MCM-100/102

Edge IoT Platform for
Machine Condition Monitoring

User's Manual



Manual Rev.: 1.0

Revision Date: June 18, 2019

Part No: 50-1Z298-1000

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Leading **EDGE COMPUTING**

Revision History

Revision	Release Date	Description of Change(s)
1.0	June 18, 2019	Initial Release

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Preface

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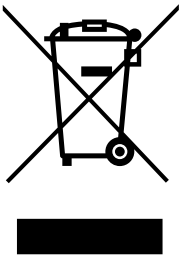
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Take note of the following conventions used throughout this manual to make sure that users perform certain tasks and instructions properly.

NOTE: Additional information, aids, and tips that help users perform tasks.

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Information to prevent ***minor*** physical injury, component damage, data loss, and/or program corruption when trying to complete a task.



Information to prevent ***serious*** physical injury, component damage, data loss, and/or program corruption when trying to complete a specific task.

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Table of Contents

Preface iii

List of Tables xiii

List of Figures xv

1 Introduction 1

1.1 Features 1

1.2 Specifications 2

1.2.1 General 2

1.2.2 I/O 3

1.2.3 Power Consumption 6

1.3 Mechanical Drawings 8

1.4 I/O Connectors 10

1.4.1 Power Button 12

1.4.2 Reset Button 13

1.4.3 DisplayPort Connector 13

1.4.4 LED Indicators 14

1.4.5 DB-9P COM Port Connector 14

1.4.6 Dual Gigabit Ethernet Ports 15

1.4.7 USB 3.0 Port 16

1.4.8 BNC Connectors 16

1.4.9 4-pin GPI/O w/ DGND Connector 17

1.4.10 DC Power Supply Connector 17

1.5 Adapters and Other Accessories 17

2 Getting Started 19

2.1 Unpacking Checklist 19

2.2 Connecting DC Power 19

2.3 DIN Rail Mounting 19

2.4 Wall Mounting 22

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2.5 Cooling Considerations 23
2.6 Installing Mini-PCIe WiFi Module (Optional) 24

3 Driver & Application Installation 29
3.1 Installing the Chipset Driver 29
3.2 Installing the Graphics Driver 30
3.3 Installing the Ethernet Driver 30
3.4 Installing the USB 3.0 Driver 31
3.5 Installing the I/O Controller Driver 31
3.6 Installing the SEMA Utility, WDT and DI/O Drivers 31
3.7 Installing AI and DI/O Drivers 32
MAPS Core 32
DAQ-LVIEW Plus 33

4 Operation 35
4.1 Analog Input 35
4.1.1 Analog Input Front End Configuration 35
Input Configuration: Differential/Pseudo-Differential 35
Input Coupling 36
IEPE Input 36
4.1.2 AI Data Format 37
4.1.3 Sampling Rate 37
DDS Timing/Sampling Rate 37
4.1.4 Data Transfer 38
Software Polling Data Transfer
(Non-Buffering Programmed I/O) 38
Continuous Acquisition Mode 38
4.1.5 Anti-Aliasing Filter and Frequency Response 38
4.2 Triggering 40
4.2.1 Analog Input Trigger Source 40
Software Triggering 40
External Analog Trigger 41

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External Digital Triggering 42
Trigger Modes 43
Delay-Trigger Acquisition (no retrigger) 44
Middle-Trigger Acquisition 45
Gated Trigger 45
Post-Trigger or Delay-Trigger Acquisition with Re-Trigger 46
4.3 Programmable Function I/O 46
4.3.1 Static Digital Input/Output 46
4.3.2 Frequency Counter 46
4.3.3 Pulse Output 47
4.3.4 Digital Trigger IN for Continuous Analog Input 47
4.3.5 Synchronization Sample Clock IN 47

5 Calibration 49
5.1 Loading Calibration Constants 49
5.2 Auto-Calibration 49
5.3 Saving Calibration Constants 50

A Appendix: BIOS Setup 51
A.1 Main 52
A.1.1 BIOS Information 52
A.1.2 System Time/System Date 52
A.1.3 Board Information 53
A.2 Advanced 54
A.2.1 CPU Configuration 55
Active Processor Cores 55
Intel Virtualization Technology 55
VT-d 55
Turbo Mode 55
Critical Trip Point 56
Passive Cooling Trip Point 56

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A.2.2 Graphics Configuration 56
GTT Size 56
Aperture Size 56
DVMT Pre-Allocated 57
DVMT Total Gfx Mem 57
A.2.3 Onboard Device Configuration 57
COM1 Control 57
COM2 Control 57
HSUART 58
LAN #1 (Intel I210) 58
LAN #2 (Intel I210) 58
Realtek Audio Support 58
Console Redirection 59
Console Redirection Settings (COM 1) 59
Console Redirection 62
Console Redirection Settings (COM 2) 62
A.2.4 Advanced Power Management 64
Power Supply Unit 65
State After G3 65
RTC Wake system from S5 65
LAN #1 Wake 65
LAN #2 Wake 65
A.2.5 USB Configuration 66
XHCI Hand-off 66
USB Mass Storage Driver Support 66
USB transfer time-out 66
Device reset time-out 66
Device power-up delay 67
A.2.6 SATA Configuration 67
Port 67
A.2.7 TPM Configuration 68
Security Device Support 68

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A.2.8 Network Stack Configuration 69
Network Stack 69
A.2.9 System Management 70
Flags 74
Power Up 75
A.2.10 Miscellaneous 76
OS Selection 76
A.2.11 Intel® I210 Gigabit Network Connection 77
Blink LEDs 77
A.2.12 NIC Configuration 78
Link Speed 78
Wake On LAN 78
A.3 Security 79
Administrator Password 79
User Password 79
BIOS Lock 79
A.3.1 Secure Boot 80
A.4 Boot 81
Setup Prompt Timeout 81
Bootup NumLock State 81
Quiet Boot 81
Fast Boot 81
Boot Option Priorities 82
A.5 Save & Exit 82
Save Changes and Exit 82
Discard Changes and Exit 82
Save Changes and Reset 83
Discard Changes and Reset 83
Save Changes 83
Discard Changes 83
Restore Defaults 83
Save as User Defaults 83

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Restore User Defaults 83
Launch EFI Shell from filesystem device 83

B Appendix: Functional Information 85

B.1 AI and GPI/O Functional Layout 86
B.2 Internal I/O Connectors 87
B.2.1 Internal HSUART Interface Wafer 89
B.2.2 USIM Port 89
B.2.3 Internal USB2.0 Interface Wafer 90
B.2.4 Internal I2C Interface Wafer 90
B.2.5 Clear CMOS Jumper 91
B.2.6 +5V GPS Antenna Power Header 91
B.2.7 Internal SATA Interface Wafer 92
B.2.8 Extended Power Wafer 93
B.2.9 Internal I2C Interface Wafer 94
B.2.10 Extended Reset Wafer 94
B.2.11 RTC Battery Header 95
B.2.12 Internal Speaker Wafer (Optional) 95
B.2.13 Internal MIC-IN & HP-OUT Wafer (Optional) 96

Important Safety Instructions 97

Getting Service 101

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List of Tables

Table 1-1: DisplayPort Pin Assignment 13
Table 1-2: LED Operation Indicators 14
Table 1-3: DB-9P COM Port Pin Assignment 14
Table 1-4: Gigabit Ethernet Port LED Function 16
Table 4-1: Signal Source-Card Configuration 35
Table 4-2: MCM-100/102 Input Ranges 37
Table B-1: Internal I/O Legend 89
Table B-2: HSUART Interface Wafer Pin Definitions 89
Table B-3: USB2.0 Interface Wafer Pin Definitions 90
Table B-4: Internal I2C Interface Wafer Pin Definitions 91
Table B-5: Clear CMOS Jumper Pin Definition 91
Table B-6: +5V GPS Antenna Power Connector Pin Definition . 92
Table B-7: SATA Wafer Pin Definition 92
Table B-8: Extended Power Header Connector Pin Definition... 93
Table B-9: I2C Box Header Connector Pin Definition 94
Table B-10: Extended Reset Header Connector Pin Definition ... 94
Table B-11: RTC Battery Connector Pin Definition 95
Table B-12: Speaker Wafer Pin Definition 95
Table B-13: MIC-IN & HP-OUT Wafer Pin Definition 96

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List of Figures

Figure 1-1: Top View 8
Figure 1-2: Front View 8
Figure 1-3: MCM-100 (Right) Side View 9
Figure 1-4: MCM-102 (Right) Side View 9
Figure 1-5: (Left) Side View 10
Figure 1-6: Front Panel I/O 10
Figure 1-7: MCM-100 Right Side Panel I/O 11
Figure 1-8: MCM-102 Right Side Panel I/O 11
Figure 1-9: Left Side Panel I/O 12
Figure 1-10: DB-9P COM Port 14
Figure 1-11: BNC Connector Polarity 16
Figure 1-12: 4-pin GPI/O w/ DGND Connector 17
Figure 1-13: DC Power Connector 17
Figure 4-1: MCM-100/102 Analog Front End 35
Figure 4-2: Excitation Current for IEPE Sensor Measurement 36
Figure 4-3: Input Frequency Response for High Resolution Mode 39
Figure 4-4: Input Frequency Response for High Speed Mode 40
Figure 4-5: Below-Low Analog Triggering 41
Figure 4-6: Above-High Analog Triggering 42
Figure 4-7: Digital Triggering 42
Figure 4-8: Post Trigger without Retrigger 43
Figure 4-9: Pre-trigger Mode Operation (valid trigger only) 44
Figure 4-10: Pre-trigger Mode Operation (w/ invalid trigger) 44
Figure 4-11: Delay-Trigger Mode Operation 45
Figure 4-12: Middle-Trigger Acquisition 45
Figure 4-13: Gated Trigger 46
Figure B-1: MCM-100/102 System Functional Block Diagram 85
Figure B-2: MCM-100/102 AI and GPI/O Functional Block Diagram 86
Figure B-3: Mainboard Top View 87
Figure B-4: Mainboard Underside View 88

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1 Introduction



ADLINK's MCM-100/102 features built-in vibration signal acquisition, with 2 or 4 BNC for analog input. The machine condition monitoring edge platform highlights around-the-clock continuous data collection and vibration measurement with maximized precision and sampling rates for rotating machinery and equipment. Combining data collection, vibration analysis algorithms, computation and network connection capabilities in a single system, the MCM-100/102 enables rotating machinery, tooling, and plant and automation equipment operators to easily overcome the challenges inherent in conventional equipment maintenance.

1.1 Features

- Intel® Atom x7-E3950 processor
- Extremely compact 183 (W) x 110 (D) x 84 (H) mm
- Rich I/O:
  - 2X or 4X BNC for analog input

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- 2X Digital I/O by terminal block
- 1x DP, 2x GbE, 2x COM(RS232/RS422/RS485), 2x USB 2.0, 2x USB 3.0

- DIN rail mounting, wall mounting

1.2 Specifications

1.2.1 General

System Core	
Processor	Intel® Atom x7-E3950
Chipset	SoC
Video	1 x DisplayPort 1.2 (supports DP++)
Memory	4 GB DDR3L 1600 MHz SODIMM module (Up to 8 GB support)
I/O Interface	
Ethernet	2 x GbE ports (2 x Intel I210IT)
Serial Ports	2 x BIOS-configurable RS232/422/485(COM1 and COM2)
USB	2 x USB 3.0 ports + 2 x USB 2.0 ports
WDT	Watchdog timer support from SEMA 3.5
Power Supply	
DC Input	Built-in 6 to 36 VDC wide-range DC input 3P pluggable connectors with latch (GND, V-, V+)
Storage	
mSATA	1x mSATA slot with full size mini PCIe (SSD-128GB III MLC)
Physical	
Dimensions	183 (W) x 110 (D) x 54 (H) mm (7.2" x 4.3" x 3.3")
Weight	1.46 kg (3.77 lb.)
Mounting	DIN rail, wall mounting
Environmental	
Operating Temperature	Standard: 0°C to 55°C
Storage Temperature	-20°C to 70°C (excl. HDD/MicroSD)

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Humidity	Approx. 95% @ 40°C (non-condensing)
Vibration	Operating, 5 Grms, 5-500 Hz, 3 axes (w/ mSATA)
ESD	Contact +/-4 KV and Air +/-8 KV
Shock	Operating 100 G, half sine 11 ms duration w/ mSATA
EMC	CE & FCC Class A (EN61000-6-4/EN61000-6-2)

1.2.2 I/O

Analog/digital

	MCM-100	MCM-102
Analog input (AI)		
Channels	4 (simultaneous-sampling)	2 (simultaneous-sampling)
ADC resolution	24-bit	
ADC type	Delta-sigma	
Sampling rate	1kHz to 128kHz	
Input range	±10V	
FIFO buffer size	8kS across all channel	
Input configuration	Differential or pseudo-differential	
Input impedance	200 kΩ between positive input and negative input. 16.93 kΩ between negative input and chassis ground.	
Input coupling	AC or DC, software selectable	
Integrated electronic piezoelectric (IEPE)	Current: 2 mA or 0 mA, software selectable, IEPE compliance: 24V	
Over-voltage protection	±60V	
Input common mode range	±10V	
Trigger source	Analog or digital, software selectable	
Trigger mode	Post trigger, delay trigger, middle trigger, gated trigger, pre-trigger, post or delay trigger with re-triggering	
Data transfer	Programmed I/O, continuous (bulk transfer mode)	

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CMRR	
AC (20Hz to 1kHz)	60 dB
Bandwidth	
-3dB bandwidth	0.49 x fs (where fs = sampling rate)
AC cut-off frequency (-3dB)	0.4 Hz
AC cut-off frequency (-0.1dB)	2.4 Hz
Digital I/O	
Channels	2 programmable function I/O
Compatibility	3.3V / TTL (single-ended)
Initial status	Input (pulled low)
Input voltage	Logic low: VIL = 0.8 V max; IIL = 0.2 mA max. Logic high: VIH = 2.0 V min.; IIH = 0.2 mA max.
Output voltage	Logic low: VOL = 0.8 V max; IIL = 0.2 mA max. Logic high: VOH = 2.0 V min.; IIH = 24 mA max.
Over-voltage protection	-2V to +7V
Supporting modes (only one can be selected and function at a time)	• Static digital input/output • PWM output, max. frequency: 4 MHz • Frequency/Event counter, max. frequency: 4MHz • Digital trigger IN • Synchronization sample clock IN, max. frequency: 128kHz
Data Transfer	Programmed I/O

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DC Accuracy @25°C

	Typical	Max.
Offset Error (mV)	±0.15mV	±0.3mV
Gain Error (%)	±0.15mV	±0.3%

AC Dynamic Performance

(typical, 25°C), THD, THD+N (Vin = 8.9 Vpk)

Input Configuration	Input Signal Frequency (fin)	THD	THD+N
Differential	20Hz to 20kHz	-94dB	-91 dB
	20Hz to 46.4kHz	-89 dB	-88 dB
Pseudo-differential	20Hz to 20kHz	-92 dB	-88 dB
	20Hz to 46.4kHz	-85 dB	-85 dB

Flatness

Input Signal Frequency (f_{in})	Flatness
20Hz to 20kHz	±0.01 dB
20Hz to 46.4kHz	±0.15 dB

Crosstalk

Input Signal Frequency (f_{in})	Crosstalk
1kHz	-102 dB
46.4kHz	-95 dB

System Noise

Measurement Bandwidth	AI Noise
High Resolution (< 52.734kHz)	50 µVrms
High Speed Mode (52.734kHz to 128kHz)	65 µVrms

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Dynamic Range

(Vin = -60 dBFS)

Input Signal Frequency (f_{in})	Dynamic Range
1kHz	100 dB

SFDR

(Vin = -1 dBFS)

Input Signal Frequency (f_{in})	SFDR
1kHz	104 dB

1.2.3 Power Consumption

Status	Power	Condition	Connected I/O
Power off	3.6W	In shutdown mode with DC input and only USB keyboard/ mouse	Keyboard and mouse
System idle	11.2W	Under Windows Desktop with no application programs executed	Keyboard and mouse
System full load	25W	Under Windows with 100% CPU Utilization. Analog Input receiving data. Burn-in test 8.1 CPU loading	Keyboard and mouse USB Disk *2 COM port loopback. AI functioning.
Processor full load	35.2W	Under Windows with 100% CPU utilization and 2D/3D graphics load. Analog Input receiving data. Burn-in test 8.1 full running.	Keyboard and mouse USB Disk *2 COM port loopback AI functioning.

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Status	Power	Condition	Connected I/O
USB port full load	38W	With voltage de-rating at high environmental temperature Analog Input receiving data. Burn-in test 8.1 full running.	USB3.0 0.9A *2 full load USB2.0 0.5A*2 full load COM port loopback AI functioning



For heavy load situations in which power consumption may exceed 40W, it is strongly recommended to employ a larger power adapter. A 90W power adapter accessory is available by contacting your ADLINK representative.

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1.3 Mechanical Drawings

NOTE: All dimensions shown are in millimeters (mm) unless otherwise stated.

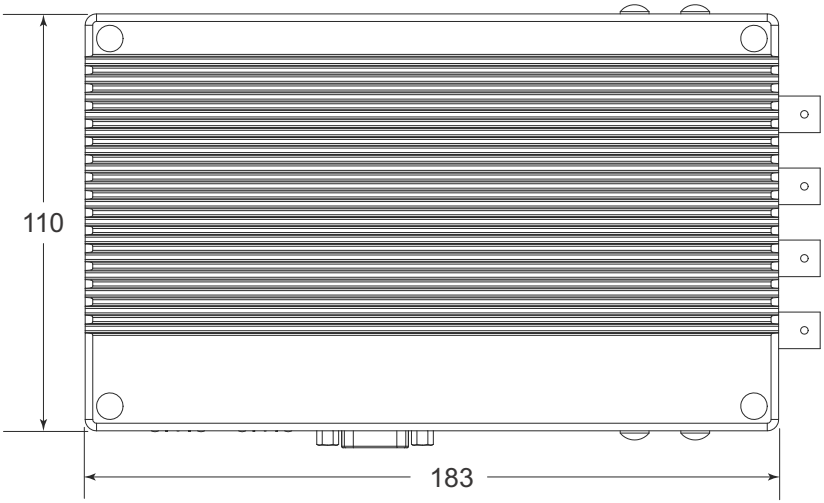


Figure 1-1: Top View (MCM-100)

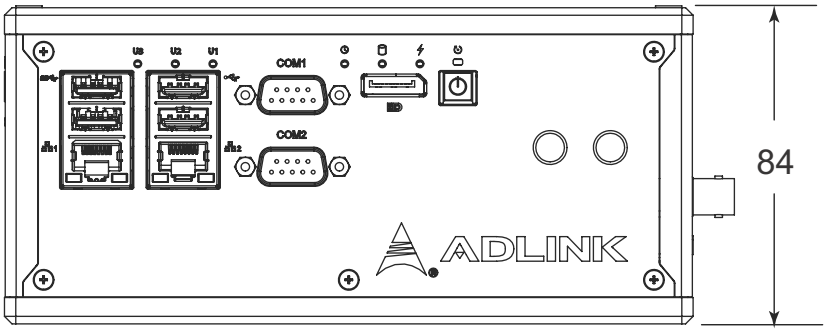


Figure 1-2: Front View

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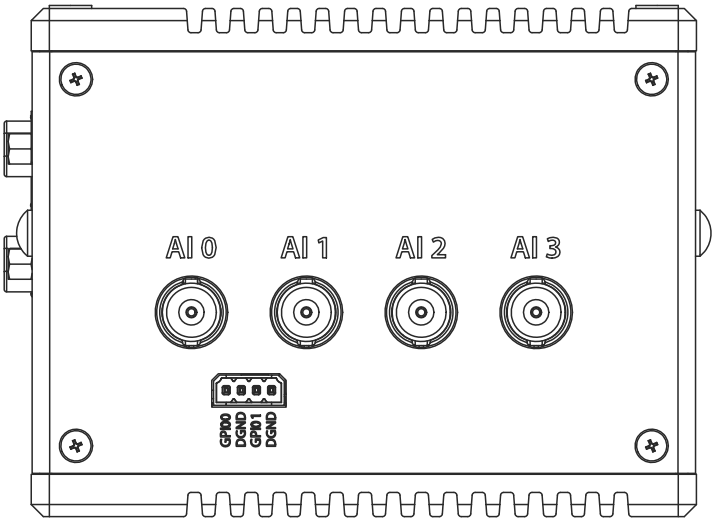


Figure 1-3: MCM-100 (Right) Side View

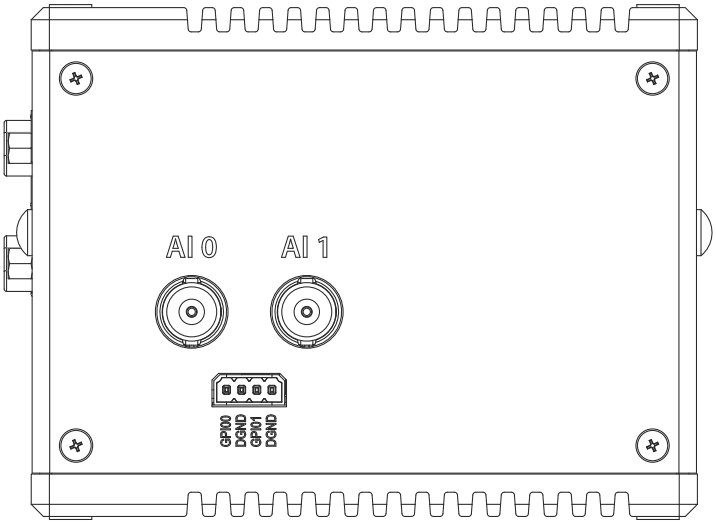


Figure 1-4: MCM-102 (Right) Side View

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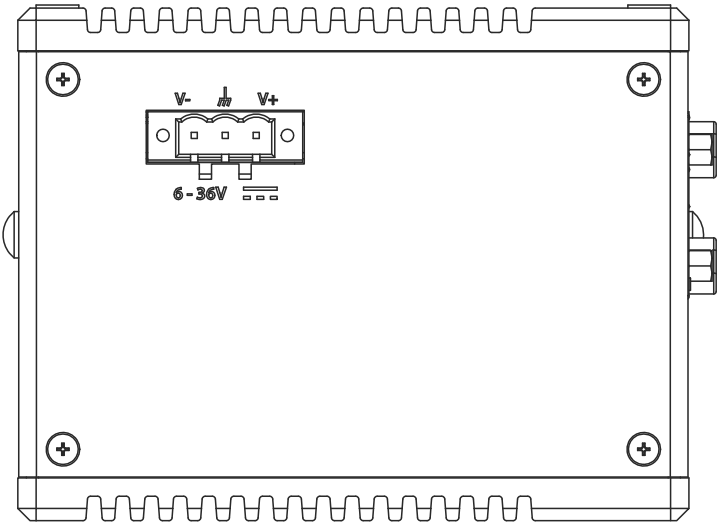


Figure 1-5: (Left) Side View

1.4 I/O Connectors

The following lists I/O connectors of the MCM-100/102, as labeled.



Figure 1-6: Front Panel I/O

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Figure 1-7: MCM-100 Right Side Panel I/O



Figure 1-8: MCM-102 Right Side Panel I/O

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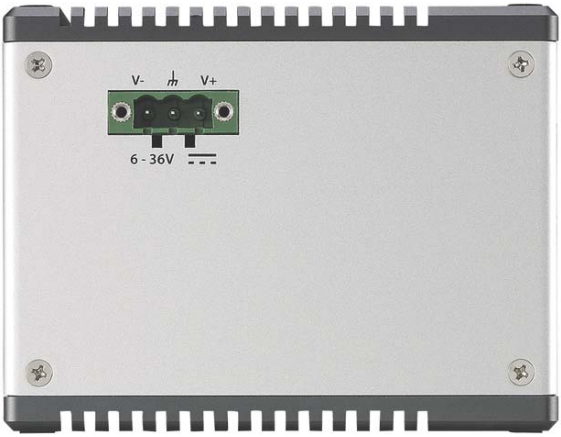


Figure 1-9: Left Side Panel I/O

- Power button
- Reset button
- Antenna port
- DisplayPort connector
- LED operation indicators (x3)
- LED user-defined indicators (x3)
- DB-9P COM ports (x2)
- GbE ports (x2)
- USB2.0 ports (x2)
- USB3.0 ports (x2)
- BNC (x4)
- 4-pin GPI/O w/ DGND
- DC power supply connector

1.4.1 Power Button

A non-latched push button with blue LED indicator. System is turned on when pressed, and the power LED lit. If the system hangs, depressing the button for 5 seconds powers down the system.

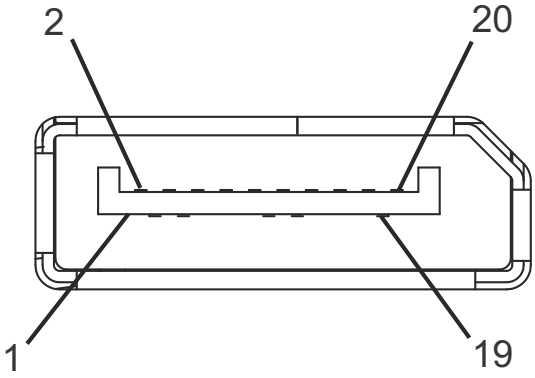
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1.4.2 Reset Button

The reset button executes hard reset for the MCM-100/102.

1.4.3 DisplayPort Connector

One DisplayPort connector on the front panel supports the DP1.2 standard specification, and can connect to VGA, DVI, HDMI, and Display Port monitors via DisplayPort to VGA adapter cable, DisplayPort to DVI adapter cable, or DisplayPort to HDMI adapter cable and Display Port cable, with DP1.2 support for resolutions up to 4096 x 2160 at 60Hz.



Pin	Signal	Pin	Signal
1	ML_Lane0_P	11	GND
2	GND	12	ML_Lane3_N
3	ML_Lane0_N	13	Config1
4	ML_Lane1_P	14	Config2
5	GND	15	Aux_P
6	ML_Lane1_N	16	GND
7	ML_Lane2_P	17	Aux_N
8	GND	18	Hot Plug
9	ML_Lane2_N	19	Return
10	ML_Lane3_P	20	DP_PWR_+3.3V

Table 1-1: DisplayPort Pin Assignment

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1.4.4 LED Indicators

In addition to the LED of the power button, three LEDs on the front panel indicate the following operations.

Indicator	Color	Description
Watchdog (WDT)	Yellow	Indicates watchdog timer status. Flashes when watchdog timer starts, and when timer is expired, system will auto-reboots.
HDD	Red	When blinking, indicates the SATA hard driver is active
Standby	Blue	Indicates the system is in power standby mode

Table 1-2: LED Operation Indicators

1.4.5 DB-9P COM Port Connector

Through D-sub 9-pin connectors, COM1 and COM2 support RS-232, RS-422, and RS-485 modes by BIOS setting.

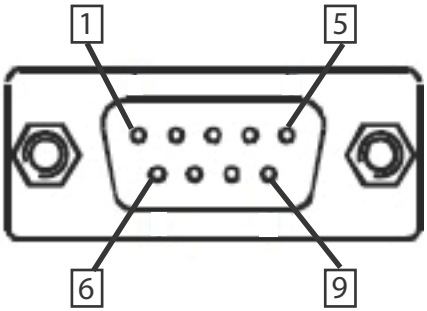


Figure 1-10: DB-9P COM Port

Pin	Signal		
	RS-232	RS-422	RS-485
1	DCD#	TXD422-	485-

Table 1-3: DB-9P COM Port Pin Assignment

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Pin	Signal		
2	RXD	TXD422+	485+
3	TXD	RXD422+	N/C
4	DTR#	RXD422-	N/C
5	GND	N/C	N/C
6	DSR#	N/C	N/C
7	RTS#	N/C	N/C
8	CTS#	N/C	N/C
9	RI#	N/C	N/C

Table 1-3: DB-9P COM Port Pin Assignment

1.4.6 Dual Gigabit Ethernet Ports

Two Gigabit Ethernet ports on the front panel support the Intel i210IT GbE controller, which provides:

- IEEE 802.3az Energy Efficient Ethernet
- IEEE 1588/802.1AS precision time synchronization
- IEEE 802.3av traffic shaper
- Interrupt moderation, VLAN support, IP checksum offload
- PCIe OBFF (Optimized Buffer Flush/Fill) for improved system power management
- Four transmit and four receive queues
- RSS and MSI-X to lower CPU utilization in multi-core systems
- ECC - error correcting memory in packet buffers
- Wake-On-LAN
- NC-SI for greater bandwidth passthrough
- Preboot eXecution Environment (PXE) flash interface support
- Jumbo frame support

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LED	LED Color	Status	Description
Active/Link	Yellow	OFF	Ethernet port is disconnected
		ON	Ethernet port is connected with no activity
		Flashing	Ethernet port is connected and active
Speed	Green/ Yellow	OFF	10 Mbps
		Green	100 Mbps
		Yellow	1000 Mbps

Table 1-4: Gigabit Ethernet Port LED Function

1.4.7 USB 3.0 Port

The USB 3.0 port supports Type A connection, compatible with SuperSpeed, Hi-Speed, full-speed and low-speed USB devices, with support for multiple boot devices, including USB flash, USB external HDD, and USB CD-ROM drivers and boot priority and boot device configured in BIOS.

NOTE:

When using USB CD-ROM via USB 3.0 port to re-install or repair the OS, cold boot should be utilized

1.4.8 BNC Connectors

Four BNC connectors are located on the right side of the MCM-100, and two are located on the right side of the MCM-102.

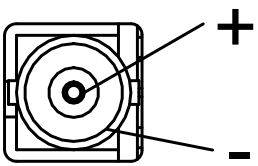


Figure 1-11: BNC Connector Polarity

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1.4.9 4-pin GPI/O w/ DGND Connector

The 4-pin removable spring terminal connector provides connection for GPI/O0, GPI/O1, and two DGND signals

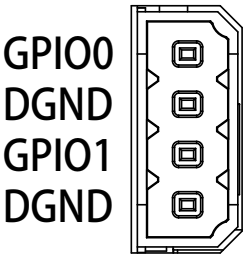


Figure 1-12: 4-pin GPI/O w/ DGND Connector

1.4.10 DC Power Supply Connector

Located on the left side panel.

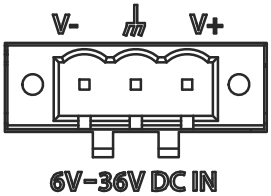


Figure 1-13: DC Power Connector

1.5 Adapters and Other Accessories

Device adaptors and other optional accessories should only be obtained through your ADLINK dealer. For more information, see “Getting Service” on page 101.

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2 Getting Started

2.1 Unpacking Checklist

Before unpacking, check the shipping carton for any damage. If the shipping carton and/or contents are damaged, inform your dealer immediately. Retain the shipping carton and packing materials for inspection. Obtain authorization from your dealer before returning any product to ADLINK. Ensure that the following items are included in the package.

- MCM-100/102 unit
- DIN rail brackets
- Wall mounting kit
- Screw pack for DIN rail, wall mounting, and storage fixing
- Quick Start Guide

2.2 Connecting DC Power



Before providing DC power to the MCM-100/102, ensure the voltage and polarity provided are compatible with the DC input. Improper input voltage and/or polarity can be responsible for system damage.

Active DC power sources must comply with LPS and SELV circuits with no energy hazard, as well as the following.

- IEC 60950-1:2005+A1:2009+A2: 2013
- Output voltage: 6 to 36VDC
- Output current: 4.2 to 0.7A minimum
- Tma: 50°C min.

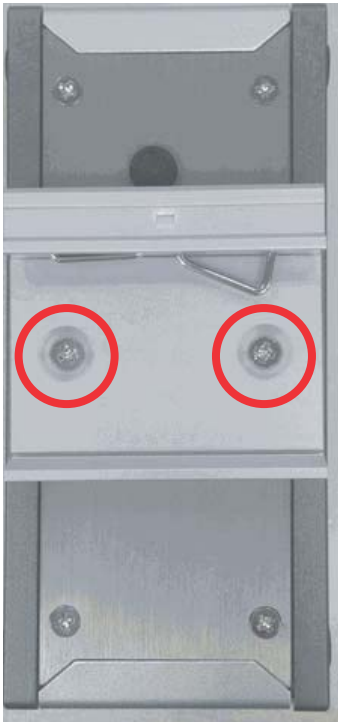
The DC power input connector of the MCM-100/102 utilizes V+, V- and chassis ground pins, and accepts input voltage as shown previously.

2.3 DIN Rail Mounting

The MCM-100/102 controller is shipped with wall-mounting brackets and accessory screws, with mounting procedures as follows.

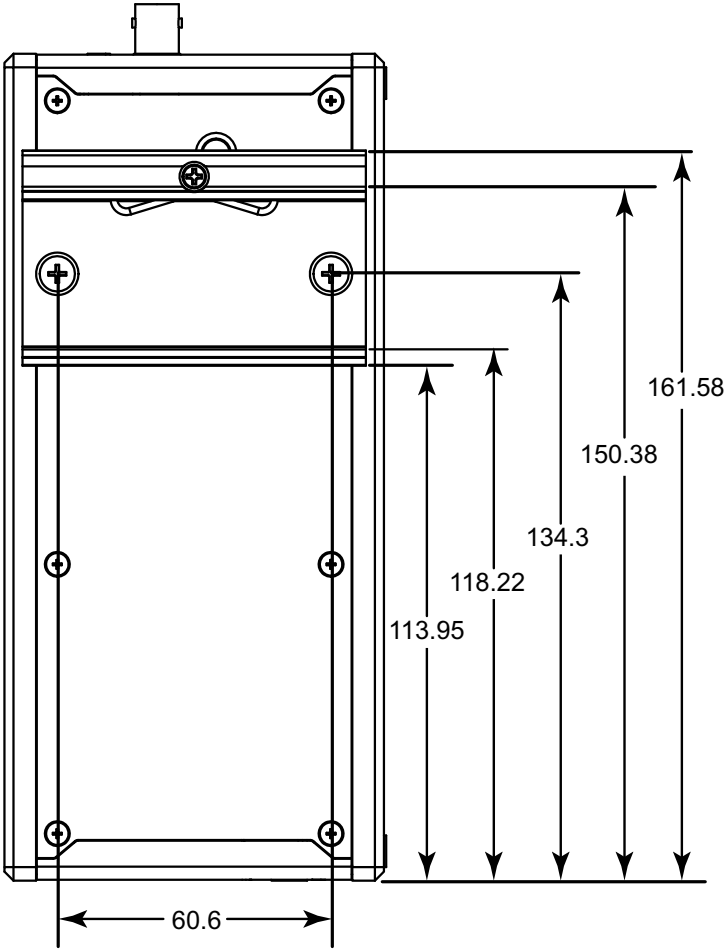
1. Prepare the DIN rail mounting bracket and 2 M4-F head screws.

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2. Use the 2 included M4-F head screws to fix the DIN rail bracket to the chassis, according to the spacing dimensions of the screw holes and brackets, as shown.

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161.58
150.38
134.3
118.22
113.95
60.6

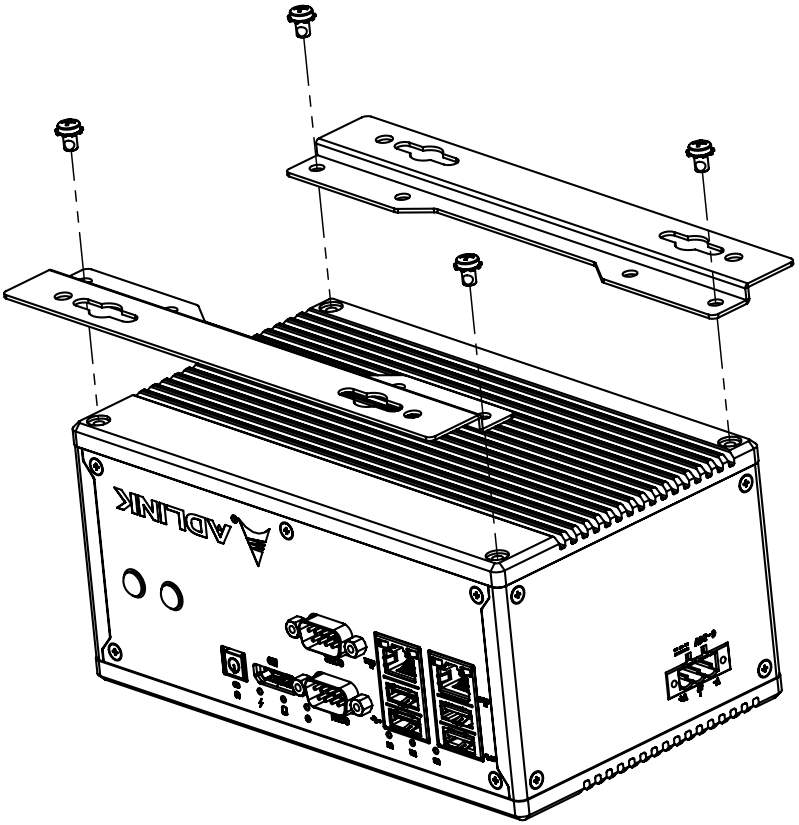
2.4 Wall Mounting

The MCM-100/102 ships with wall-mounting brackets and accessory screws, with mounting procedures as follows.

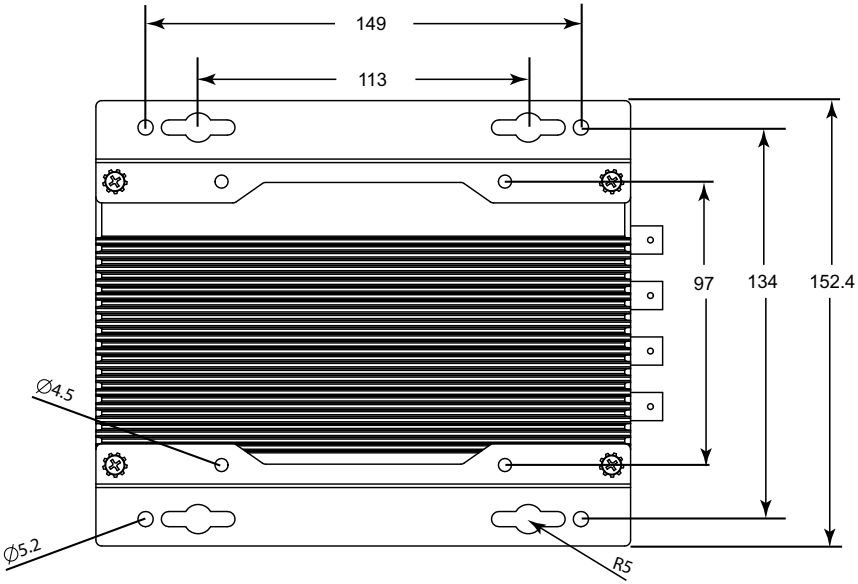
CAUTION:

While configuration shown may indicate otherwise, due to the presence of antenna ports, for safety, the device should ONLY be wall-mounted with the front and rear panels on the sides, NEVER on the top or underside.

Use the 4 M4 screws to fix the 2 wall-mount brackets to the chassis, according to the spacing dimensions of the screw holes and brackets. The MCM-100 is shown as an example.



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2.5 Cooling Considerations

Heat-generating components of the MCM-100/102 (such as CPU and PCH) are all situated on the left side of the system. These components directly contact the heat sink via thermal pads and dissipate heat generated by the components. To maximize efficiency of heat dissipation, maintain a minimum of 2 inches (5cm) clearance on the top of the MCM-100/102.

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2.6 Installing Mini-PCIe WiFi Module (Optional)

1. Remove all screws and internal mini-USB connector, separating the MCM-100/102 into five parts.



2. Fix bracket with two screws.

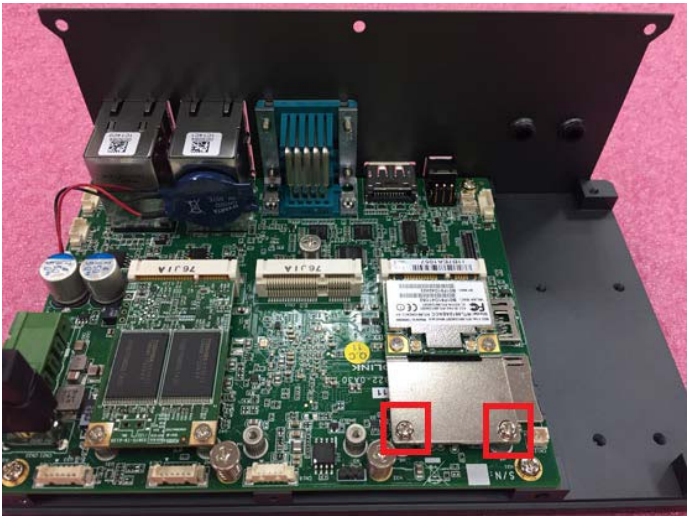


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3. Insert mini-PCIe WiFi module into the carriage at an angle.



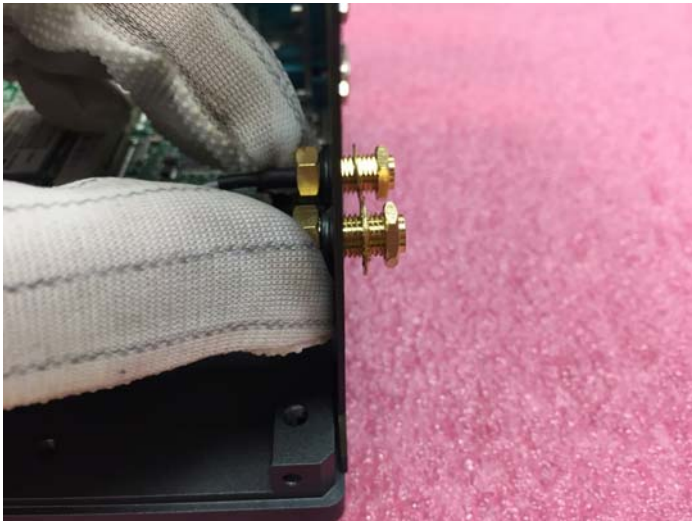
4. Depress the module until seated and fix with two M2.5-P-head-L5 screws.



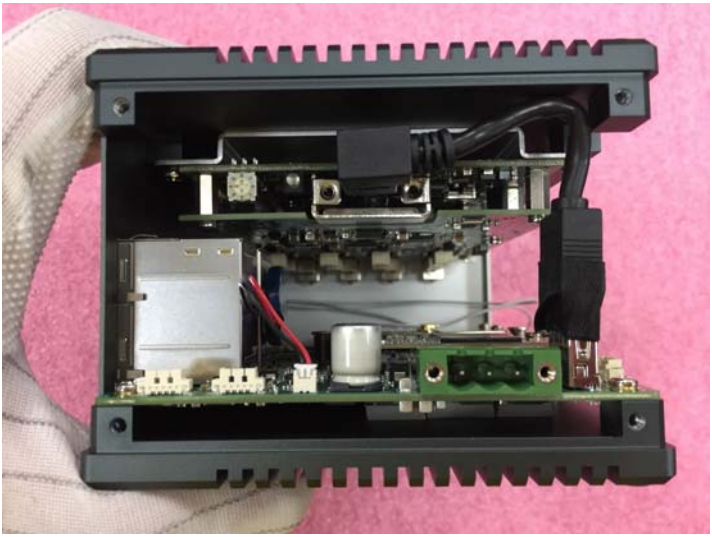
5. Connect SMA-to-IPEX cable to WiFi module.



6. Remove plastic cap and mount SMA connectors.



7. Reassemble all parts and connect mini-USB, fixing the chassis with screws.



8. Connect antenna to SMA connector



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3 Driver & Application Installation

After installing the operating system, all related drivers must be installed for the system to function properly. This section describes the drivers needed for Windows operating systems and the procedures to install them. For other OS support, please contact ADLINK for further information.

Install drivers as follows.

1. Fully install Microsoft Windows OS before installing any drivers. Most standard I/O device drivers have been included in Microsoft Windows OS. For Windows 10 IoT Enterprise users, please note that you need Administrator privilege to install the drivers properly.
2. Install the chipset driver.
3. Install the graphics driver.
4. Install the Ethernet driver.
5. Install the USB 3.0 driver
6. Install the I/O controller
7. Install the SEMA utility, WDT and DI/O drivers.
8. Install AI and DI/O drivers

3.1 Installing the Chipset Driver

The chipset driver directs the operating system to configure the Intel® chipset components in order to ensure that the following features function properly:

- SATA Storage Support
- USB Support
- Identification of Intel® Chipset Components in the Device Manager

Windows 10 IoT Enterprise must be fully installed and running on the system before installing this software:

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To install the chipset driver for the MCM-100/102

1. Close any running applications.
2. From ADLINK's website, download Windows 10 IoT Enterprise drivers for the MCM-100/102.
3. Execute Setup.exe and follow onscreen instructions to complete the setup.
4. After installation is complete, reboot the system.

3.2 Installing the Graphics Driver

The MCM-100/102 is equipped with the Intel® Graphics Media Accelerator Driver package, which supports Windows 10 IoT Enterprise.

To install the graphics driver:

1. Close any running applications.
2. From ADLINK's website, download Windows 10 IoT Enterprise drivers for the MCM-100/102.
3. Execute Setup.exe and follow onscreen instructions to complete the setup.
4. After installation is complete, reboot the system.

3.3 Installing the Ethernet Driver

To install the driver for the Intel I210 Gigabit Ethernet controller:

1. Close any running applications.
2. From ADLINK's website, download Windows 10 IoT Enterprise drivers for the MCM-100/102.
3. Execute autorun.exe and follow onscreen instructions to complete the setup.
4. After installation is complete, reboot the system.

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3.4 Installing the USB 3.0 Driver

To install the driver for the USB 3.0 controller:

1. Close any running applications.
2. From ADLINK's website, download Windows 10 IoT Enterprise drivers for the MCM-100/102.
3. Launch setup.exe and follow onscreen instructions to complete the setup.
4. After installation is complete, reboot the system.

3.5 Installing the I/O Controller Driver

To install the driver for the I/O controller:

1. Close any running applications.
2. From ADLINK's website, download Windows 10 IoT Enterprise drivers for the MCM-100/102.
3. Execute setup.msi and follow onscreen instructions to complete the setup.
4. After installation is complete, reboot the system.

3.6 Installing the SEMA Utility, WDT and DI/O Drivers

The MCM-100/102 supports ADLINK Smart Embedded Management Utility with features as follows.

- System Health for real time CPU, system temperature, total/current uptime
- User-defined 1KB Flash
- Watchdog Timer
- Hardware Monitoring for input voltage levels and current power consumption

A WDT (watchdog timer) is a hardware mechanism resetting the system when the operating system or application is halted. A typical usage of WDT is to start the timers and periodically reset the timer, and when timer is expired, the system resets. SEMA utility installation is required to access the WDT function.

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To install the SEMA utility, WDT and DI/O drivers:

1. Close any running applications.

   From ADLINK's website, download Windows 10 IoT Enterprise drivers for the MCM-100/102.

2. Execute Setup.exe and follow onscreen instructions to complete the setup.

After installation is complete, reboot the system.


NOTE:

Administrator privilege is required to use the API in Windows 10 IoT Enterprise.

Complete document support for SEMA utility can be found at:

https://www.adlinktech.com/Products/Industrial_IoT_and_Cloud_solutions/SEMA_Smart_Embedded_Management_Agent/SEMA?lang=en

3.7 Installing AI and DI/O Drivers

MAPS Core

MAPS Core utilizes advanced 32/64-bit kernel drivers for customized DAQ application development. MAPS Core enables detailed operations for superior performance and reliability from data acquisition systems. MAPS kernel drivers now support Windows 7/10 OS.


NOTE:

Only MAPS Core versions 18.10 and later are supported by the MCM-100/102.

Install the MAPS Core Installer Suite, available for download from the ADLINK website.

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DAQ-LVIEW Plus

The task-oriented SDK supports LVOOP VI and Polymorphic VI for LabVIEW.

Download DAQ-LVIEW Plus from the ADLINK website.

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4 Operation

Operation of the MCM-100/102 is described here to assist in configuration and programming of the module. Functions addressed include analog input and GPI/O.

4.1 Analog Input

4.1.1 Analog Input Front End Configuration

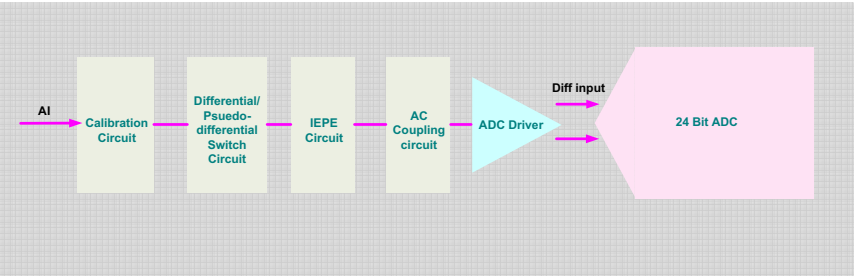


Figure 4-1: MCM-100/102 Analog Front End

Input Configuration: Differential/Pseudo-Differential

Differential input mode provides anode and cathode inputs of the BNC connector that respond to signal voltage differences therebetween. If the signal source is ground-referenced, the differential input mode can be used for common-mode noise rejection.

If the signal source is a floating signal, setting pseudo-differential input mode will provide a reference ground connected to the cathode input of the BNC through a 20 kΩ resistor.

Recommended configurations for the signal sources are as follows.

Signal Source	Card Configuration
Floating	Pseudo-differential
Ground-reference	Differential

Table 4-1: Signal Source-Card Configuration

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Input Coupling

When DC coupling is selected, DC offset present in the input signal is passed to ADC. DC coupling configuration is indicated when the signal source has a small offset voltage or if the DC content of the signal is important. When AC coupling is selected, DC offset present in the input signal is removed. AC coupling configuration is indicated when the DC content of the input signals is to be rejected. AC coupling enables a high pass R-C filter through the input signal path, with corner frequency (-3dB) about 0.4 Hz.

IEPE Input

For applications utilizing sensors such as accelerometers or microphones, the MCM-100/102 provides an excitation current source.

The excitation current is 2 mA for the IEPE sensors, with DC voltage offset generated because of the excitation current and sensor impedance. When enabling IEPE current sources, the MCM-100/102 automatically sets input configuration to AC coupling.

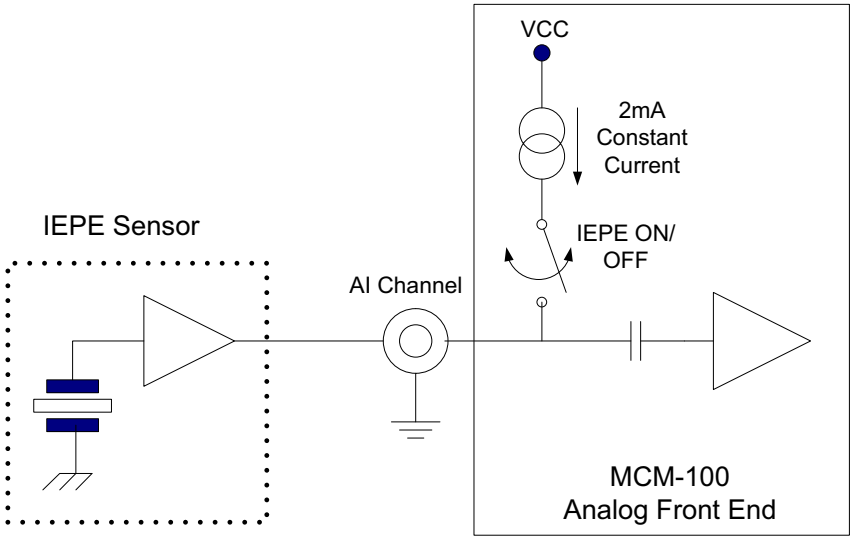


Figure 4-2: Excitation Current for IEPE Sensor Measurement

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4.1.2 AI Data Format

When an A/D converter is used, properties of the signal to be measured must be ascertained to determine the channel to be used and connections to the card. After A/D conversion, the A/D data is buffered in a Data FIFO, for transfer to memory for further processing. Transfer characteristics of various input ranges of the MCM-100/102 are as follows, with data format 2's complement.

Description	Bipolar Analog Input Range	Digital Code
Full-scale Range	±10V	
Least significant bit	1.19uV	
FSR-1LSB	9.99999881V	7FFFFFh
Midscale +1LSB	1.19uV	000001h
Midscale	0V	000000h
Midscale –1LSB	-1.19uV	FFFFFFh
-FSR	-10V	800000h

Table 4-2: MCM-100/102 Input Ranges

4.1.3 Sampling Rate

To drive the sigma-delta ADC, an onboard timebase clock is applied, with frequency exceeding the sampling rate, produced from a DDS (Direct Digital Synthesis) chip. The output frequency of the DDS chip is programmable, with excellent resolution.

DDS Timing/Sampling Rate

Mode	High Resolution	High Speed
Sampling Rate	1 kHz ~ 52.734 kHz	52.734 kHz ~ 128 kHz
fCLK/fDATA	512	256
DDS CLK	512kHz to 26.999808MHz	13.499904 MHz to 2.768 MHz
Sampling Rate Resolution	0.0003 Hz	0.0003 Hz

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4.1.4 Data Transfer

Software Polling Data Transfer (Non-Buffering Programmed I/O)

Polling mode supports flexible timing and is suitable for retrieving recent data without FIFO buffering latency. The MCM-100/102 continuously updates the most recently acquired data onto a data port for specific channels. Data not retrieved in time is overwritten with new data without notification. The UD-DASK Function Library Reference provides corresponding software API details.

Continuous Acquisition Mode

Differs from software polling mode only in the generation of block data in continuous acquisition mode without the need to consider data overwriting or acquiring repeat data in software polling mode. This mode is suitable for when continuous data is to be acquired in a fixed and precise time interval. Please note the data buffer size must be a multiple of 256 in continuous acquisition mode. The UD-DASK Function Library Reference provides corresponding software API details.

4.1.5 Anti-Aliasing Filter and Frequency Response

The filter limits the bandwidth of the signal path and rejects out-of-band noise. The digital filter of the Sigma-Delta ADC sets the overall frequency response, using multi-stage FIR topology to provide linear phase with minimal passband ripple and high stopband attenuation. These image frequencies, if present in the signal and not externally filtered, will fold back (or alias) into the passband, causing errors. The stopband of the ADC provides 100dB attenuation of frequencies that begin just beyond the passband and continue out to ADC over-sampling rate. The MCM-100/102 provides an anti-aliasing, low-pass, simple RC filter in front of the ADC inputs to limit possible high amplitude out-of-band signals and noise.

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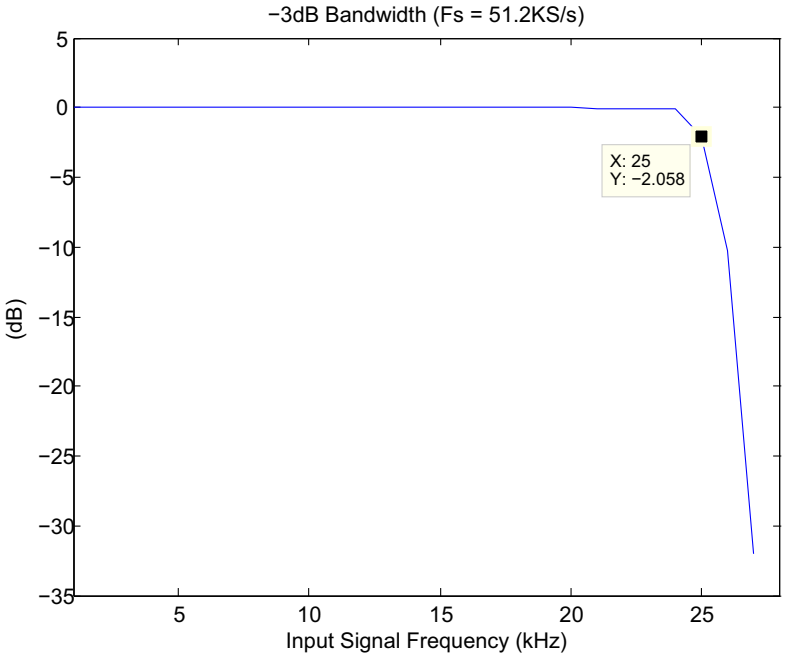


Figure 4-3: Input Frequency Response for High Resolution Mode

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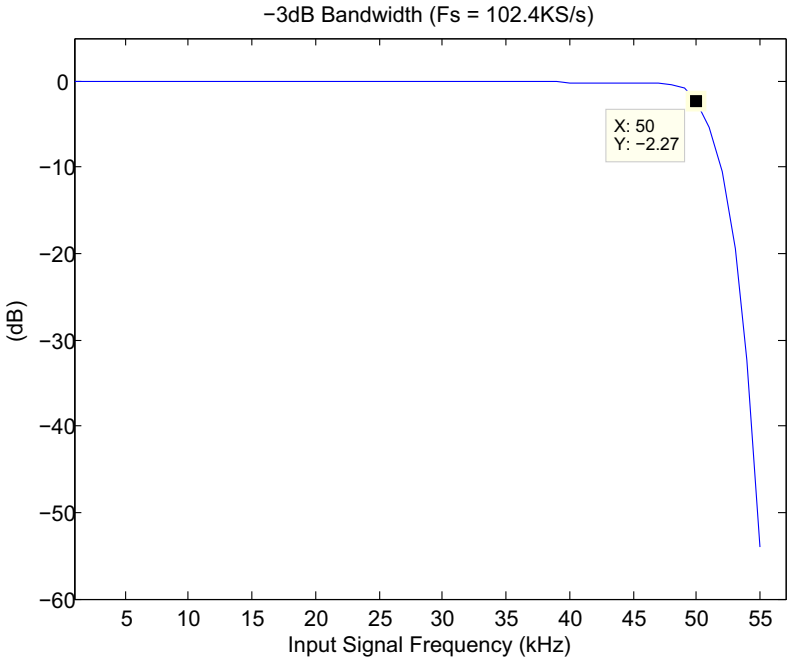


Figure 4-4: Input Frequency Response for High Speed Mode

4.2 Triggering

The MCM-100/102 supports flexible trigger sources and trigger modes for analog input functionality. The trigger source can originate with software command, external analog, or external digital signal in continuous analog input mode. Trigger source and mode are programmable by software.

4.2.1 Analog Input Trigger Source

Software Triggering

This trigger mode requires no external trigger signals. The trigger asserts immediately following execution of the specified function calls to begin the operation.

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External Analog Trigger

The analog multiplexer can select one input channel as the analog trigger source. That is, one of 4 input channels can be selected as the analog trigger source. An external analog trigger occurs when the analog trigger signal crosses above (above high) or below (below low) the pre-defined voltage level. The range of trigger level is the full-scale range of the selected input channel and the resolution is 24-bit. In external analog trigger mode, the first acquired data starts with a delay time of 1/(sampling rate).

Below-Low Analog Triggering

As shown, the trigger signal is generated when the input analog signal is less than the Low_Threshold voltage. High_Threshold setting is not used in this triggering situation.

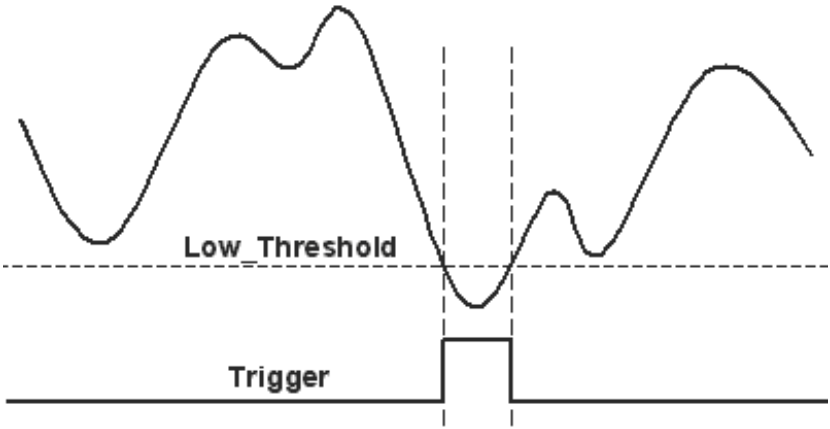


Figure 4-5: Below-Low Analog Triggering

Above-High Analog Triggering

As shown, the trigger signal is generated when the input analog signal exceeds the High_Threshold voltage. Low_Threshold setting is not used in this triggering situation

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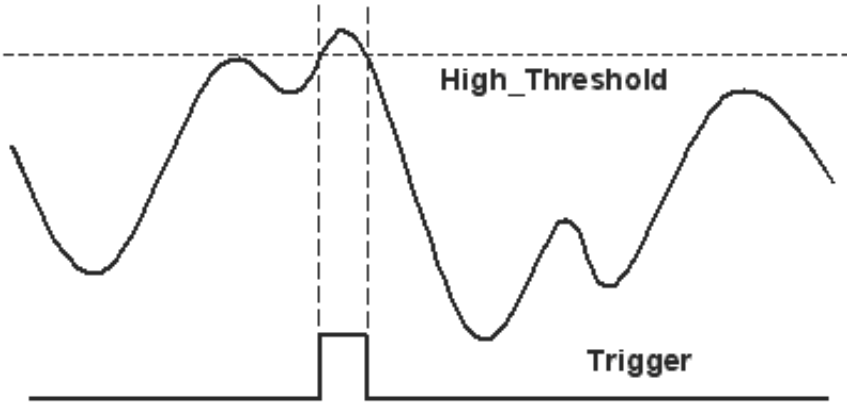


Figure 4-6: Above-High Analog Triggering

External Digital Triggering

An external digital trigger occurs when a rising or falling edge is detected on the digital signal connected to the GPI/O pin. Trigger polarity can be programmed using ADLINK software drivers.

NOTE:

Signal level of the external digital trigger signals should be 3/3V/TTL-compatible, with a minimum pulse of 20ns.

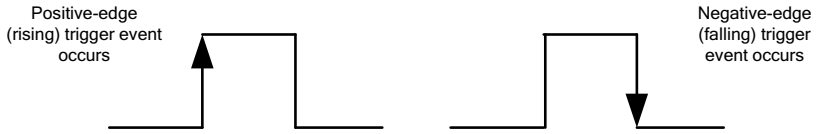


Figure 4-7: Digital Triggering

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Trigger Modes

Analog input supports post, delay, middle, gate, post trigger with retrigger, and delay trigger with retrigger modes.

Post-Trigger Acquisition Mode (no retrigger)

Post-trigger acquisition is indicated in applications where data is to be collected after a trigger event, as shown.

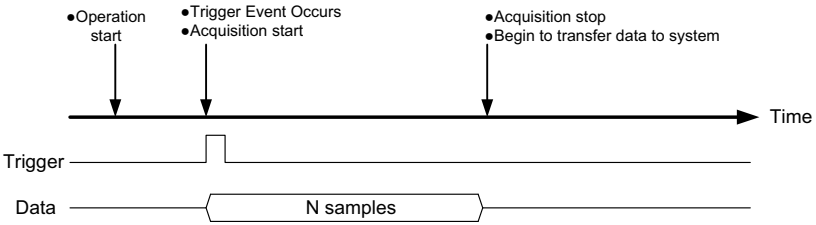


Figure 4-8: Post Trigger without Retrigger

Pre-trigger Acquisition (no retrigger)

Collects data before the trigger event, with acquisition starting once specified function calls are executed to begin the pre-trigger operation, and stopping when the trigger event occurs. If the trigger event occurs after the specified amount of data has been acquired, the system stores only data preceding the trigger event by a specified amount, as shown. Note that N must be equal to or less than 8k samples for all analog input channels.

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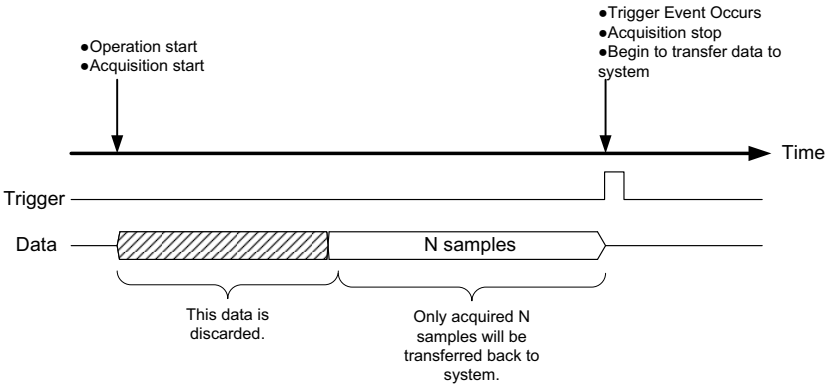


Figure 4-9: Pre-trigger Mode Operation (valid trigger only)

The trigger event occurs after the specified amount of data has been acquired. However, if the trigger event occurs before the specified amount of data has been acquired, the acquisition engine ignores the trigger signal until the specified amount of data has been acquired, as shown.

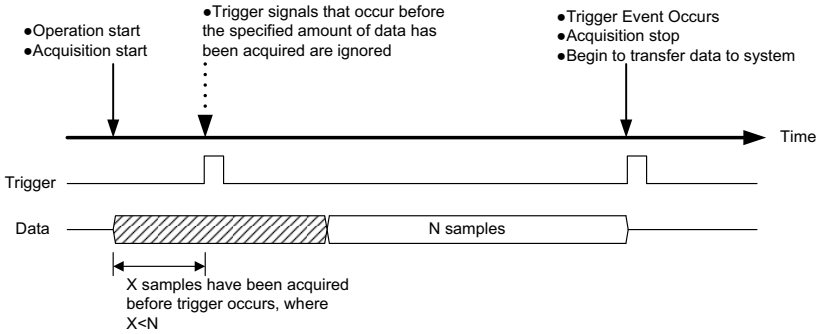


Figure 4-10: Pre-trigger Mode Operation (w/ invalid trigger)

Delay-Trigger Acquisition (no retrigger)

Delays data collection after the trigger event, as shown. The delay count is specified by a 32-bit counter value, such that the maximum delay count is (2^{32}-1) when the minimum delay count is 1.

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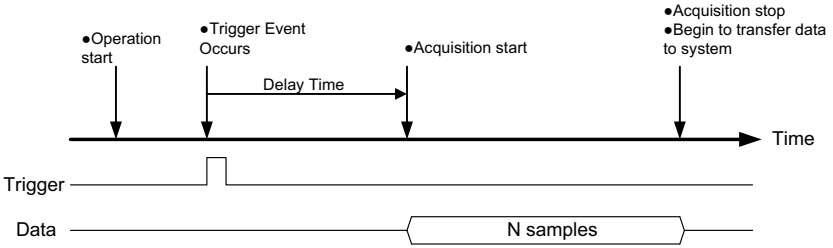


Figure 4-11: Delay-Trigger Mode Operation

Middle-Trigger Acquisition

Middle-trigger acquisition is indicated when data is to be collected before and after the trigger event. The amount of stored data before and after trigger event can be set individually (M and N samples), as shown. Please note that M+N must be equal to or less than 8k samples for all analog input channels, and that the trigger event can only be accepted when the specified amount of data has been acquired (M samples), otherwise the trigger event will be ignored.

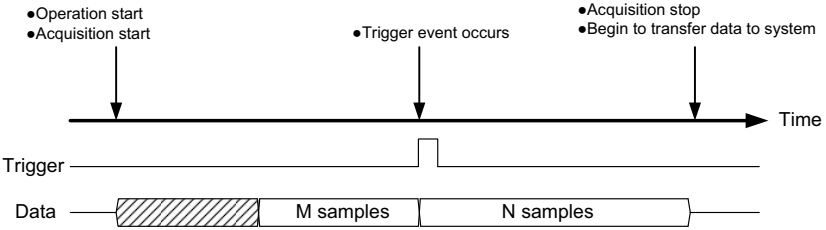


Figure 4-12: Middle-Trigger Acquisition

Gated Trigger

Gated-trigger acquisition is indicated in applications where data is to be collected when trigger events are set to level high/low, and acquisition suspended when trigger events are set to the opposite level. The process repeats until the specified amount of data is acquired.

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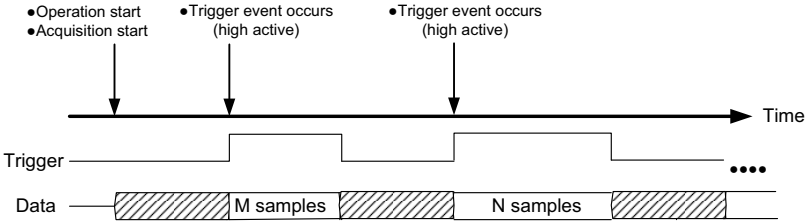


Figure 4-13: Gated Trigger

Post-Trigger or Delay-Trigger Acquisition with Re-Trigger

Post-trigger or delay-trigger acquisition with re-trigger function is indicated in applications where data is to be collected after several trigger events. The number of scans after each trigger and the re-trigger number are valid from 1 to the buffer size allocated in kernel space. The process repeats until the specified amount of re-trigger signals is detected.

4.3 Programmable Function I/O

The MCM-100/102 supports powerful programmable I/O function provided by an FPGA chip, configurable as static digital input/output, 32-bit frequency counters, pulse output, synchronization sample clock IN, and trigger IN. These signals are single-ended and 3.3 V/ TTL-compliant.

4.3.1 Static Digital Input/Output

Programmable function I/O can be used as static digital inputs or outputs, with I/O lines readable and writeable by software polling, with sample and update rate fully controlled by software timing.

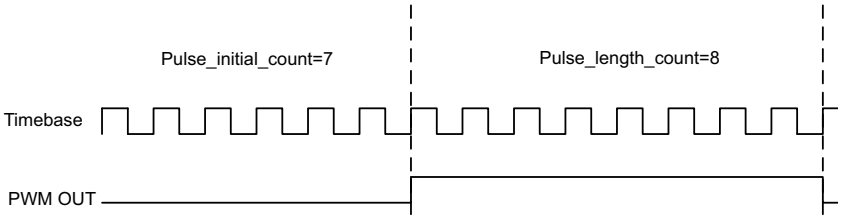
4.3.2 Frequency Counter

Calculates base clocks occurring within a period (rising edge to rising edge or falling edge to falling edge) of the repetitive input signal, which is then converted to frequency value. Counter polarity can be adjusted to rising edge active or falling edge active, with maximum frequency measurable of 4MHz.

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4.3.3 Pulse Output

The GPI/O can also simulate a pulse output. By setting a varying amount of Pulse_initial_cnt and Pulse_length_cnt, varying pulse frequencies and duty cycles can be obtained. The maximum output frequency is 4MHz, as shown.



Calculation of the pulse frequency and duty cycle is as follows.

$$F_{PWM} = \frac{F_{Timebase}}{Pulse_initial_cnt + Pulse_length_cnt}$$

$$Duty_{PWM} = \frac{Pulse_length_cnt}{Pulse_initial_cnt + Pulse_length_cnt}$$

4.3.4 Digital Trigger IN for Continuous Analog Input

The GPI/O can be programmed as the digital trigger source for continuous analog input acquisition. See “External Digital Triggering” on page 42. for details.

4.3.5 Synchronization Sample Clock IN

To synch multiple devices, the GPI/O can be programmed as external sample clock input, with the same trigger signal and external sample clock applicable to multiple MCM-100/102s to achieve more than 4 channel synchronization without phase delay. Note the synchronization sample clock must be continuous, with valid frequency range from 1 kHz to 128 kHz.

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5 Calibration

This chapter introduces the process of calibrating the MCM-100/102 to optimize AD measurement.

5.1 Loading Calibration Constants

The MCM-100/102 is factory-calibrated before shipment, with associated calibration constants of the TrimDACs firmware written to the onboard EEPROM. TrimDACs firmware is the algorithm in the FPGA. Loading calibration constants entails loading the values of TrimDACs firmware stored in the onboard EEPROM.

ADKLINK provides a software utility that automatically reads the calibration constants, if necessary.

Dedicated space for storing calibration constants is provided in the EEPROM. In addition to the default bank of factory calibration constants, there is one user-utilization bank, allowing loading of the TrimDACs firmware values either from the original factory calibration or a subsequently-performed calibration.

Since measurement errors may vary depending on time and temperature, it is recommended that the MCM-100/102 module be calibrated in the existing testing environment, as follows.

5.2 Auto-Calibration



The MCM-100/102 module should be warmed up for at least 15 minutes before initiating auto-calibration.

The MCM-100/102 auto-calibration utility measures and corrects almost all calibration errors with no requirement for external signal connection, reference voltage, or measurement devices. An onboard calibration reference is provided to ensure accuracy of auto-calibration. The reference voltage is measured in the production line by a digital potentiometer and compensated in the software. The calibration constant is stored after auto-calibration.

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5.3 Saving Calibration Constants

Factory-calibrated constants are permanently stored in a bank of the onboard EEPROM and cannot be modified. When the device is recalibrated through auto-calibration, the software stores the new constants in a user-configurable section of the EEPROM. To restore original factory calibration settings, the software can copy the factory-calibrated constants to the user-configurable section of the EEPROM. When auto-calibration is complete, the new calibration constants can be saved to the user-configurable banks in the EEPROM.

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Appendix A BIOS Setup



BIOS options in the manual are for reference only, and are subject to configuration. Users are welcome to download the latest BIOS version from the ADLINK website.

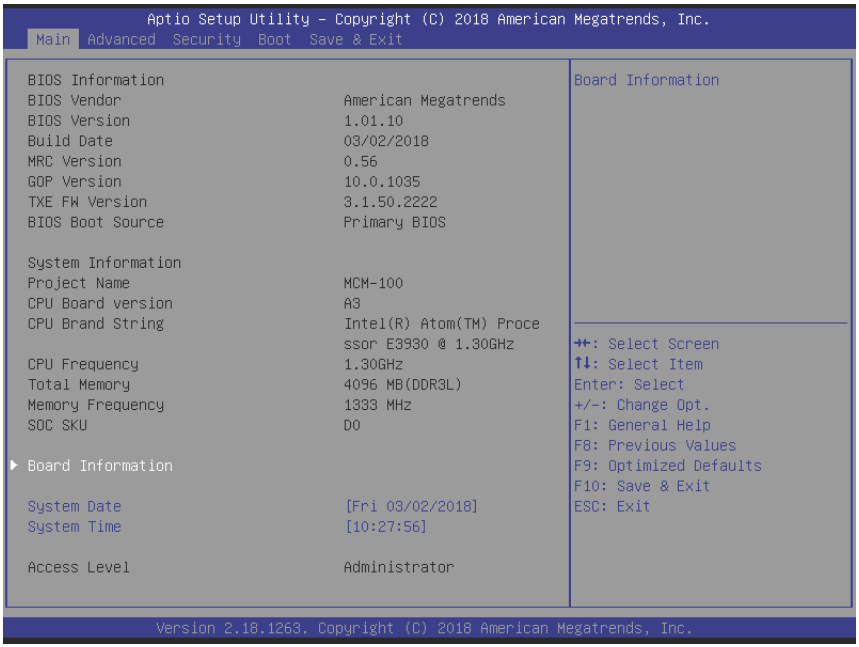
The Basic Input/Output System (BIOS) is a program that provides a basic level of communication between the processor and peripherals. In addition, the BIOS also contains codes for various advanced features applied to the MCM-100/102. The BIOS setup program includes menus for configuring settings and enabling features of the MCM-100/102. Most users do not need to use the BIOS setup program, as the MCM-100/102 ships with default settings that work well for most configurations.



Changing BIOS settings may lead to incorrect controller behavior and possible inability to boot. In such a case, Section B.2.5 Clear CMOS Jumper on page 91 provides instruction on clearing the CMOS and restoring default settings

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A.1 Main



A.1.1 BIOS Information

Shows current system BIOS core version, BIOS version and Board version.

A.1.2 System Time/System Date

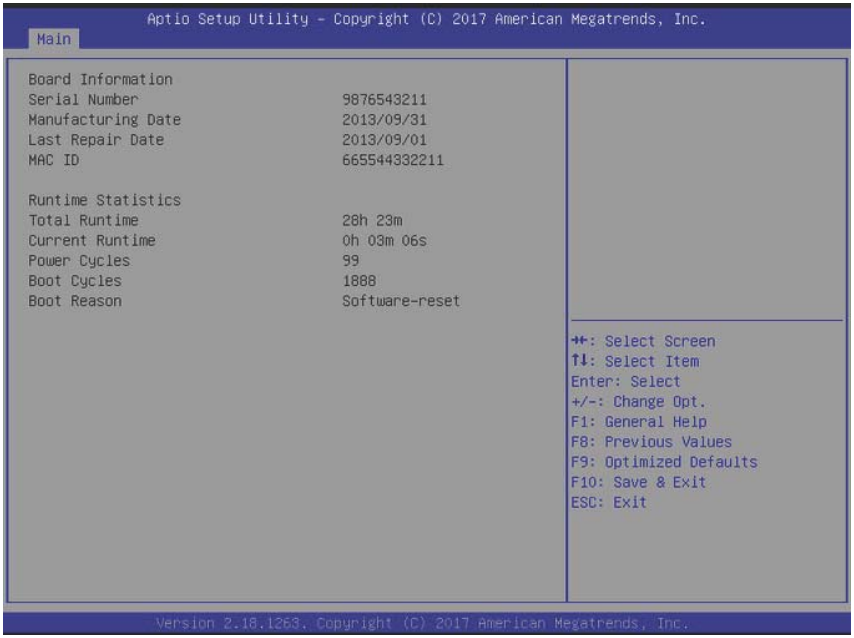
Changes system time and date. Highlight System Time or System Date using the up or down <Arrow> keys. Enter new values using the keyboard then <Enter>. Use < Tab > to move between fields. The date must be entered in MM/DD/YY format. The time is entered in HH:MM:SS format.

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NOTE:

The time is in 24-hour format, for example, 5:30 A.M. appears as 05:30:00, and 5:30 P.M. as 17:30:00.

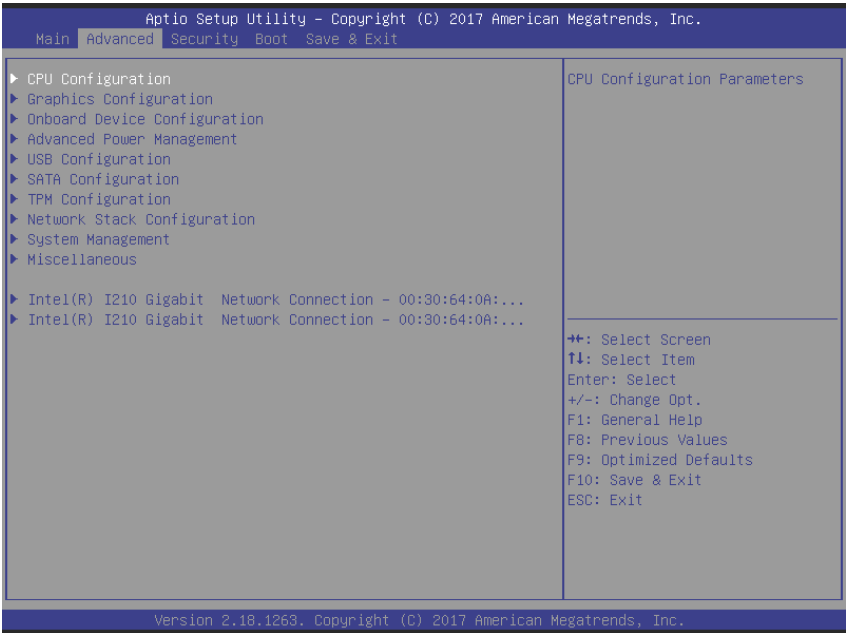
A.1.3 Board Information



Displays serial number, manufacturing date, last repair date, and MAC ID. As well, Runtime Statistics are listed, including total runtime, current runtime, power cycles, boot cycles, and boot reason.

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A.2 Advanced

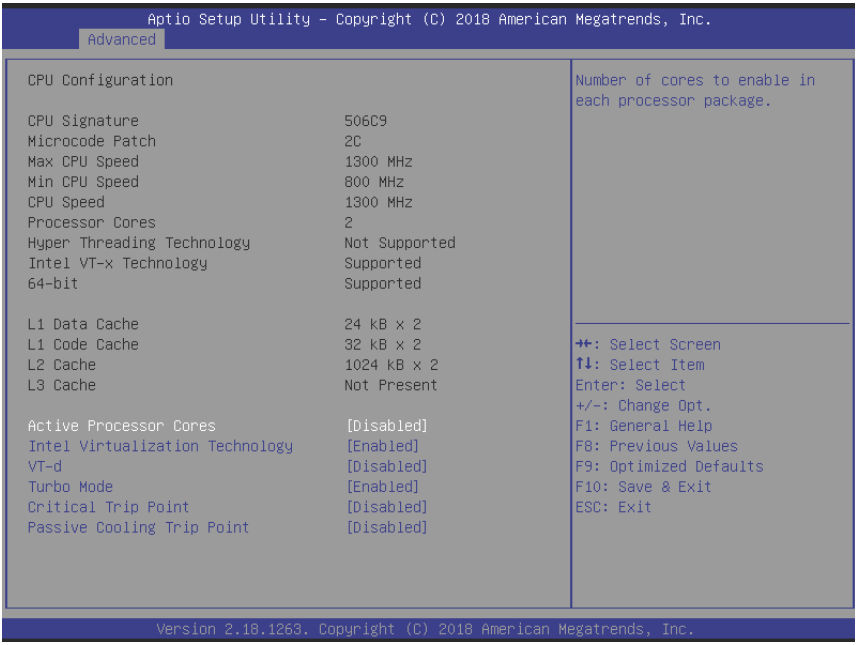


CAUTION:

Setting incorrect or conflicting values in Advanced BIOS Setup may cause system malfunction.

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A.2.1 CPU Configuration



Active Processor Cores

Number of cores to enable in each processor package.

Intel Virtualization Technology

When enabled, allows a VMM to utilize the additional hardware capabilities provided by Vanderpool Technology

VT-d

Enables/disables CPU VT-d

Turbo Mode

Enables/disables Turbo Mode.

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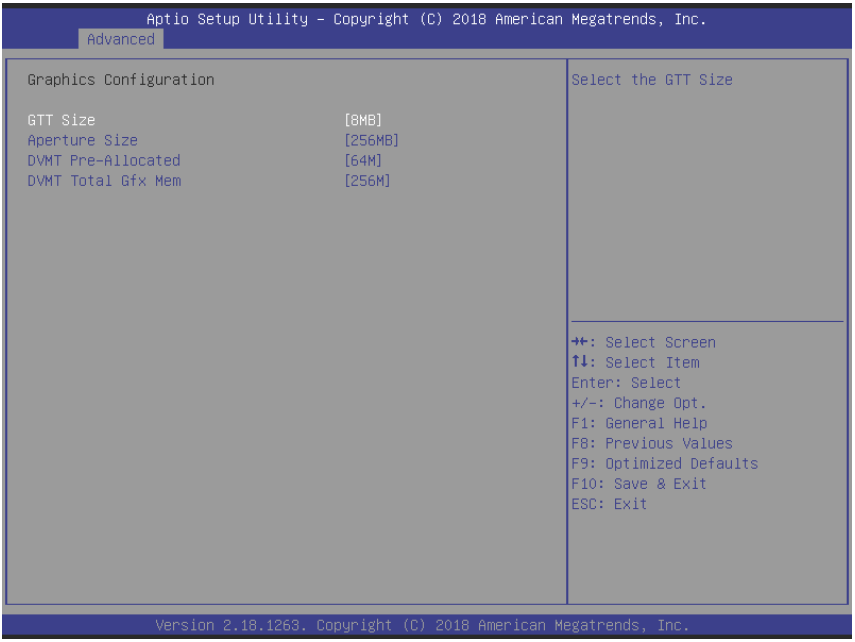
Critical Trip Point

Temperature threshold of the Critical Trip Point.

Passive Cooling Trip Point

Temperature threshold of the Passive Cooling Trip Point.

A.2.2 Graphics Configuration



GTT Size

Sets GTT size

Aperture Size

Sets aperture size

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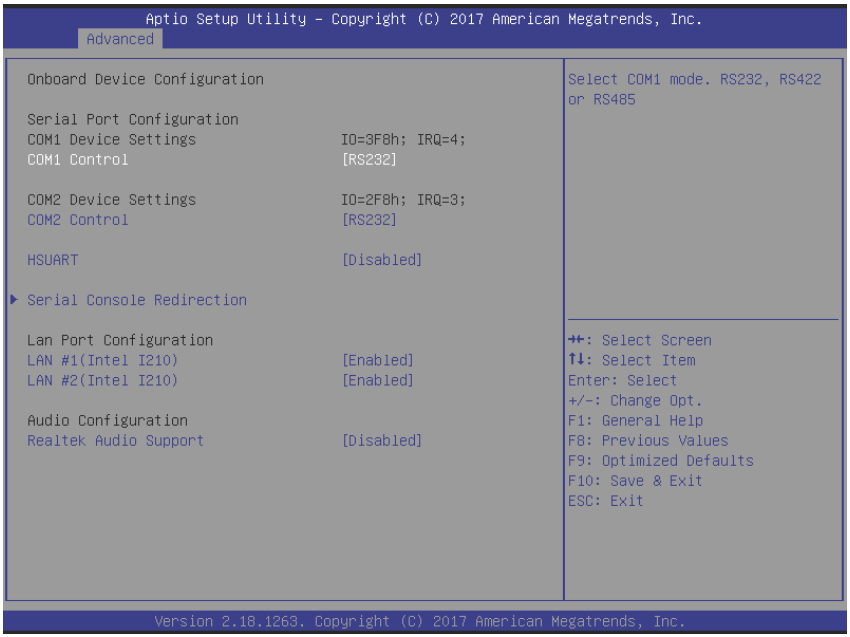
DVMT Pre-Allocated

Sets size of DVMT 5.0 pre-allocated (fixed) graphics memory used by internal graphics device

DVMT Total Gfx Mem

Sets size of DVMT5.0 total graphic memory used by internal graphics device

A.2.3 Onboard Device Configuration



COM1 Control

Selects COM1 mode from among RS232, RS422, and RS485.

COM2 Control

Selects COM2 mode from among RS232, RS422, and RS485.

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HSUART

Enables/disables LPSS HSUART support.

LAN #1 (Intel I210)

Enables/disables LAN device #1.

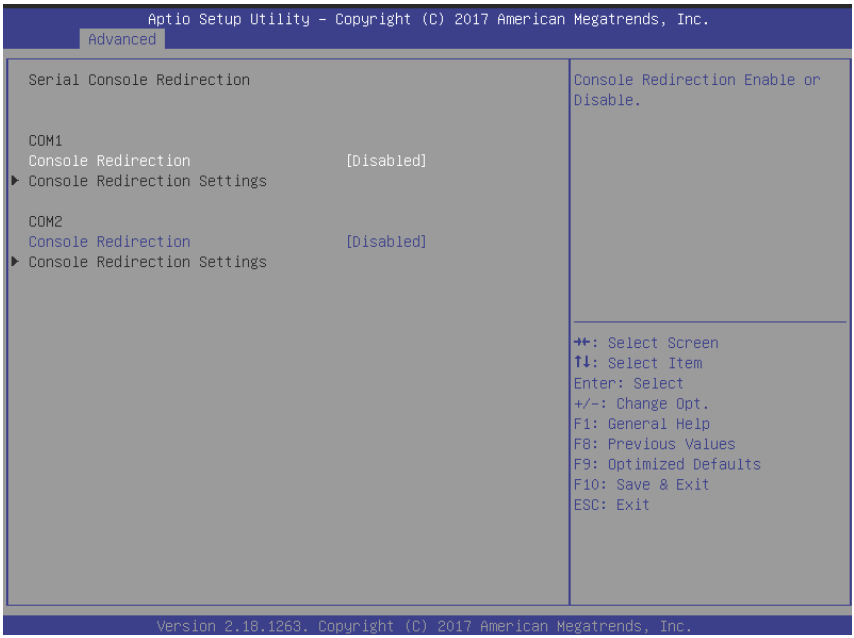
LAN #2 (Intel I210)

Enables/disables LAN device #2.

Realtek Audio Support

Enables/disables Realtek audio device.

Serial Console Redirection



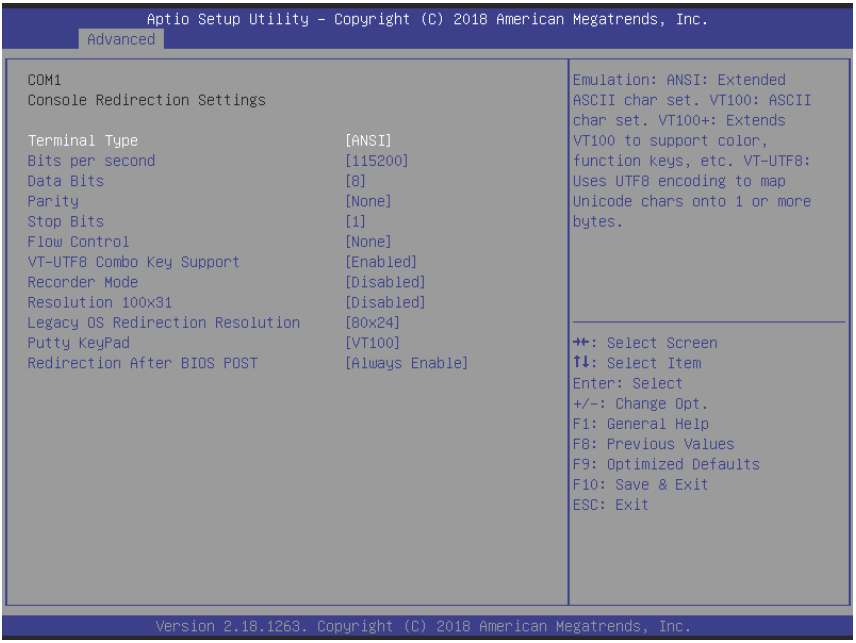
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COM 1

Console Redirection

Enables/Disables COM 1 console redirection.

Console Redirection Settings (COM 1)



Terminal Type

Emulation:

ANSI: Extended ASCII char set.

VT100: ASCII char set.

VT100+: Extends VT100 to support color, function keys, etc.

VT-UTF8: Uses UTF8 encoding to map Unicode chars onto 1 or more bytes.

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Bits per second

Selects serial port transmission speed, which must be matched on the other side, where long or noisy lines may require lower speeds.

Data Bits

Number of data bits

Parity

Parity bit can be sent with data bits to detect transmission errors, where

Even: parity bit is 0 if the number of 1's in the data bits is even

Odd: parity bit is 0 if number of 1's in the data bits is odd.

Mark: parity bit is always 1.

Space: Parity bit is always 0.

Mark and Space Parity do not allow for error detection, and can be used as an additional data bit.

Stop Bits

Indicate the end of a serial data packet (a start bit indicates the beginning), with standard setting 1 stop bit, and communication with slow devices may require more than 1 stop bit.

Flow Control

Can prevent data loss from buffer overflow, where, when sending data, if the receiving buffers are full, a 'stop' signal can be sent to stop the data flow, and once buffers are empty, a Start signal can be sent to re-start the flow. Hardware flow control uses two wires to send start/stop signals.

VT-UTF8 Combo Key Support

Enables VT-UTF8 Combination Key Support for ANSI/VT100 terminals

Recorder Mode

When enabled, only text will be sent, to capture terminal data.

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Resolution 100x31

Enables/disables extended terminal resolution

Legacy OS Redirection Resolution

In legacy OS, the number of rows and columns supporting redirection

Putty KeyPad

Selects FunctionKey and KeyPad on PuTTY

Redirection After BIOS Post

When Bootloader is selected, Legacy Console Redirection is disabled before booting to legacy OS.

When Always Enable is selected, Legacy Console Redirection is enabled for legacy OS.

Default is set to Always Enable.

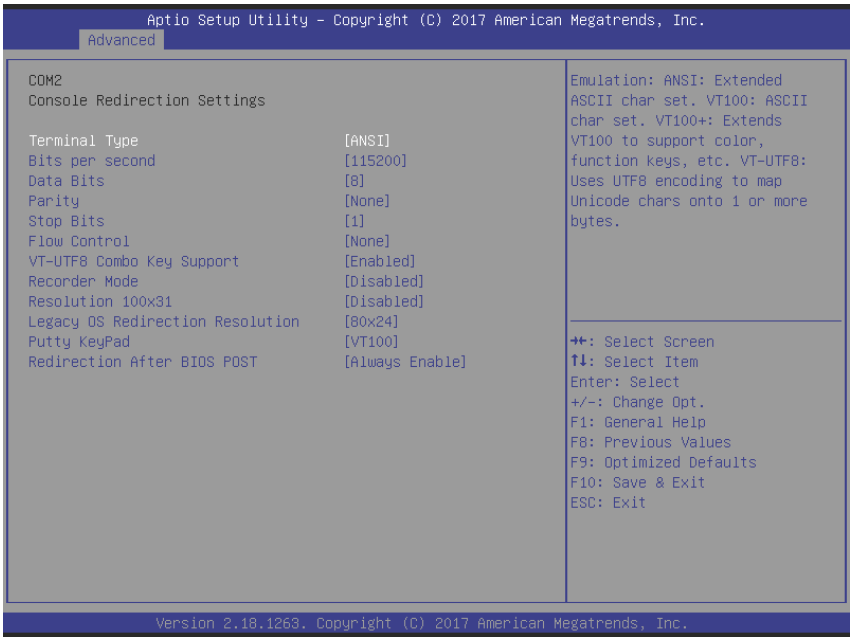
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COM 2

Console Redirection

Enables/Disables COM 2 console redirection.

Console Redirection Settings (COM 2)



Terminal Type

Emulation:

ANSI: Extended ASCII char set.

VT100: ASCII char set.

VT100+: Extends VT100 to support color, function keys, etc.

VT-UTF8: Uses UTF8 encoding to map Unicode chars onto 1 or more bytes.

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Bits per second

Selects serial port transmission speed, which must be matched on the other side, where long or noisy lines may require lower speeds.

Data Bits

Number of data bits

Parity

Parity bit can be sent with data bits to detect transmission errors, where

Even: parity bit is 0 if the number of 1's in the data bits is even

Odd: parity bit is 0 if number of 1's in the data bits is odd.

Mark: parity bit is always 1.

Space: Parity bit is always 0.

Mark and Space Parity do not allow for error detection, and can be used as an additional data bit.

Stop Bits

Indicate the end of a serial data packet (a start bit indicates the beginning), with standard setting 1 stop bit, and communication with slow devices may require more than 1 stop bit.

Flow Control

Can prevent data loss from buffer overflow, where, when sending data, if the receiving buffers are full, a 'stop' signal can be sent to stop the data flow, and once buffers are empty, a Start signal can be sent to re-start the flow. Hardware flow control uses two wires to send start/stop signals.

VT-UTF8 Combo Key Support

Enables VT-UTF8 Combination Key Support for ANSI/VT100 terminals

Recorder Mode

When enabled, only text will be sent, to capture terminal data.

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Resolution 100x31

Enables/disables extended terminal resolution

Legacy OS Redirection Resolution

In legacy OS, the number of rows and columns supporting redirection

Putty KeyPad

Selects FunctionKey and KeyPad on PuTTY

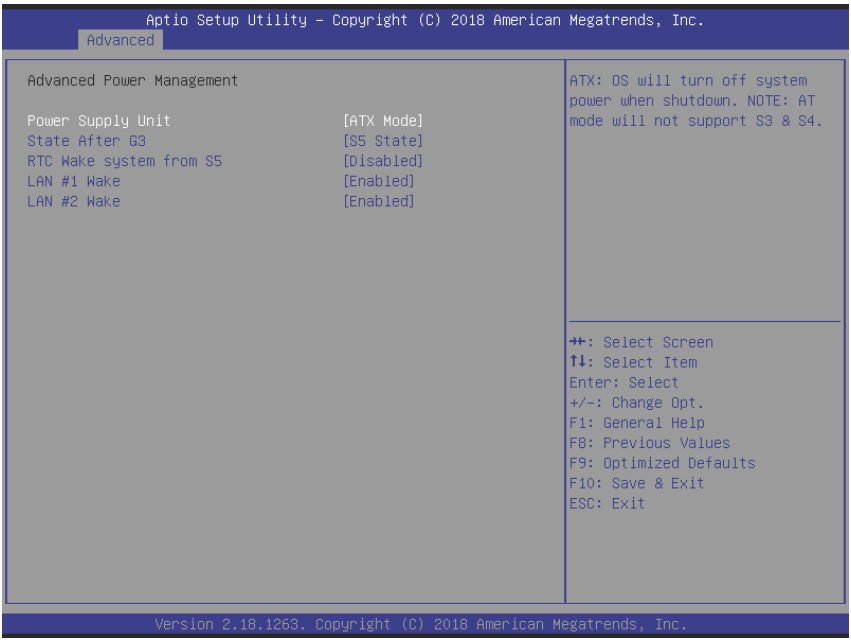
Redirection After BIOS Post

When Bootloader is selected, Legacy Console Redirection is disabled before booting to legacy OS.

When Always Enable is selected, Legacy Console Redirection is enabled for legacy OS.

Default is set to Always Enable.

A.2.4 Advanced Power Management



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Power Supply Unit

ATX: OS will turn off system power when shutdown, where AT mode does not support S3 & S4.

State After G3

Specifies state to enter when power is re-applied after a power failure (G3 state).

RTC Wake system from S5

Enables/disables System Wake on alarm event, where selecting FixedTime wakes system at hr::min::sec specified, and Dynamic-Time wakes system at the current time + Increase minute(s) specified

LAN #1 Wake

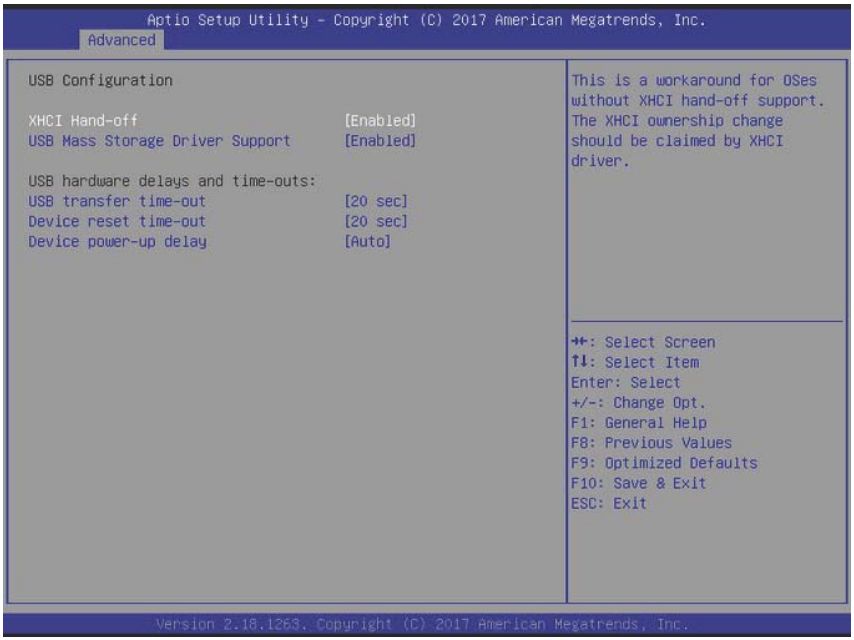
Enables/disables onboard Wake on LAN for #1

LAN #2 Wake

Enables/disables onboard Wake on LAN for #2

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A.2.5 USB Configuration



XHCI Hand-off

A workaround for OS without XHCI handoff support, where XHCI ownership change should be claimed by the XHCI driver.

USB Mass Storage Driver Support

Enables/disables USB mass storage driver support.

USB transfer time-out

Timeout value for Control, Bulk, and Interrupt transfers.

Device reset time-out

USB mass storage device Start Unit command timeout.

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Device power-up delay

Maximum time the device will take before reporting to the Host Controller, where Auto uses default value, for a Root port 100 ms, and for a Hub port the delay is taken from the Hub descriptor.

A.2.6 SATA Configuration

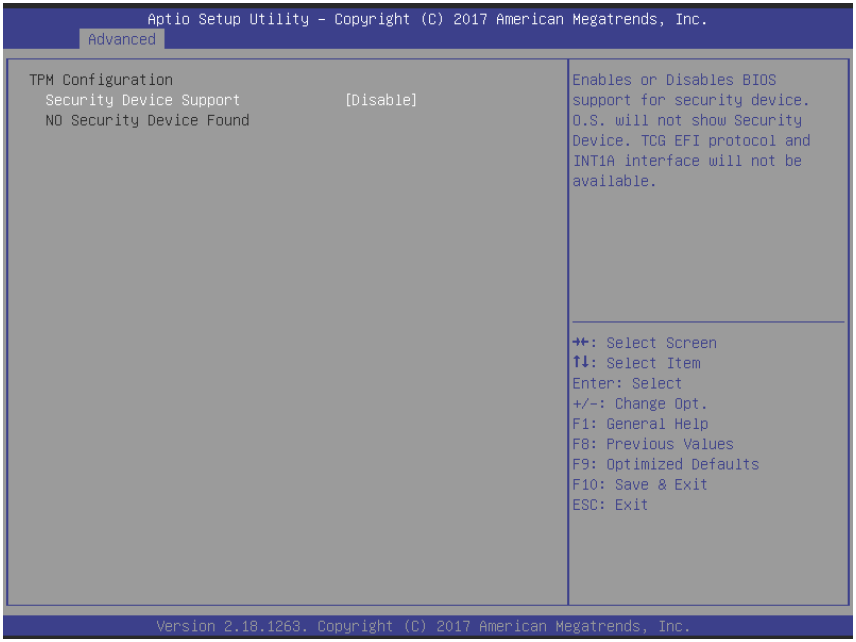


Port

Enables/disables SATA Port

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A.2.7 TPM Configuration

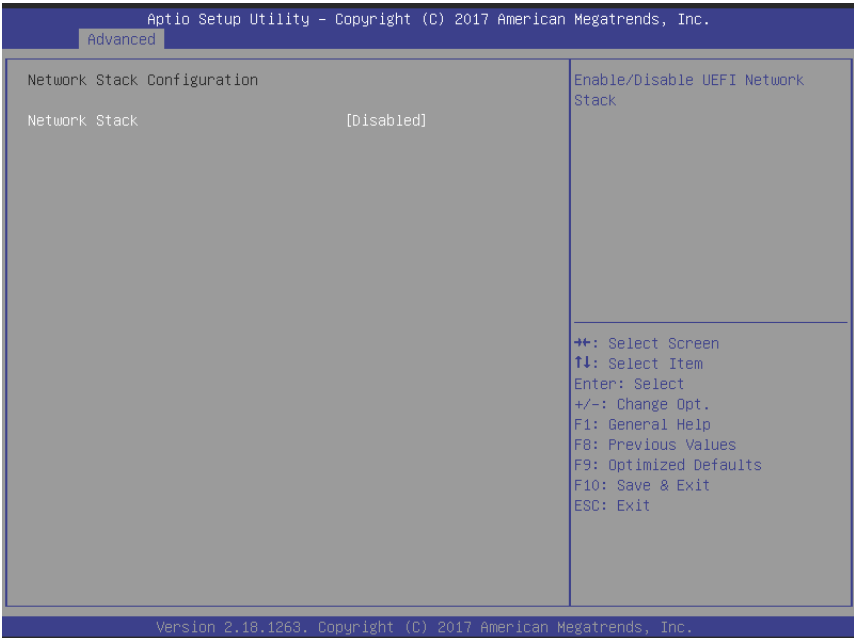


Security Device Support

Enables/disables BIOS support for security device, when enabled, OS will not show the security device, and TCG EFI protocol and INT1A interface will not be available.

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A.2.8 Network Stack Configuration



Network Stack

Enables/disables UEFI network stack

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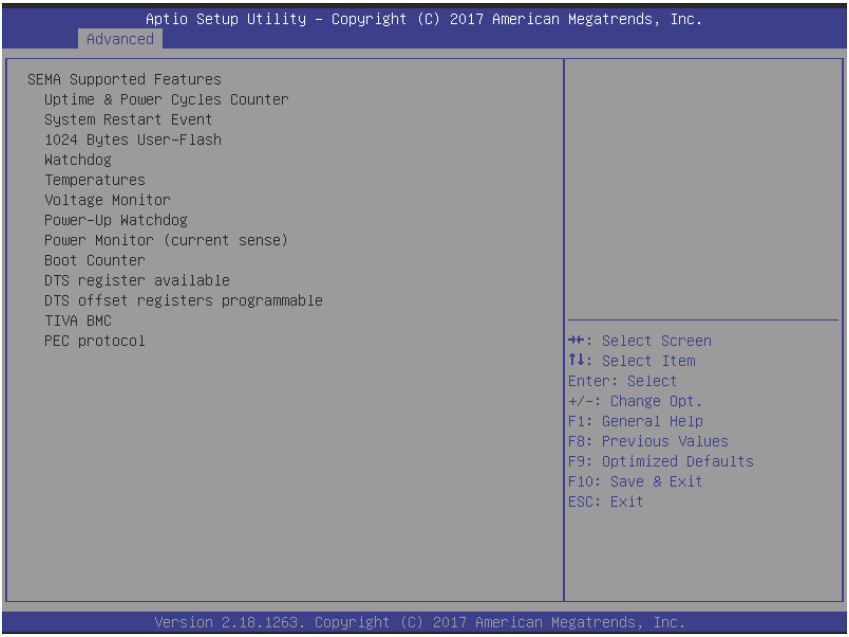
A.2.9 System Management



Shows SEMA firmware and bootloader versions and build dates.

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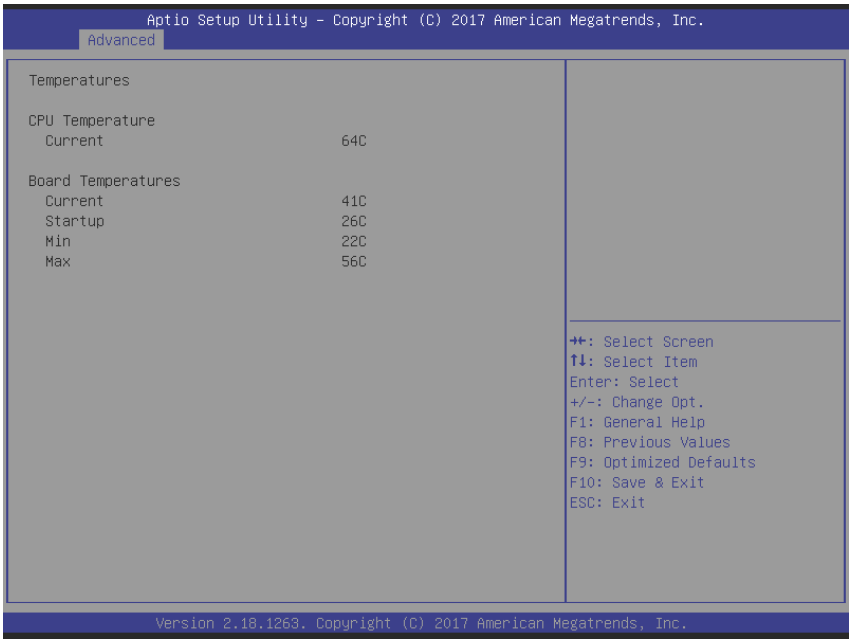
SEMA Features



Shows features supported by the SEMA version.

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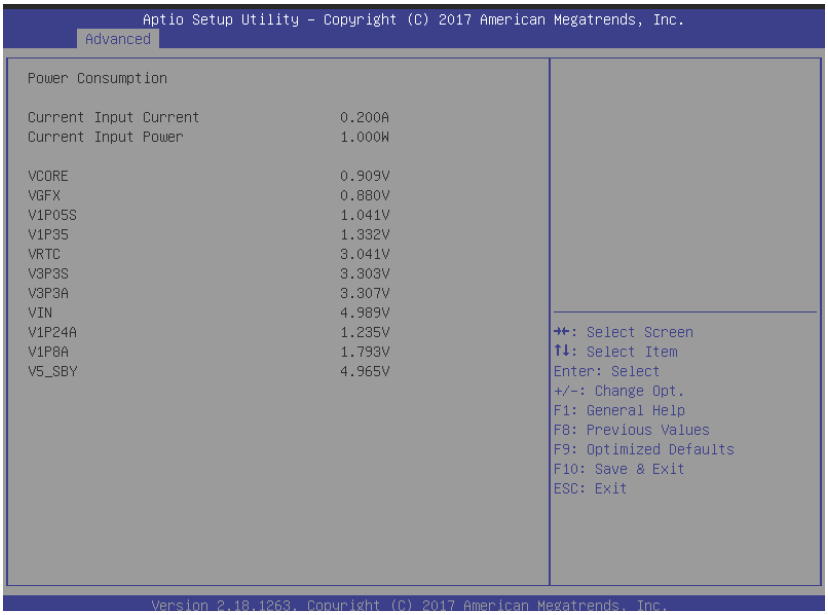
Temperatures



Shows current CPU temperature, and current, startup, minimum, and maximum board temperatures.

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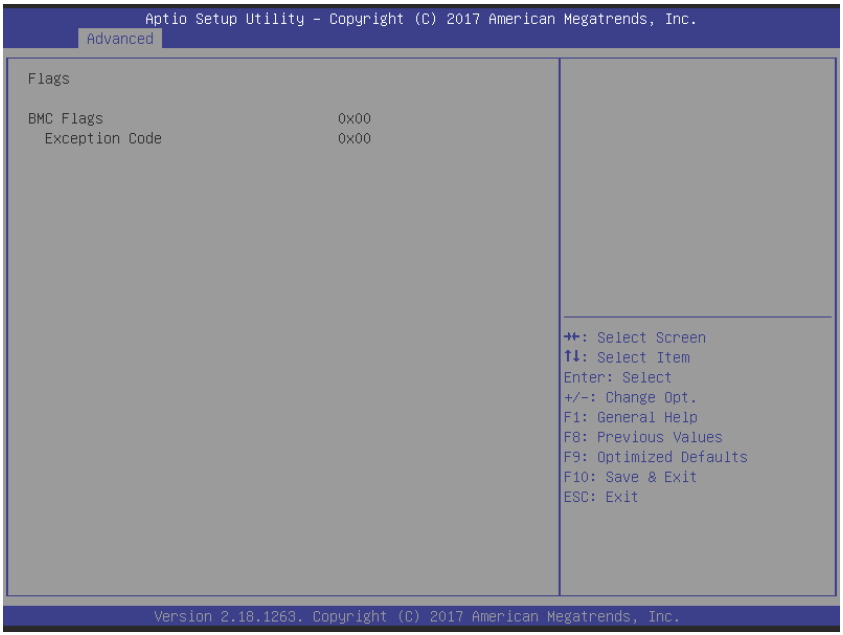
Power Consumption



Shows current input current and power, as well as system voltages.

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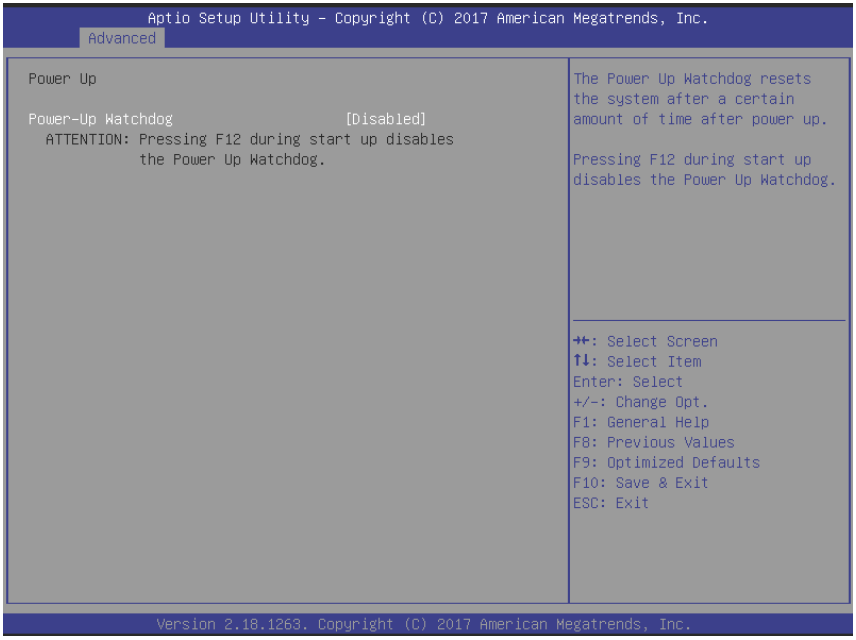
Flags



Shows BMC flags with exception codes.

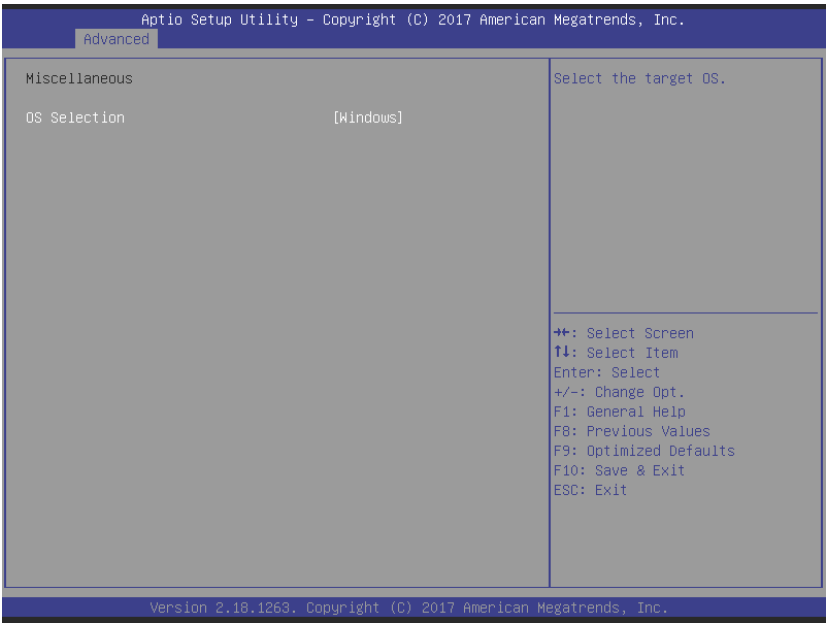
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Power Up



Lists Power-Up Watchdog status.

A.2.10 Miscellaneous

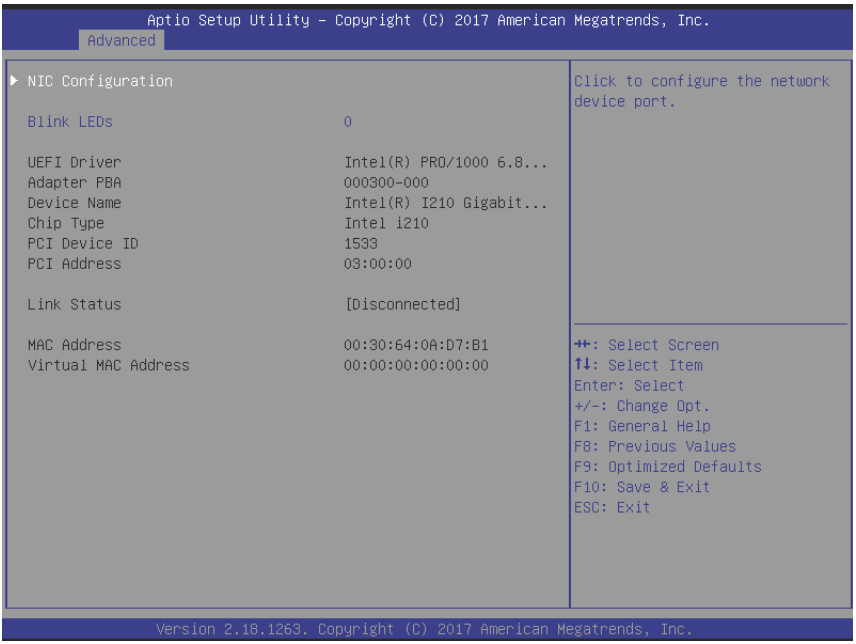


OS Selection

Allows selection of active OS.

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A.2.11 Intel® I210 Gigabit Network Connection

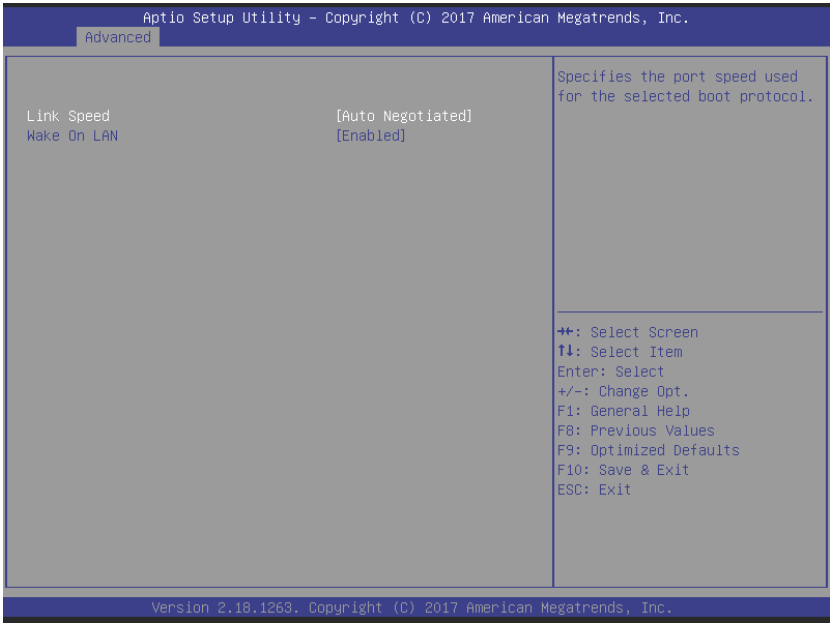


Blink LEDs

Identifies the physical network port by flashing the associated LED.

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A.2.12 NIC Configuration



Link Speed

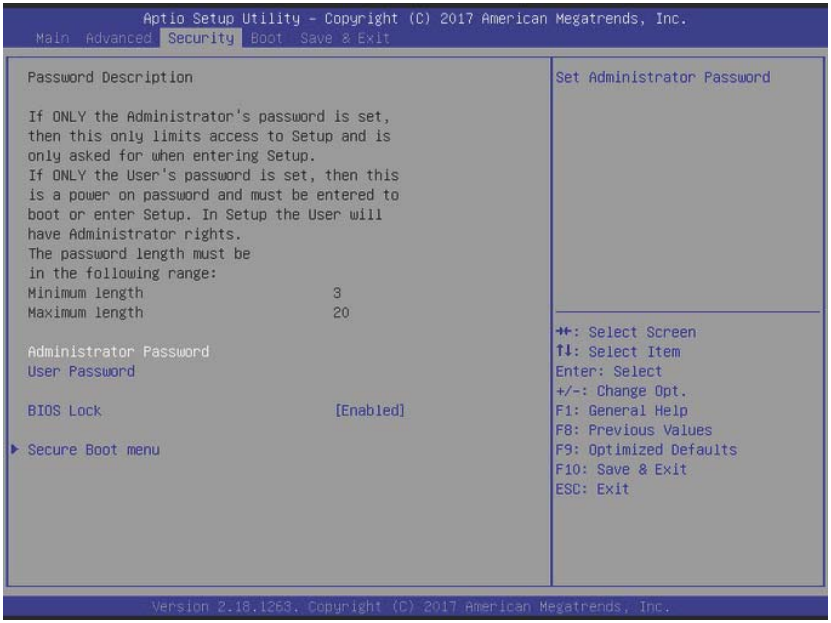
Specifies the port speed used for the selected boot protocol.

Wake On LAN

Enables server power-up using an in-band magic packet.

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A.3 Security



NOTE: If only the Administrator's password is set, only access to Setup is limited and authorization requested only when entering Setup. If only the User's password is set, a password must be entered to boot or enter setup. In Setup the user has Administrator rights.

Administrator Password

Sets Administrator password.

User Password

Sets User password.

BIOS Lock

Enables/disable SC BIOS Lock, which must be enabled to ensure SMM flash protection.

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A.3.1 Secure Boot

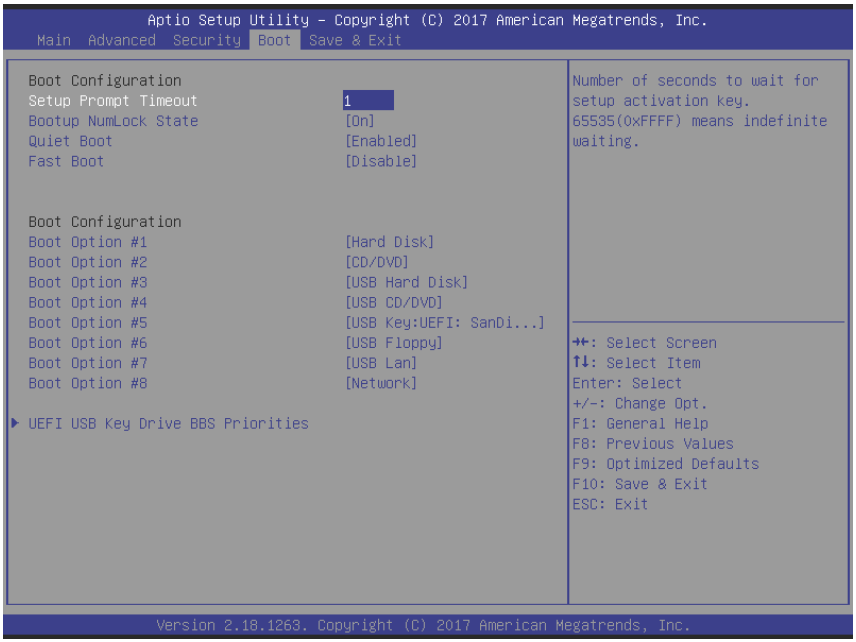


Shows System Mode and Secure Boot status.

NOTE: Secure Boot is activated when Platform Key (PK) is enrolled, where System Mode is User/Deployed, and CSM function is disabled.

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A.4 Boot



Setup Prompt Timeout

Number of seconds to wait for setup activation key, with 65535(0xFFFF) indicating infinite wait.

Bootup NumLock State

Sets keyboard NumLock status

Quiet Boot

Enables/disables Quiet Boot option

Fast Boot

Enables/disables boot with the minimal device initialization required to launch active boot option, with no effect on BBS boot options.

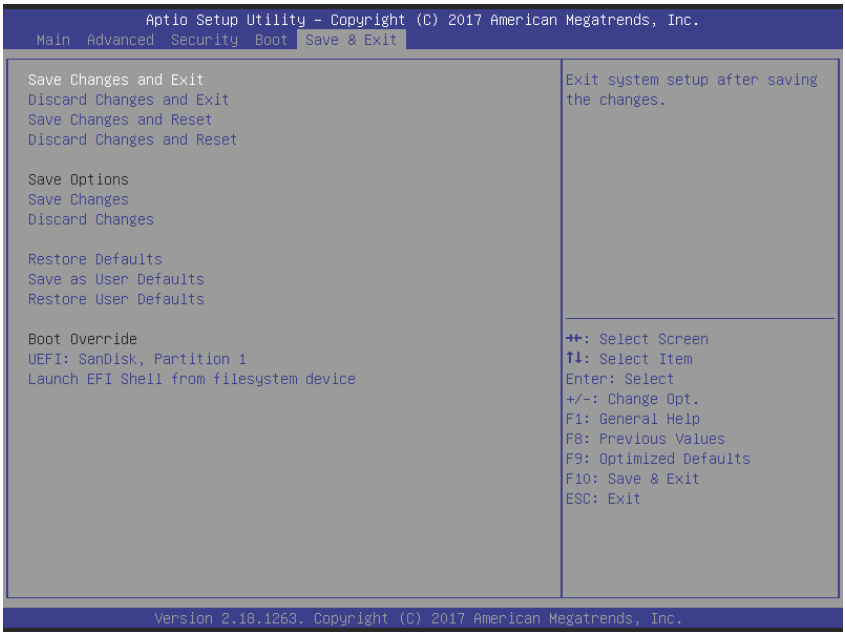
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Sets number of seconds to wait for setup activation key.

Boot Option Priorities

Specifies the priority of boot devices, with all installed boot devices detected during POST and displayed, where selecting Boot Option # specifies the desired boot device.

A.5 Save & Exit



Save Changes and Exit

Exits system setup after saving the changes.

Discard Changes and Exit

Exits system setup without saving any changes.

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Save Changes and Reset

Resets the system after saving changes.

Discard Changes and Reset

Resets system setup without saving any changes.

Save Changes

Saves changes to any setup options.

Discard Changes

Discards changes to any of the setup options.

Restore Defaults

Restores/loads default values for all setup options.

Save as User Defaults

Saves changes as User Defaults.

Restore User Defaults

Restores User Defaults to all setup options.

Launch EFI Shell from filesystem device

Attempts to launch EFI Shell application (Shell.efi) from one of the available filesystem devices.

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Appendix B Functional Information

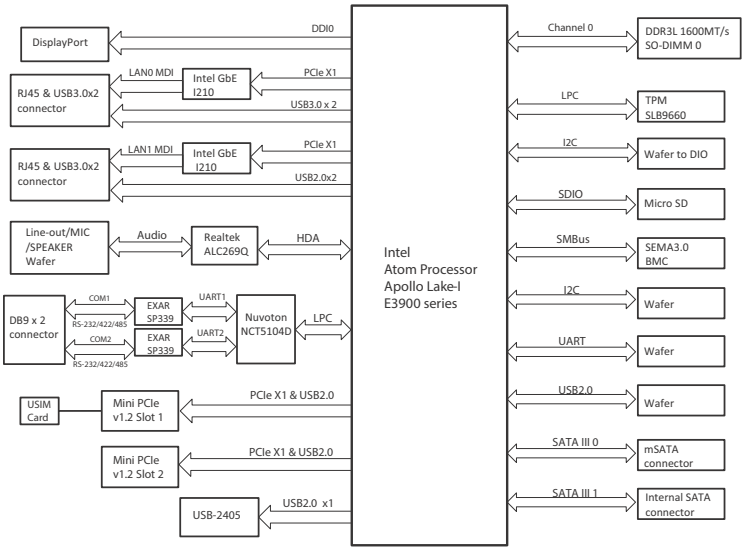


Figure B-1: MCM-100/102 System Functional Block Diagram

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B.1 AI and GPI/O Functional Layout

The MCM-100 is equipped with four simultaneous-sampling analog input channels and the MCM-102 with two. Both provide two general-purpose digital I/Os (GPI/O).

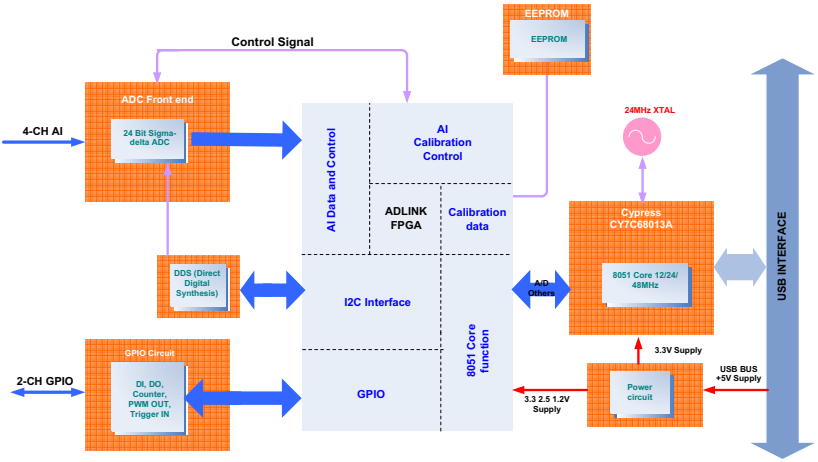


Figure B-2: MCM-100/102 AI and GPI/O Functional Block Diagram

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B.2 Internal I/O Connectors

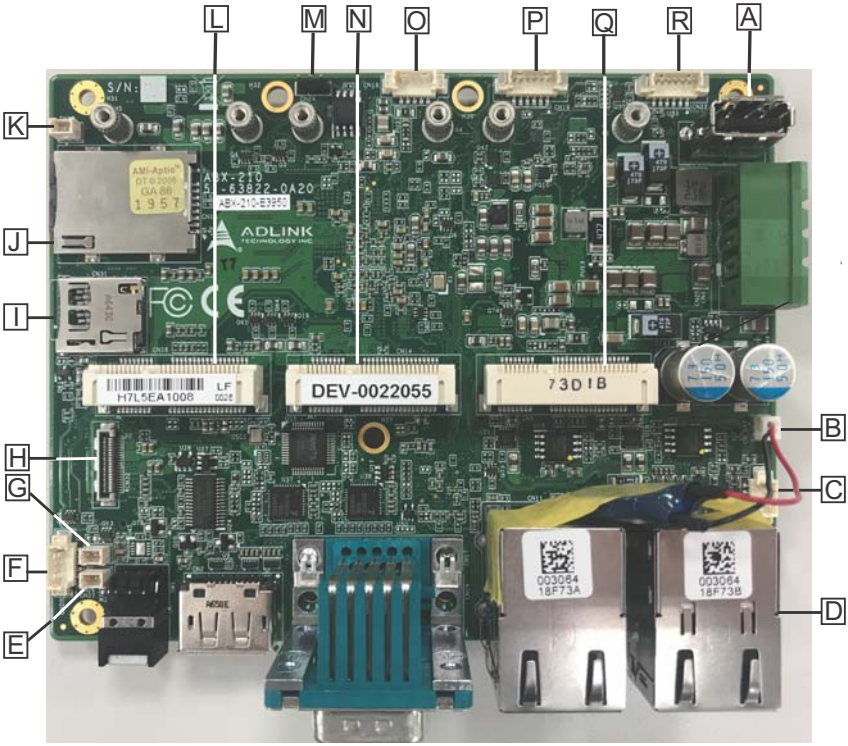


Figure B-3: Mainboard Top View

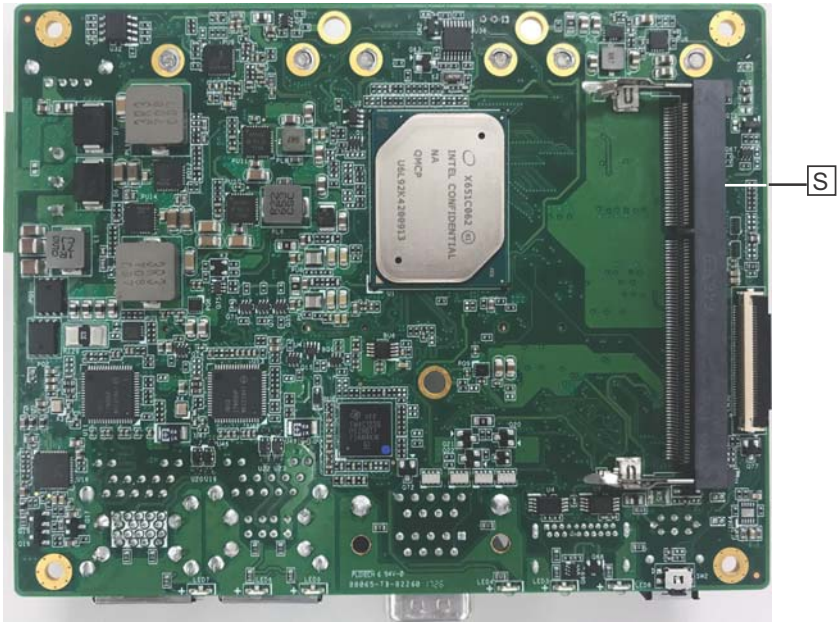


Figure B-4: Mainboard Underside View

A	USB2.0 internal dongle (CN21)*
B	RTC Battery Header (CN_BAT)
C	Internal Speaker Wafer (Optional) (CN8)
D	Internal MIC-IN & HP-OUT Wafer (Optional) (CN6)
E	Extended reset wafer (CN27)
F	Internal I2C Interface Wafer (CN20)
G	Extended power wafer (CN26)
H	Internal SATA Interface Wafer (CN32)
I	Micro SD card socket (CN31)
J	USIM slot (CN15)
K	+5V GPS Antenna Power Header (CN12)
L	Mini-PCIe slot 2 (CN16)
M	Clear CMOS Jumper (CN24)
N	Mini-PCIe slot 1 (CN14)

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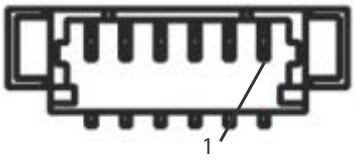
O	Internal I2C Interface Wafer (CN18)
P	Internal USB2.0 Interface Wafer (CN19)
Q	mSATA slot (CN5)
R	Internal HSUART Interface Wafer (CN22)
S	DDR3L SO-DIMM slot (CN1)

* Hot-plugging the USB dongle resets system. Be sure to plug the USB cable then power up.

Table B-1: Internal I/O Legend

B.2.1 Internal HSUART Interface Wafer

HSUART signal and +3.3V power are provided by the connector with cable.



Pin	Signal
1	+3.3V
2	SOC_UART1_RX_CON
3	SOC_UART1_TX_CON
4	SOC_UART1_CTS_CON-L
5	SOC_UART1_RTS_CON-L
6	GND

Table B-2: HSUART Interface Wafer Pin Definitions

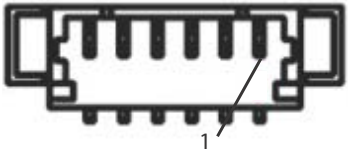
B.2.2 USIM Port

Use of 3G/4G mini-PCIe module requires a SIM card for communication with telecom operator. The MCM-100/102 provides a USIM

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port connected to the mini-PCIe connector, with which a SIM card and 3G/4G mini-PCIe module can be installed to facilitate 3G/4G communication.

B.2.3 Internal USB2.0 Interface Wafer

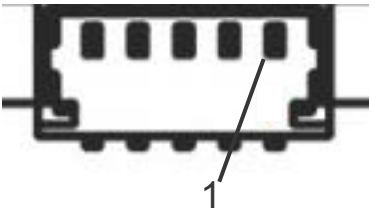


Pin	Signal
1	+5V
2	SOC_USB2_D6_P
3	SOC_USB2_D6_N
4	GND
5	+3.3V
6	USB2_WAFER-L

Table B-3: USB2.0 Interface Wafer Pin Definitions

B.2.4 Internal I2C Interface Wafer

I2C and +3.3V/+5V power by this connector with cable. are provided by the connector with cable.



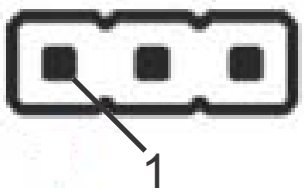
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Pin	Signal
1	GND
2	SOC_I2C1_CLK
3	SOC_I2C1_DAT
4	+3.3V
5	+5V

Table B-4: Internal I2C Interface Wafer Pin Definitions

B.2.5 Clear CMOS Jumper

Under conditions in which the MCM-100/102 fails to boot, clearing the BIOS content stored in CMOS and restoring the default settings may be effective. To clear CMOS, short Pin 1 and Pin 2 of CN24 and remove the jumper, after which the CMOS will be restored to factory default settings.



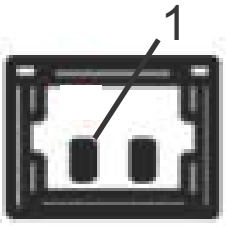
Pin	Signal
1	SOC_RTC_TEST-L
2	GND
3	SOC_RTC_RST-L-=p

Table B-5: Clear CMOS Jumper Pin Definition

B.2.6 +5V GPS Antenna Power Header

External +5V power is reserved for GPS antenna power, with +5V provided by this connector with cable.

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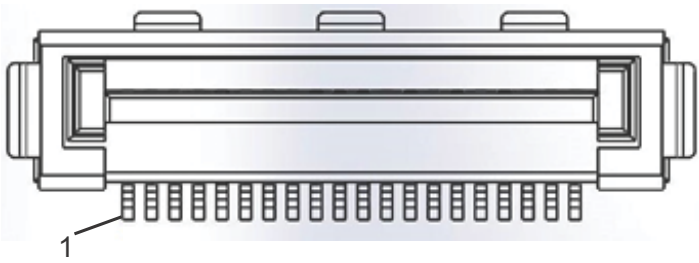


Pin	Signal
1	+5
2	GND

Table B-6: +5V GPS Antenna Power Connector Pin Definition

B.2.7 Internal SATA Interface Wafer

Reserved for extended 2.5” SSD, providing SATA signal and +3.3V/+5V power with cable.



Pin	Signal	Pin	Signal
1	GND	13	+5V
2	SOC_SATA_TX1_P_C	14	+5V
3	SOC_SATA_TX1_N_C	15	+5V

Table B-7: SATA Wafer Pin Definition

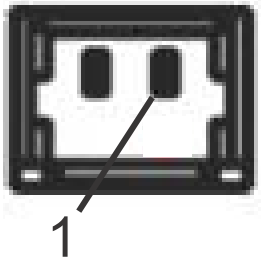
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Pin	Signal	Pin	Signal
4	GND	16	NC
5	SOC_SATA_RX1_N_C	17	GND
6	SOC_SATA_RX1_P_C	18	GND
7	GND	19	GND
8	NC	20	GND
9	+3.3V	G1	GND
10	+3.3V	G2	GND
11	+3.3V	G3	GND
12	NC	G4	GND

Table B-7: SATA Wafer Pin Definition

B.2.8 Extended Power Wafer

Provides internal connectors for the power button.



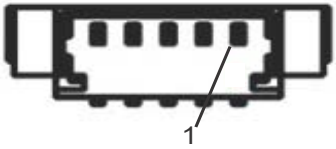
Pin	Signal
1	PWR_BTN_CN-L
2	GND

Table B-8: Extended Power Header Connector Pin Definition

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B.2.9 Internal I2C Interface Wafer

Provides the I2C signal and +3.3V power with cable.

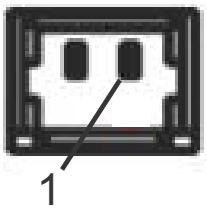


Pin	Signal
1	+3.3V
2	SOC_I2C0_DAT
3	SOC_I2C0_CLK
4	SOC_I2C0_INT
5	GND

Table B-9: I2C Box Header Connector Pin Definition

B.2.10 Extended Reset Wafer

Provides internal connectors for the reset button.



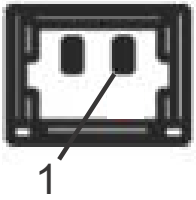
Pin	Signal
1	RESET_BTN_CN-L
2	GND

Table B-10: Extended Reset Header Connector Pin Definition

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B.2.11 RTC Battery Header

Links to the 3V coin battery pack for system RTC function.

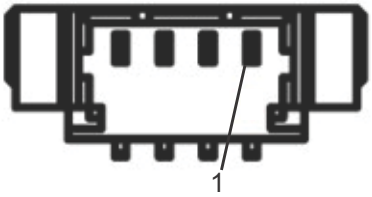


Pin	Signal
1	P_+3V3_VBAT
2	GND

Table B-11: RTC Battery Connector Pin Definition

B.2.12 Internal Speaker Wafer (Optional)

Provides the audio speaker signal, supporting 2x 2W8Ω speaker.



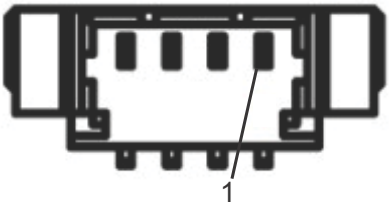
Pin	Signal
1	SPKR_L_P
2	SPKR_L_N
3	SPKR_R_P
4	SPKR_R_N

Table B-12: Speaker Wafer Pin Definition

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B.2.13 Internal MIC-IN & HP-OUT Wafer (Optional)

Provides MIC-IN and HP-OUT signals with cable.



Pin	Signal
1	EX_MIC_CN
2	HP_CN_L
3	HP_CN_R
4	AGND_AUDIO

Table B-13: MIC-IN & HP-OUT Wafer Pin Definition

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Important Safety Instructions

For user safety, please read and follow all instructions, Warnings, Cautions, and Notes marked in this manual and on the associated device before handling/operating the device, to avoid injury or damage.

S'il vous plaît prêter attention stricte à tous les avertissements et mises en garde figurant sur l'appareil , pour éviter des blessures ou des dommages.

- Read these safety instructions carefully
- Keep the User's Manual for future reference
- Read the Specifications section of this manual for detailed information on the recommended operating environment
- The device can be operated at an ambient temperature of 50ºC
- When installing/mounting or uninstalling/removing device; or when removal of a chassis cover is required for user servicing (See "Getting Started" on page 19.):
  - Turn off power and unplug any power cords/cables
  - Reinstall all chassis covers before restoring power
- To avoid electrical shock and/or damage to device:
  - Keep device away from water or liquid sources
  - Keep device away from high heat or humidity
  - Keep device properly ventilated (do not block or cover ventilation openings)
  - Always use recommended voltage and power source settings
  - Always install and operate device near an easily accessible electrical outlet
  - Secure the power cord (do not place any object on/over the power cord)
  - Only install/attach and operate device on stable surfaces and/or recommended mountings
- If the device will not be used for long periods of time, turn off and unplug from its power source

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- Never attempt to repair the device, which should only be serviced by qualified technical personnel using suitable tools
- A Lithium-type battery may be provided for uninterrupted backup or emergency power.



Risk of explosion if battery is replaced with one of an incorrect type; please dispose of used batteries appropriately.
Risque d'explosion si la pile est remplacée par une autre de type incorrect. Veuillez jeter les piles usagées de façon appropriée.

- The device must be serviced by authorized technicians when:
  - The power cord or plug is damaged
  - Liquid has entered the device interior
  - The device has been exposed to high humidity and/or moisture
  - The device is not functioning or does not function according to the User's Manual
  - The device has been dropped and/or damaged and/or shows obvious signs of breakage
- Disconnect the power supply cord before loosening the thumbscrews and always fasten the thumbscrews with a screwdriver before starting the system up
- It is recommended that the device be installed only in a server room or computer room where access is:
  - Restricted to qualified service personnel or users familiar with restrictions applied to the location, reasons therefor, and any precautions required
  - Only afforded by the use of a tool or lock and key, or other means of security, and controlled by the authority responsible for the location

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	**BURN HAZARD** Touching this surface could result in bodily injury. To reduce risk, allow the surface to cool before touching. ***RISQUE DE BRÛLURES*** *Ne touchez pas cette surface, cela pourrait entraîner des blessures.* *Pour éviter tout danger, laissez la surface refroidir avant de la toucher.*

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