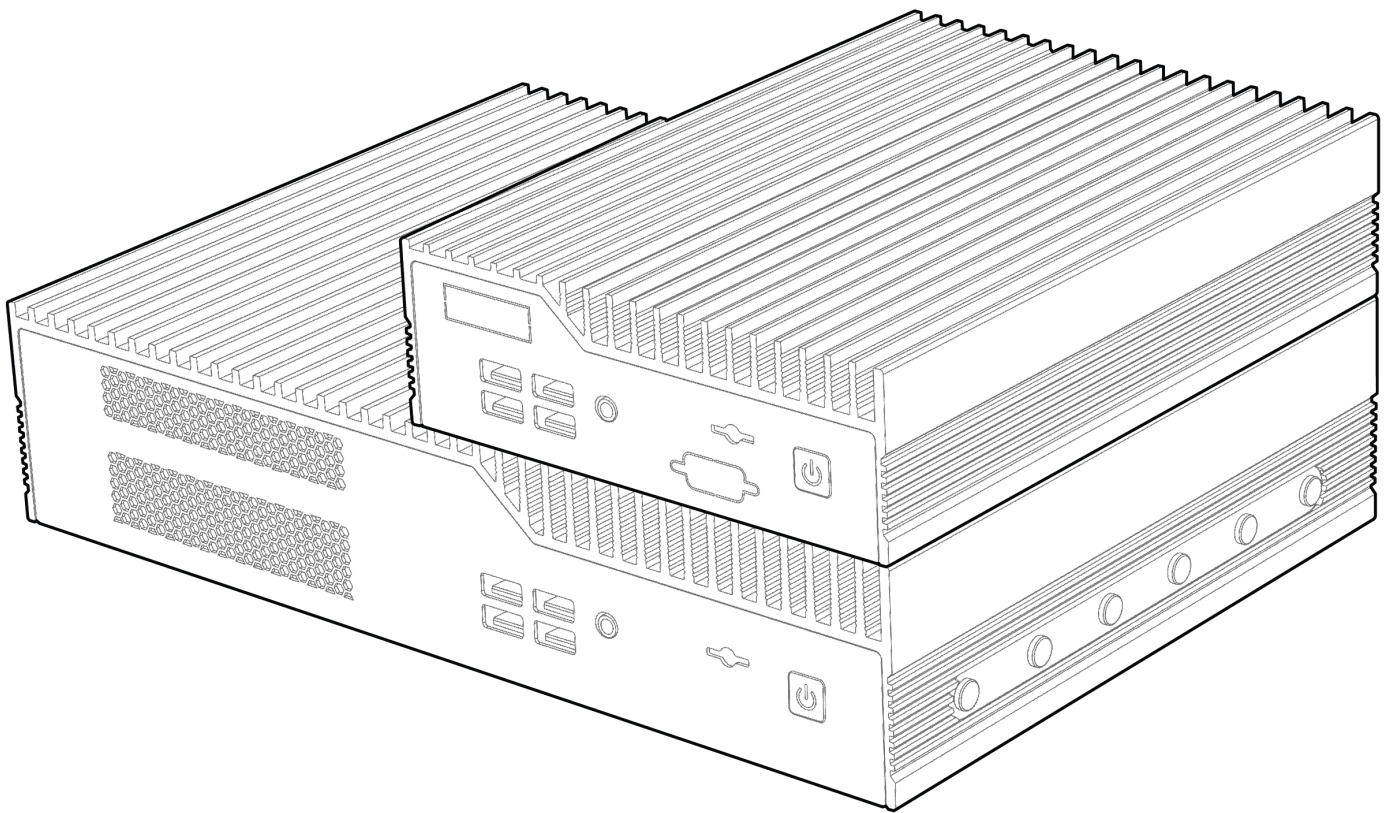


HX500 / HX600 Product Manual



Revision History

Revision History	Date
First release of HX500/HX600 manual	7/10/2020
Included page numbers	7/22/2020
Appendix G: Errata added	8/27/2020
Added Section 4.3 Input voltage qualifications	10/20/2020
Updated mounting dimensions for HX500 Corrected block diagram to 3FF SIM slot	01/21/2021
Revision 3.0 - Extrovert 4G LTE changed to > OnLogic Cellular	02/09/2023

Table of Contents

1 - System Overview	5
1.1 System Introduction	5
1.2- In-box Accessories	5
1.3 - Product Specifications	6
1.4 - Exterior Features and Dimensions	8
1.4.1 - Front I/O	8
1.4.2 - Back I/O	8
1.4.3 - Helix 500 Dimensions (HX500)	9
1.4.4 - Helix 600 Dimensions with PCIe Expansion (HX600)	9
1.5 - System Block Diagram	10
2 - I/O Definitions	11
2.1 - Front I/O definition	11
2.2 Rear I/O definition	14

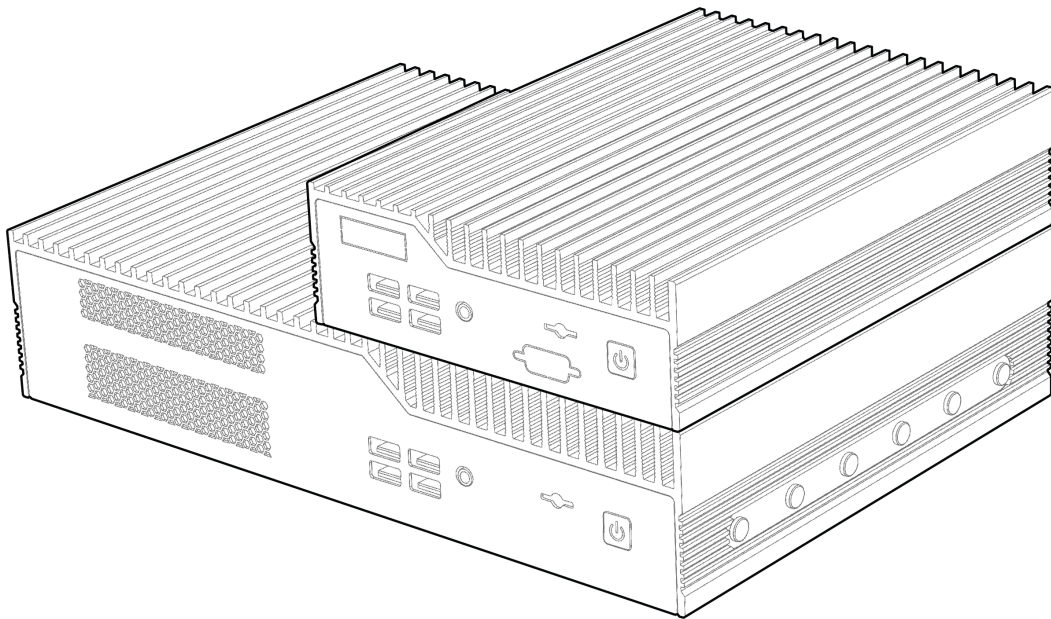
2.3 - Motherboard Connectors	18
3 - Mounting Instructions	26
3.1 - Wall Mount & DIN Rail Mounting	26
3.1 - VESA Mounting	28
4 - Power Management	29
4.1 - Wake-Up Events	29
4.2 - Protection Circuitry	29
4.3 - Input voltage qualification	29
5 - Test Reports	31
5.1 - EN 60601-1-2 Summary	31
5.1.1 - ESD Immunity Data	31
5.1.2 - Radiated Immunity Data	31
5.1.3 - Magnetic Immunity Data	31
5.1.4 - Electrical Fast Transient Immunity Data	31
5.1.5 Dips/Interrupts Immunity Data	32
6. Appendices	33
6.1 - Appendix A: Power consumption	33
6.2 - Appendix B: Isolated DIO guide	35
6.3 - Appendix C: BIOS manual	35
6.4 - Appendix D: System thermal results	36
6.5 - Appendix E: Expansion port pinout	39
6.5.1 - M.2 B-Key	39
6.5.2 - M.2 E-Key	40
6.5.3 - M.2 M-Key	41
6.5.4 - mPCIe	42
6.6 Appendix F: Safety Information	43
6.6.1 Safe use and installation instructions	43

6.6.2 Précautions et guide d'installation	44
6.7 - Appendix G: Errata	45
6.7.1 JP-136: Failure to Boot Without RTC Battery	45
Overview	45
Description	45
Workaround	45
Resolution	45

1 - System Overview

1.1 System Introduction

The OnLogic Helix series puts Intel® 10th generation Comet Lake processing anywhere you need it. Helix gives you installation flexibility, reliable solid state performance, and unique expandability to help make your next innovation possible.



Helix leverages desktop processing in a form factor that would previously have been limited to lower wattage, mobile CPUs. Our unique Hardshell™ Fanless Technology lets you reap the benefits of the improved performance and thermal management of Intel 10th gen processing while offering triple independent display support, an extended operating temperature range and a wide input power range.

1.2- In-box Accessories

- 4x Rubber Feet

If you purchased additional items such as mounting brackets, power supplies or terminal block connectors, they will be located in the system box or within the outer shipping carton.

All drivers and product guides can be found on the corresponding product page. For more information on accessories and additional features, visit the Helix series page.

Helix Series Page: <https://www.onlogic.com/computers/industrial/fanless/helix/>

Helix 500 Product Page: <https://www.onlogic.com/hx500/>

Helix 600 Product Page: <https://www.onlogic.com/hx600/>

1.3 - Product Specifications

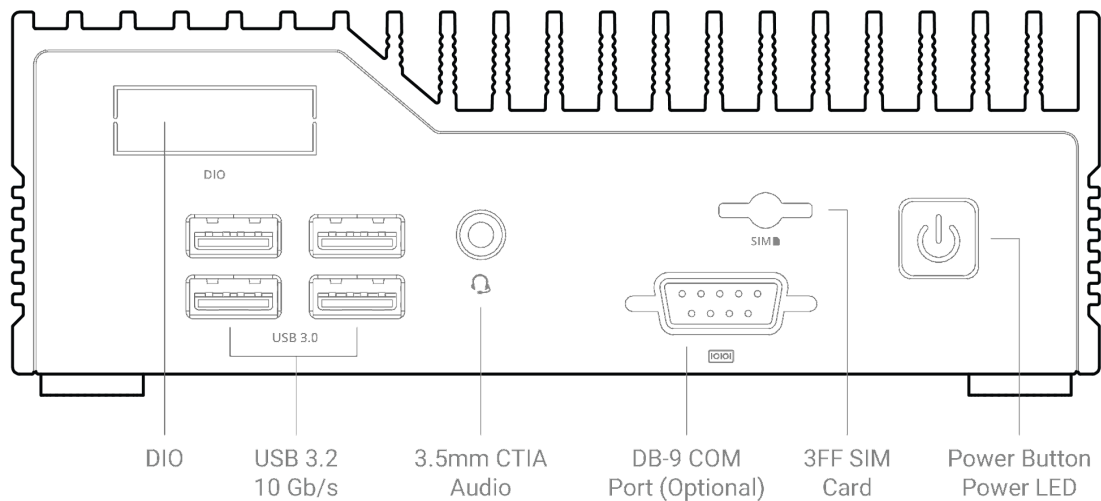
Model	Helix 500	Helix 600
System Dimensions	8.26" x 2" x 6.06" 210 x 50.8 x 154 mm	8.26" x 2.55" x 11.9" 210 x 64.8 x 303mm
Board Dimensions	8" x 5.5"	8" x 5.5"
CPU (on solder side of board)	Socket LGA 1200 - Comet Lake S	Socket LGA 1200 - Comet Lake S
PCH	Q470	Q470
Memory	2 x SO-DIMM (2 x 32GB max Dual Channel) 64 GB Total	2 x SO-DIMM (2 x 32GB max Dual Channel) 64 GB Total
LAN Controller	1x Intel 219 -with AMT 1x Intel 210	1x Intel 219 -with AMT 1x Intel 210
Expansion	1x M.2 2280/60/3042 B-Key (PCIe x2, USB 3.2 5Gb/s, SATA) 1x M.2 2230 E-key (Wi-Fi) (PCIe / USB 2.0 / CNVi) 1x M.2 2280 M-key (PCIe x 4, SATA III) 1x mPCIe (PCIe x 1, USB 2.0)	1x M.2 2260/3042 B-Key (PCIe x 2, USB 3.2 5Gb/s, SATA) 1x M.2 2230 E-key (Wi-Fi) (PCIe / USB 2.0 / CNVi) 1x M.2 2280 M-key (PCIe x 4, SATA III) 1x 16x PCIe Gen 3 1x mPCIe (PCIe x 1, USB 2.0)
Back I/O	3x Full size DisplayPort 1.2 with CEC support by optional add-on module 2x Gb LAN (2 x Intel) 2x USB 3.2 10 Gb/s 2x USB 3.2 5 Gb/s 4pin Mini DIN with 12~24 V input	3x Full size DisplayPort 1.2 with CEC support by optional add-on module 2x Gb LAN (2 x Intel) 2x USB 3.2 10 Gb/s 2x USB 3.2 5 Gb/s 4pin Mini DIN with 12~24 V input Expansion bay I/O (GPU, hot swap drive, Etc)
Front I/O	1x Power LED button 1x 3.5 mm Audio headset (mic-in, line-out) - CTIA 3FF-Sim slot (Mapped to the B-Key and mPCIe, BIOS selected) 4x USB 3.2 10Gb/s	1x Power LED button 1x 3.5 mm Audio headset (mic-in, line-out) - CTIA 3FF-Sim slot (Mapped to the B-Key and mPCIe, BIOS selected) 4x USB 3.2 10Gb/s
Onboard Headers & Connectors	1x Battery on a cable 2x Serial Header 2x USB 2.0 (2x5 header 2.54mm) 1x 4-Pin power for devices, 12V and 5V 1x 4-Pin power for Terminal Block Power/GPU power Auto Power On (AT/ATX Mode Select) 1x PCIe x16 mating connector 2x SATA III connector 1x 4-Pin Fan Header 1x CEC Header	1x Battery on a cable 2x Serial Header 2x USB 2.0 (2x5 header 2.54mm) 1x 4-Pin power for devices, 12V and 5V 1x 4-Pin power for Terminal Block Power/GPU power Auto Power On (AT/ATX Mode Select) 1x PCIe x16 mating connector 2x SATA III connector 1x 4-Pin Fan Header 1x CEC Header

Voltage Input	8~24V via DC jack or Aux power header	12~24V via DC jack or Aux power header (without GPU) 19~24V via DC jack or Aux power header (with GPU present)
Power Input	4 Pin Din with optional 4-pin Terminal Block (support remote switch, 4 Pin Din covered when not in use.)	4 Pin Din with optional 4-pin Terminal Block (support remote switch, 4 Pin Din covered when not in use.)
BIOS	Insyde H2O BIOS	Insyde H2O BIOS
Operating Systems	Windows 10, Ubuntu 18.04, Ubuntu 20.04 LTS, Yocto, Win10 IOT Core, ThinManager	Windows 10, Ubuntu 18.04, Ubuntu 20.04 LTS, Yocto, Win10 IOT Core, ThinManager
Special Features	Watchdog timer RTC PTT in BIOS, TPM header - support TPM01 Support for Vision Processing Units Support for 4G LTE and GPS expansion cards Hardware Auto Power On Rapid Branding	Watchdog timer RTC PTT in BIOS, TPM header - support TPM01 Support for Vision Processing Units Support for 4G LTE and GPS expansion cards Hardware Auto Power On Rapid Branding
Thermal Standards (Subject to change through RFI and RFQ steps)	Board Operating Temperature: 0-50C Storage Temperature: -10-85C Operating Humidity: 0% - 90% (non-condensing)	Board Operating Temperature: 0-50C Storage Temperature: -10-85C Operating Humidity: 0% - 90% (non-condensing)
Extra Chassis Features	6 Antenna holes Wall Mount DIN Rail Mount VESA Mount	6 Antenna holes 2.5" Hard drive hot swap bracket (later release, Q3 2020) GPU Fan array
Regulatory	SAFETY IEC/UL/EN 62368-1 EMC CISPR 32/35 Class A FCC Part 15 Class A IEC/EN 60601-1-2:2014 EMC Ready Radio Equipment Directive (2014/53/EU) - Only applicable for configurations with wireless transmitters RoHS 3 Directive (2015/863/EU) WEEE Directive (2012/19/EU)	SAFETY IEC/UL/EN 62368-1 EMC CISPR 32/35 Class A FCC Part 15 Class A IEC/EN 60601-1-2:2014 EMC Ready Radio Equipment Directive (2014/53/EU) - Only applicable for configurations with wireless transmitters RoHS 3 Directive (2015/863/EU) WEEE Directive (2012/19/EU)

1.4 - Exterior Features and Dimensions

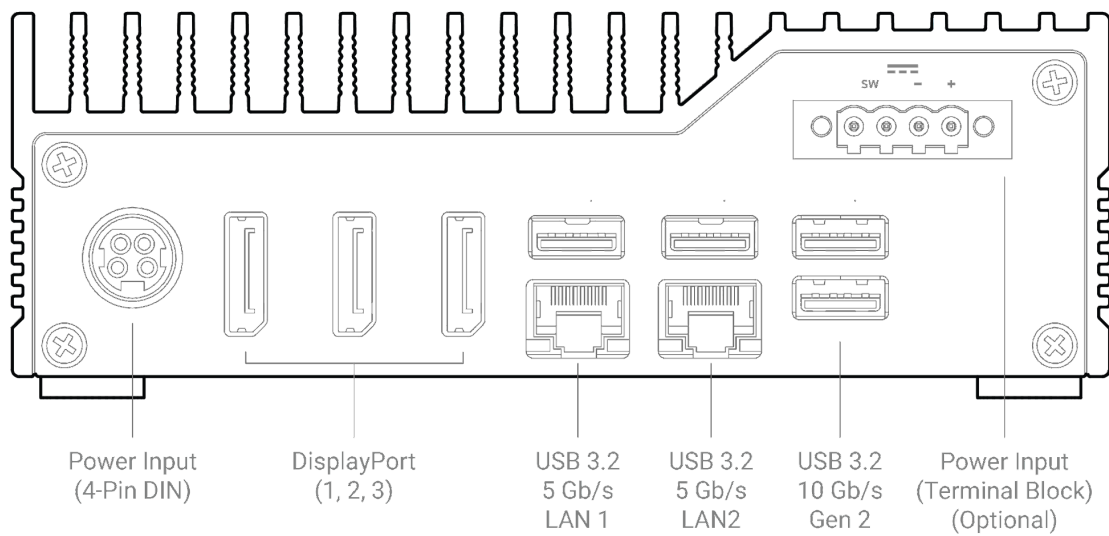
1.4.1 - Front I/O

Note: the HX500 is pictured, the HX600 has the same I/O configuration.

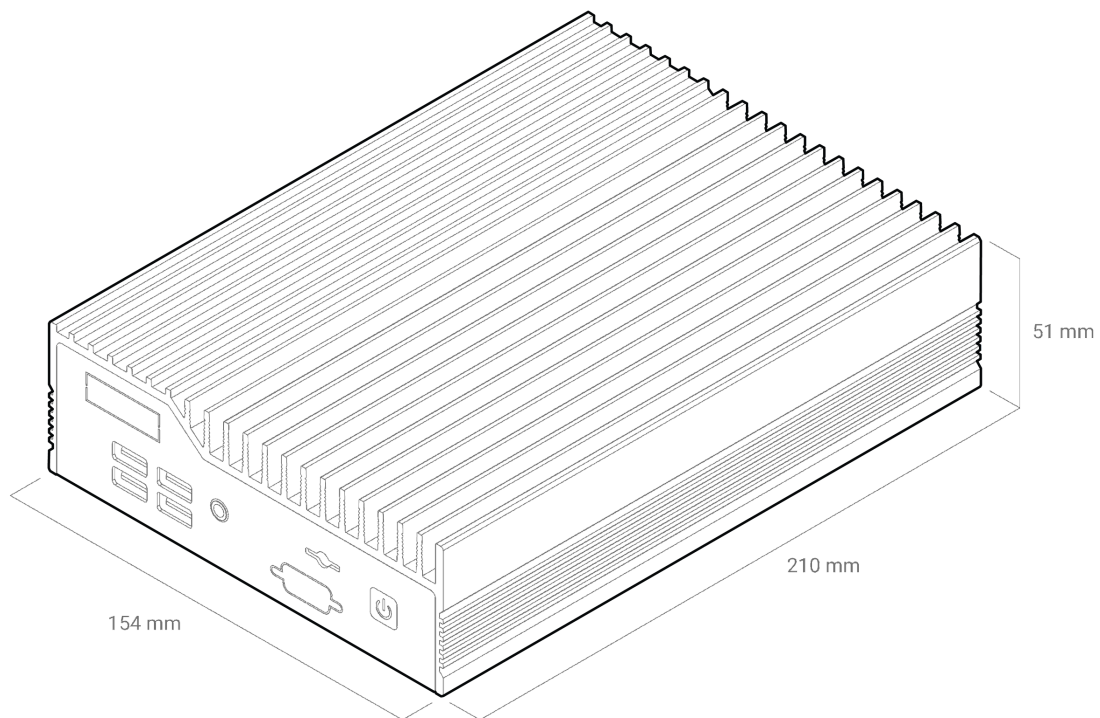


1.4.2 - Back I/O

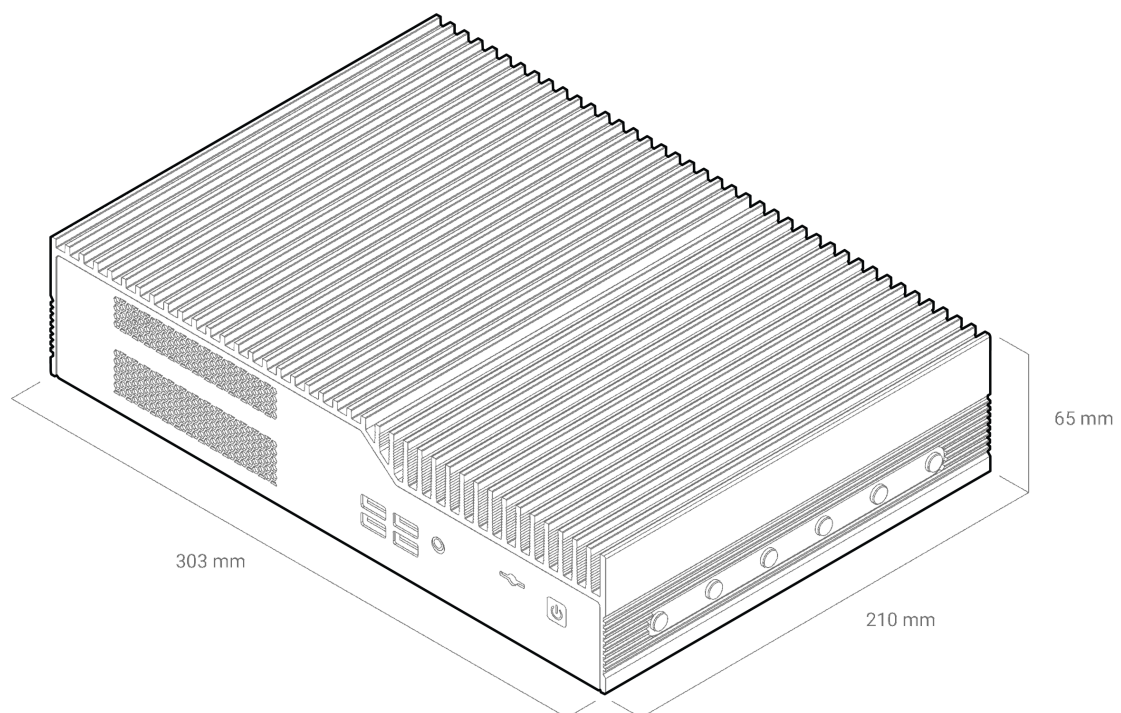
Note: the HX500 is pictured, the HX600 has the same I/O configuration.



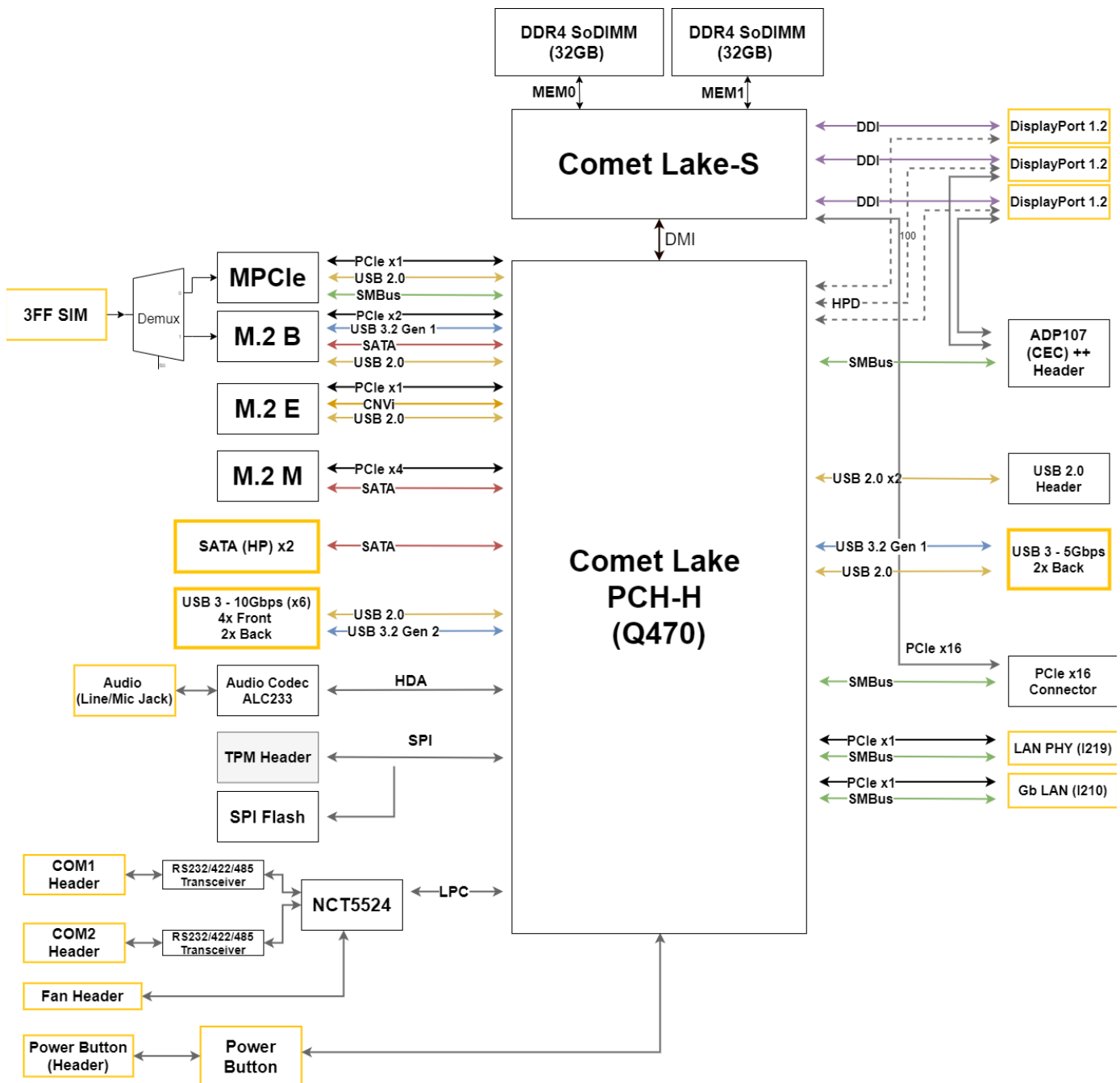
1.4.3 - Helix 500 Dimensions (HX500)



1.4.4 - Helix 600 Dimensions with PCIe Expansion (HX600)



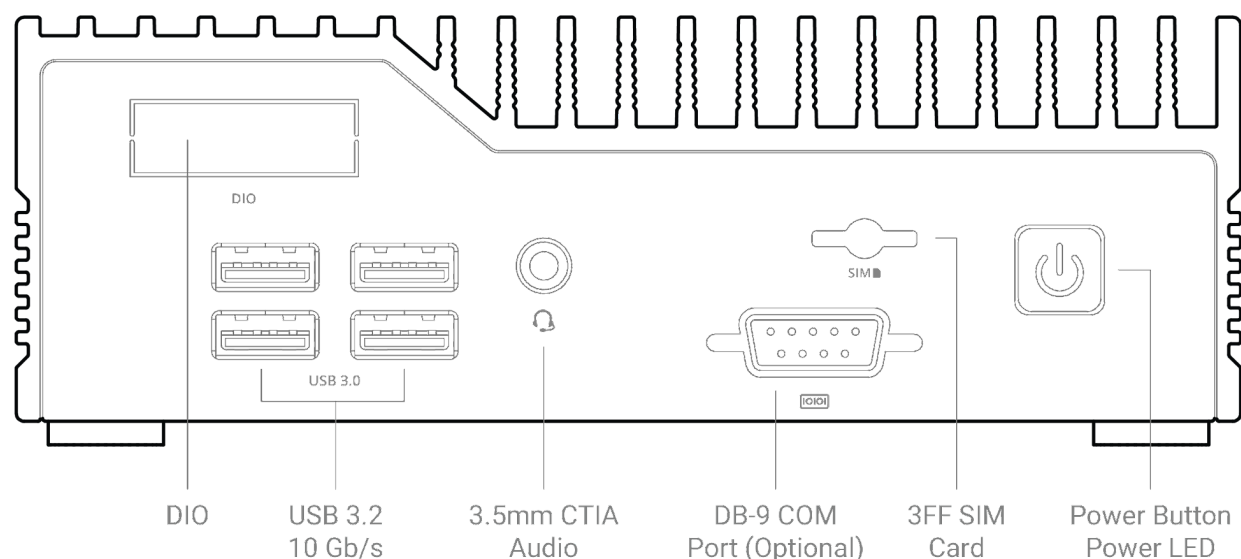
1.5 - System Block Diagram



2 - I/O Definitions

2.1 - Front I/O definition

Note: the HX500 is pictured, the HX600 has the same I/O configuration. The location of the DIO option is different for the HX600.



Power button / Power LED

The front power button can be used to turn on and off the Helix system. The power button is a momentary contact button with a blue LED backlight used to display the status of the system. A single press while the system is on will initiate a graceful shutdown operation from the OS. Pressing and holding the button for 4 seconds while the system is running will cause a hard reset of the system. The system can be woken by a single press of the power button from any state.

The LED backlight will indicate the system status. A solid blue light indicates that the system is powered in the S0 state. A flashing blue light indicates the system is in the sleep state. The LED is off in S5 and deep sleep states.

SIM card

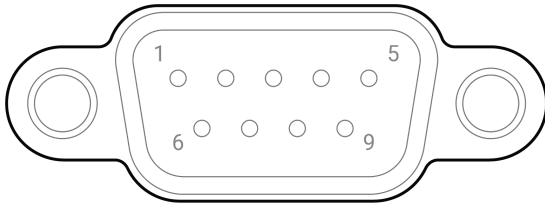
A 3FF Subscriber Identity Module (SIM) card slot is present on the front panel of the Helix platform allowing native support for OnLogic Cellular modules. The SIM signals can be connected to either the

mPCIe or M.2 B-Key internal expansion slots. This selection is controlled in BIOS with the default BIOS setting being mPCIe. Please refer to the BIOS user manual for more information.

The SIM slot is a Push-Push type receptacle. To insert or remove the SIM card from the front panel of the Helix platform, please use a small implement to push the card into the slot until it clicks. To remove the card, push with a small implement until the card clicks, then remove pull on the free end of the card to remove it.

COM DB9 option

The serial port mode and voltage between Off/5V on Pin 9 on Helix can be selected in the BIOS configuration. The serial ports support RS-232, RS-422, and RS-485 configurations. Refer to the BIOS manual in Appendix C for configuration instructions.

	Pin	RS-232	RS-422	RS-485
	1	DCD	TX-	TX-/RX-
	2	RX	TX+	TX+/RX+
	3	TX	RX+	NC
	4	DTR	RX-	NC
	5	GND	NC	NC
	6	DSR	NC	NC
	7	RTS	NC	NC
	8	CTS	NC	NC
	9	RI/PWR	NC/PWR	NC/PWR

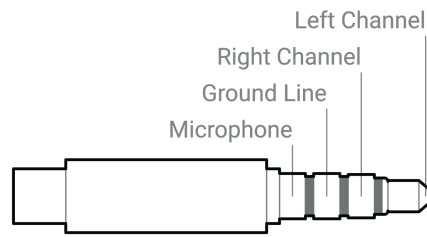
COM DB9 pinout

Audio

Audio input and output is provided by way of a 3.5mm CTIA audio jack on the front panel of the Helix platform. A pinout is provided below. The audio codec used is a Realtek ALC233. Proper drivers must be installed for both the Q470 chipset and Realtek ALC233 codec. Drivers can be found on the Helix product pages.

<https://www.onlogic.com/hx500/>

<https://www.onlogic.com/hx600/>



CTIA Pinout

USB 3.2

There are four USB 3.2 Gen 2 ports on the front panel of the Helix platform. These ports are capable of linking at 10Gb/s transfer rates.

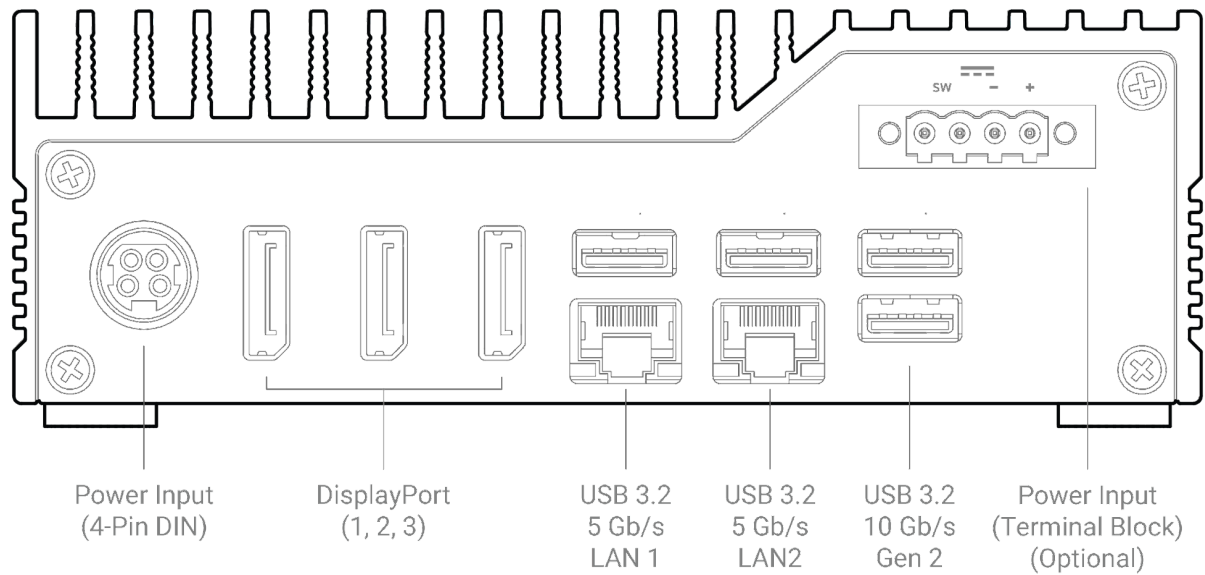
DIO option

The Helix platform supports an optional Isolated Digital I/O add-in card (OnLogic ADP102). This option allows for integration of the Helix platform with existing PLC integrations or other digital logic applications. For a complete explanation of features, operating voltages, and safety information, please refer to the DIO expansion manual on the OnLogic support site.

<https://www.onlogic.com/support/documentation/adp102-dio/>

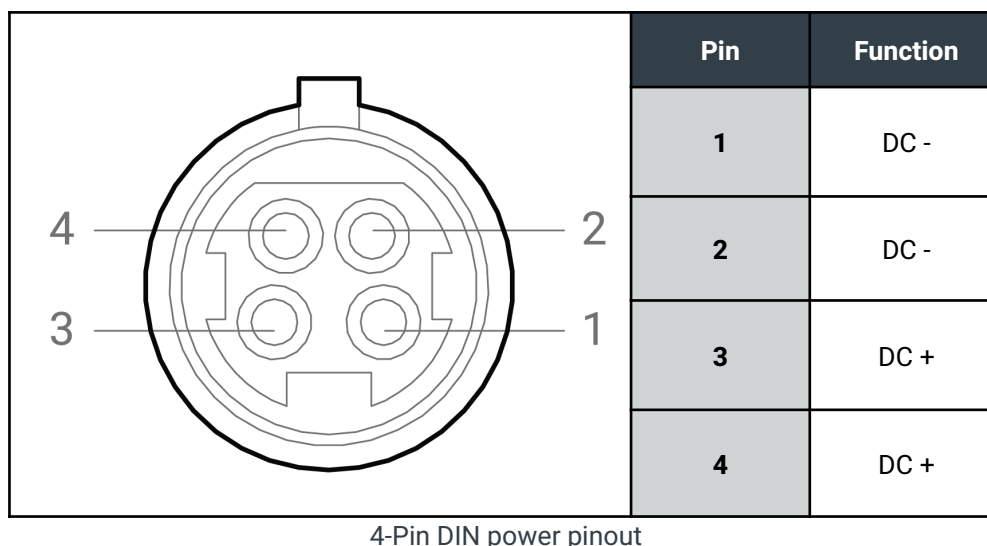
2.2 Rear I/O definition

The rear I/O of the HX500 is shown below. The HX600 has the same connector orientations and locations on the motherboard. The location of the Terminal block power option is different for the HX600.



4-Pin DIN power connector

Mainboard power is applied to the Helix platform by way of a locking 4-pin female DIN connector (Mating part: Kycon #KPPX-4P or equivalent). The system is operational from 8V~24V (HX 500) and 19V~24V (HX600 with GPU option) [see section 4.3 for input voltage qualifications]. The maximum rated current of the connector is 7A per pin. Use a wire gauge that is rated for the operational current. See below for on-board connector pinout.



DisplayPort 1, 2, & 3

Helix utilizes Intel's Integrated processor graphics that power the onboard DisplayPorts. This means resolutions up to 4096x2304 @ 60Hz are supported on all three outputs simultaneously. All ports support Multi-Stream Transport (MST).

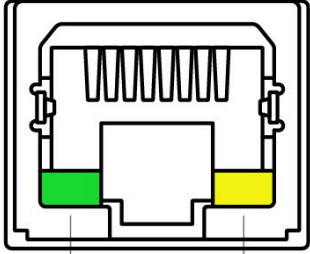
An additional CEC module can be included to add CEC (Consumer Electronics Control) functionality on DisplayPort 1 & 2. This feature is not supported on the DisplayPort 3 connector.

LAN1 - Intel I219-LM

The Intel I219 LAN Port on Helix supports up to 1Gbps link speeds over standard shielded CAT5e or CAT6 cables. The connector is the industry standard RJ45 connector. This port also features Intel's vPro(R) technology enabling remote out-of-band management and security features (requires Intel Core i5 or higher). The LAN link state is shown by the two LEDs enclosed in the port. The description is included below.

LAN2 - Intel I210-IT

The second LAN Port on Helix supports up to 1Gbps link speeds over standard shielded CAT5e or CAT6 cables. The connector is the industry standard RJ45 connector. The LAN link state is shown by the two LEDs enclosed in the port. The description is included below.

 Link LED (Green) Speed LED (Green/Yellow)	LED	Color	State	Function
	Link	-	Off	LAN link is not established
		Green	On	LAN link is established
			Blinking	LAN activity occurring
	Speed	-	Off	10 Mb/s data rate
		Green	On	100 Mb/s data rate
		Yellow	On	1000 Mb/s data rate

LAN activity light description

USB 3.2

The dual stack USB 3.2 ports on the rear panel are USB 3.2 Gen 2 ports, capable of linking at 10Gb/s transfer rates.

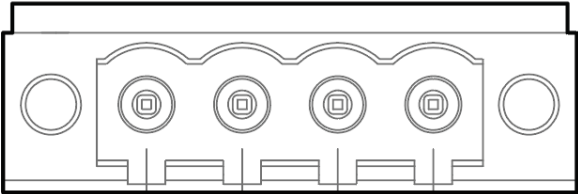
The two USB ports above the RJ45 LAN connectors are USB 3.2 Gen 1 ports, capable of linking at 5 Gb/s.

Terminal block power option

If the terminal block power option is selected, mainboard power is applied to the Helix platform through a 4-pin terminal block connector (Mating part: Dinkle #2ESDAM-04P or equivalent).

The system is operational from 8V~24V (HX 500) and 19V~24V (HX600 with GPU option) [see section 4.3 for input voltage qualifications]. The maximum rated current of the connector is 15A per pin. Use a wire gauge that is rated for the operational current. Cables should be properly terminated with wire ferrules. Do not use the terminal block with tinned wire ends or solid core wire. See below for connector pinout.

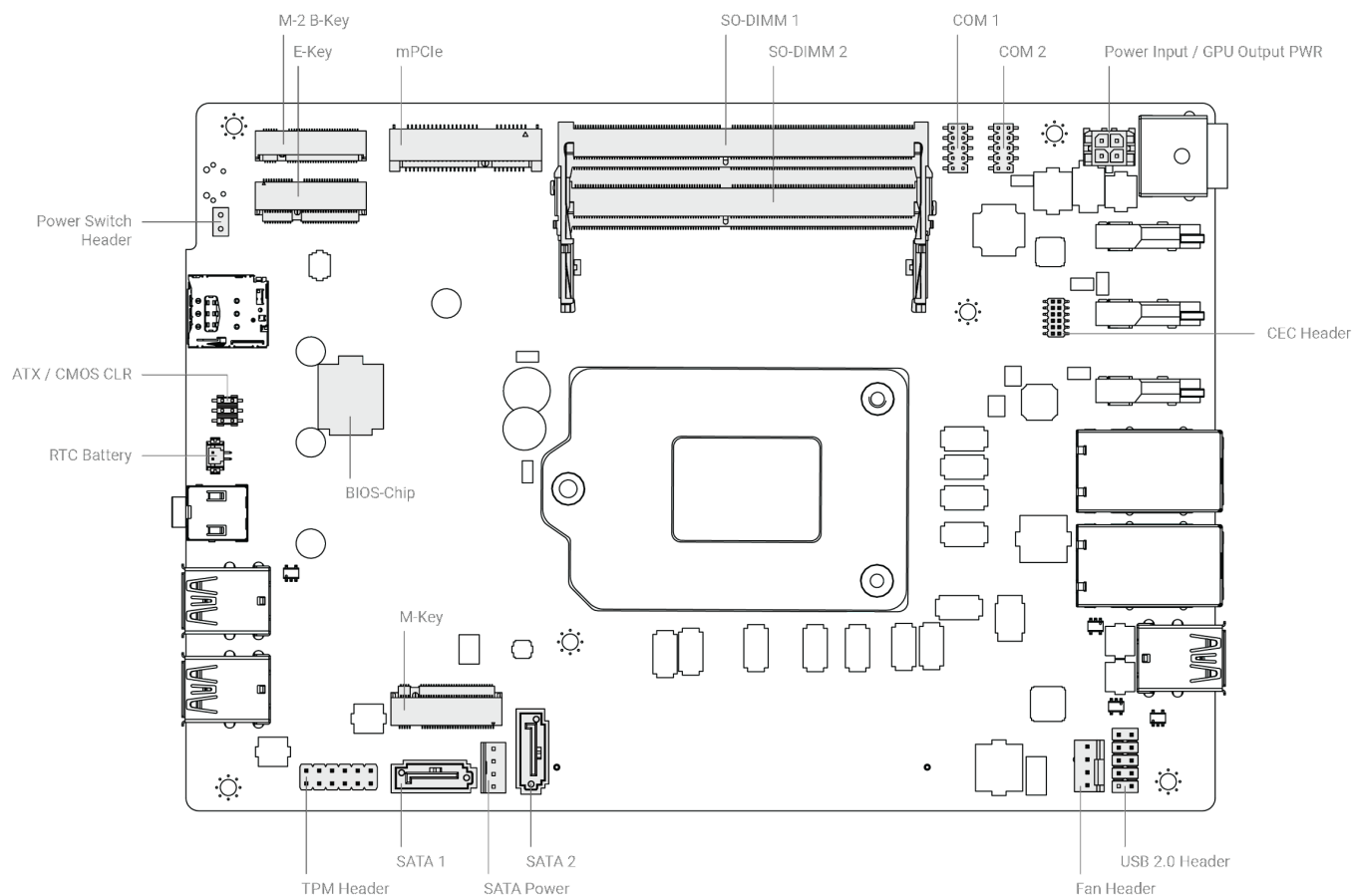
When using the remote switch connections with the terminal block option, mating power switch cables should be a twisted-pair wire with floating shield to assure proper immunity to EMI/RFI. It is recommended to keep wires at less than 3 meters in length. Switches should be momentary contact type only.

	Pin	Function
	1	DC +
	2	DC -
	3	SW1
	4	SW2

Terminal block power pinout

2.3 - Motherboard Connectors

The motherboard is the same for HX500 and HX600.



M.2 B-Key

An M.2 B-Key port is present on the Helix motherboard to allow support for B-Key form-factor expansion cards. Supported cards include 3042, 2242, 2260, 2280 form-factors. The B-Key connector on the Helix platform supports PCIe Gen 3 x2, USB 3.2 5Gb/s, USB 2.0, SATA Gen I (1.5Gbps), SATA Gen II (3.0Gbps), and SATA Gen III (6.0Gbps) devices.

The 3FF Micro SIM card slot is multiplexed to both the M.2 B-Key and mPCIe expansion slot.. The routing can be selected in the BIOS and is set to the mPCIe slot by default. Please refer to the BIOS user manual (**Appendix C**) for more information.

The M.2 B-Key slot can be used in tandem with the M.2 M-Key slot to create firmware-level RAID arrays using Intel Rapid Storage Technology. These arrays can be created with M.2 SATA SSDs; NVMe RAID is not supported by the chipset. RAID arrays that mix together M.2 SATA and cabled 2.5" SATA

drives can also be created. Refer to the BIOS user manual (**Appendix C**) for information about using Rapid Storage Technology.

A full pinout table for this expansion slot is provided in **Appendix E**.

M.2 E-Key

An M.2 E-Key port is present on the Helix motherboard to allow support for E-Key form-factor wireless expansion cards. Only 2230 form-factor cards are supported. The E-Key connector on the Helix platform supports PCIe Gen 3 x1, USB 2.0, and Intel CNVi devices. A full pinout table for this expansion slot is provided in **Appendix E**.

M.2 M-Key

An M.2 M-Key port is present on the Helix motherboard to allow support for M-Key form-factor expansion cards. Only 2280 form-factor cards are supported. The M-Key connector on the Helix platform includes support for PCIe Gen 3 x4, PCIe Gen 3 x2, SATA Gen I (1.5Gbps), SATA Gen II (3.0Gbps), and SATA Gen III (6.0Gbps) devices.

The M.2 M-Key slot can be used in tandem with the M.2 B-Key slot to create firmware-level RAID arrays using Intel Rapid Storage Technology. These arrays can be created with M.2 SATA SSDs; NVMe RAID is not supported by the chipset. RAID arrays that mix together M.2 SATA and cabled 2.5" SATA drives can also be created. Refer to the BIOS user manual (**Appendix C**) for information about using Rapid Storage Technology.

A full pinout table for this expansion slot is provided in **Appendix E**

mPCIe

A mPCIe port is present on the Helix motherboard to allow support for mini-PCIe form-factor expansion cards. Full length cards and half-length cards (with adapter) are supported. The mPCIe connector on the Helix platform supports PCIe Gen 3 x1 and USB 2.0 devices. A full pinout table for this expansion slot is provided in **Appendix E**.

The 3FF Micro SIM card slot is multiplexed to both the M.2 B-Key and mPCIe expansion slot.. The routing can be selected in the BIOS and is set to the mPCIe slot by default.. Please refer to the BIOS user manual (**Appendix C**) for more information.

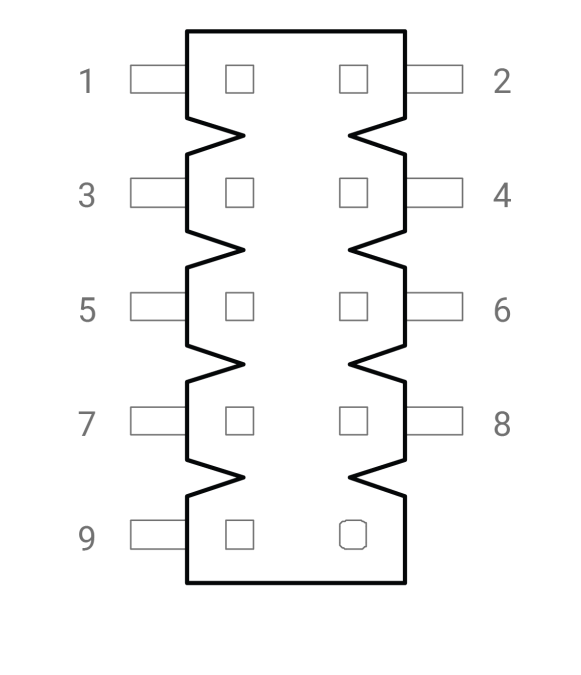
SO-DIMM1 & SO-DIMM2

The Helix platform has two onboard DDR4 SO-DIMM Slots. Below find the specifications of the two SO-DIMM Slots:

- Maximum Capacity: DDR4-2666 64GB with two 32GB SO-DIMM Modules
- Channel configuration: 1DIMM Per Channel (DPC) - 2 Channels
- No ECC Support

COM1 & COM2

The two on-board COM headers utilize standard 9-pin 2.00mm pitch male pin headers with the pin configuration in the chart below. These serial ports support RS-232, RS-422 Full-Duplex, and RS-485 half-Duplex configurations. The serial port communication mode can be selected in the BIOS configuration. In addition, 5V power can be enabled on pin 9 in the same BIOS menu. Pin 9 is rated to provide 250mA of current. Refer to the BIOS manual (**Appendix C**) for configuration instructions.

	Pin	RS-232	RS-422	RS-485
	1	DCD	TX-	TX-/RX-
	2	RX	TX+	TX+/RX+
	3	TX	RX+	NC
	4	DTR	RX-	NC
	5	GND	NC	NC
	6	DSR	NC	NC
	7	RTS	NC	NC
	8	CTS	NC	NC
	9	RI/PWR	NC/PWR	NC/PWR
	10	(KEY)	(KEY)	(KEY)

Motherboard Serial header pinout

BIOS EEPROM

If the BIOS needs to be updated, please refer to **Appendix C** for reflashing instructions.

Power Switch Header

The on-board power switch header can be used to control the power state of the Helix platform in parallel with the front panel power button. Mating power switch cables should be a twisted-pair wire with floating shield to assure proper immunity to EMI/RFI. Mating connector is a standard 2.54mm female header. It is recommended to keep wires at less than 3 meters in length. Switches must be momentary contact type only.

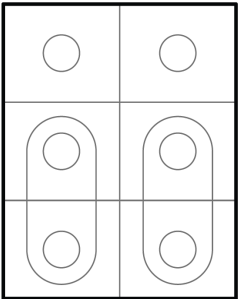
ATX/CMOS Jumper Header

A 2mm pin header and jumpers are used to clear the CMOS settings and select the hardware auto power-on behavior of the Helix platform.

ATX mode can be selected by moving the pin jumper to connect pins 3 and 5 will select ATX power mode. The system power-on will be controlled by the system power button or other supported wake events. When the pin jumper is moved to connect pins 1 and 3, the system will operate in AT mode, where the system will power on when system power is first applied. The default selection is ATX mode.

The system CMOS settings can be cleared with the second pin jumper. To clear the CMOS the following steps shall be followed:

1. Disconnect system power.
2. Place jumper in the “clear” position.
3. Wait 10 seconds.
4. Remove jumper from the “clear” position and return to default position

	Jumper Position	Function
	1-3	AT mode
	3-5	ATX Mode (Default)
	2-4	Clear CMOS
	4-6	No Function (Default)

ATX/CMOS header pinout

RTC battery header

The RTC battery on the Helix platform is used to retain BIOS CMOS settings and maintain the real-time clock for the system. If the RTC battery is low, CMOS settings will not be retained and you may receive an alert in the operating system. The cabled RTC battery should be replaced with a Maxell CR2032-WK11 (or UL listed equivalent). An equivalent battery shall use a Hirose DF13-2S-1.25c connector to mate with the on-board connector.

TPM header

Helix features an onboard TPM (Trusted Platform Module) header. Helix supports OnLogic’s module (OnLogic part TPM01) featuring TPM 2.0. This gives the option to have a dedicated secure module to secure Helix through cryptographic keys.

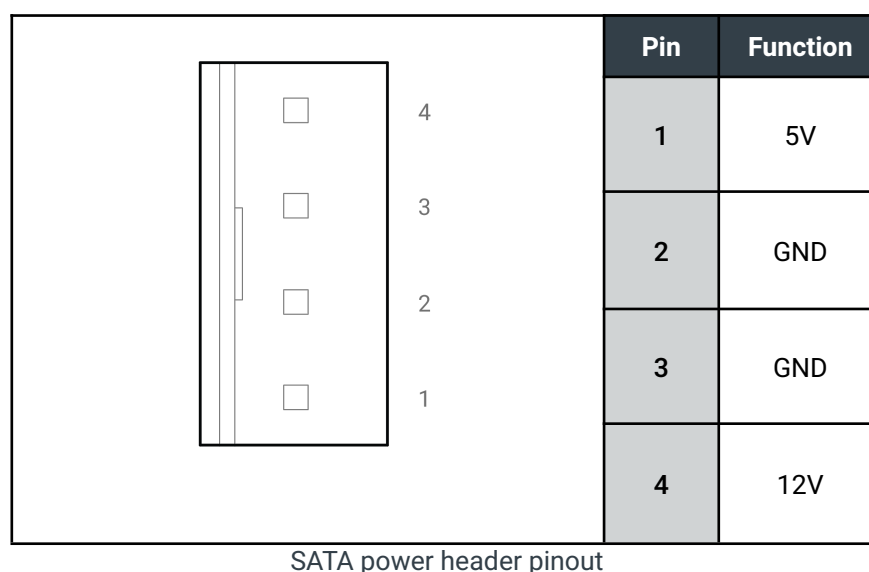
SATA Data 1 & SATA Data 2

The two on-board SATA Data connectors utilize the standard 7-pin SATA Data latching connector with the standard pin configuration. These connectors support SATA Gen I (1.5Gbps), SATA Gen II

(3.0Gbps), and SATA Gen III (6.0Gbps). In addition, they support firmware-level RAID arrays using Intel Rapid Storage Technology. RAID arrays that mix together M.2 SATA and cabled 2.5" SATA drives can also be created. Characteristics of the SATA ports, such as those RAID arrays, can be configured in the BIOS; refer to the BIOS manual (**Appendix C**) for further details.

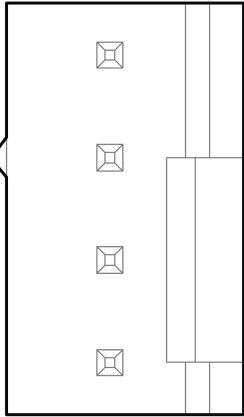
SATA Power

The on-board SATA Power connector provides 5V and 12V power to multiple SATA devices with the pin configuration in the chart below. It uses a 4-pin 2.50mm pitch male pin connector with an opening for a small retention tab. The connector is rated to 2A per contact. Any mating connector with the correct form factor, such as TE Connectivity part number 171822-4, can be used to connect a cable to the header. The connector can only be used to power internal devices.



Fan Header

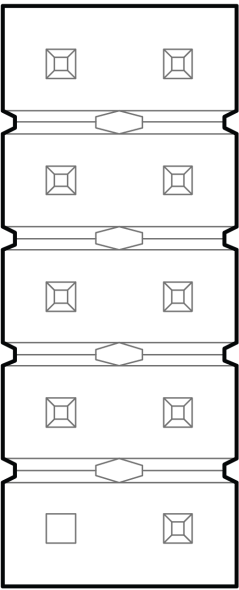
The on-board fan header can power and control any three or four-wire fan (including variable-speed PWM fans) using the standard pin configuration in the chart below. Three-wire fans will only connect to pins 1-3. This header utilizes a standard 4-pin 2.54mm pitch fan connector with a small retention tab. Any mating connector with the standard form factor, such as Molex part number 0470541000, can be used to connect a fan. Most CPU and case fans utilize this connector and pinout. The 12V pin on this connector can provide up to 1A of current

		Pin	Function
	4	1	GND
	3	2	12V
	2	3	RPM
	1	4	PWM

Fan header pinout

USB 2.0 Header

The on-board USB 2.0 header provides a pair of USB 2.0 signals. It utilizes a standard 9-pin 2.54mm pitch male pin connector with the pin configuration in the chart below. The 5V power pins (1 & 2) can provide up to 1A of current.

		Pin	Function
	1	1	5V
	2	2	5V
	3	3	D0-
	4	4	D1-
	5	5	D0+
	6	6	D1+
	7	7	GND
	8	8	GND
	9	9	(KEY)
	10	10	GND

USB 2.0 header pinout

CEC Expansion Header

HDMI-CEC (Consumer Electronics Control) is a communication protocol supporting the control of displays over an HDMI interface.

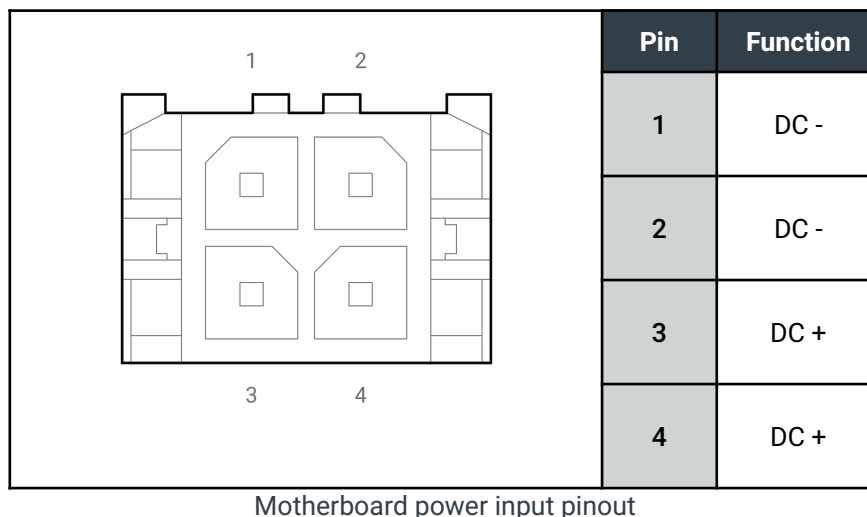
The Helix platform supports CEC via the optional add-on module ADP107. For a full description of supported features, refer to the ADP107 product manual located on the Helix platform product pages.

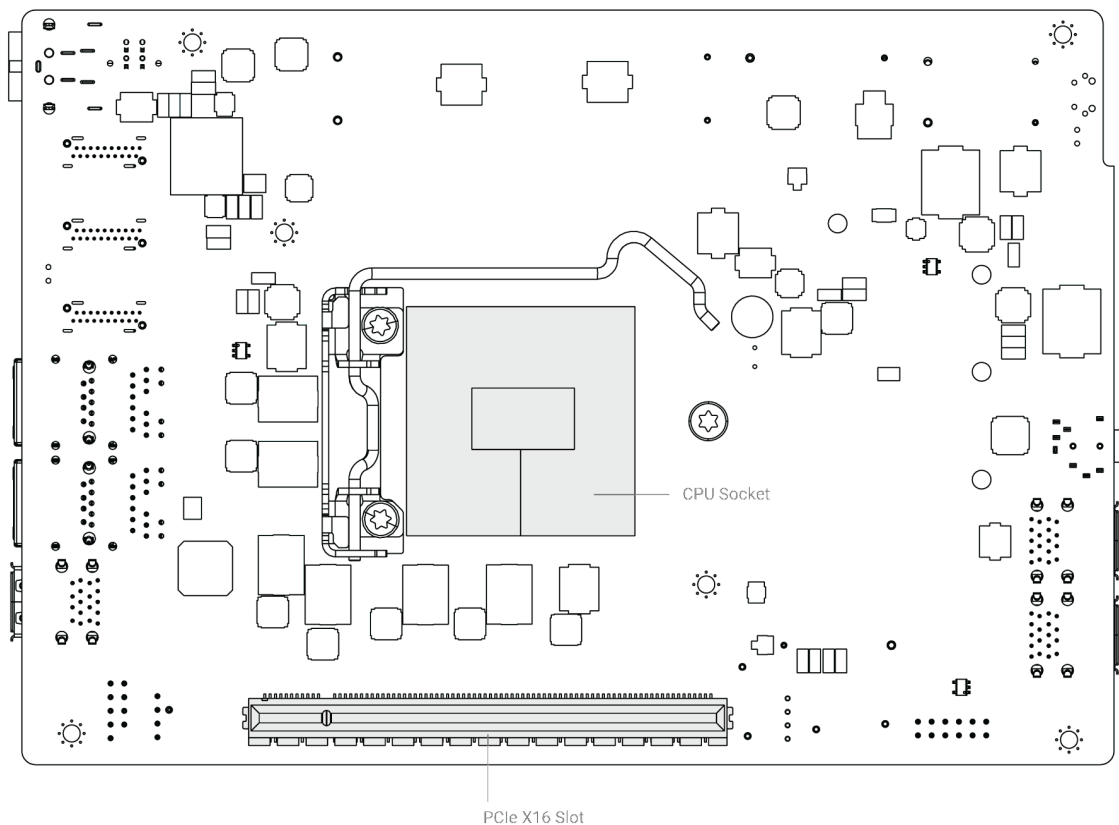
<https://www.onlogic.com/hx500/>

<https://www.onlogic.com/hx600/>

Power Input Header

Mainboard power can be applied to the Helix platform by way of the locking 4-pin Molex Micro-Fit connector (Mating part: Molex #0430250400 or equivalent). The system is operational from 8V~24V (HX 500) and 19V~24V (HX600 with GPU option) [see section 4.3 for input voltage qualifications]. The maximum rated current of the connector is 8A per pin. Use a wire gauge that is rated for the operational current. See below for connector pinout.





Motherboard bottom view (Heatsink side)

CPU socket

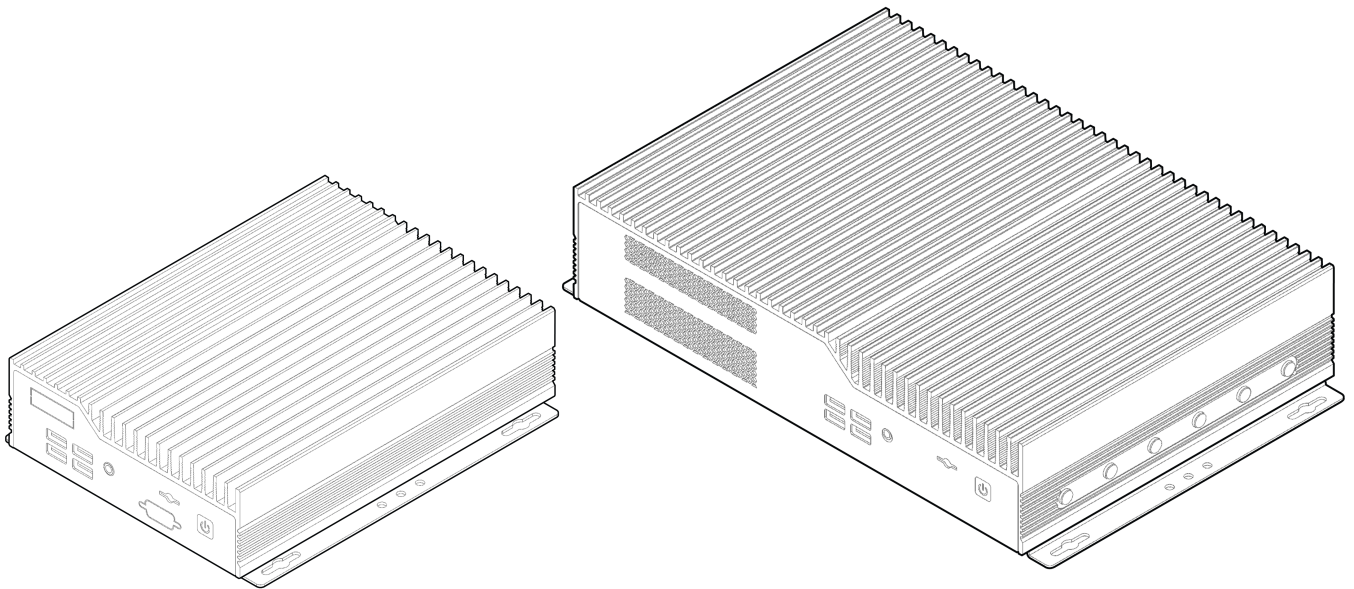
The LGA1200 CPU socket on the Helix platform supports all 10th Gen Intel S-series processors up to 35W TDP.

PCIe x16 Slot

The Helix platform features a standard PCI Express x16 slot on the bottom side that supports PCIe Gen 1 (2.5 GT/s), Gen 2 (5 GT/s), and Gen 3 (8 GT/s). Any PCIe x1, x4, x8, or x16 card using PCIe Gen 1 through Gen 3 will function in this slot. In the HX600, a riser card is included to add a PCIe expansion card to the expanded chassis.

3 - Mounting Instructions

3.1 - Wall Mount & DIN Rail Mounting



Step 1: Attach wall mounting brackets to the chassis using the supplied screws. Specifications can be found below:

Screw type: M3X0.5 FH 120 Degree Screw
Length: 4 mm

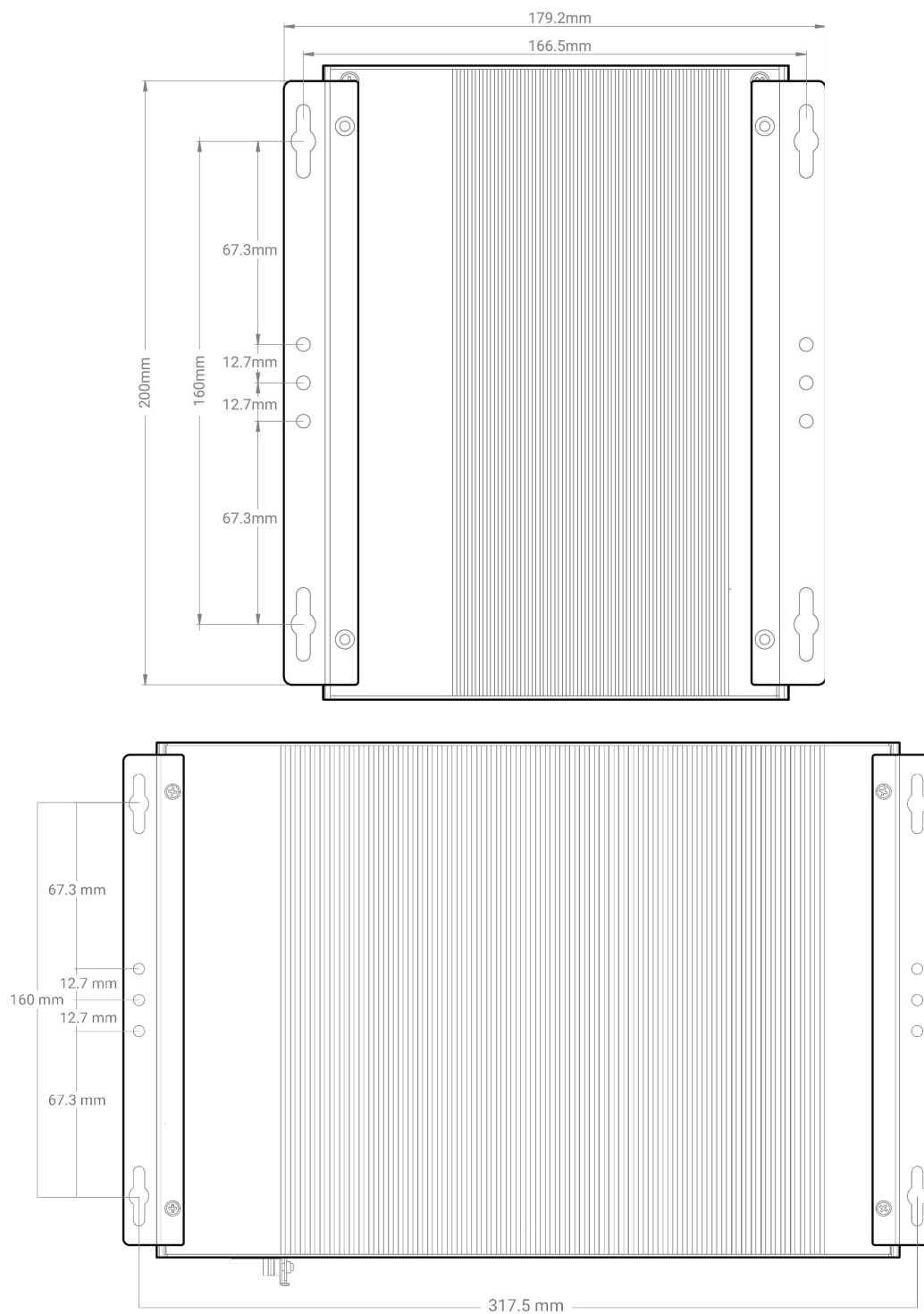
Step 2: Locate the 4 holes that line up accordingly to the bracket as shown below.

Step 3: Fasten system to surface. The mounting bracket systems are required to secure 3x the hanging weight of the computer system. The mating substrate must be capable of maintaining the same rating.

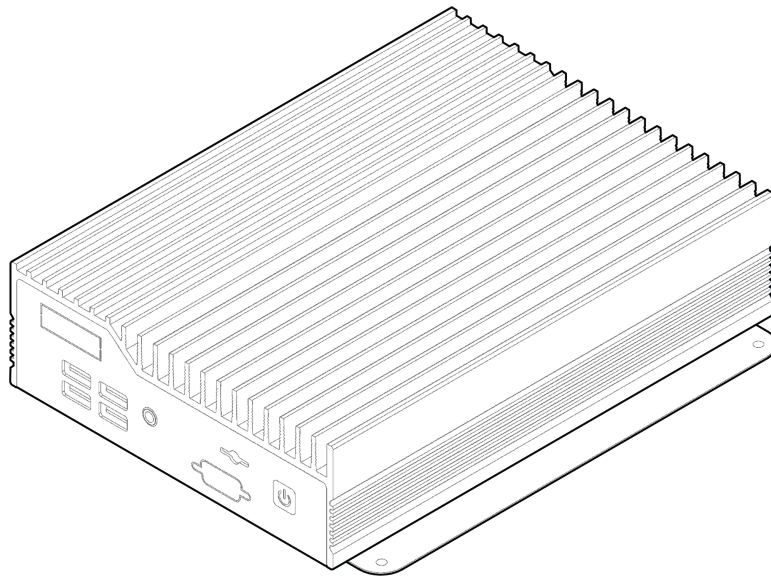
Step 4 (for DIN Bracket - HX500 only): Using the outer 2 holes of the 3 hole set on the wall mount bracket, line up the DIN bracket.

Step 5 (for DIN Bracket - HX500 only): Using the supplied screws, using a Phillips head screwdriver, mount the DIN bracket to the bracket.

Step 6 (for DIN Bracket - HX500 only): Mount system onto the DIN rail.



3.1 - VESA Mounting



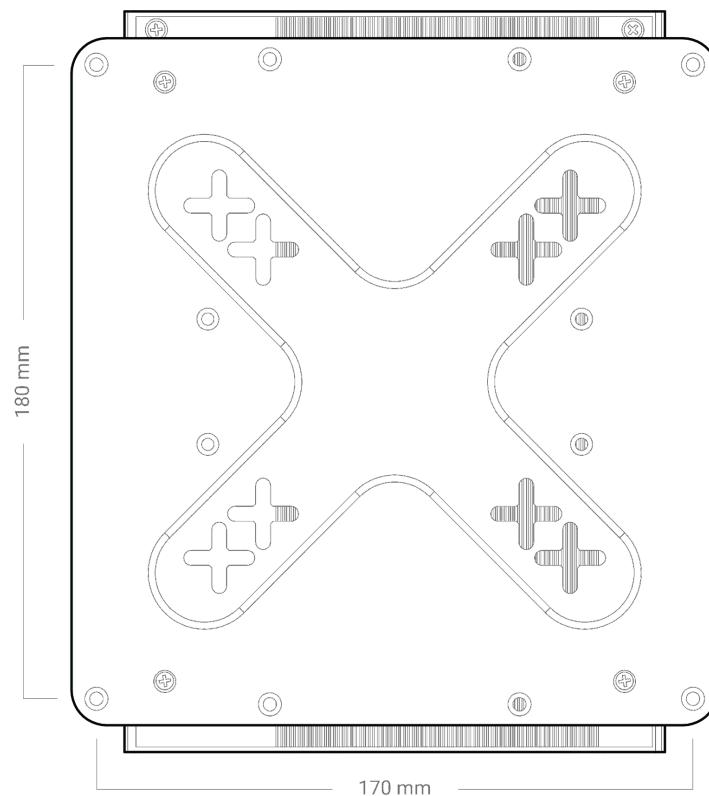
Step 1: Attach VESA mounting plate to the chassis using:

Screw type: M3X0.5 FH 120 Degree Screw

Length: 4 mm

Step 2: Locate the 4 holes that line up accordingly to the bracket as shown

Step 3: Fasten system to surface. The mounting bracket systems are required to secure 3x the hanging weight of the computer system. The mating substrate must be capable of maintaining the same rating.



4 - Power Management

4.1 - Wake-Up Events

The Helix platform supports multiple power states. The wake-up events can be configured in the BIOS. This section describes the supported power management functions and gives information on protection circuitry for power adapters.

Wake-Up Event	From ACPI State	Comments
Power Button	Deep S5, S5, S3	
LAN	S5, S3	Must be enabled in BIOS
USB	S3	
RTC Wake set by BIOS	Deep S5, S5, S3	Must be enabled in BIOS
RTC Wake set by OS	S3	

4.2 - Protection Circuitry

Parameter	Value
Nominal operating voltage (Rated DC value of input)	8~24V
Undervoltage protection trip DC level (system turns off)	6.5V
Maximum safe DC voltage (system not damaged)	27V

These DC levels specified are the absolute max values for the pins for function and safety of the system. The protection circuitry allows for brief transient voltages above these levels without the system turning off or being damaged. A transient voltage suppressor on the power input allows momentary excursions above stated limits. For input power consumption and current see **Appendix A**.

4.3 - Input voltage qualification

The base HX500 system is capable of operation with an input voltage ranging from 8V - 24V DC, however different configurations will impact total system draw and may limit input voltage flexibility in the final application. The minimum system voltage will be limited by total system power draw and the 14A current limit of the power connectors on the motherboard. The total system power draw should

be divided by the input voltage to stay within the current limit of the power connector and checked against supply capability. HX600 systems with GPU configurations should utilize no less than 19V at the input, with 24V recommended. Please contact OnLogic for assistance calculating the total max power draw of your desired configuration.

Most HX500 systems operating at 8V with turbo enabled will exceed the input current limit. Systems with Intel Turbo Boost enabled can draw up to 70W at the CPU with stock settings. Additional internal system peripherals and USB loads may cause system instability due to protection mechanisms. Systems requiring an input voltage under 12V will achieve best stability by disabling CPU turbo, or by limiting peak CPU turbo draw under 50W with a custom BIOS. Please contact OnLogic sales for additional information on custom BIOS configurations.

5 - EMC results

5.1 - Summary of EN 55032 / EN 55035 / EN 60601-1

The Helix platform complies with the EN 55032:2015 standards for radiated and conducted emissions limits. The unit is compliant with EN 55035:2016 and tailored by EN 60601-1-2 for ESD, radiated immunity, magnetic immunity, electrical fast transient (EFT) AC power line, dips/interrupts and EFT signal line immunity based on performance criteria in Tables 4, 5, 6, 7, 8, and 9.

5.1.1 - ESD Immunity Data

ESD immunity tests were performed following EN 55035 in accordance with EN 61000-4-2 and EN 60601-1-2 in accordance with EN 61000-4-2.

The unit does not exhibit susceptibility to 4-kV and 6-kV contact/8-kV air and 8kV contact/15kV air discharges applied singly or repetitively and directly or indirectly. The relative humidity during unit testing was measured to be between 30% and 60%. The Helix platform was unaffected during testing.

5.1.2 - Radiated Immunity Data

Radiated immunity tests were performed following EN 55035 in accordance with EN 61000-4-3 and EN 60601-1-2 in accordance with EN 61000-4-3.

The system does not exhibit susceptibility to 10 V/m radiated electric fields, amplitude modulated at 1000 Hz, 80%, from 80 MHz to 6 GHz. Frequencies listed are samples and spots. The Helix platform was unaffected during testing.

The system does not exhibit susceptibility to radiated electric fields, in accordance with EN 61000-4-3 Table 9. The Helix platform was unaffected during testing.

5.1.3 - Magnetic Immunity Data

Magnetic immunity tests were performed following EN 60601-1-2 in accordance with EN 61000-4-8.

The system does not exhibit susceptibility to radiated magnetic fields of 30 A/m at 50/60Hz. The Helix platform was unaffected during testing.

5.1.4 - Electrical Fast Transient Immunity Data

Electrical fast transient immunity tests were performed following EN 55035 in accordance with EN 61000-4-4 and EN 60601-1-2 in accordance with EN 61000-4-4.

The system does not exhibit susceptibility to 1-kV/2-kV electrical fast transients, delivered in 5-kHz bursts to power lines. "A" result = No effect on EUT.

The system does not exhibit susceptibility 0.5-kV/1-kV electrical fast transients, delivered in 5-kHz bursts to signal lines. The Helix platform was unaffected during testing.

5.1.5 Dips/Interrupts Immunity Data

Dips/interrupts immunity tests were performed following EN 55035 and EN 60601-1-2 in accordance with EN 61000-4-11.

The system does not exhibit susceptibility. The Helix platform was unaffected during testing.

6. Appendices

6.1 - Appendix A: Power consumption

The power consumption of the H500 and H600 systems was measured for various system configurations, workloads, and power states at both 12V and 24V system input voltages. Tests were performed using Burnintest v9.0 build 1012 to stress system components with and without graphics enabled. These tests were performed with Intel Turbo Boost disabled. Enabling Turbo will draw additional power. The build configurations and power consumption are listed in the tables below. (**note:** system configurations using discrete GPUs are limited to 19V-24V input. Only 24V is tested for Configuration 3).

*The configurations below are using representative samples of internal devices, the specific components mentioned below may vary from the devices provided by OnLogic.

System Component	Config 1 Low	Config 2 Mid	Config 3 High
CPU	i3-10300T (4C/8T @ 3.00GHz)	i5-10500T (6C @ 2.30GHz)	i9-10900T (10C @ 1.90 GHz)
Memory	Transcend TS512MSH64V1H (DDR4-2133 4GB)	Innodisk M4SS-AGS105RG-B (DDR4-2133 16GB)	2x Innodisk M4S0-AGS105IK (DDR4-2666 16GB) 32 Gb total
GPU	none	none	Nvidia GTX 1660
Storage #1 M.2 M-Key	none	Innodisk DEM28-64GM61EWADF (NVMe x2 64GB)	Innodisk DEM28-B56M61EWAQF-27 (SATA III 256Gb) (OS drive)
Storage #2 M.2 B-Key	Innodisk DEM28-A28M41BCBC1DC (SATA III 128GB) (OS Drive)	Innodisk DEM28-A28M41BCBC1DC (SATA III 128GB) (OS Drive)	Innodisk DEM28-32GM41BW1DC27 (SATA III 32Gb)
M.2 E key	none	SparkLAN WNFQ-261ACNI(BT) (Wide-Temp M.2 WiFi)	none
mPCIe	none	none	Unex DNXA-116 WiFi
Sata #1	none	none	None
Sata #2	none	None	None
OS	Win10 Pro 1909	Win10 Pro 1909	Win10 Pro 1909
BIOS Version	1.20	1.20	1.20
System Fan	Fanless	Fanless	GPU Bay fan array

The power consumption for each system configuration is record below

Config 1 Low		
Power Consumption	12V (W)	24V (W)
Windows Idle	8.2	9.4
CPU / system Stress	33.6	35.4
CPU / System & Graphics Stress	41.1	41.5
S3	1.14	1.42
S5	0.97	1.18
Deep S5	0.28	0.43

Config 2 Mid		
Power Consumption	12V (W)	24V (W)
Windows Idle	10.0	12.3
CPU / system Stress	41.8	43.4
CPU / System & Graphics Stress	45.7	47.0
S3	1.66	1.92
S5	1.50	1.68
Deep S5	0.28	0.43

Config 3 High		
Power Consumption	12V (W)	24V (W)
Windows Idle	N/A	27.6
CPU / system Stress	N/A	61.2
CPU / System & Graphics Stress	N/A	173.5
S3	N/A	2.40
S5	N/A	1.92
Deep S5	N/A	0.96

6.2 - Appendix B: Isolated DIO guide

Additional information for the Isolated DIO Module (OnLogic PN: ADP102) can be found on the OnLogic support site. Please refer to the link below for additional information.

<https://www.onlogic.com/support/documentation/adp102-dio/>

6.3 - Appendix C: BIOS manual

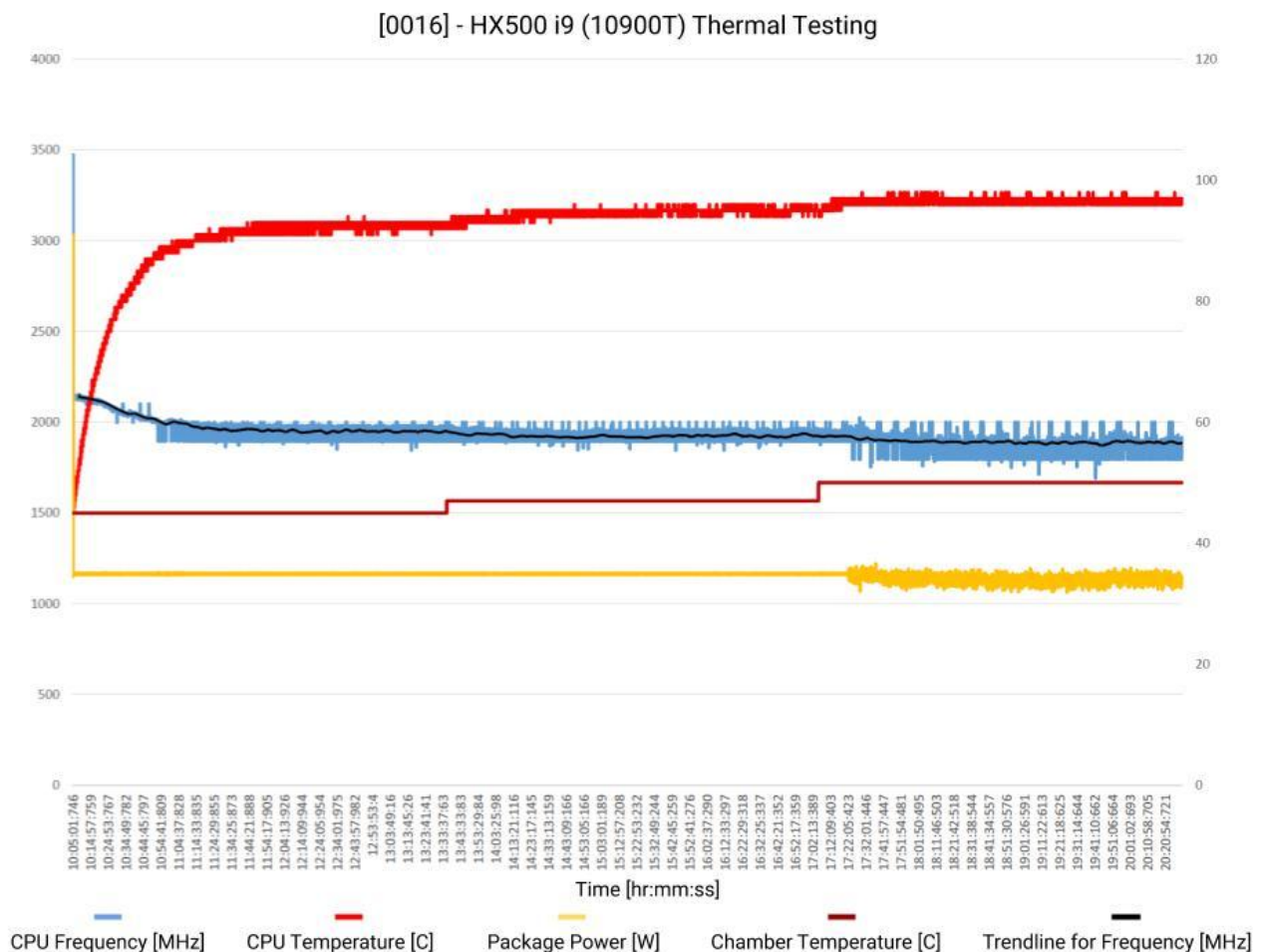
For a detailed overview of the BIOS screens and individual settings, please refer to the OnLogic support site. Instructions for updating the BIOS can also be found on the support site. Please refer to the link below for detailed instructions.

<https://www.onlogic.com/support/documentation/helix-series-technical-resources/>

6.4 - Appendix D: System thermal results

The thermal performance of the Helix platform was validated by fully loading system components while the test system was exposed to high ambient temperatures in a thermal chamber environment. CPU and GPU clock speeds were measured for the duration of the test. The results were analyzed by comparing the average clock speed over the duration of the test to the rated base clock speed. A passing result was defined by an average clock speed no less than 10% of the rated base clock. No CPU or GPU throttling was observed during testing of both the HX500 and HX600 at the maximum rated temperature, with some configurations running above the base clock frequency.

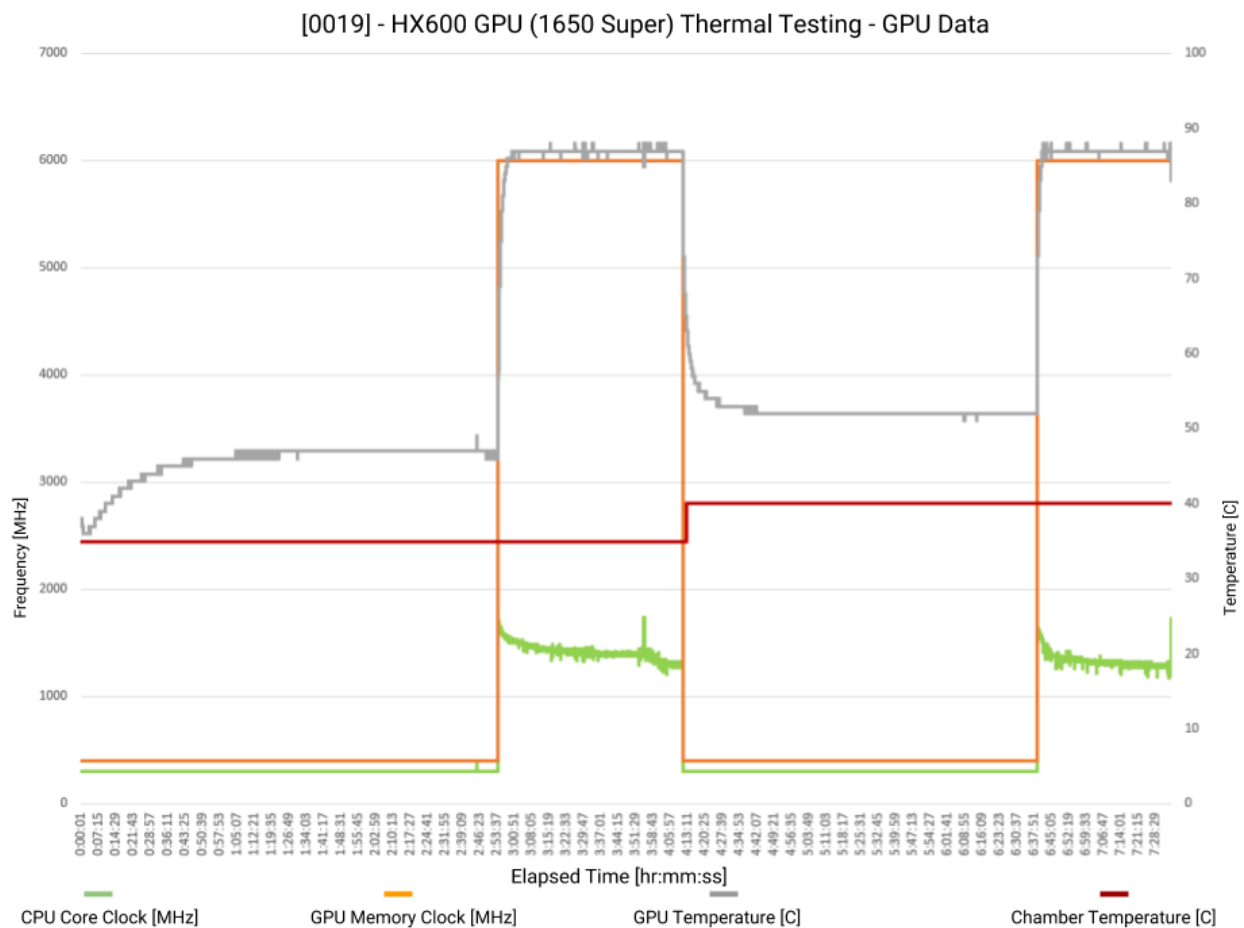
HX500 - i9 10900T (10C @1.90GHz) Thermal Testing Graph - The image below shows the thermal test results from an HX500 in a thermal chamber with an I9 10900T (10C @1.90GHz) processor installed over the course of 10 hours at a workload of 100%.



HX500 - i9 10900T (10C @1.90GHz) Thermal Testing Results Table - the table below shows the key takeaway values from the above test

Item Tested	Pass	Test Result	Delta [%]
CPU Temp.	<100 C	98C	2%
Restarted	<1 times	0 times	0%
Frequency Drop Average	>1520 MHz	~1900 MHz	20%
Avg. Power	35W	~34W	0%

HX600 - GPU Validation Thermal Testing Graph - The image below shows the thermal test results from an HX600 in a thermal chamber over the course of 4 hours. The last hour of the test, after the system saturates at the required temperature, FurMark is started. FurMark runs the GPU at 100% workload in an attempt to find the limits of the system.



HX600 - GPU Validation Thermal Testing Results Table - the table below shows the key takeaway values from the above test.

Item Tested	Pass	Test Result	Delta [%]
Highest CPU Temp.	<100 [C]	@35 [C]: 77 [C] @40 [C]: 81 [C]	23% 19%
Restarted	<1 times	0 times	100%
Highest GPU Temp. on FurMark	<98 [C]	@35 [C]: 88 [C] @40 [C]: 88 [C]	11.4% 11.4%
Avg. CPU Frequency	>2640 [Mhz]	@ 35C: ~3100 [MHz] @40C: ~3100 [MHz]	17.4% 17.4%
Avg. GPU Core Clock on FurMark	>1224 [MHz]	@ 35C: 1390 [MHz] @40C: 1290 [MHz]	13.6% 5.4%

6.5 - Appendix E: Expansion port pinout

6.5.1 - M.2 B-Key

Pin	Function	Function	Pin
1	CONFIG_3	3.3V	2
3	GND	3.3V	4
5	GND	FULL_CARD_POWER_OFF#	6
7	USB 2.0 D+	W_DISABLE1#	8
9	USB 2.0 D-	NC	10
11	GND	KEY	
	KEY	KEY	
	KEY	KEY	
	KEY	KEY	
		NC	20
21	CONFIG_0	NC	22
23	NC	NC	24
25	NC	GPIO_10/W_DISABLE2#	26
27	GND	NC	28
29	PERn1/USB3.1-Rx-	UIM-RESET	30
31	PERp1/USB3.1-Rx+	UIM_CLK	32
33	GND	UIM_DATA	34
35	PETn1/USB3.1-Tx-	UIM_PWR	36
37	PETp1/USB3.1-Tx+	NC	38
39	GND	NC	40
41	PERn0/SATA-B+	NC	42
43	PERp0/SATA-B-	NC	44
45	GND	NC	46
47	PETn0/SATA-A-	NC	48
49	PETp0/SATA-A+	PERST#	50
51	GND	CLKREQ#	52
53	REFCLKn	PEWAKE#	54
55	REFCLKp	NC	56
57	GND	NC	58
59	NC	NC	60
61	NC	NC	62

63	NC	NC	64
65	NC	SIM_DETECT	66
67	RESET_N	SUSCLK	68
69	CONFIG_1	3.3V	70
71	GND	3.3V	72
73	GND	3.3V	74
75	CONFIG_2		

6.5.2 - M.2 E-Key

Pin	Function	Function	Pin
1	GND	3.3 V	2
3	USB_D+	3.3 V	4
5	USB_D-	NC	6
7	GND	PCM_CLK	8
9	RESERVED	CNV_RF_RESET#_R	10
11	RESERVED	BT_PCMIN	12
13	GND	BT_PCMOUT	14
15	RESERVED	NC	16
17	RESERVED	GND	18
19	GND	NC	20
21	RESERVED	RESERVED	22
23	RESERVED	KEY	
	KEY	KEY	
	KEY	KEY	
	KEY	KEY	
	KEY	RESERVED	32
33	GND	RESERVED	34
35	PETp0	RESERVED	36
37	PETn0	RESERVED	38
39	GND	RESERVED	40
41	PERp0	RESERVED	42
43	PERn0	RESERVED	44
45	GND	RESERVED	46
47	REFCLKp0	RESERVED	48
49	REFCLKn0	SUSCLK(32kHz)	50

51	GND	PERST0#	52
53	CLKREQ0#	W_DISABLE2#	54
55	PEWAKE0#	W_DISABLE1#	56
57	GND	NC	58
59	RESERVED	NC	60
61	RESERVED	NC	62
63	GND	RESERVED	64
65	RESERVED	NC	66
67	RESERVED	NC	68
69	GND	NC	70
71	RESERVED	3.3V	72
73	RESERVED	3.3V	74
75	GND		

6.5.3 - M.2 M-Key

Pin	Function	Function	Pin
1	GND	3.3 V	2
3	GND	3.3 V	4
5	PERn3	NC	6
7	PERp3	NC	8
9	GND	DAS/DSS (I/O)/LED_1# (I)(0/3.3V)	10
11	PETn3	3.3 V	12
13	PETp3	3.3 V	14
15	GND	3.3 V	16
17	PERn2	3.3 V	18
19	PERp2	NC	20
21	GND	NC	22
23	PETn2	NC	24
25	PETp2	NC	26
27	GND	NC	28
29	PERn1	NC	30
31	PERp1	NC	32
33	GND	NC	34
35	PETn1	NC	36
37	PETp1	DEVSLP (O)	38

39	GND	SMB_CLK (I/O)(0/1.8V)	40
41	PERn0/SATA-B+	SMB_DATA (I/O) (0/1.8V)	42
43	PERp0/SATA-B-	ALERT# (I) (0/1.8V)	44
45	GND	NC	46
47	PETn0/SATA-A-	NC	48
49	PETp0/SATA-A+	PERST# (O)(0/3.3V) or NC	50
51	GND	CLKREQ# (I/O)(0/3.3V) or NC	52
53	REFCLKn	PEWAKE# (I/O)(0/3.3V) or NC	54
55	REFCLKp	NC	56
57	GND	NC	58
	CONNECTOR Key M	CONNECTOR Key M	
	CONNECTOR Key M	CONNECTOR Key M	
	CONNECTOR Key M	CONNECTOR Key M	
	CONNECTOR Key M	CONNECTOR Key M	
67	NC	SUSCLK(32kHz) (O)(0/3.3V)	68
69	PEDET (NC-PCIe/GND-SATA)	3.3 V	70
71	GND	3.3 V	72
73	GND	3.3 V	74
75	GND		

6.5.4 - mPCIe

Pin	Function	Function	Pin
1	WAKE#	3.3V	2
3	NC	GND	4
5	NC	1.5V	6
7	CLKREQ#	UIM_PWR	8
9	GND	UIM_DATA	10
11	REFCLK-	UIM_CLK	12
13	REFCLK+	UIM_RESET	14
15	GND	UIM_SPU	16
	KEY	KEY	
17	NC	GND	18
19	NC	W_DISABLE1#	20
21	GND	PERST#	22
23	PERn0	3.3V	24

25	PERp0	GND	26
27	GND	1.5V	28
29	GND	SMB_CLK	30
31	PETn0	SMB_DATA	32
33	PETp0	GND	34
35	GND	USB 2.0_D-	36
37	GND	USB 2.0_D+	38
39	3.3V	GND	40
41	3.3V	NC	42
43	GND	NC	44
45	NC	NC	46
47	NC	1.5V	48
49	NC	GND	50
51	W_DISABLE2#	3.3V	52

6.6 Appendix F: Safety Information

Do not open or modify the device. The device uses components that comply with FCC and CE regulations. Modification of the device may void these certifications.

6.6.1 Safe use and installation instructions

1. Install the device securely. Be careful handling the device to prevent injury and do not drop.
2. Wall or ceiling mounting device requires use of a mounting plate or bracket. The plate or bracket must be of metal construction and have a minimum thickness of 1mm.
3. Use M3x0.5mm Flat Head screws to attach mounting plate or mounting brackets to threaded holes on bottom or rear of chassis. Screws should be a minimum length of 4mm. Add 1mm of screw length for every mm of additional thickness of plate or bracket beyond 1.5mm.
4. Ambient operating temperature must be between 0 °C to 50 °C with a non-condensing relative humidity of 10-90%.
5. The device can be stored at temperatures between -10 °C to 85 °C.
6. Keep the device away from liquids and flammable materials.
7. Do not clean the device with liquids. The chassis can be cleaned with a cloth.
8. Allow at least 2 inches of space around all sides of the device for proper cooling. If the device is mounted to a vertical surface then recommended device orientation is so that heatsink fins allow air to rise unobstructed. Alternative orientations may result in reduced operational temperature range.
9. This device is intended for indoor operation only.
10. Use UL Listed external power supply with rated output 8-24Vdc
11. Install the device only with shielded network cables.
12. Only use SAE approved cables for automotive installation.
13. The installer should be experienced in aftermarket installation and familiar with general practices for installing electronics devices in vehicles.
14. The device should not be installed in the driver's area of a vehicle.
15. The device should be mounted in accordance with accepted aftermarket practices and materials for vehicle installation.

16. Only use UL Listed connectors for
17. Service and repair of the device must be done by qualified service personnel. This includes, but is not limited to, replacement of the CMOS battery. Replacement CMOS battery must be of the same type as the original.
18. Proper disposal of CMOS battery must comply with local governance.



WARNING: There is danger of explosion if the CMOS battery is replaced incorrectly. Disposal of battery into fire or a hot oven, or mechanically crushing or cutting of a battery can result in an explosion.

6.6.2 Précautions et guide d'installation

1. Ne pas ouvrir ou modifier l'appareil. L'appareil utilise des composants conformes aux réglementations FCC et EC. La modification de l'appareil peut annuler ces certifications.
2. Installez l'appareil en toute sécurité. Soyez prudent lors de la manipulation de l'appareil pour éviter les blessures et ne pas faire tomber.
3. Le montage au mur ou au plafond nécessite l'utilisation d'une plaque de montage ou d'un support. La plaque ou le support doit être en métal et doit avoir une épaisseur minimale de 1 mm.
4. Utilisez des vis à tête plate M3x0,5mm pour fixer la plaque de montage ou les supports aux trous filetés situés au bas ou à l'arrière du châssis. Les vis doivent avoir une longueur minimale de 4 mm. Ajoutez 1 mm de longueur de vis pour chaque mm d'épaisseur supplémentaire de plaque ou de support dépassant 1,5 mm.
5. La plage de températures de fonctionnement doit être de 0 °C à 50 °C avec une humidité relative de 10 à 90% sans condensation. La température de fonctionnement dépend du choix du composant, y compris de l'adaptateur d'alimentation. Voir le tableau 1 ci-dessous pour le déclassement.
6. La plage de températures de stockage doit être de -10 °C à 85 °C.
7. Gardez l'appareil à l'écart des liquides et des matières inflammables.
8. Ne nettoyez pas l'appareil avec des liquides. Le châssis peut être nettoyé avec un chiffon.
9. Laissez au moins 5 cm d'espace autour de tous les côtés de l'appareil pour un refroidissement correct. Si l'appareil est monté sur une surface verticale, l'orientation recommandée est telle que les ailettes du dissipateur de chaleur permettent à l'air de monter sans obstruction. Les orientations alternatives peuvent entraîner une réduction de la plage de température de fonctionnement.
10. Cet appareil est conçu uniquement pour une utilisation en intérieur.
11. Utilisez une alimentation externe listée UL avec une sortie nominale de 8-24Vdc.
12. Installez l'appareil uniquement avec des câbles réseau blindés.
13. L'entretien et la réparation de l'appareil doivent être effectués par du personnel qualifié. Cela inclut, sans toutefois s'y limiter, le remplacement de la batterie CMOS. La batterie CMOS de remplacement doit être du même type que l'originale.
14. La mise au rebut des batteries usagées doit être réalisée conformément aux réglementations environnementales.



ATTENTION: Risque d'explosion si la batterie est remplacée par une batterie de type incorrect. Les batterie doivent être recyclées dans la mesure du possible.

6.7 - Appendix G: Errata

6.7.1 JP-1: Failure to Boot Without RTC Battery

Overview

Category:	Hardware / Battery
SKU(s) Affected:	HX500, HX600, HX610
Revision(s) Affected:	F01-00003R(1-4)
Revision Resolved:	F01-x0003R(5-current)
Severity:	Medium

Description

EXM501 does not start the power-up sequence if an RTC battery is not installed, or the battery is low-voltage (dead).

Battery discharge occurs primarily in systems that are not connected to power. Expected battery lifetime in completely unpowered systems exceeds 3 years. Time spent in service, connected to external power, does not count against battery expected lifetime and therefore extends time-to-failure.

Customers in common use cases where power is applied at all (or nearly all) times should not expect to encounter this issue in the system lifetime.

Workaround

None. If the system fails to boot, a user may confirm that battery voltage exceeds 2.7V and replace if needed.

Resolution

Power sequence timings adjusted in revision F01-x0003R(5-current) to enable startup without a battery.

6.7.2 JP-2: Digital and Chassis Ground Not Isolated

Overview

Category:	Hardware / PCB
SKU(s) Affected:	HX500, HX600, HX610
Revision(s) Affected:	B01-00003R(5-7)
Revision Resolved:	B01-00003R8
Severity:	Low

Description

Beginning in PCB rev B01-00003R5, the SIM slot connects the digital and chassis ground planes, removing isolation between the two. Under normal operating conditions, the function of the motherboard should not be affected.

Customers who rely on chassis ground isolation are recommended to isolate the chassis from earth ground externally.

Resolution

Steps to mitigate the issue were taken in PCB B01-00003R8 by eliminating the short. The changes are present in F01-x0003R11.