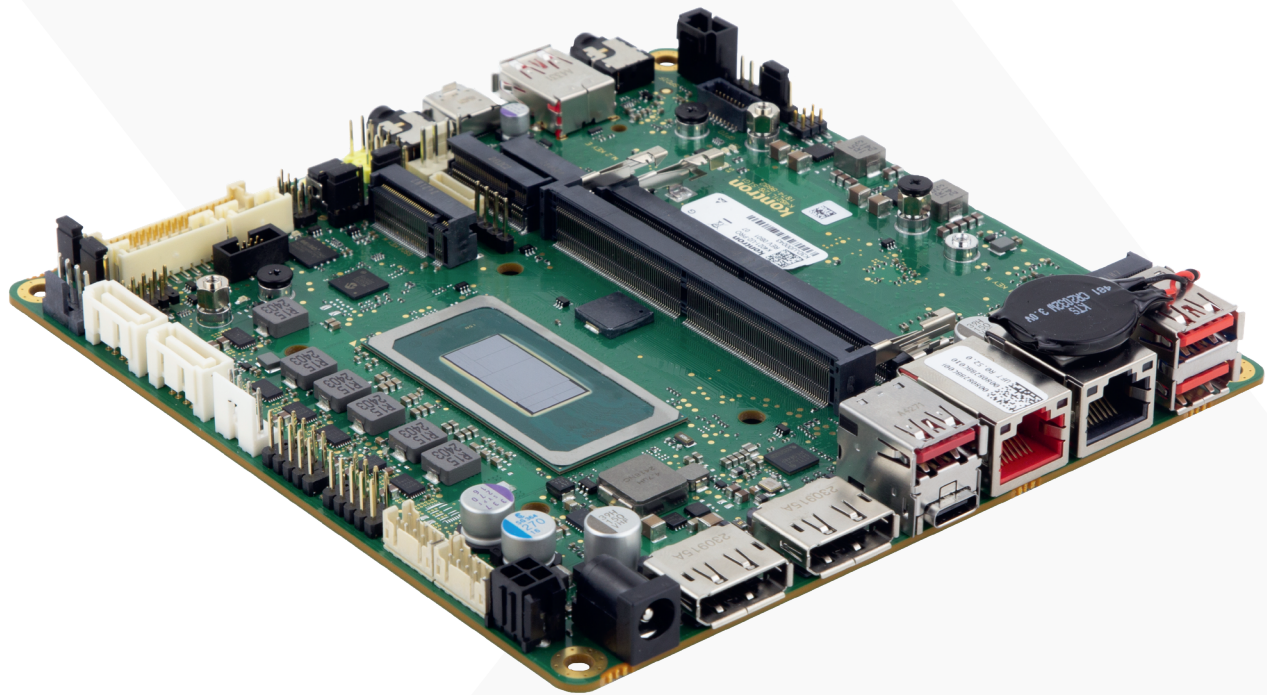


# K4021-U mSTX

## Industrial Series



## Intel® Core™ Ultra 7 & 5 Processors Meteor Lake U

- › Latest DDR5 memory technology for best-in-class system performance
- › Intel® Graphics - driven by Intel® X<sup>e</sup> architecture (within SoC)
- › Up to four concurrent 4K60 HDR displays or two 8K displays
- › Dual Channel LVDS (24 Bit) and eDP V1.4b (4K) onboard
- › New integrated NPU for dedicated AI acceleration with up to 20x performance/watt improvement

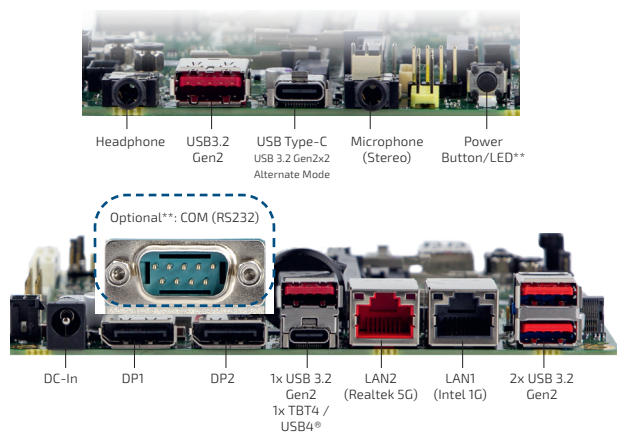
## K4021-U mSTX Industrial Series

The Industrial Motherboard K4021-U mSTX is based on the latest Intel® Core™ Ultra Processor series with powerful UHD Gen12 graphics using Intel® Xe architecture. There are two DisplayPorts, one DisplayPort via front USB-Type-C and one Display Port via rear USB-Type-C with Thunderbolt™ 4\* support plus onboard connectors for Embedded DisplayPort™ and Dual-Channel 24bit LVDS panels. Four independent displays with up to 4K display resolution or up to two with 8K are supported.

- Intel® Core™ Ultra Processors
- DDR5-5600 SODIMM, max 96 GByte
- Intel® Graphics @ MTL-U, Xe LPG (within SoC)
- 2x DisplayPort™ V1.4a
- 1x USB Type-C with DP Alt mode / USB3.2 Gen2x2
- 1x USB Type-C with Thunderbolt™ 4\* / USB4® Support
- Dual Channel LVDS (24 bit) and eDP V1.4b
- 8 Bit GPIO & HD Audio onboard
- 4x USB3.2 Gen2
- 1x Intel® i219LM (with iAMT support) GbE LAN,
- 1x Realtek RTL8126 5GbE incl. Teaming
- 2x SATA 6G
- 2x M.2 Key M x4 Gen4
- 1x M.2 Key B
- 1x M.2 Key E (WLAN)
- Intel® integrated iTPM V2.0
- 2x RS-232 support onboard

The K4021-U is equipped with four M.2 (Storage and Wifi) connectors and in addition to this offers many other connectivity options like GPIO, two COM ports, Thunderbolt™ 4\* and USB 3.2 Gen2. Designed and approved for 24/7 continuous operation and an enhanced temperature range up to 60 °C the K4021-U is applicable in many vertical markets.

- HW Watchdog onboard
- WideRange internal/external DC input 9-24V
- PowerDelivery Sink Mode (20V DC-In via Rear USB-C)



\*) Thunderbolt(TM) 4 certification planned  
\*\*) Prepared for SMARTCASE™ 5502 chassis kit  
\*\*\*) Via optional COM port cable. Breakout feature SC5xx chassis rear I/O

## Technical Information

|                       |                 |                                                                                                                                                                                                                                                                                       |
|-----------------------|-----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| SYSTEM                | PROCESSOR       | Intel® Core™ Ultra 7 155U<br>Intel® Core™ Ultra 5 125U                                                                                                                                                                                                                                |
|                       | AI CO-PROCESSOR | Intel® NPUs* integrated (up to 11 TOPS), Intel® GNA 3.5                                                                                                                                                                                                                               |
|                       | MEMORY          | DDR5 5600 SDRAM<br>2x SO DIMM socket, up to 96 GByte memory, non-ECC                                                                                                                                                                                                                  |
| VIDEO                 | GRAPHICS        | Intel® Graphics driven by Intel® Xe with up to 8 Xe-cores<br>1x Thunderbolt 4 (DP2.1 up to UHBR20 8K)<br>2x DP V1.4a up to 8K<br>1x USB-C with DPoC**<br>1x eDP V1.4b up to 5K, 1x Dual-Channel 24bit LVDS<br>1x Dual-Channel 24bit LVDS<br>Supports 4 simultaneous 4K encode streams |
| AUDIO                 | AUDIO CODEC     | Realtek ALC256                                                                                                                                                                                                                                                                        |
|                       | AUDIO INTERFACE | Stereo, High Definition Audio Codec                                                                                                                                                                                                                                                   |
| NETWORK CONNECTION    | ETHERNET 1      | Intel® i219LM with 10/100/1000 MBit/s, Wake-on-LAN (WoL) by interesting Packets, Link Status Change and Magic Packet™, PXE Support, BIOS MAC Address Display, Teaming Support                                                                                                         |
|                       | ETHERNET 2      | Realtek RTL8126 with 10/100/1000/2500/5000 MBit/s, TSN Support, Wake-on-LAN (WoL) by interesting Packets, Link Status Change and Magic Packet™, PXE Support, BIOS MAC Address Display, Teaming Support                                                                                |
| PERIPHERAL CONNECTION | USB             | 4x USB 2.0 (by headers)<br>1x USB-C 3.2 Gen2x2 + 1x USB-C with Thunderbolt™ 4***/USB4® support<br>4x USB3.2 Gen2 Type A                                                                                                                                                               |
|                       | SERIAL PORT     | 2x RS232 (by headers)                                                                                                                                                                                                                                                                 |
|                       | OTHER I/Os      | 8 Bit GPIO (by header); WLAN LED support, WLAN enable/disable support<br>3.3 V/5 V/12 V supply voltage output                                                                                                                                                                         |

\*) Neural Processing Unit: Dedicated Low Power AI Engine, integrated in Intel CPU  
\*\*) DPoC: DisplayPort over USB-Type-C (Alternate Mode)  
\*\*\*) Thunderbolt™ 4 certification planned

|                     |                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|---------------------|------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| STORAGE & EXPANSION | SATA<br>PCIe/M.2 SLOTS                         | 2x Serial ATA III 600 Interface (up to 6Gbit/s), NCQ, AHCI,<br>1x M.2 2230/2242/2280 (Key-M, PCIe x4/Gen4/NVMe SSD modules)<br>1x M.2 2230/2242 (Key-M, PCIe x4/Gen4/NVMe SSD modules)<br>1x M.2 2242 (Key-B PCIe x2/USB2)<br>1x M.2 2230 (Key-E, WLAN/Bluetooth modules, PCIe/USB/CNVio)                                                                                                                                                                                                |
| POWER               | CONNECTOR<br>INPUT VOLTAGE                     | External/Internal DC-In (DC Jack/4-Pin Micro-Fit)<br>DC Input 9-24V, max. 5A/100W (external DC-In),<br>max. 10A/120W (internal DC-In)<br>USB-C PowerDelivery (Sink, 20V, max. 100 W)                                                                                                                                                                                                                                                                                                     |
| FIRMWARE            | BIOS<br><br>WATCHDOG<br>REAL TIME CLOCK<br>TPM | AMI Aptio 5.x (UEFI) BIOS modified and adapted by Kontron;<br>Recovery BIOS, SM-BIOS (DMI), BIOS and CPU Microcode Update, Quick Boot,<br>Logo Boot, Quiet Boot, Plug & Play, Automatic DRAM and PCIe Configuration,<br>BIOS Support for S.M.A.R.T., Advanced Power Management,<br>ACPI S3/S4 (planned), Wake on time from S5.<br>No legacy OS support, no MBR installation (UEFI only)<br>Programmable WDT to generate system reset event<br>Integrated<br>TPM V2.0 (Intel® integrated) |
| SYSTEM CONTROL      | FP HEADER<br>SECURITY                          | 1x Header for Reset button, HDD LED, Power button, Power LED<br>Recovery BIOS, System and BIOS Password, Boot Sequence Control,<br>Serial-/USB-Port Access Protection, Write Protection for Flash BIOS,<br>EraseDisk (BIOS Feature), Intel integrated TPM V2.0                                                                                                                                                                                                                           |
| COOLING             | FAN                                            | 2x PWM fan (CPU/System)                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| SOFTWARE            | OS SUPPORT                                     | MS Windows® 10 IoT (LTSC),<br>MS Windows® 11, MS Windows® 11 IoT (LTSC),<br>Linux 64<br>No legacy OS support, no MBR installation (UEFI only)                                                                                                                                                                                                                                                                                                                                            |
| MECHANICAL          | DIMENSION (L x W)                              | Mini-STX: 5.5" x 5.8" (140 x 148 mm)                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| ENVIRONMENTAL       | OPERATION TEMPERATURE                          | 0 °C - 60 °C                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| CERTIFICATION       | EMC + SAFETY                                   | Planned: cTUVus acc. IEC62368-1, CE Class B incl. Industrial Immunity, UKCA,<br>FCC-B verified                                                                                                                                                                                                                                                                                                                                                                                           |

## Motherboard Versions

|          | PROCESSOR (SoC)                                                                               | GRAPHICS<br>Intel® UHD Gen12 Gfx                                                                                                    | MEMORY                                    |
|----------|-----------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------|
| K4021-U2 | Intel® Core™ Ultra 5 125U<br>12-Core @15W TDP (Flex cTDP option **)<br>TDP 15W: 1.3 / 4.3 GHz | GPU @ 1.85 GHz<br>64x EU<br>Up to 4 displays<br>4K120/5K60 HDR (1 pipe/1 port),<br>8K60 (2 pipe/1 port),<br>4x4K60 HDR (concurrent) | DDR5-5600<br>Two sockets<br>Max. 96 Gbyte |
| K4021-U5 | Intel® Core™ Ultra 7 155U<br>12-Core @15W TDP (Flex cTDP option **)<br>TDP 15W: 1.7 / 4.8 GHz | GPU @ 1.95 GHz<br>64x EU<br>Up to 4 displays<br>4K120/5K60 HDR (1 pipe/1 port),<br>8K60 (2 pipe/1 port),<br>4x4K60 HDR (concurrent) | DDR5-5600<br>Two sockets<br>Max. 96 Gbyte |

\*) Base Frequency / 1 core Turbo / Multi core Turbo

\*\*) cTDP – Easy & flexible reduction of CPU TDP down to 12 W

## Power Supply Requirements

| SOURCE               | VOLTAGE RANGE | MIN. PS LOAD | MAX. VOLTAGE<br>TOLERANCE | TYP. MOTHERBOARD<br>INPUT POWER <sup>1</sup> | MAX. MOTHERBOARD<br>INPUT POWER <sup>2</sup> |
|----------------------|---------------|--------------|---------------------------|----------------------------------------------|----------------------------------------------|
| DC-IN<br>(WideRange) | 9-24V         | 0 A          | -5%/+10%, max 28V         | 12W / 24W                                    | 120 W (external or<br>internal DC-In)        |
| USB-C (Rear)         | 20V PD Sink   | 0 A          | 20V: +-5%                 | 12W / 24W                                    | 100 W                                        |

1) Motherboard incl. Memory and M.2 NVMe SSD (approximations for MS Windows 10 Idle Mode / Full Processor Load @ 15 W TDP

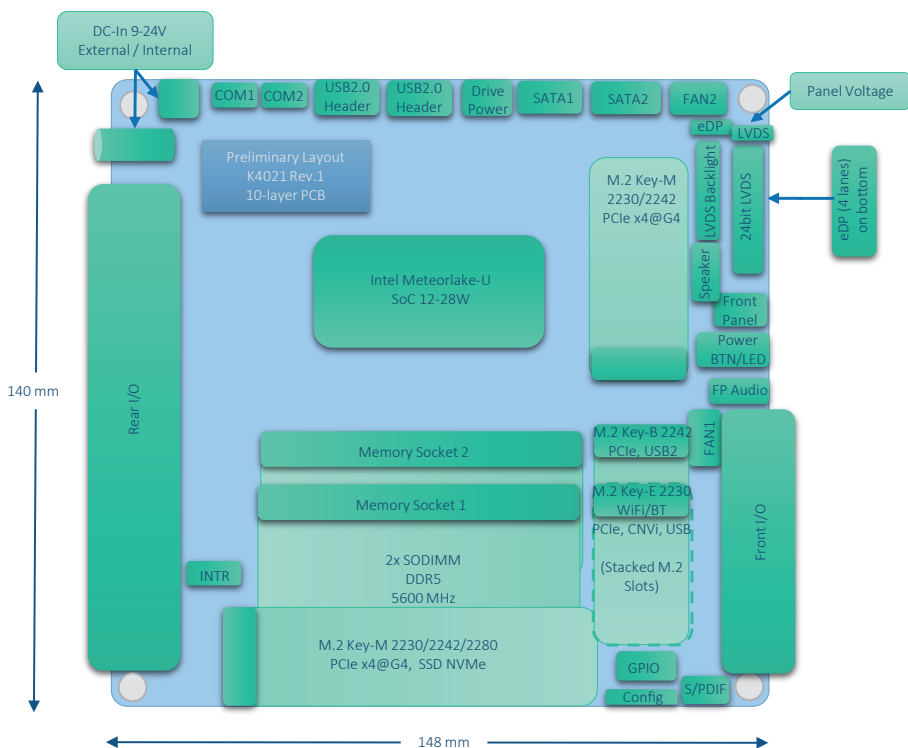
2) Motherboard incl. Memory, M.2, PCIe/M.2 PCIe devices, USB

See TechNotes document for detailed power requirements

|                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                          |
|---------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| FEATURES            | Chipset / SoC (APU)<br>DPP / HDMI / LVDS / eDP<br>Stereo Audio / 5.1 Multichannel Audio / Front Panel Audio<br>Buzzer /int. Speaker support (stereo) <sup>2</sup><br>GbE LAN / Dual GbE LAN / 2.5 GbE LAN / 5 GbE Lan<br>WoL / PXE / LAN Teaming / TSN<br>SATA / SATA RAID / M.2 (SATA) / M.2 (PCIe/NVME)<br>USB 2.0 / USB 3.2 (Gen1) / USB 3.2 (Gen2) / USB 3.2 (Gen2x2) Type-C<br>FAN monitored & controlled CPU / AUX1 / AUX2<br>TEMP monitored CPU / onboard sensors / external sensor                                                                                                                                                                                                                                                           | Intel® Core™ Ultra SoC<br>+ / - / + / +<br>+ / 0 <sup>1</sup> / +<br>+ / +<br>+ / - / - / +<br>+ / + / + / +<br>+ / + / - / +<br>+ / - / + / +<br>+ / + / -<br>+ / + / - |
| SPECIAL FEATURES    | COM interface support for RS-232 / RS-485 / RS-422<br>Fan configuration / System Monitoring<br>Recovery BIOS / Flash Update / Multi Boot<br>HDD Password / EraseDisk / TPM V2.0 onboard / optional TPM module<br>Multi Stage Watchdog<br>Operating Mode 24-7 / 8-5 (hrs per day - days per week)<br>Motherboard operating temperature range (chassis inside) <sup>3</sup>                                                                                                                                                                                                                                                                                                                                                                            | + / - / -<br>+ / +<br>+ / + / +<br>+ / + / + / -<br>+<br>+ / -<br>0 °C ... +60 °C                                                                                        |
| INTERNAL CONNECTORS | SO DIMM Sockets (DDR5 5600)<br>SATA-III / M.2 Key-M SSD / M.2 Key-B<br>M.2 2230 (Key-E for WLAN/Bluetooth)<br>Front Panel Audio (9-Pin, HD Audio) / S/PDIF Out (Digital Audio)<br>USB 2.0 pin header (2 port) / USB 2.0 single port header / USB Stick socket<br>USB 3.2 Gen1 pin header (2 ports) / USB 3.2 Gen2 Type A header<br>Serial COM header / CCTalk header / Parallel Port header<br>LVDS / LVDS Backlight / Embedded DisplayPort @ 4 lanes<br>FAN PSU / CPU (PWM) / AUX1 (PWM)<br>Intrusion (Case Open) / GPIO (8 Bit) / SMBus<br>Stereo Speaker header / Digital Mic header<br>Front Panel (Power Switch, Reset Switch, LEDs, Intel 10 pin header) <sup>4</sup><br>SATA Drive Power Connector (5 V/12 V) / DC-In Connector 9-24V (4 pin) | 2<br>2 / 2 / 1<br>1<br>1 / 1<br>2 / 0 / 0<br>0 / 0<br>2 / 0 / -<br>1 / 1 / 1<br>- / 1 / 1<br>1 / 1 / 1<br>1 / -<br>1<br>1 / 1                                            |
| EXTERNAL CONNECTORS | HDMI / DVI / VGA<br>DisplayPort / USB Type-C Alternate Mode (DPoC) / Thunderbolt™ 4<br>Audio Mic. In / Line in / Line out (or driver configuration)<br>LAN (RJ-45) / PS/2 Keyboard / Mouse<br>USB 2.0 / USB 3.2 Gen1 / USB 3.2 Gen2<br>DC-In connector (external input) 9-24V, 100W max.<br>Serial COM interface                                                                                                                                                                                                                                                                                                                                                                                                                                     | - / - / -<br>2 / 1 / 1<br>1 / 0 / 1<br>2 / - / -<br>0 / 0 / 4<br>1<br>0                                                                                                  |

1) Multichannel audio only via S/PDIF or DisplayPort™  
2) Stereo speaker support; 2 W @4Ω  
3) Forced cooling required for high operating temperature range. See TechNotes document for details  
4) Header pin pitch is 2.0mm

Connector/Socket Diagram



| ARTICLE  | PART NO.   | DESCRIPTION               |
|----------|------------|---------------------------|
| K4021-U2 | F5120-V252 | Intel® Core™ Ultra 5 125U |
| K4021-U5 | F5120-V255 | Intel® Core™ Ultra 7 155U |

## Accessories

|                                   |                   |                                                                                                                                            |
|-----------------------------------|-------------------|--------------------------------------------------------------------------------------------------------------------------------------------|
| SLIM ACTIVE HEATSINK + BACKPLATE  | F5000-C027        | max. 28W TDP, designed for SMARTCASE™ S502                                                                                                 |
| DRIVE POWER CABLE                 | S26361-F5000-K001 | 400 mm, power connector for 1x SATA and 1x slimline DVD                                                                                    |
| SERIAL PORT CABLE                 | S26361-F5000-K007 | Short cable (120 mm), w/o slot bracket                                                                                                     |
| SERIAL PORT CABLE                 | S26361-F5000-K010 | 400 mm, fullsize slot bracket                                                                                                              |
| AC-ADAPTER 19V/65W                | S26361-F5000-P006 | For applications up to 35 W TDP (SoC)                                                                                                      |
| AC-ADAPTER 20V/120W               | S26361-F5000-P007 | lockable connector                                                                                                                         |
| WLAN ANTENNA KIT                  | S26361-F5000-W005 | WLAN antenna kit; left (grey)/right (black) antennas incl. cable for SMARTCASE™ S5xx. M.2 WLAN module not included!                        |
| WLAN ANTENNA KIT                  | F5000-W006        | Box contains 10 dual antennas (incl. antenna cable) for SMARTCASE™ S5xx series. Additional support for WiFi 6E/WiFi 7; replaces F5000-W005 |
| SMARTCASE™ S502                   | F5000-J015        | Chassis kit solution, active cooling                                                                                                       |
| WALL MOUNT BRACKETS               | S26361-F5000-X001 | Suitable for SMARTCASE™ S5xx, 2x Brackets per chassis incl. screws                                                                         |
| VESA MOUNT KIT                    | S26361-F5000-X002 | Suitable for SMARTCASE™ S5xx                                                                                                               |
| DC-IN CONNECTOR LOCK              | S26361-F5000-X003 | Suitable for SMARTCASE™ S5xx, fits to AC-Adapter F5000-P006                                                                                |
| CHASSIS INTRUSION KIT FOR SC-S5XX | F5000-K017        | Contains 20x chassis intrusion cable plus 20x mounting bracket for Smartcase™ S5xx                                                         |

## Global Headquarters

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