	RS232 Signal	Note
7	DTR	
8	RI	
9	GND	
10	+5V	
Connector Type		
B2W, 1x10-pin, 1.25 mm pitch		
Mating Connector		
Vendor	PINREX	
Housing Model No.	712-75-10W001	
Terminal Model No.	712-70-T00001	

Table 30: Signal Description

Signal	Description
TXD	Transmitted Data, sends data to the communications link. The signal is set to the marking state (-12 V) on hardware reset when the transmitter is empty or when loop mode operation is initiated.
RXD	Received Data, receives data from the communications link.
DTR	Data Terminal Ready, indicates to the modem etc. that the on-board UART is ready to establish communication link.
DSR	Data Set Ready, indicates that the modem etc. is ready to establish a communications link.
RTS	Request To Send, indicates to the modem etc. that the on-board UART is ready to exchange data.
CTS	Clear To Send, indicates that the modem or data set is ready to exchange data.
DCD	Data Carrier Detect, indicates that the modem or data set has detected the data carrier.
RI	Ring Indicator, indicates that the modem has received a ringing signal from the telephone line.
TX+/-	Transmitted Data differential pair sends data to the communications link.
RX+/-	Received Data differential pair receives data from the communications link.
GND	Power Supply GND signal

7.10. LVDS Panel Connector (LVDS1)

The 30-pole 1.0 mm pitch JAE connector provides 18/24-bit, 2-channel LVDS panel connection.

Figure 23: LVDS Connector LVDS1

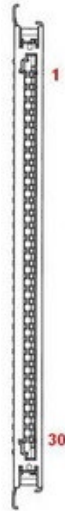


Table 31: Pin Assignment LVDS1

Pin	Signal	Description	Note
1	LVDS_A0-	LVDS Channel A Data 0 differential pair (-)	
2	LVDS_A0+	LVDS Channel A Data 0 differential pair (+)	
3	LVDS_A1-	LVDS Channel A Data 1 differential pair (-)	
4	LVDS_A1+	LVDS Channel A Data 1 differential pair (+)	
5	LVDS_A2-	LVDS Channel A Data 2 differential pair (-)	
6	LVDS_A2+	LVDS Channel A Data 2 differential pair (+)	
7	GND	Ground	
8	LVDS_ACLK-	LVDS Channel A clock differential pair (-)	
9	LVDS_ACLK+	LVDS Channel A clock differential pair (+)	
10	LVDS_A3- / NC	LVDS Channel A Data 3 differential pair (-)	
11	LVDS_A3+ / NC	LVDS Channel A Data 3 differential pair (+)	
12	LVDS_B0-	LVDS Channel B Data 0 differential pair (-)	
13	LVDS_B0+	LVDS Channel B Data 0 differential pair (+)	
14	GND	Ground	
15	LVDS_B1-	LVDS Channel B Data 1 differential pair (-)	
16	LVDS_B1+	LVDS Channel B Data 1 differential pair (-)	
17	GND	Ground	
18	LVDS_B2-	LVDS Channel B Data 2 differential pair (-)	
19	LVDS_B2+	LVDS Channel B Data 2 differential pair (+)	
20	LVDS_BCLK-	LVDS Channel B clock differential pair (-)	
21	LVDS_BCLK+	LVDS Channel B clock differential pair (+)	

Pin	Signal	Description	Note
22	LVDS_B3- / NC	LVDS Channel B Data 3 differential pair (-)	
23	LVDS_B3+ / NC	LVDS Channel B Data 3 differential pair (+)	
24	GND	Ground	
25	DDC_DATA	DDC channel Data	
26	VDDEN	Output Display Enable	
27	DDC_CLK	DDC Channel Clock	
28	+3.3V / +5V *	+3.3 V / +5 V panel power supply	500 mA max.
29	+3.3V / +5V *	+3.3 V / +5 V panel power supply	500 mA max.
30	+3.3V / +5V *	+3.3 V / +5 V panel power supply	500 mA max.
Connector Type			
B2W, 1x30-pin, 1.0 mm pitch			
Mating Connector			
Vendor	JAE		
Model No.	FI-X30HL		



* Panel Power can be selected by JP3.

7.11. Backlight Power Output Wafer (CN8)

The 7-pin 1.25 mm pitch wafer CN8 provides power supply for flat panel and its backlight inverter.

Figure 24: Backlight Power Output Wafer CN8



Table 32: Pin Assignment CN8

Pin	Signal	Description	Note
1	BL_ADJ_PWM*	Backlight Adjustment PWM (Pulse Width Modulation) signal	
2	BL_ADJ_VOL*	Backlight Adjustment Voltage signal	
3	GND	Ground	
4	+5V / +12V**	+5 V / +12 V backlight power supply	750 mA max.
5	+5V / +12V**	+5 V / +12 V backlight power supply	750 mA max.
6	GND	Ground	
7	BL_EN***	Backlight Enable signal	
Connector Type			
B2W, 1x7-pin, 1.25 mm pitch			
Mating Connector			
Vendor	PINREX		
Housing Model No.	712-75-07W001		
Terminal Model No.	712-70-T00001		



* BL_ADJ can be configured in BIOS setup.



** Backlight Power can be selected by JP3.



*** BL_EN can be selected by JP2.

7.12. Digital Input / Output Header (CN20)

The 10-pin 1.25 mm pitch header CN20 supports 8-bit digital input / output signals to provide powering-on function of the connected devices.

Figure 25: Digital Input / Output Wafer CN20

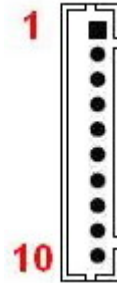


Table 33: Pin Assignment CN20

Pin	Signal	Description	Note
1	+5V	+5 V power supply	500 mA max.
2	DIO_0	Digital input / output channel 0	
3	DIO_1	Digital input / output channel 1	
4	DIO_2	Digital input / output channel 2	
5	DIO_3	Digital input / output channel 3	
6	DIO_4	Digital input / output channel 4	
7	DIO_5	Digital input / output channel 5	
8	DIO_6	Digital input / output channel 6	
9	DIO_7	Digital input / output channel 7	
10	GND	Ground	
Connector Type			
B2W, 1x10-pin, 1.25 mm pitch			
Mating Connector			
Vendor	PINREX		
Housing Model No.	712-75-10W001		
Terminal Model No.	712-70-T00001		

7.13. mPCIe Socket (MPCIE1)

Half-sized Mini-PCI Express V1.2 socket (MPCIE1). Socket MPCIE1 supports PCIe x1, USB 2.0 and SIM-card socket. The SIM-card socket makes it possible to use a WWAN wireless modem in this mPCIe slot. The USB does support WAKE function.

Figure 26: mPCIe Socket MPCIE1

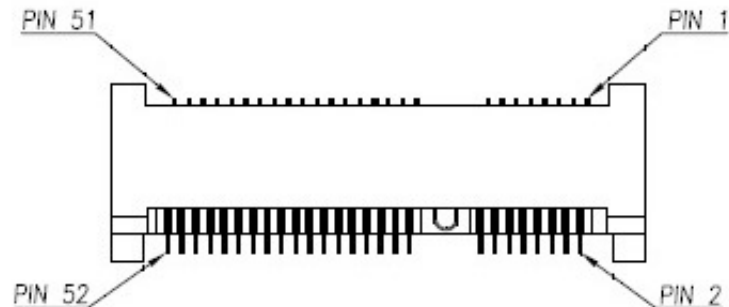


Table 34: Pin Assignment MPCIE1

Pin	Signal	Description	Note
1	WAKE#	Requests the host interface to return to full operation and respond to PCIe	
2	+3.3VSB	+3.3 V standby power supply	
3	Reserved		
4	Ground		
5	Reserved		
6	+1.5V	+1.5 V power supply	
7	CLKREQ#	Reference clock request signal	
8	UIM_PWR*	Power source for User Identity Modules (UIM)	
9	Ground		
10	UIM_DATA*	Data signal for User Identity Modules (UIM)	
11	REFCLK-	Reference clock differential pair (-)	
12	UIM_CLK*	Clock signal for User Identity Modules (UIM)	
13	REFCLK+	Reference clock differential pair (+)	
14	UIM_RESET*	Reset signal for User Identity Modules (UIM)	
15	Ground		
16	UIM_VPP*	Variable supply voltage for User Identity Module (UIM)	
17	Reserved		
18	Ground		
19	Reserved		
20	W_Disable#	Wireless disable signal	
21	Ground		
22	PERST#	PCI Express reset	
23	PERn0	PCIe Lane 0 receiver differential pair (-)	
24	+3.3VSB	+3.3 V standby power supply	

Pin	Signal	Description	Note
25	PERp0	PCIe Lane 0 receiver differential pair (+)	
26	Ground		
27	Ground		
28	+1.5V	+1.5 V power supply	
29	Ground		
30	SMB_CLK	System management bus clock	
31	PETn0	PCIe Lane 0 transmitter differential pair (-)	
32	SMB_DATA	System management bus data	
33	PETp0	PCIe Lane 0 transmitter differential pair (+)	
34	Ground		
35	Ground		
36	USB_D-	USB 2.0 differential pair (-)	
37	Ground		
38	USB_D+	USB 2.0 differential pair (+)	
39	+3.3VSB	+3.3 V standby power supply	
40	Ground		
41	+3.3VSB	+3.3 V standby power supply	
42	LED_WWAN#	LED status indicator signal for WWAN	
43	Ground		
44	LED_WLAN#	LED status indicator signal for WLAN	
45	Reserved		
46	LED_WPAN#	LED status indicator signal for WPAN	
47	Reserved		
48	+1.5V	+1.5 V power supply	
49	Reserved		
50	Ground		
51	Reserved		
52	+3.3VSB	+3.3 V standby power supply	



* These pins are connected to SIM1 Micro SIM card holder directly.

7.14. M.2 Key M Socket (M2M2)

The 3.5"-SBC-VR1000 supports M.2 modules in format 2280 with Key M. The M.2 specification supports PCIe x4 signals. The slot can be used to integrate an M.2 PCIe x4 SSD (NVMe) to the mainboard.

Figure 27: M.2 Key M Socket M2M2

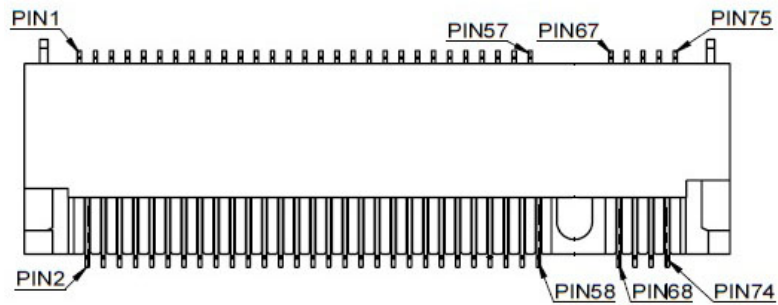


Table 35: Pin Assignment M2M2

Pin	Signal	Description	Note
1	GND	Ground	
2	+3.3V	3.3 V power supply	
3	GND	Ground	
4	+3.3V	3.3 V power supply	
5	M2M_RXN3	PCIe Lane 3 receiver pair (-)	
6	NC	No connection	
7	M2M_RXP3	PCIe Lane 3 receiver pair (+)	
8	NC	No connection	
9	GND	Ground	
10	M2M_LED1#	Open drain, active low signal for status LED driving	
11	M2M_TXN3	PCIe Lane 3 transmitter pair (-)	
12	+3.3V	3.3 V power supply	
13	M2M_TXP3	PCIe Lane 3 transmitter pair (+)	
14	+3.3V	3.3 V power supply	
15	GND	Ground	
16	+3.3V	3.3 V power supply	
17	M2M_RXN2	PCIe Lane 2 receiver pair (-)	
18	+3.3V	3.3 V power supply	
19	M2M_RXP2	PCIe Lane 2 receiver pair (+)	
20	NC	No connection	
21	GND	Ground	
22	NC	No connection	
23	M2M_TXN2	PCIe Lane 2 transmitter pair (-)	
24	NC	No connection	
25	M2M_TXP2	PCIe Lane 2 transmitter pair (+)	
26	NC	No connection	

Pin	Signal	Description	Note
27	GND	Ground	
28	NC	No connection	
29	M2M_RXN1	PCIe Lane 1 receiver pair (-)	
30	NC	No connection	
31	M2M_RXP1	PCIe Lane 1 receiver pair (+)	
32	NC	No connection	
33	GND	Ground	
34	NC	No connection	
35	M2M_TXN1	PCIe Lane 1 transmitter pair (-)	
36	NC	No connection	
37	M2M_TXP1	PCIe Lane 1 transmitter pair (+)	
38	DEVSLP	Device sleep	
39	GND	Ground	
40	NC	No connection	
41	PCIE_RXN	PCIe Lane 0 receiver pair (-)	
42	NC	No connection	
43	PCIE_RXP	PCIe Lane 0 receiver pair (+)	
44	NC	No connection	
45	GND	Ground	
46	NC	No connection	
47	PCIE_TXN	PCIe Lane 0 transmitter pair (-)	
48	NC	No connection	
49	PCIE_TXP	PCIe Lane 0 transmitter pair (+)	
50	PERST#	PCIe reset	
51	GND	Ground	
52	CLKREQ#	Reference clock request signal	
53	REFCLKn	PCIe reference clock pair (-)	
54	PEWAKE#	PCIe wake	
55	REFCLKp	PCIe reference clock pair (+)	
56	NC	No connection	
57	GND	Ground	
58	NC	No connection	
59	Key		
60	Key		
61	Key		
62	Key		
63	Key		
64	Key		
65	Key		
66	Key		
67	NC	No connection	
68	NC	No connection	

Pin	Signal	Description	Note
69	PEDET	PCIe detect	
70	+3.3V	3.3 V power supply	
71	GND	Ground	
72	+3.3V	3.3 V power supply	
73	GND	Ground	
74	+3.3V	3.3 V power supply	
75	GND	Ground	

7.15. Micro SIM Card Holder (SIM1)

The Micro SIM card holder SIM1 is intended to accommodate an Micro SIM card and connected to UIM signals on the mPCIe socket.

Figure 28: Micro SIM Card Holder SIM1

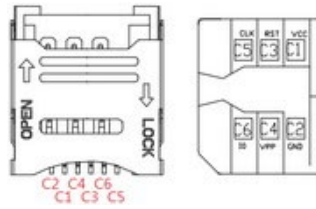


Table 36: Pin Assignment SIM1

Pin	Signal	Description	Note
C1	VCC	Power +3.3 V	
C2	GND	Ground	
C3	RST	Reset signal	
C4	VPP	Programming voltage input	
C5	CLK	Clock signal	
C6	IO	Input or Output for serial data	

7.16. M.2 Key M / mPCIe Activity LED Pin Header (CN18 & CN19)

The header CN18 is intended to connect M.2 Key M activity LED cable.

The pin header CN19 is intended to connect mPCIe activity LED cable.

Figure 29: M.2 Key M / mPCIe Activity LED Pin Header CN18, CN19

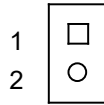


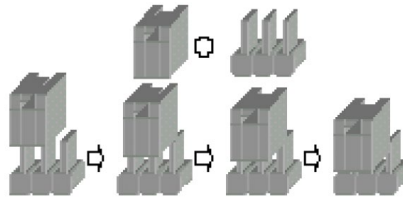
Table 37: Pin Assignment CN18, CN19

Pin	Signal	Description	Note
1	LED+		
2	LED-		
Connector Type			
B2W, 1x2-pin, 2.54 mm pitch			

7.17. Switches and Jumpers

The product has several jumpers which must be properly configured to ensure correct operation.

Figure 30: Jumper Connector



For a three-pin jumper (see Figure 29), the jumper setting is designated "1-2" when the jumper connects pins 1 and 2. The jumper setting is designated "2-3" when pins 2 and 3 are connected and so on. You will see that one of the lines surrounding a jumper pin is thick, which indicates pin No.1.

To move a jumper from one position to another, use needle-nose pliers or tweezers to pull the pin cap off the pins and move it to the desired position.

7.17.1. EEPROM WP Selection (JP1)

The 2.54 mm pitch "EEPROM Write Protect Selection" jumper (JP1) can be used to update EEPROM firmware.

Figure 31: EEPROM WP Selection JP1

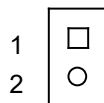


Table 38: Pin Assignment JP1

Jumper 1 Position	Description
Pin 1-2	
-	Memory is inhibited
X	Allows normal write

"X" = Jumper set (short) and "-" = jumper not set (open)

7.17.2. Backlight Enable Selection (JP2)

The 2.0 mm pitch "Backlight Enable Selection" jumper (JP2) can be used to select voltage level of backlight enable signal.

Figure 32: Backlight Enable Selection JP2

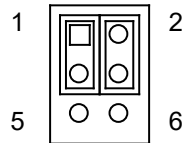


Table 39: Pin Assignment JP2

Jumper 1 Position		Description
Pin 1-3	Pin 3-5	
X	-	Backlight Enable Level = +3.3 V
-	X	Backlight Enable Level = +5 V
Jumper 2 Position		Description
Pin 2-4	Pin 4-6	
X	-	Backlight Enable High Active
-	X	Backlight Enable Low Active

"X" = Jumper set (short) and "-" = jumper not set (open)

7.17.3. Panel & Backlight Power Selection (JP3)

The 2.0 mm pitch "Panel & Backlight Power Selection" jumper (JP3) can be used to select LVDS panel and backlight power voltage.

Figure 33: Panel & Backlight Power Selection JP3

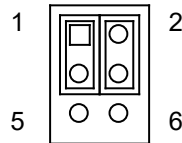


Table 40: Pin Assignment JP3

Jumper 1 Position		Description
Pin 1-3	Pin 3-5	
X	-	Backlight Power = +12 V
-	X	Backlight Power = +5 V
Jumper 2 Position		Description
Pin 2-4	Pin 4-6	
X	-	Panel Power = +3.3 V
-	X	Panel Power = +5 V

"X" = Jumper set (short) and "-" = jumper not set (open)

7.17.4. AT / ATX Power Mode Selection (JP5)

The 2.54 mm pitch jumper JP5 can be used to select AT power mode or ATX power mode.

Figure 34: AT / ATX Power Mode Selection JP5

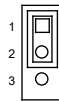


Table 41: Pin Assignment JP5

Jumper 1 Position		Description
Pin 1-2	Pin 2-3	
X	-	ATX Mode
-	X	AT Mode

"X" = Jumper set (short) and "-" = jumper not set (open)

7.17.5. USB Power Selection (JP6)

The 2.54 mm pitch "USB Power Selection" jumper (JP6) can be used to determine whether the USB ports are powered in the S4 / S5 state.

Figure 35: USB Power Selection JP6



Table 42: Pin Assignment JP6

Jumper 1 Position		Description
Pin 1-2	Pin 2-3	
X	-	USB power will be cut off in S4 & S5 state.
-	X	USB power is always supplied.

"X" = Jumper set (short) and "-" = jumper not set (open)

7.17.6. Clear CMOS Selection (JP7)

The 2.54 mm pitch "Clear COMS Selection" jumper (JP7) can be used to reset the Real Time Clock (RTC) and drain RTC well.

The jumper has one position: Pin 1-2 mounted (default position) and Pin 2-3 mounted. More information on setting the "Clear CMOS Selection" jumper can be found in the following table.

Figure 36: Clear CMOS Selection JP7



Table 43: Pin Assignment JP7

Jumper 1 Position		Description
Pin 1-2	Pin 2-3	
X	-	Normal Operation (default position)
-	X	Clear CMOS (board does not boot with the jumper in this position)

"X" = Jumper set (short) and "-" = jumper not set (open)



Do not leave the jumper in position 2-3, otherwise if the power is disconnected, the battery will fully deplete within a few weeks.

7.17.7. Backlight Adjustment Selection (JP9)

The 2.0 mm pitch "Backlight Adjustment Selection" jumper (JP9) can be used to select by which mode the brightness level in the LCD panel is adjusted.

Figure 37: Backlight Control Selection JP9



Table 44: Pin Assignment JP9

Jumper 1 Position		Description
Pin 1-2	Pin 2-3	
X	-	PWM Mode
-	X	Voltage Mode

"X" = Jumper set (short) and "-" = jumper not set (open)

7.17.8. LVDS EDID Selection (JP10)

The 2.0 mm pitch "LVDS EDID Selection" jumper (JP10) can be used to update LVDS firmware.

Figure 38: LVDS EDID Selection JP10



Table 45: Pin Assignment JP10

Jumper 1 Position		Description
Pin 1-2	Pin 2-3	
X	-	Normal
-	X	LVDS EDID Write

"X" = Jumper set (short) and "-" = jumper not set (open)

8/ BIOS

8.1. Starting the uEFI BIOS

The 3.5"-SBC-VR1000 is provided with a Kontron-customized, pre-installed and configured version of AMI Aptio® V uEFI BIOS. AMI BIOS firmware 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 3.5"-SBC-VR1000.

The uEFI BIOS comes with a setup program that provides quick and easy access to the individual function settings for control or modification of the uEFI BIOS configuration. The setup program allows the accessing of various menus that 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 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 3.5"-SBC-VR1000 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 46: Hotkeys Table

Signal	Description
<F1>	The <F1> key invokes the General Help window.
<->	The <Minus> key selects the next lower value within a field.
<+>	The <Plus> key selects the next higher value within a field.
<F2>	The <F2> key loads the previous values.
<F3>	The <F3> key loads the standard default values.
<F4>	The <F4> key saves the current settings and exit the uEFI BIOS setup.
<=> or <←>	The <Left/Right> arrows selects major setup menus on the menu bar. For example: Main, Advanced, Security, etc.
<↑> or <↓>	The <Up/Down> arrows selects fields in the current menu. For example: A setup function or a sub-screen.
<ESC>	The <ESC> key exits a major setup menu and enter the Exit setup menu. Pressing the <ESC> key in a sub-menu displays the next higher menu level.
<RERURN>	The <RETURN> key executes a command or select a submenu.

8.2. Starting the uEFI BIOS

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

- ▶ Main
- ▶ Advanced
- ▶ Power
- ▶ Boot
- ▶ Security
- ▶ Save & Exit

The Setup menus are selected via the left and right arrow keys. The currently active menu and the currently active uEFI BIOS Setup item are highlighted in white. Each Setup menu provides two main frames. The left frame displays all available functions. Functions that can be configured are displayed in blue. Functions displayed in gray provide information about the status or the operational configuration. The right frame displays an Item Specific Help window providing an explanation of the respective function.

8.2.1. Main Setup Menu

Upon entering the uEFI BIOS Setup program, the Main Setup menu is displayed. This screen lists the Main Setup menu sub-screens and provides basic system information. Additionally functions for setting the system time and date are offered.

Table 47: Main Setup Menu Sub-Screens and Functions

Function	Description
BIOS Information	Read only field. Displays information about the system BIOS
Memory Information	Read only field. Displays information about total memory
ME Information	Read only field. Displays information about Intel Management Engine (ME) version
Firmware Information	Code version and firmware information
System Date	Set System Date
System Time	Set System Time

Figure 39: BIOS Main Menu

BIOS SETUP UTILITY						
Main	Advanced	Power	Boot	Security	Save & Exit	
Product Information						
Product Name	3.5-SBC-VR1000					
BIOS Version	VR1KEX.004 (x64)					
BIOS Build Date	02/14/2020					
CPU Information						
AMD Ryzen Embedded R1606G with Radeon Vega Gfx						
2600 Mhz, 2 Core(s), 4 Logical Processor(s)						
Processor ID	810F81h					
Memory Information						
Total Size	4096 MB (DDR4)					
Frequency	2400 MHz					
Board Information						
UUID	652A5353-7341-4AB1-B4F8-0175DFBBFC2C					
Serial #	Default string					
LAN1 MAC Address	00:50:08:09:01:01				→ ←: Select Screen ↑ ↓: Select Item Enter: Select +/-: Change Opt. F1: General Help F2: Previous Values F3: Optimized Defaults F4: Save & Exit ESC: Exit	
LAN2 MAC Address	00:50:08:09:01:02					
> AMD Firmware Version						
System Date	[Fri 04/17/2020]					
System Time	[16:18:19]					
Access Level	Administrator					
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Feature	Option	Description
System Date	[dd/mm/yyyy]	Set the Date. Use Tab to switch between Data elements.
System Time	[hh:mm:ss]	Set the Time. Use Tab to switch between Time elements.

Figure 40: BIOS Main Menu - AMD Firmware Version

BIOS SETUP UTILITY					
Main	Advanced	Power	Boot	Security	Save & Exit
AMD Firmware Version					
AGESA Version	EmbeddedPI-FP5_1.2.0.2RC2				
PSP BootLoader Version	0.8.0.74				
PSP SecureOS Version	0.8.0.74				
ABL Version	19071700				
APCB Version	0029				
APOB	0013				
Ucode Patch Version	8108109				
SMU FW Version	0.30.89.0				
SMU RV2 FW Version	0.37.39.0				
DXIO FW Version	001F.01B4				
MP2 I2C FW Version	1.0.24.3				
MP2 I2C RV2 FW Version	1.2.2.3				
XHCI FW Version	FF.FF.FF.FF				
VBIOS FW Version	113-RAVEN2-117				
GOP Driver Version	0				
				→ ←: Select Screen ↑ ↓: Select Item Enter: Select +/-: Change Opt. F1: General Help F2: Previous Values F3: Optimized Defaults F4: Save & Exit ESC: Exit	
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8.2.2. Advanced Setup Menu

The Advanced setup menu provides sub-screens and functions for advanced configurations. The following sub-screen functions are included in the menu:

- ▶ LAN Configuration
- ▶ Display Configuration
- ▶ CPU Chipset Configuration
- ▶ NVMe Configuration
- ▶ SATA Configuration
- ▶ USB Configuration
- ▶ Trusted Computing
- ▶ DIO Configuration
- ▶ Super IO Configuration
- ▶ H/W Monitor
- ▶ Tls Auth Configuration
- ▶ Network Stack Configuration

NOTICE

Setting items on this screen to incorrect values may cause the system to malfunction.

Figure 41: BIOS Advanced Menu

BIOS SETUP UTILITY					
Main	Advanced	Power	Boot	Security	Save & Exit
Onboard LAN1 Controller		[Enabled]			
Onboard LAN2 Controller		[Enabled]			
Load Intel I211/I210 UNDI		[Disabled]			
LAN Boot I210-AT		[Disabled]			
LAN Boot I211-AT		[Disabled]			
> Display Configuration					
> CPU Chipset Configuration					
> NVMe Configuration					
> SATA Configuration					
> USB Configuration					
> Trusted Computing					
> DIO Configuration					
> Super IO Configuration					
> H/W Monitor					
> Tls Auth Configuration					
> Network Stack Configuration					
				→ ←: Select Screen	
				↑ ↓: Select Item	
				Enter: Select	
				+/-: Change Opt.	
				F1: General Help	
				F2: Previous Values	
				F3: Optimized Defaults	
				F4: Save & Exit	
				ESC: Exit	
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Feature	Option	Description
Onboard LAN1 Controller	[Disabled], [Enabled]	Select whether to enable or disable Onboard LAN1 Controller. I210-AT
Onboard LAN2 Controller	[Disabled], [Enabled]	Select whether to enable or disable Onboard LAN2 Controller. I211-AT
Load Intel I211/I210 UNDI	[Disabled], [Enabled]	Select whether to load onboard UNDI (Universal Network Driver Interface) for I211/I210.
LAN Boot I210-AT	[Disabled], [Load PXE]	Select whether to enable or disable load onboard PXE (Preboot Execution Environment) or uEFI-SNP (Simple Network Protocol). Intel I210-AT.
LAN Boot I211-AT	[Disabled], [Load PXE]	Select whether to enable or disable load onboard PXE (Preboot Execution Environment) or uEFI-SNP (Simple Network Protocol). Intel I211-AT.

Figure 42: BIOS Advanced Menu - Display Configuration

BIOS SETUP UTILITY					
Main	Advanced	Power	Boot	Security	Save & Exit
Display Configuration					
Integrated Graphics Controller		[Enabled]			
UMA Frame Buffer Size*		[512M]		→ ←: Select Screen	
Active LVDS		[Disabled]		↑ ↓: Select Item	
LVDS Panel Type**		[1366x768 1CH]		Enter: Select	
LVDS Panel Color Depth**		[18Bit]		+/-: Change Opt.	
PWM Backlight Control**		[By External]		F1: General Help	
LVDS Backlight Control Mode**		[PWM]		F2: Previous Values	
LVDS Backlight Control - PWM***		127		F3: Optimized Defaults	
LVDS Backlight Control - Voltage****		[2.5 V]		F4: Save & Exit	
				ESC: Exit	
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* This item appears only when enabling Integrated Graphics Controller.

** This item is selectable only when selecting PEG for the Primary Display.

*** This item appears only when selecting PWM for the LVDS Backlight Control Mode.

**** This item appears only when selecting Voltage for the LVDS Backlight Control Mode.

Feature	Option	Description
Integrated Graphics Controller	[Disabled], [Enabled]	Select whether to enable or disable Integrated Graphics Controller
UMA Frame Buffer Size	[64M], [128M], [256M], [384M], [512M], [1G], [2G], [3G]	Configure the memory size for internal graphic.
Active LVDS	[Disabled], [Enabled]	Select the Active LVDS Configuration. [Disabled]: VBIOS does not enable LVDS. [Enabled]: VBIOS will enable LVDS.
LVDS Panel Type	[800x600 1CH], [1024x768 1CH], [1280x1024 2CH], [1366x768 1CH], [1366x768 2CH], [1600x1200 2CH], [1920x1080 2CH]	LVDS panel by selecting the appropriate setup item.
LVDS Panel Color Depth	[18Bit], [24Bit]	LVDS panel color depth by appropriate setup item.
PWM Backlight Control	[By External], [By Internal]	LVDS Backlight Power output control [By External]: Control by external HW circuit. [By Internal]: Control by LBKL_CTL on the AMD Chipset.
LVDS Backlight Control Mode	[Voltage], [PWM]	CN8 LVDS Backlight Power Wafer output control [Voltage]: Pin 1 output [PWM]: Pin 2 output

Feature	Option	Description
LVDS Backlight Control - Voltage	[0.0 V], [0.5 V], [1.0 V], [1.5 V], [2.0 V], [2.5 V], [3.0 V], [3.5 V], [4.0 V], [4.5 V], [5.0 V]	Min: 0.0 V Max: 5.0 V

Figure 43: BIOS Advanced Menu - CPU Chipset Configuration

BIOS SETUP UTILITY					
Main	Advanced	Power	Boot	Security	Save & Exit
CPU Chipset Configuration					
SVM Mode		[Enabled]		→ ←: Select Screen	
NX Mode		[Enabled]		↑ ↓: Select Item	
IOMMU		[Enabled]		Enter: Select	
Active CPU Cores		[All]		+/-: Change Opt.	
				F1: General Help	
				F2: Previous Values	
				F3: Optimized Defaults	
				F4: Save & Exit	
				ESC: Exit	
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Feature	Option	Description
SVM Mode	[Disabled], [Enabled]	Select whether to enable or disable CPU Virtualization
NX Mode	[Disabled], [Enabled]	Select whether to enable or disable No-execute page protection Function
IOMMU	[Disabled], [Enabled]	Select whether to enable or disable IOMMU
Active Processor Cores	[All], [1 CPU Cores], [2 CPU Cores], [3 CPU Cores]	Select number of cores to be used. WARNING - S3 is NOT SUPPORTED on systems where cores / threads have been removed / disabled.

Figure 44: BIOS Advanced Menu - NVMe Configuration

BIOS SETUP UTILITY					
Main	Advanced	Power	Boot	Security	Save & Exit
NVMe Configuration					
No NVMe Device Found				→ ←: Select Screen ↑ ↓: Select Item Enter: Select +/-: Change Opt. F1: General Help F2: Previous Values F3: Optimized Defaults F4: Save & Exit ESC: Exit	
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Figure 45: BIOS Advanced Menu - SATA Configuration

BIOS SETUP UTILITY					
Main	Advanced	Power	Boot	Security	Save & Exit
SATA Configuration					
SATA Controller		[Enabled]		→ ←: Select Screen	
SATA1*		Not Present		↑ ↓: Select Item	
SATA2*		Not Present		Enter: Select	
				+/-: Change Opt.	
				F1: General Help	
				F2: Previous Values	
				F3: Optimized Defaults	
				F4: Save & Exit	
				ESC: Exit	
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* These items appear only when enabling SATA Controller.

Feature	Option	Description
SATA Controller	[Enabled], [Disabled]	Select whether to enable or disable OnChip SATA Controller.

Figure 46: BIOS Advanced Menu - USB Configuration

BIOS SETUP UTILITY					
Main	Advanced	Power	Boot	Security	Save & Exit
USB Configuration					
USB Devices: 1 Keyboard, 1 Hub				→ ←: Select Screen ↑ ↓: Select Item Enter: Select +/-: Change Opt. F1: General Help F2: Previous Values F3: Optimized Defaults F4: Save & Exit ESC: Exit	
Legacy USB Support		[Enabled]			
XHCI Hand-off		[Enabled]			
USB Mass Storage Driver Support		[Enabled]			
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Feature	Option	Description
Legacy USB Support	[Enabled], [Disabled], [Auto]	Select whether to enable or disable Legacy USB support. AUTO option disables legacy support if no USB devices are connected.
XHCI Hand-off	[Enabled], [Disabled]	Select whether to enable or disable XHCI Hand-off function. This is a workaround for Oses without XHCI hand-off support. The XHCI ownership change should be claimed by XHCI driver.
USB Mass Storage Driver Support	[Disabled], [Enabled]	Select whether to enable or disable USB Mass Storage Driver Support.

Figure 47: BIOS Advanced Menu - Trusted Computing

BIOS SETUP UTILITY					
Main	Advanced	Power	Boot	Security	Save & Exit
Configuration					
Security Device Support		[Disabled]			
No Security Device Found				→ ←: Select Screen ↑ ↓: Select Item Enter: Select +/-: Change Opt. F1: General Help F2: Previous Values F3: Optimized Defaults F4: Save & Exit ESC: Exit	
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Feature	Option	Description
Security Device Support	[Disabled], [Enabled]	Select whether to enable or disable BIOS support for security device. O.S. will not show Security Device. TCG EFI protocol and INT1A interface will not be available.

Figure 48: BIOS Advanced Menu - DIO Configuration

BIOS SETUP UTILITY					
Main	Advanced	Power	Boot	Security	Save & Exit
DIO Configuration					
User Configuration		[Disabled]			
DIO_0*		[Output High]			
DIO_1*		[Output High]			
DIO_2*		[Output High]			
DIO_3*		[Output High]			
DIO_4*		[Output High]			
DIO_5*		[Output High]			
DIO_6*		[Output High]			
DIO_7*		[Output High]			
→ ←: Select Screen					
↑ ↓: Select Item					
Enter: Select					
+/-: Change Opt.					
F1: General Help					
F2: Previous Values					
F3: Optimized Defaults					
F4: Save & Exit					
ESC: Exit					
DIO_0 Value 1					
DIO_1 Value 1					
DIO_2 Value 1					
DIO_3 Value 1					
DIO_4 Value 1					
DIO_5 Value 1					
DIO_6 Value 1					
DIO_7 Value 1					
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* These items appear only when enabling User Configuration.

Feature	Option	Description
User Configuration	[Enabled], [Disabled]	Select whether to allow user to set the DO pin output value
DIO_0..7	[Output Low], [Output High], [Input]	Setting the DO pin output value

Figure 49: BIOS Advanced Menu - Super IO Configuration

BIOS SETUP UTILITY					
Main	Advanced	Power	Boot	Security	Save & Exit
Super IO Configuration					
Serial Port UART Protection		[No Protection]			
> Serial Port 1 Configuration > Serial Port 2 Configuration > Serial Port 3 Configuration > Serial Port 4 Configuration				→ ←: Select Screen ↑ ↓: Select Item Enter: Select +/-: Change Opt. F1: General Help F2: Previous Values F3: Optimized Defaults F4: Save & Exit ESC: Exit	
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Feature	Option	Description
Serial Port UART Protection	[No Protection], [Keep Device On]	Set Super IO Serial Port into Device D3 or not. [No Protection]: UART device have be entry D3 for OS control. [Keep Device On]: Protection UART device not entry D3 state.

Figure 50: BIOS Advanced Menu - Super IO Configuration - Serial Port 1 Configuration

BIOS SETUP UTILITY					
Main	Advanced	Power	Boot	Security	Save & Exit
Super Port 1 Configuration					
Serial Port		[Enabled]		→ ←: Select Screen	
Device Settings ⁽¹⁾		IO=3F8h; IRQ=4;		↑ ↓: Select Item	
Change Settings ⁽¹⁾		[Auto]		Enter: Select	
Serial Port 1 Type ⁽¹⁾		[RS232]		+/-: Change Opt.	
RS485 Duplex Mode ⁽¹⁾⁽²⁾		[Half Duplex]		F1: General Help	
RS485 Auto Flow Control ⁽¹⁾⁽²⁾⁽³⁾		[Disabled]		F2: Previous Values	
RS485/422 Receiver Termination ⁽¹⁾⁽²⁾⁽⁴⁾		[Enabled]		F3: Optimized Defaults	
				F4: Save & Exit	
				ESC: Exit	
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⁽¹⁾ These items appear only when enabling Serial Port.

⁽²⁾ These items appear only when selecting RS485 for the Serial Port 1 Type.

⁽³⁾ This item appears only when selecting Half Duplex for RS485 Duplex Mode

⁽⁴⁾ This item appears only when selecting RS485 or RS422 for the Serial Port 1 Type.

Feature	Option	Description
Serial Port	[Disabled], [Enabled]	Select whether to enable or disable Serial Port (COM).
Change Settings	[Auto], [IO=3F8h; IRQ=4;], [IO=3F8h; IRQ=3, 4, 5, 6, 7, 9, 10, 11, 12;], [IO=2F8h; IRQ=3, 4, 5, 6, 7, 9, 10, 11, 12;], [IO=3E8h; IRQ=3, 4, 5, 6, 7, 9, 10, 11, 12;], [IO=2E8h; IRQ=3, 4, 5, 6, 7, 9, 10, 11, 12;]	Select an optimal setting for Super IO device.
Serial Port 1 Type	[RS232], [RS422], [RS485]	Select an appropriate type for Serial Port 1.
RS485 Duplex Mode	[Half Duplex], [Full Duplex]	Select an appropriate RS485 Duplex Mode.
RS485 Auto Flow Control	[Disabled], [Enabled]	Select whether to enable or disable RS485 Auto Flow Control.
RS485/422 Receiver Termination	[Disabled], [Enabled]	Select whether to enable or disable RS485/422 Receiver Termination.

Figure 51: BIOS Advanced Menu - Super IO Configuration - Serial Port 2 Configuration

BIOS SETUP UTILITY					
Main	Advanced	Power	Boot	Security	Save & Exit
Super Port 2 Configuration					
Serial Port		[Enabled]		→ ←: Select Screen	
Device Settings ⁽¹⁾		IO=2F8h; IRQ=3;		↑ ↓: Select Item	
Change Settings ⁽¹⁾		[Auto]		Enter: Select	
Serial Port 2 Type ⁽¹⁾		[RS232]		+/-: Change Opt.	
RS485 Duplex Mode ⁽¹⁾⁽²⁾		[Half Duplex]		F1: General Help	
RS485 Auto Flow Control ⁽¹⁾⁽²⁾⁽³⁾		[Disabled]		F2: Previous Values	
RS485/422 Receiver Termination ⁽¹⁾⁽²⁾⁽⁴⁾		[Enabled]		F3: Optimized Defaults	
				F4: Save & Exit	
				ESC: Exit	
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⁽¹⁾ These items appear only when enabling Serial Port.

⁽²⁾ These items appear only when selecting RS485 for the Serial Port 2 Type.

⁽³⁾ This item appears only when selecting Half Duplex for RS485 Duplex Mode

⁽⁴⁾ This item appears only when selecting RS485 or RS422 for the Serial Port 2 Type.

Feature	Option	Description
Serial Port	[Disabled], [Enabled]	Select whether to enable or disable Serial Port (COM).
Change Settings	[Auto], [IO=2F8h; IRQ=3;], [IO=3F8h; IRQ=3, 4, 5, 6, 7, 9, 10, 11, 12;], [IO=2F8h; IRQ=3, 4, 5, 6, 7, 9, 10, 11, 12;], [IO=3E8h; IRQ=3, 4, 5, 6, 7, 9, 10, 11, 12;], [IO=2E8h; IRQ=3, 4, 5, 6, 7, 9, 10, 11, 12;]	Select an optimal setting for Super IO device.
Serial Port 2 Type	[RS232], [RS422], [RS485]	Select an appropriate type for Serial Port 2.
RS485 Duplex Mode	[Half Duplex], [Full Duplex]	Select an appropriate RS485 Duplex Mode.
RS485 Auto Flow Control	[Disabled], [Enabled]	Select whether to enable or disable RS485 Auto Flow Control.
RS485/422 Receiver Termination	[Disabled], [Enabled]	Select whether to enable or disable RS485/422 Receiver Termination.

Figure 52: BIOS Advanced Menu - Super IO Configuration - Serial Port 3 Configuration

BIOS SETUP UTILITY					
Main	Advanced	Power	Boot	Security	Save & Exit
Super Port 3 Configuration					
Serial Port		[Enabled]		→ ←: Select Screen	
Device Settings*		IO=3E8h; IRQ=5;		↑ ↓: Select Item	
Change Settings*		[Auto]		Enter: Select	
				+/-: Change Opt.	
				F1: General Help	
				F2: Previous Values	
				F3: Optimized Defaults	
				F4: Save & Exit	
				ESC: Exit	
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* These items appear only when enabling Serial Port.

Feature	Option	Description
Serial Port	[Disabled], [Enabled]	Select whether to enable or disable Serial Port (COM).
Change Settings	[Auto], [IO=3E8h; IRQ=7;], [IO=3E8h; IRQ=3, 4, 5, 6, 7, 9, 10, 11, 12;], [IO=2E8h; IRQ=3, 4, 5, 6, 7, 9, 10, 11, 12;], [IO=2F0h; IRQ=3, 4, 5, 6, 7, 9, 10, 11, 12;], [IO=2E0h; IRQ=3, 4, 5, 6, 7, 9, 10, 11, 12;]	Select an optimal setting for Super IO device.

Figure 53: BIOS Advanced Menu - Super IO Configuration - Serial Port 4 Configuration

BIOS SETUP UTILITY					
Main	Advanced	Power	Boot	Security	Save & Exit
Super Port 4 Configuration					
Serial Port		[Enabled]		→ ←: Select Screen	
Device Settings*		IO=2E8h; IRQ=5;		↑ ↓: Select Item	
Change Settings*		[Auto]		Enter: Select	
				+/-: Change Opt.	
				F1: General Help	
				F2: Previous Values	
				F3: Optimized Defaults	
				F4: Save & Exit	
				ESC: Exit	
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* These items appear only when enabling Serial Port.

Feature	Option	Description
Serial Port	[Disabled], [Enabled]	Select whether to enable or disable Serial Port (COM).
Change Settings	[Auto], [IO=2E8h; IRQ=7;], [IO=3E8h; IRQ=3, 4, 5, 6, 7, 9, 10, 11, 12;], [IO=2E8h; IRQ=3, 4, 5, 6, 7, 9, 10, 11, 12;], [IO=2F0h; IRQ=3, 4, 5, 6, 7, 9, 10, 11, 12;], [IO=2E0h; IRQ=3, 4, 5, 6, 7, 9, 10, 11, 12;]	Select an optimal setting for Super IO device.

Figure 54: BIOS Advanced Menu - H/W Monitor

BIOS SETUP UTILITY					
Main	Advanced	Power	Boot	Security	Save & Exit
PC Health Status					
> Smart FAN Configuration					
CPU Temperature - TSI		: +53 C			
CPU Temperature - Thermistor		: +40 C			
System Temperature		: +37 C			
CPU Fan Speed				→ ←: Select Screen	
				↑ ↓: Select Item	
				Enter: Select	
				+/-: Change Opt.	
+VCORE		: +1.253 V		F1: General Help	
+VIN		: +12.268 V		F2: Previous Values	
+5V		: +5.066 V		F3: Optimized Defaults	
+VMEM		: +1.299 V		F4: Save & Exit	
+3.3V		: +3.360 V		ESC: Exit	
+VRTC		: +3.280 V			
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Figure 55: BIOS Advanced Menu - H/W Monitor - Smart FAN Configuration

BIOS SETUP UTILITY					
Main	Advanced	Power	Boot	Security	Save & Exit
Smart FAN Configuration					
CPU FAN Setting		[Manual]			
Manual Duty*		255		→ ←: Select Screen	
1st Boundary Temperature**		30		↑ ↓: Select Item	
1st FAN Speed**		50		Enter: Select	
2nd Boundary Temperature**		40		+/-: Change Opt.	
2nd FAN Speed**		100		F1: General Help	
3rd Boundary Temperature**		50		F2: Previous Values	
3rd FAN Speed**		150		F3: Optimized Defaults	
4th Boundary Temperature**		60		F4: Save & Exit	
4th FAN Speed**		200		ESC: Exit	
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* This item appears only when selecting Manual for CPU FAN Setting.

** These items appear only when selecting Smart for CPU FAN Setting.

Feature	Option	Description
CPU FAN Setting	[Manual], [Smart]	Switch the CPU FAN control mode.

Figure 56: BIOS Advanced Menu - Tls Auth Configuration

BIOS SETUP UTILITY					
Main	Advanced	Power	Boot	Security	Save & Exit
> Server CA Configuration					
				→ ←: Select Screen ↑ ↓: Select Item Enter: Select +/-: Change Opt. F1: General Help F2: Previous Values F3: Optimized Defaults F4: Save & Exit ESC: Exit	
> Client Cert Configuration					
Version 2.20.1274. Copyright (C) 2020, American Megatrends, Inc.					

Figure 57: BIOS Advanced Menu - Tls Auth Configuration - Server CA Configuration

BIOS SETUP UTILITY					
Main	Advanced	Power	Boot	Security	Save & Exit
> Enroll Cert					
				→ ←: Select Screen ↑ ↓: Select Item Enter: Select +/-: Change Opt. F1: General Help F2: Previous Values F3: Optimized Defaults F4: Save & Exit ESC: Exit	
> Delete Cert					
Version 2.20.1274. Copyright (C) 2020, American Megatrends, Inc.					

Figure 58: BIOS Advanced Menu - Tls Auth Configuration - Server CA Configuration - Enroll Cert

BIOS SETUP UTILITY					
Main	Advanced	Power	Boot	Security	Save & Exit
> Enroll Cert Cert GUID > Commit Changes and Exit > Discard Changes and Exit				→ ←: Select Screen ↑ ↓: Select Item Enter: Select +/-: Change Opt. F1: General Help F2: Previous Values F3: Optimized Defaults F4: Save & Exit ESC: Exit	
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Feature	Option	Description
Cert GUID	[11111111-2222-3333-4444-1234567890ab]	Input digit character in 11111111-2222-3333-4444-1234567890ab format.

Figure 59: BIOS Advanced Menu - Network Stack Configuration

BIOS SETUP UTILITY					
Main	Advanced	Power	Boot	Security	Save & Exit
Network Stack		[Enabled]			
Ipv4 PXE Support*		[Enabled]			
Ipv4 HTTP Support*		[Disabled]			
Ipv6 PXE Support*		[Disabled]			
Ipv6 HTTP Support*		[Disabled]			
IPSEC Certificate*		[Enabled]			
PXE boot wait time*		0			
Media detect count*		1			
				→ ←: Select Screen	
				↑ ↓: Select Item	
				Enter: Select	
				+/-: Change Opt.	
				F1: General Help	
				F2: Previous Values	
				F3: Optimized Defaults	
				F4: Save & Exit	
				ESC: Exit	
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* These items appear only when enabling Network Stack.

Feature	Option	Description
Network Stack	[Disabled], [Enabled]	Select whether to enable or disable UEFI network stack.
Ipv4 PXE Support	[Disabled], [Enabled]	Select whether to enable or disable Ipv4 PXE boot support. If disabled, IPv4 PXE boot support will not be available.
Ipv4 HTTP Support	[Disabled], [Enabled]	Select whether to enable or disable Ipv4 HTTP boot support. If disabled, IPv4 HTTP boot support will not be available.
Ipv6 PXE Support	[Disabled], [Enabled]	Select whether to enable or disable Ipv6 PXE boot support. If disabled, IPv6 PXE boot support will not be available.
Ipv6 HTTP Support	[Disabled], [Enabled]	Select whether to enable or disable Ipv6 HTTP boot support. If disabled, IPv6 HTTP boot support will not be available.
IPSEC Certificate	[Disabled], [Enabled]	Select whether to enable or disable IPSEC certificate for Ikev.

8.2.3. Power Setup Menu

The Power setup menu provides functions and a sub-screen for power configurations. The following sub-screen function is included in the menu:

- ▶ WatchDog Timer Configuration

Figure 60: BIOS Power Setup Menu

BIOS SETUP UTILITY					
Main	Advanced	Power	Boot	Security	Save & Exit
Power Configuration					
ACPI Sleep State		[S3 (Suspend to RAM)]			
Restore AC Power Loss		[Power Off]			
Power Saving Mode		[Disabled]		→ ←: Select Screen	
Resume Event Control				↑ ↓: Select Item	
ResumeLan I210-AT		[Disabled]		Enter: Select	
ResumeLan I211-AT		[Disabled]		+/-: Change Opt.	
Resume By PCI-E Device		[Disabled]		F1: General Help	
Resume By Ring Device		[Disabled]		F2: Previous Values	
Resume By RTC Alarm		[Disabled]		F3: Optimized Defaults	
> WatchDog Timer Configuration				F4: Save & Exit	
				ESC: Exit	
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Feature	Option	Description
ACPI Sleep State	[Suspend Disabled], [S3 (Suspend to RAM)]	Select the highest ACPI sleep state the system will enter when the SUSPEND button is pressed.
Restore AC Power Loss	[Power Off], [Power On], [Last State]	Select AC power state when power is re-applied after a power failure. Select [Power Off] if you want the system to remain off after power restored. Select [Power On] if you use a power strip to turn the system on.
Power Saving Mode	[Disabled], [EUP Enabled]	Configure the Power Saving Mode configuration. [EUP Enabled]: The system will enter to EUP Power Saving Mode during power off. [Disabled]: Disables function of all Power Saving Mode.
ResumeLan I210-AT	[Disabled], [OS-Driver], [FW-MagicPacket]	Select whether to enable or disable Wake from LAN Device Intel I210-AT.
ResumeLan I211-AT	[Disabled], [OS-Driver], [FW-MagicPacket]	Select whether to enable or disable Wake from LAN Device Intel I211-AT.
Resume By PCI-E Device	[Disabled], [Enabled]	Select whether to enable or disable Wake from PCI-E Device.
Resume By Ring Device	[Disabled], [Enabled]	Select whether to enable or disable Wake from Ring Device.

Feature	Option	Description
Resume By RTC Alarm	[Disabled], [Enabled]	Select whether to enable or disable Wake Up on Alarm, to turn on your system on a special day of the month.

Figure 61: BIOS Power Setup Menu - WatchDog Timer Configuration

BIOS SETUP UTILITY					
Main	Advanced	Power	Boot	Security	Save & Exit
WatchDog Timer Configuration					
WDT Function		[Disabled]		→ ←: Select Screen	
WDT Count Mode*		[Minute]		↑ ↓: Select Item	
WDT Timer*		30		Enter: Select	
				+/-: Change Opt.	
				F1: General Help	
				F2: Previous Values	
				F3: Optimized Defaults	
				F4: Save & Exit	
				ESC: Exit	
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* These items appear only when enabling WDT Function.

Feature	Option	Description
WDT Function	[Disabled], [Enabled]	Select whether to enable or disable WatchDog Timer function.
WDT Count Mode	[Second], [Minute]	Select WatchDog Count Mode: Second or Minute.

8.2.4. Boot Setup Menu

The boot setup menu lists the for boot device priority order, that is generated dynamically.

Figure 62: BIOS Boot Setup Menu

BIOS SETUP UTILITY					
Main	Advanced	Power	Boot	Security	Save & Exit
Boot Configuration					
Full Screen LOGO Display		[Disabled]			
Setup Prompt Timeout		1			
Bootup NumLock State		[On]		→ ←: Select Screen	
				↑ ↓: Select Item	
CSM Support		[Enabled]		Enter: Select	
Boot Option Filter		[UEFI and Legacy]		+/-: Change Opt.	
Load built-in Shell		[Enabled]		F1: General Help	
File System Drivers		[Disabled]		F2: Previous Values	
				F3: Optimized Defaults	
Boot Option Priorities				F4: Save & Exit	
Boot Option #1		[UEFI: Built-in EFI Shell]		ESC: Exit	
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Feature	Option	Description
Full Screen LOGO Display	[Disabled], [Enabled]	Select whether to enable or disable to display logo screen.
Bootup NumLock State	[On], [Off]	This field indicates the state of the NumLock feature of the keyboard after Startup. [On]: The keys on the keypad will act as numeric keys. [Off]: The keys on the keypad will act as cursor keys.
CSM Support	[Enabled], [Disabled]	Select whether to enable or disable CSM support.
Boot Option Filter	[UEFI and Legacy], [Legacy only], [UEFI only]	This option controls Legacy / UEFI ROMs priority.
Load built-in Shell	[Enabled], [Disabled]	It controls installation of the boot option for a built-in Shell
File System Drivers	[Enabled], [Disabled]	Free Software UEFI File System Drivers, such as a read-only NTFS or exFAT EFI drivers, courtesy of the GRUB project.
Boot Option #1	[UEFI: Built-in EFI Shell], [Disabled]	Select an option for first boot device.

8.2.5.1. Remember the password

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

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



HDD security passwords cannot be cleared using the above method.

8.2.6. Save & Exit Setup Menu

The exit setup menu provides functions for handling changes made to the UEFI BIOS settings and the exiting of the setup program.

Figure 64: BIOS Save & Exit Setup Menu

BIOS SETUP UTILITY					
Main	Advanced	Power	Boot	Security	Save & Exit
Save Changes and Reset					
Discard Changes and Reset					
Save Options				→ ←: Select Screen	
Save Changes				↑ ↓: Select Item	
Discard Changes				Enter: Select	
Restore Defaults				+/-: Change Opt.	
				F1: General Help	
				F2: Previous Values	
				F3: Optimized Defaults	
				F4: Save & Exit	
				ESC: Exit	
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Feature	Description
Save Changes and Exit	Exit system setup after saving the changes. Once you are finished making your selections, choose this option from the Exit menu to ensure the values you selected are saved to the CMOS RAM. The CMOS RAM is sustained by an onboard backup battery and stays on even when the PC is turned off. When you select this option, a confirmation window appears. Select [Yes] to save changes and exit.
Discard Changes and Exit	Exit system setup without saving any changes. Select this option only if you do not want to save the changes that you made to the Setup program. If you made changes to fields other than system date, system time, and password, the BIOS asks for a confirmation before exiting.
Save Changes	Save changes done so far to any of the setup values. This option allows you to save the selections you made. After selecting this option, a confirmation appears. Select [Yes] to save any changes.
Discard Changes	Discards changes done so far to any of the setup values. This option allows you to discard the selections you made and restore the previously saved values. After selecting this option, a confirmation appears. Select [Yes] to discard any changes and load the previously saved values.
Restore Defaults	Restore Default values for all the setup values. This option allows you to load optimal default values for each of the parameters on the Setup menus, which will provide the best performance settings for your system. The F9 key can be used for this operation.

Appendix A: List of Acronyms



The following table does not contain the complete acronyms used in signal names, signal type definitions or similar. A description of the signals is included in the I/O Connector and Internal connector chapters within this user guide.

Table 48: List of Acronyms

2D	Two-Dimensional
3D	Three-Dimensional
AT	Advanced Technology
ATX	Advanced Technology eXtended
BGA	Ball Grid Array
BIOS	Basic Input / Output System
BSP	Board Support Package
CMOS	Complementary Metal Oxide Semiconductor
CPU	Central Processing Unit
DC	Direct Current
DDC	Display Data Channel
DIO	Digital Input / Output
DP	DisplayPort
ECC	Error-Correcting Code
EEE	Electrical and Electronic Equipment
EOS	Electrical OverStress
ESD	ElectroStatic Discharge
GbE	Gigabit Ethernet
HDD	Hard Disk Drive
HDMI	High Definition Multimedia Interface
LAN	Local Area Network
LED	Light Emitting Device
LVDS	Low-Voltage Differential Signaling
ME F/W	Management Engine Firmware
mPCIe	mini Peripheral Component Interconnect express
NGFF	Next Generation Form Factor
PC-AT	Personal Computer - Advanced Technology
PCB	Printed Circuit Board
PSU	Power Supply Unit
PVC	PolyViny Chloride
PWM	Pulse Width Modulation
RAM	Random Access Memory
ROM	Read-Only Memory

RTC	Real-Time Clock
SATA	Serial Advanced Technology Attachment
SD	Secure Digital memory card
SDP	Serial Download Protocol
SELV	Safety Extra-Low Voltage
SIM	Subscriber Identity Module
SMBus	System Management Bus
SoC	System on Chip
SO-DIMM	Small Outline Dual In-line Memory Module
SPD	Serial Presence Detect
SPI	Serial Peripheral Interface
TDP	Thermal Design Power
TPM	Trusted Platform Module
UEFI	Unified Extensible Firmware Interface
USB	Universal Serial Bus
UTP	Update Transfer Protocol
VGA	Video Graphics Array
WDT	WatchDog Timer
WEEE	Waste Electrical and Electronic Equipment



About Kontron

Kontron, a global leader in Embedded Computing Technology (ECT), 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: www.kontron.com



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