Rugged Substation Automation Edge Controller Mk2

Version:
v1.0.0

Date:
18.08.2025

Contents

1 Copyright

2 Regulatory Compliances

2.1 CE and UKCA Notice

This device complies with the requirements of the CE directive and UKCA regulations.

Low Voltage Directive 2014/35/EU + Electrical Equipment Safety Regulations 2016 (SI 2016 No 1101)

- EN IEC 62368-1:2020+A11:2020
- EN IEC 62368-1:2014+A11:2017
- BS EN IEC 62368-1:2020+A11:2020
- BS EN IEC 62368-1:2014+A11:2017

EMC Directive 2014/30/EU + Electromagnetic Compatibility Regulations 2016

- EN 55032:2015+A1:2020
- EN 55032:2015+A11:2020
- CISPR 32:2015+C1:2016+A1:2019
- AS/NZS CISPR 32:2015+A1:2020
- EN 55035:2017+A11:2020
- CISPR 35:2016
- IEC 61000-4-2:2008
- IEC 61000-4-3:2020
- IEC 61000-4-4:2012
- IEC 61000-4-5:2014/AMD1:2017
- IEC 61000-4-6:2013
- IEC 61000-4-8:2009

RoHS 2 Directive 2011/65/EU & 2015/863/EU + RoHS 2 Directive 2020 No. 1647

- Exemption(s) used:
- 6c,7a,7c-I

2.2 FCC PART 15 VERIFICATION STATEMENT

WARNING

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Notice: The changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

2.3 ICES-003 ISSUE 7 VERIFICATION STATEMENT

CAN ICES3(A)/NMB3(A)

This device complies with CAN ICES-003 Issue 7 Class A. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

3 Safety Instructions

Please read these safety instructions carefully and retain them for future reference.

3.1 General Safety Guidelines

1. Keep the chassis clean and dust-free during and after installation.
2. Secure loose clothing and accessories to avoid entanglement.
3. Wear safety glasses when working in hazardous environments.
4. Always disconnect power before servicing or handling components.
5. Do not work alone in potentially dangerous conditions.
6. Never assume a circuit is de-energized—always verify before starting any work.

3.2 Lithium Battery Caution

1. **Risk of Explosion:** Use only the specified battery type. Improper replacement may result in explosion.
2. Follow local laws and regulations for battery disposal.
3. Installation must be performed by qualified personnel only.
4. Do not lift or transport power supplies using their handles.
5. Do not dispose of batteries in fire, or expose them to high temperatures or mechanical stress.
6. Batteries exposed to extreme heat or low air pressure may explode or leak flammable substances.

3.3 Operating Safety

1. Ensure adequate air circulation to maintain safe operating temperatures.
2. Always secure the chassis cover to preserve airflow integrity.
3. Use electrostatic discharge (ESD) protection when handling internal components.
4. Wear an ESD wrist strap that maintains direct contact with the skin. If unavailable, ground yourself by touching an exposed metal part of the chassis.
5. Periodically check the resistance of your antistatic strap—it should measure between 1 and 10 megohms (MΩ).

3.4 Mounting and Installation Precautions

1. Do not install or operate this equipment near flammable materials.
2. Ensure adequate ventilation when installing the unit in rack environments.
3. Maintain proper airflow by keeping intake and exhaust vents unobstructed.
4. Distribute mechanical loading evenly to avoid hazardous conditions.
5. Avoid overloading supply circuits—refer to the equipment's nameplate ratings.
6. Ensure proper grounding, especially when using indirect power connections such as power strips.

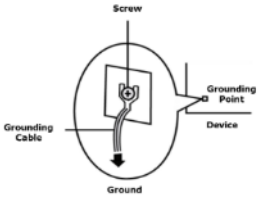
7. This equipment must be installed in restricted access locations only, by qualified personnel.
8. Suitable for installation in IT rooms per NEC Article 645 and NFPA 75.

3.5 Electrical Safety Instructions

1. Properly ground the equipment before applying power.
2. Grounding is critical for protection against electrical noise and lightning.
3. Turn off power before disconnecting the grounding cable.
4. The ground wire must be no smaller than 4 mm^2 (10 AWG).
5. Use a 30 A protection device on the power source prior to the power input.

3.6 Grounding Procedure for DC Power Source

1. Loosen the screw on the grounding point.
2. Securely connect the grounding cable to earth ground.
3. Use a protection device rated for 30 A current.
4. Ensure the protection device is connected to the power source before applying power.
5. Use a 16 AWG cable for the grounding connection.



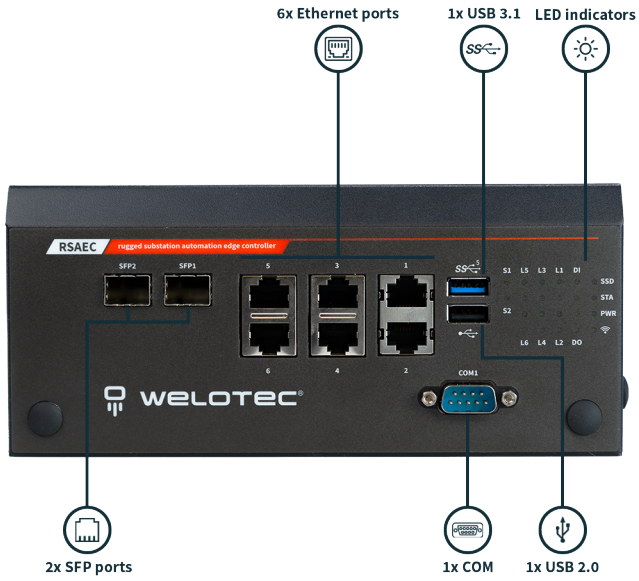
4 Product Specifications

4.1 Technical Details

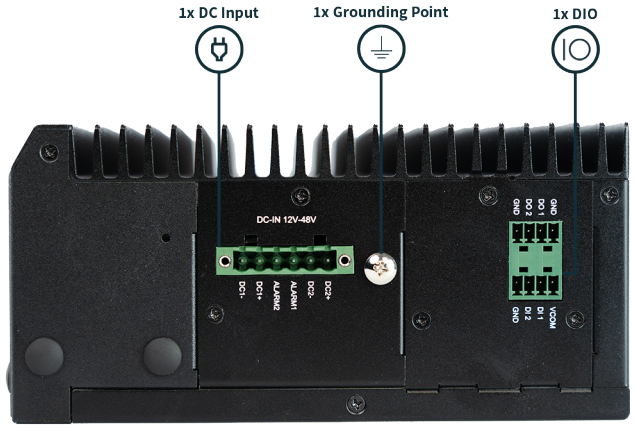
Feature	Specification	Details
Processor	CPU	Intel® Atom™ X6425E (Quad-Core, up to 2.0 GHz)
	BIOS	AMI SPI Flash BIOS
	Chipset	SoC (System on Chip)
Memory	System Memory	DDR4, non-ECC & IB-ECC, up to 32 GB
	Socket	1 × 260-pin SODIMM
Networking	Ethernet	6 × RJ45 (100M/1G/2.5GbE), 2 × SFP (1GbE)
	Controller	Intel® i226IT / i210IS
	LAN Bypass	1 pair RJ45 LAN1/2
Storage	Drive Bay	1 × 2.5” SATA Drive Bay; 1 × M.2 M-Key 2242
	SD Card	1 × MicroSD Reader
Expansion	M.2 Slots	1 × M.2 B-Key (LTE/5G Sub-6, dual Nano-SIM)1 × M.2 E-Key (Wi-Fi)
I/O Interfaces	COM Port	1 × RS-232 (DB9 Male)
	DIO	2 × Isolated DI, 2 × Isolated DO
	USB	1 × USB 3.1 Gen1 (5 Gbps), 1 × USB 2.0 Type-A
	LED Indicators	System Status, Ethernet, Programmable LEDs
	Buttons	1 × Reset Button
Watchdog Timer	Reset Interval	Software programmable, 256-level
Power	Input Voltage	Dual +12–48 VDC
	Connector	Phoenix Contact 6-pin Terminal Block with Lock
	Consumption (Idle/Full)	24.2 W ~ 31.7 W (Idle), 41.6 W ~ 46.8 W (Full Load)
Cooling	Design	Fanless
Mechanical	Dimensions	87 × 196 × 180 mm
	Package Dimensions	366 × 251 × 150 mm (inner), 468 × 385 × 279 mm (3-in-1 pack)
	Weight	3.4 kg
	Mounting	DIN Rail or Optional Wall Mount
	Construction	Aluminum & SGCC
Environmental	Operating Temperature	–40°C to 70°C
	Storage Temperature	–40°C to 85°C
	Humidity	5% to 95%, non-condensing
Certifications	Compliance	FCC, CE, UL (IEC-62368), IEC 61850-3, IEEE 1613
Operating System	OS Support	Windows® 10/11 IoT, Linux Kernel 2.6X or later (pending Intel® release)

5 Interfaces and Connections

5.1 Front Panel



5.2 Side Panel



5.3 Back Panel

6 DIP Switch Settings and Pin Definitions

6.1 Power Board Connector – PWR1

Pin	Signal
1	DC_GND
2	DC_IN
3	ALARM2
4	ALARM1
5	DC_IN
6	DC_GND

Voltage Range: +12 ~ +36V

6.2 Internal Jumpers & Connectors

6.2.1 JCMOS1 – RTC Reset Jumper

Jumper	Function
1–2	Clear CMOS for RTC
2–3	Clear CMOS for SRTC

Pin	Signal
1	RTC_RST#
2	NC
3	SRTC_RST#

6.2.2 J8 – Power SMBus Debug Header

Pin	Signal
1	GND
2	SMB_CLK_VR
3	SMB_DATA_VR

6.2.3 J18 – MCU Programming Header (Debug/Burn-In)

Jumper	Function
1–2	Disable (Default)
2–3	Enable

Pin	Signal
1	+P3V3_STBY
2	PIO1_1_GPIO2
3	GND

6.2.4 J17 – LTE Module GPS Selection

Jumper	Module Selected
1–2	EM7455 / MV31-W / RM00Q
2–3	FN980

Pin	Signal
1	+P3V3
2	W_DIS2#_OE
3	GND

6.2.5 COM1 – Serial Port

Pin	Signal
1	N/A
2	RX
3	TX
4	N/A
5	GND
6	N/A
7	RTS
8	CTS
9	N/A

6.2.6 JDebug1 – UART Debug Header

Pin	Signal
1	+P3V3_STBY
2	GND
3	UART_TX
4	UART_RX

6.2.7 JSPI1 – SPI Debug Header

Pin	Signal
1	SPI0_IO3_HOLD#
2	NC
3	SPI0_CS0_R#
4	+P3V3_STBY_SPI
5	SPI0_IO1_MISO_R
6	NC
7	NC
8	SPI0_CLK_R
9	GND
10	SOC_SPI_MOSI_R

6.2.8 JPW1 – Power Supply Header

Pin	Signal
1	+P12V
2	GND
3	GND
4	+P5V

6.2.9 ESPI1 – Embedded SPI Interface

Pin	Signal	Pin	Signal
1	ESPI_CLK	2	ESPI_IO1
3	ESPI_RST#	4	ESPI_IO0
5	ESPI_CS0#	6	+P3V3
7	ESPI_IO3	8	NA
9	ESPI_IO2	10	GND
11	+P3V3_STBY	12	NC

6.2.10 DP1 – Debug Port

- **Note:** This port is for debug use only and cannot be used simultaneously with the IPMI interface.

6.3 Carrier Board Connector

6.3.1 JDebug1 – UART Debug Header (Carrier Board)

Pin	Signal
1	+P3V3_STBY
2	GND
3	UART_TX
4	UART_RX

7 Hardware Installation

7.1 Safety Notice

To reduce the risk of injury, electrical shock, or system damage, **disconnect all power sources** before beginning installation. Always wear **ESD-safe gloves** when handling internal components.

7.2 Opening the Chassis

1. Power off the system and unplug the power cord.
2. Remove the six (6) screws securing the system's top panel, then remove the side metal partitions.
3. Loosen the one (1) screw on the top panel and six (6) screws on the bottom and rear panels.
4. Turn the system upside down, slide the chassis cover away, and lift to remove.

8 BIOS Setup

8.1 Introduction

The BIOS (Basic Input/Output System) is firmware embedded directly on the system's motherboard. RSAEC Mk2's BIOS includes security features such as:

- `Secure Boot`
- `Intel Boot Guard`

These help defend the platform against malware and unauthorized boot sequences.

8.2 Entering the BIOS

To access the BIOS Setup Utility:

1. Boot up the RSAEC Mk2.
2. Press `Tab` or `Del` during startup.

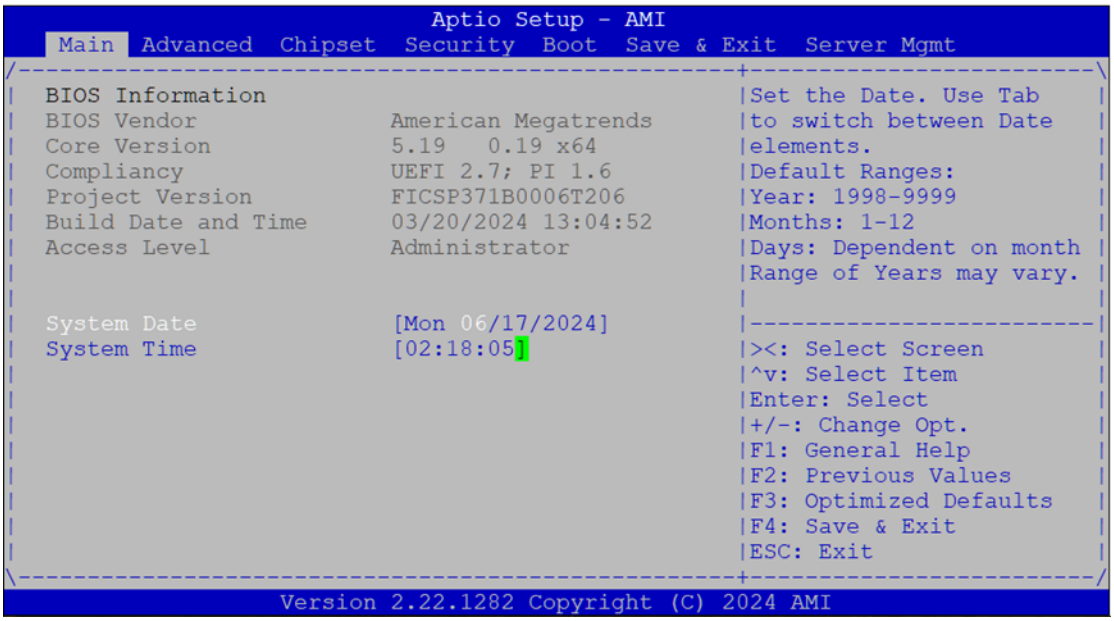
You will be directed to the BIOS main menu.

8.2.1 Navigation Keys

Key	Description
`←` / `→`	Select a setup screen
`↑` / `↓`	Select an item or option
`Enter`	Select item / enter sub-menu
`+` / `-`	Adjust value of selected item
`F1`	Display general help
`F2`	Restore previous configuration
`F3`	Load optimized defaults
`F4`	Save configuration and exit BIOS
`Esc`	Exit current screen

8.3 Main Page

The Main tab shows BIOS version details and allows basic date/time configuration.



BIOS Information:

- **Vendor**: American Megatrends
- **Core Version**: AMI Kernel, CRB code base, X64
- **UEFI/PI Compliancy**
- **Build Date and Time**: `MM/DD/YYYY`
- **Access Level**: `Administrator` or `User`

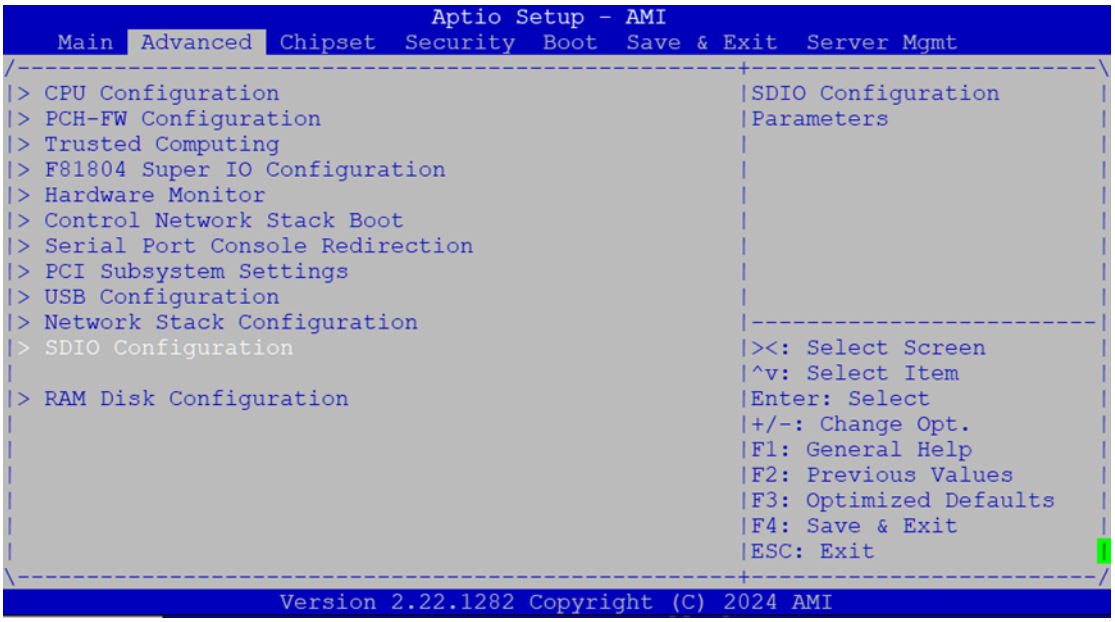
Date & Time Setup:

- Use `Tab` to switch between year, month, day.
- Default year range: 2005–2099
- Day count depends on month selected.

8.4 Advanced Tab

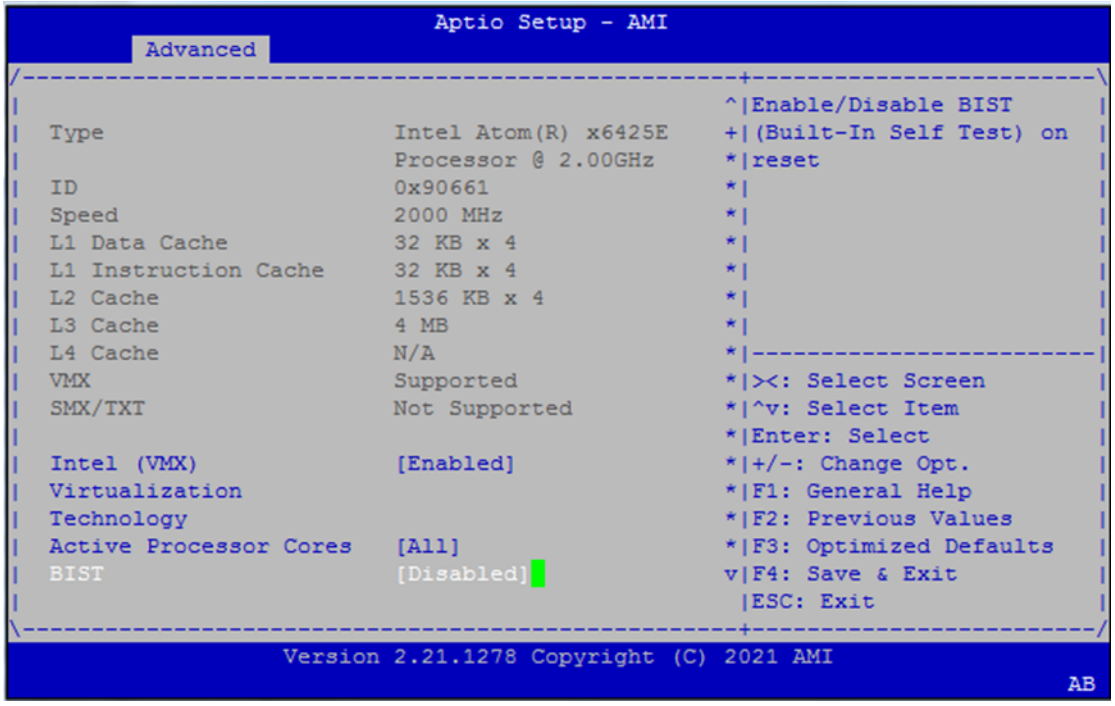
This tab provides access to configuration for CPU, chipset, PCIe, USB, and more.

Select `Advanced` from the top menu to enter.



8.5 CPU Configuration

This section allows you to adjust CPU-related features, including core count and diagnostic settings.

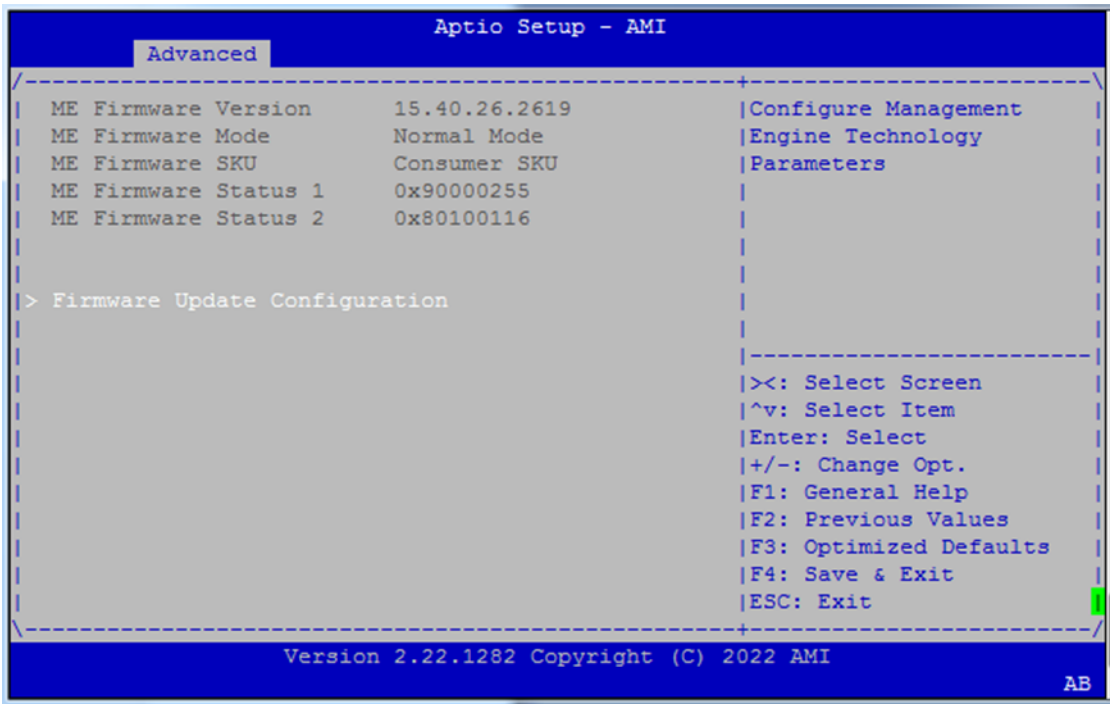


Options available:

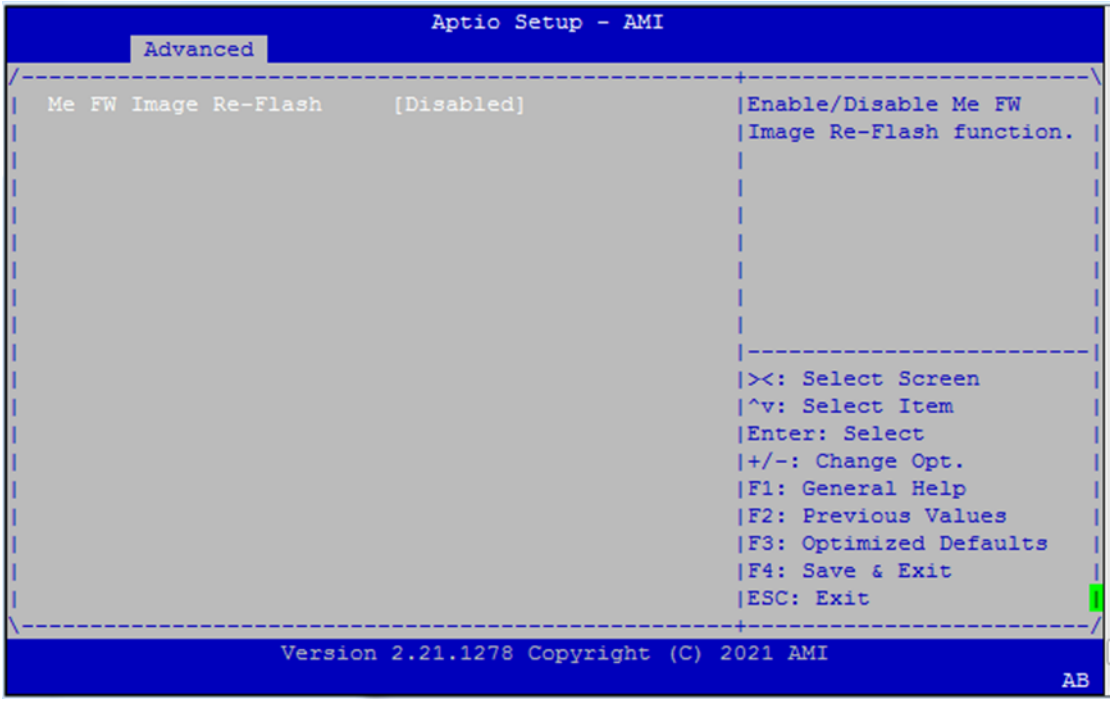
- **Security Device Support**: Enables or disables BIOS support for the TPM security device. If disabled, the OS will not detect the device. TCG EFI protocol and INT1A interface will also be disabled.
- **Active Processor Cores**: Allows enabling a subset of the CPU cores (`All`, 1, 2, 3, etc.).
- **BIST (Built-In Self-Test)**: Enables or disables a self-diagnostic test at system reset.

8.6 PCH-FW Configuration

Contains settings for the Platform Controller Hub firmware.



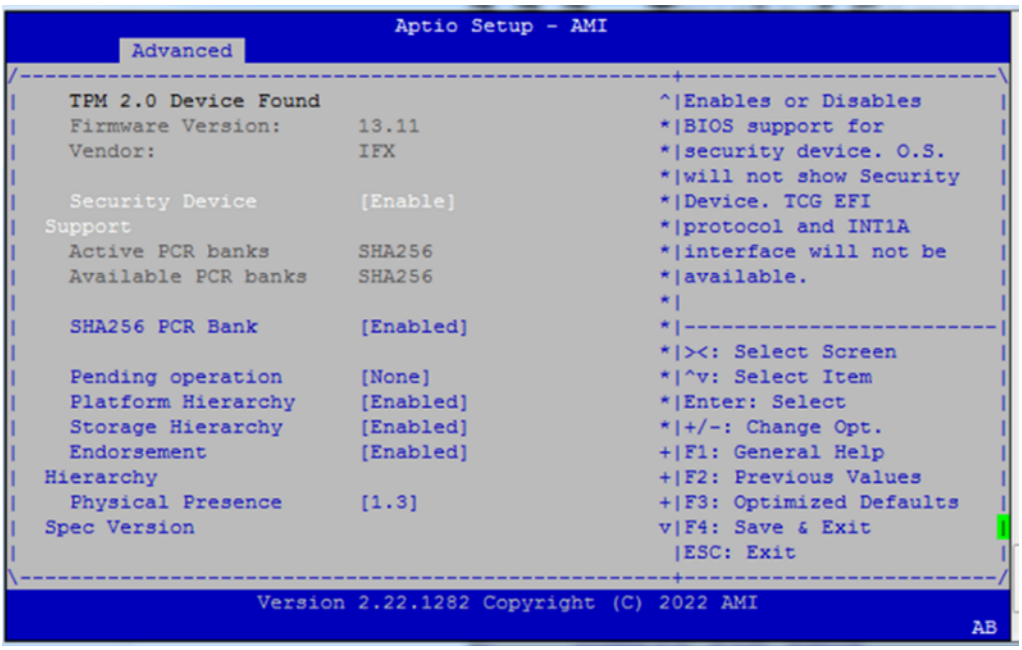
8.6.1 Firmware Update Configuration

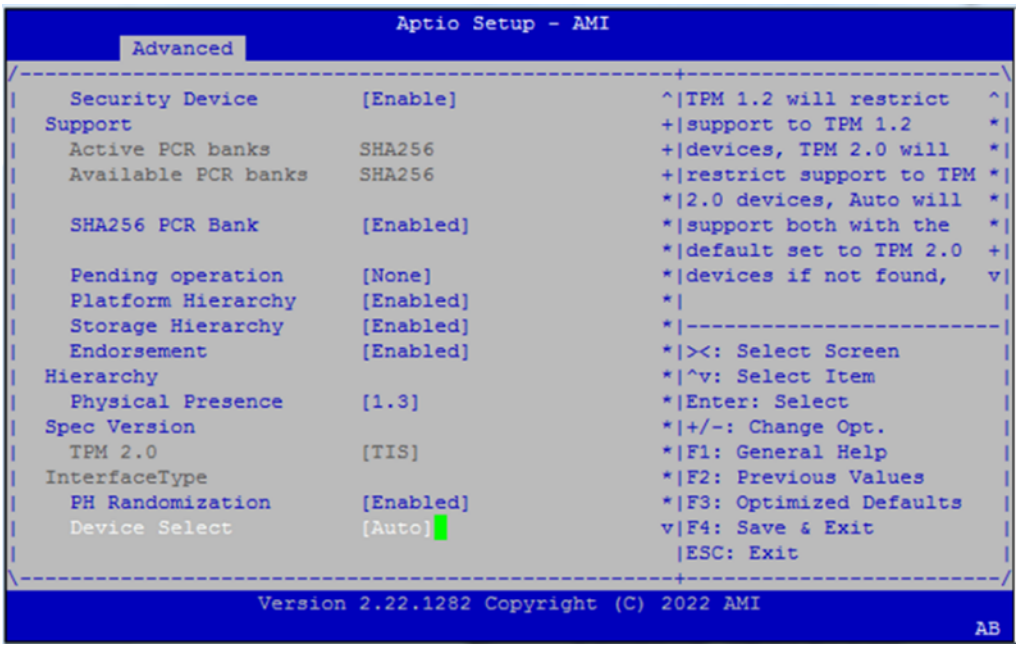


- **ME FW Image Re-Flash**: Allows the firmware for the Management Engine (ME) to be updated from within BIOS. *Use with caution in production environments.*

8.7 Trusted Computing

Configure TPM support and related security hierarchies.



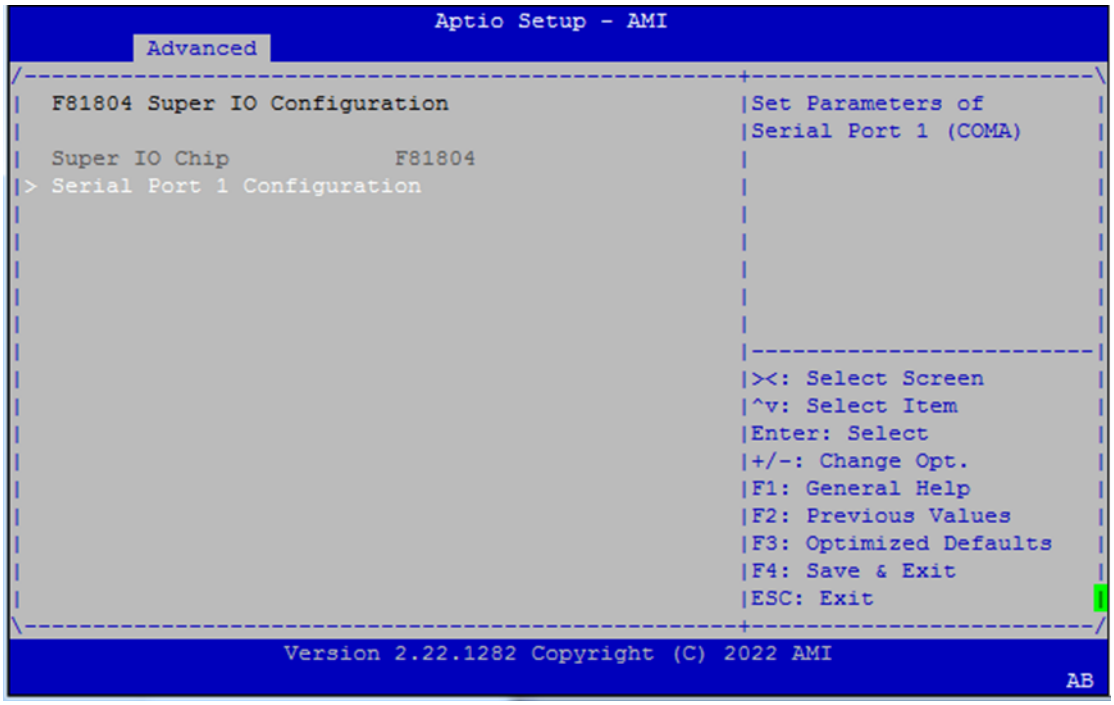


Options include:

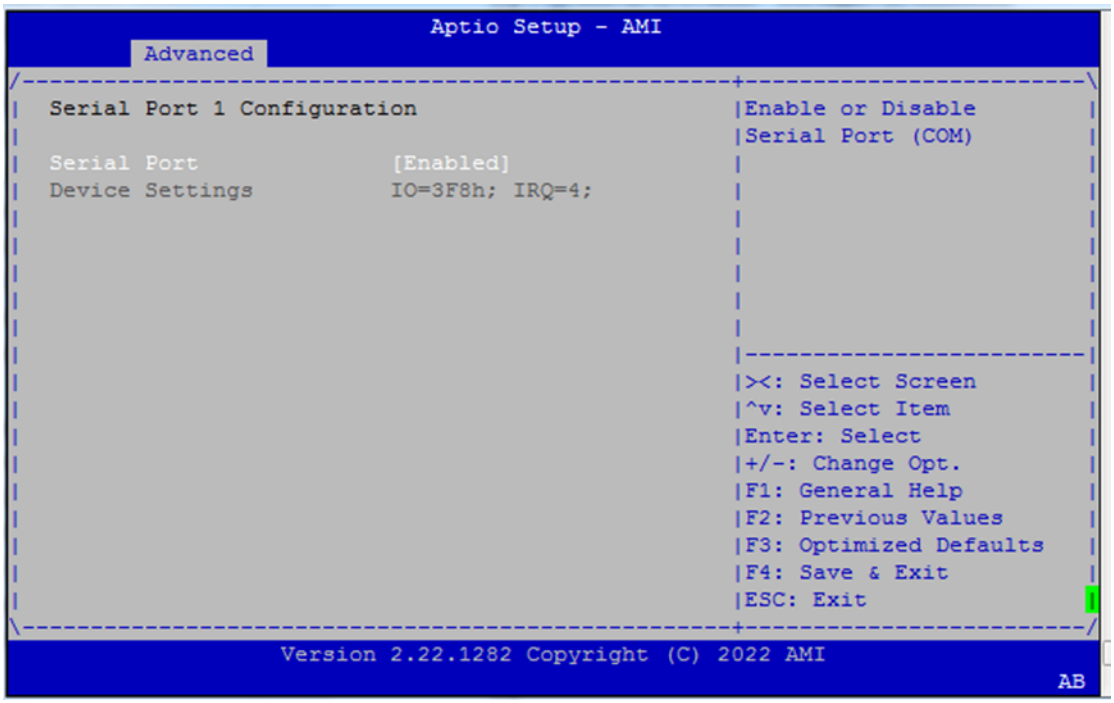
- **Security Device Support**
- **SHA256 PCR Bank**
- **Pending Operation** (e.g., `TPM Clear`)
- **Platform / Storage / Endorsement Hierarchies**
- **Physical Presence Spec Version** (`1.2` or `1.3`)
- **PH Randomization** *(testing only)*
- **Device Select**: `TPM 1.2`, `TPM 2.0`, `Auto`

8.8 Super IO Configuration

This section allows enabling/disabling onboard serial ports.



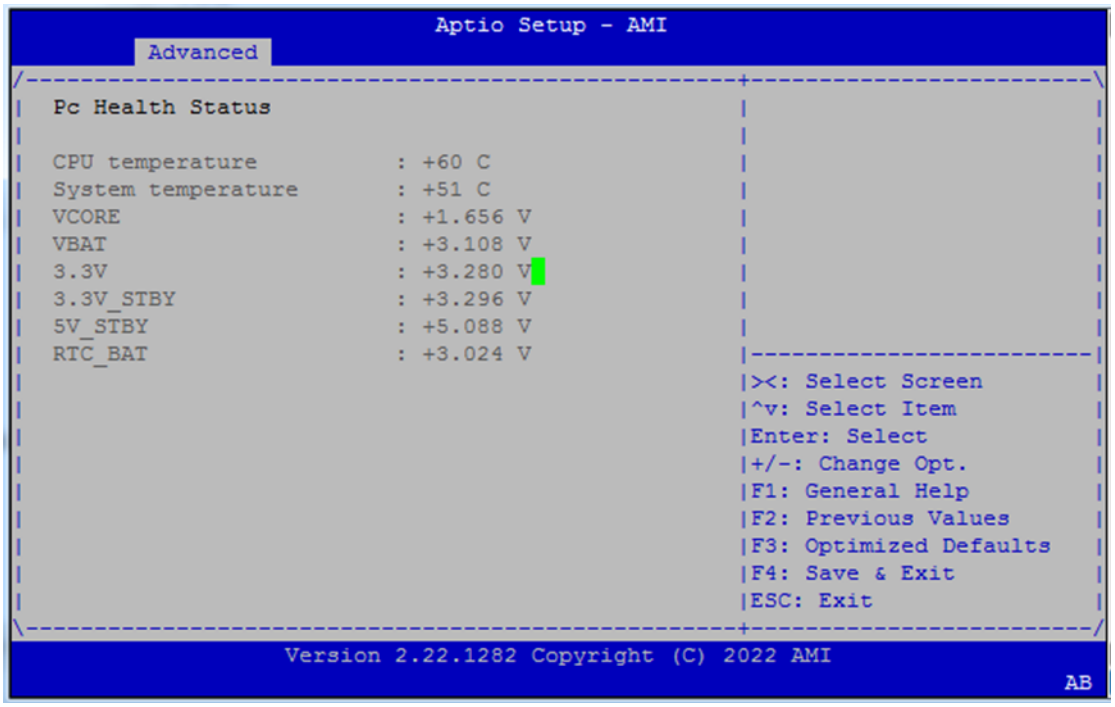
8.8.1 Serial Port 1 Configuration



- **Serial Port** (COM1): Enable if serial console access is needed.

8.9 Hardware Monitor

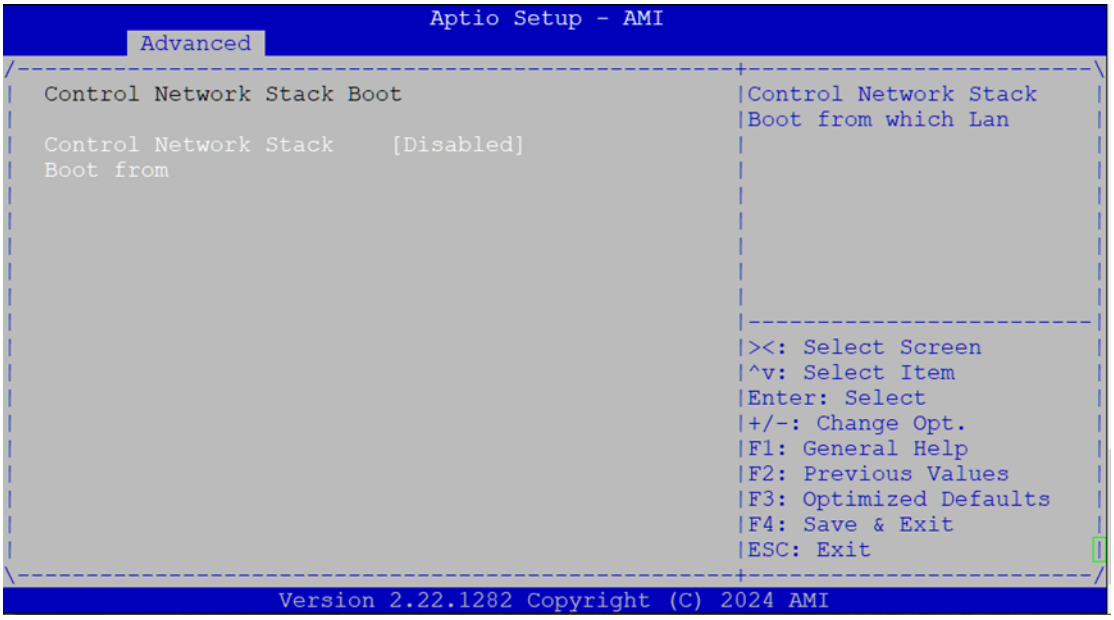
Real-time temperature and voltage readings.



- **CPU Temperature**
- **System Temperature**
- **Voltage Rails**:
  - VCORE
  - VBAT
  - 3.3V
  - 3.3V_STBY
  - 5V_STBY
  - RTC_BAT

8.10 Network Stack Boot Configuration

Configure which LAN interface to use for PXE or network stack booting.

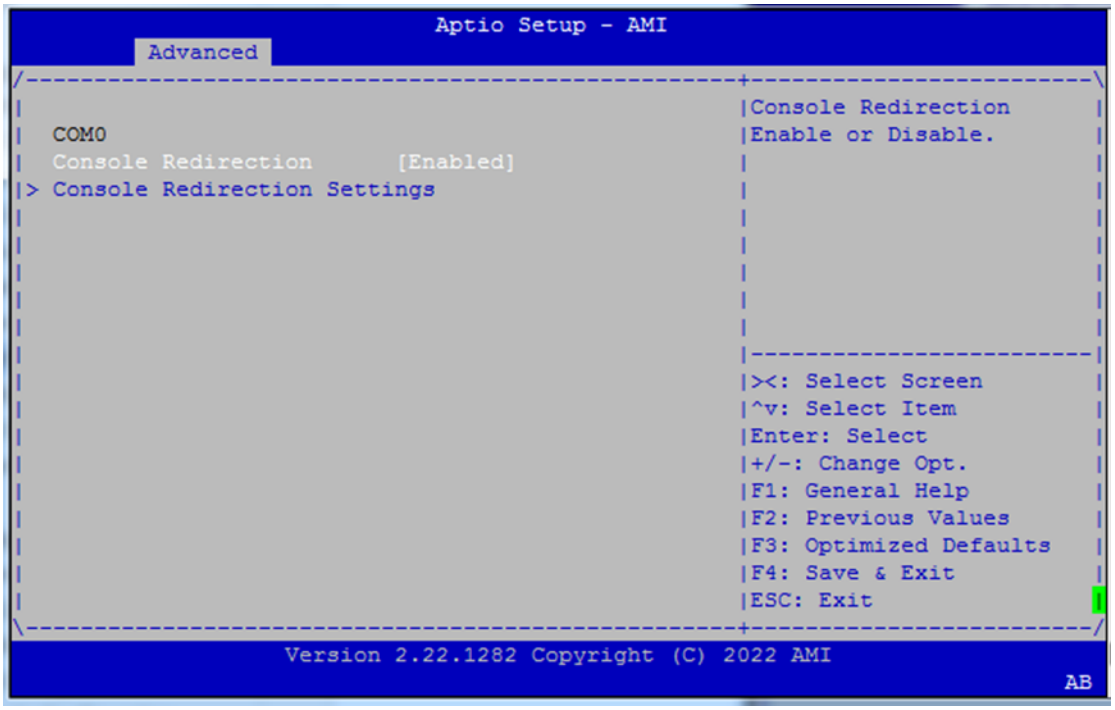


- **Control Network Stack Boot From**: Options: `Disabled`, `LAN1`, `LAN2`, `LAN3`

  Use this setting if you're using PXE boot or UEFI network boot.

8.11 Serial Port Console Redirection

Enables BIOS messages to be output to COM0, allowing headless remote management.

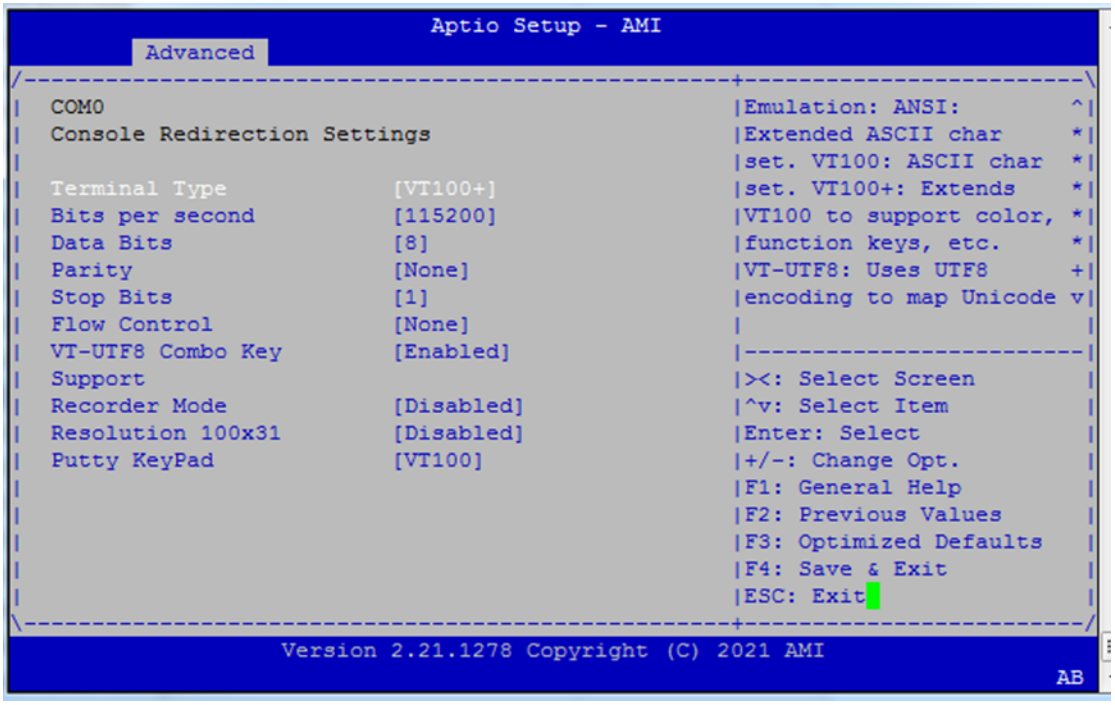


- **Console Redirection (COM0)**: `Enabled` or `Disabled`

  Useful for serial-over-LAN environments or embedded deployments.

8.11.1 Console Redirection Settings

Fine-grained settings for serial terminal behavior.



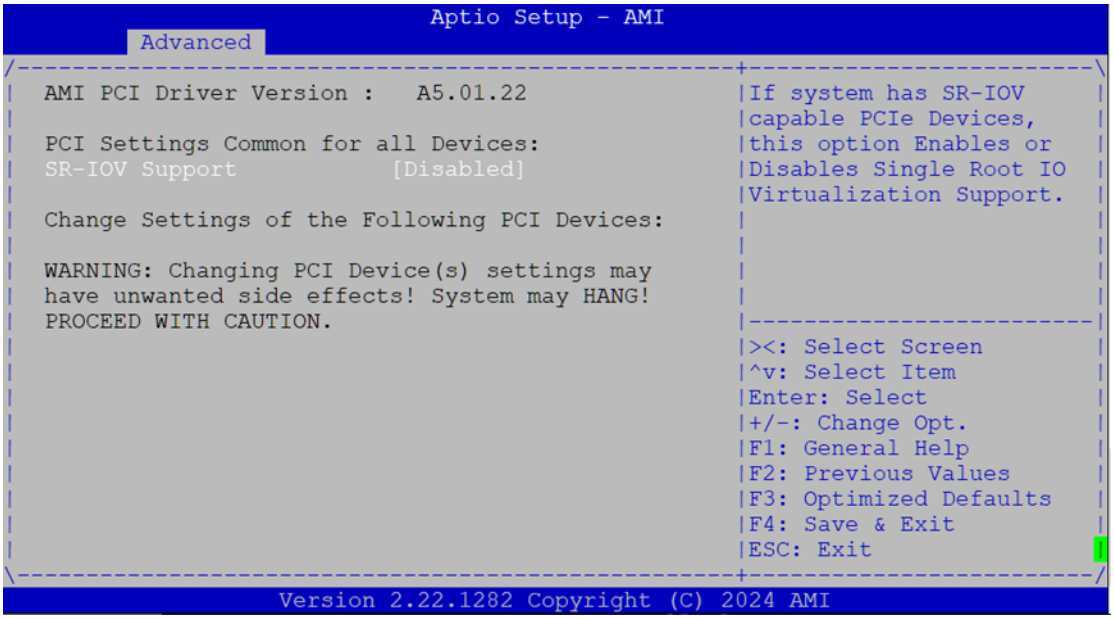
Settings:

- **Terminal Type**:
  - `VT100` – Basic
  - `VT100+` – Adds color, key support
  - `VT-UTF8` – UTF-8 support
  - `ANSI` – Extended ASCII
- **Baud Rate**: Options: `9600`, `19200`, `38400`, `57600`, `115200`
- **Data Bits**: `7`, `8`
- **Parity**: `None`, `Even`, `Odd`, `Mark`, `Space`
- **Stop Bits**: `1`, `2`
- **Flow Control**: `None`, `Hardware`, `RTS/CTS`

  Match these with your serial terminal (e.g., PuTTY, TeraTerm).
- **VT-UTF8 Combo Key Support**: Enables UTF-8 key combos (use only if terminal supports it)
- **Recorder Mode**: Outputs text-only stream for logging
- **Resolution 100x31**: Enables extended terminal size (100 columns × 31 rows)
- **Putty KeyPad**: Choose from `VT100`, `LINUX`, `XTERM86`, `SCO`, `ESCN`, `VT400` — sets keypad behavior

8.12 PCI Subsystem Settings

This section lets you manage virtualization features for PCIe devices.

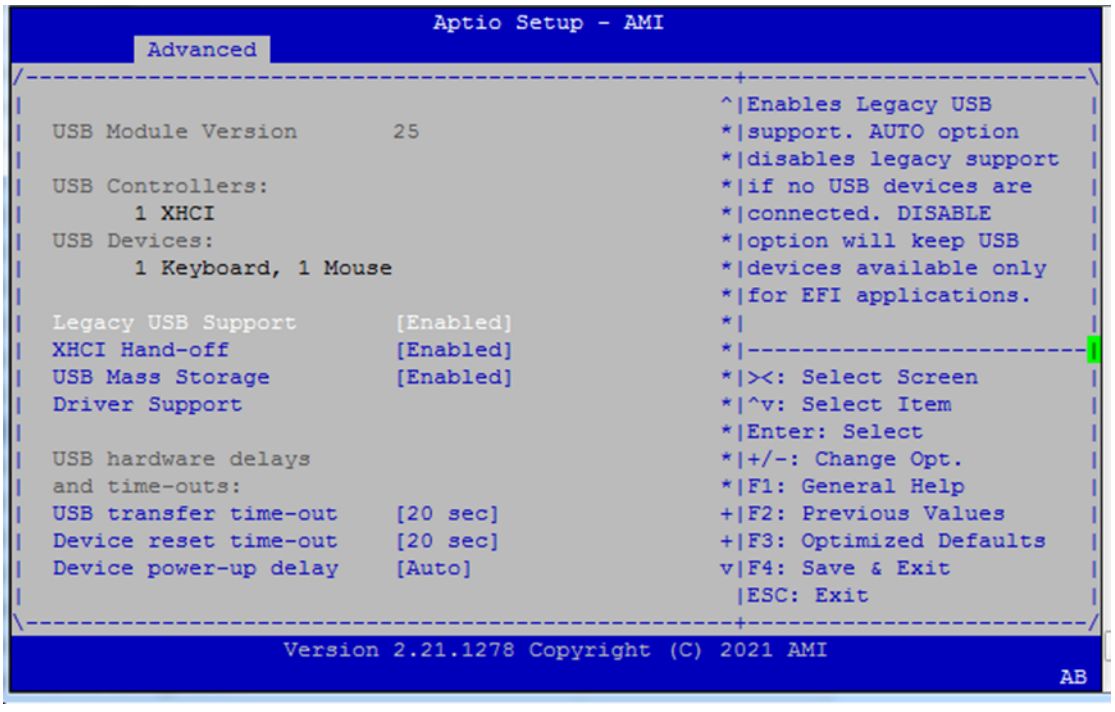


- **SR-IOV Support**: Enable or disable `Single Root I/O Virtualization` for supported PCIe hardware.

  Only applicable if your expansion devices support SR-IOV (e.g., some NICs or FPGA cards).

8.13 USB Configuration

Configure USB behavior for both legacy and UEFI environments.



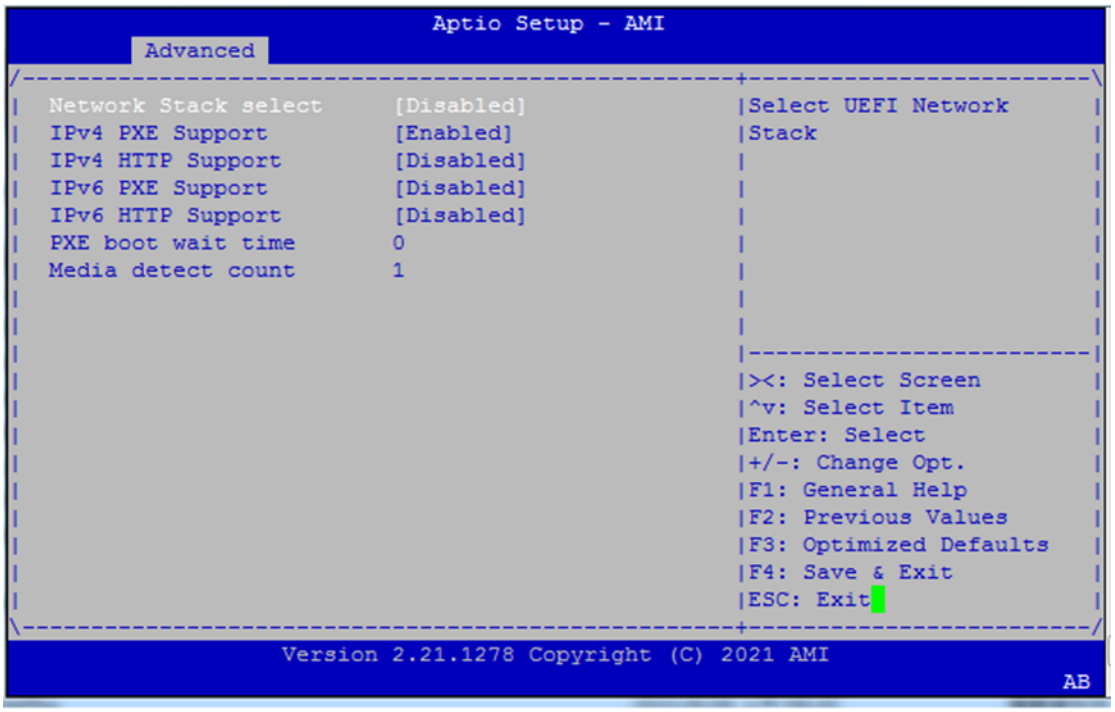
Key options:

- **Legacy USB Support**:

  - `Enabled`: USB available for BIOS/OS
  - `Auto`: Disable if no devices are present
  - `Disabled`: USB only available post-boot via UEFI
- **XHCI Hand-off**: Enable if the OS doesn't support USB 3.0 hand-off natively
- **USB Mass Storage Driver Support**: Enables booting from USB drives
- **Transfer Timeouts**:
  - Transfer: `1s`, `5s`, `10s`, `20s`
  - Device Reset: `10–40s`
- **Device Power-up Delay**:
  - `Auto` or manual override per USB port

8.14 Network Stack Configuration

Enable UEFI booting over IPv4/IPv6 using PXE or HTTP.



Settings:

- **Network Stack**: Enable/disable the entire UEFI network stack
- **IPv4 PXE Boot / HTTP Boot**
- **IPv6 PXE Boot / HTTP Boot**
- **PXE Boot Wait Time**: Seconds to wait for PXE boot before continuing
- **Media Detect Count**: Number of retries to detect connected Ethernet media