ADLINK TECHNOLOGY INC.

SEMA® 3.5

Software Manual

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Revision History

Revision	Date	Changes
1.00	September 2016	Initial release
1.01	December 2016	Update based on SEMA® 3.5 R7 Added Chapter 2.4 BMC Error Log Added Chapter 2.1.9 ADC Tab (A/D conversion feature)

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Abbreviations

SEMA®	Smart Embedded Management Agent
BMC	Board Management Controller
GUI	Graphical User Interface
CLI	Command Line Interface
RPM	Revolutions per minute
mA	milliamps
W	watt
LVDS	Low-Voltage Differential Signaling
S.M.A.R.T.	Self-Monitoring, Analysis and Reporting Technology
MD5	MD5 message-digest algorithm
ADC	A/D conversion

1 Overview

Downtime of devices or systems is not acceptable in today's industries. To help customers to analyze their systems and take counter measures for preventive maintenance, ADLINK has developed a tool which is able to monitor and collect system performance and status information from the hardware in a timely, flexible and precise manner: the Smart Embedded Management Agent (SEMA®).

A Board Management Controller collects all relevant technical information from the chipset and other sources. Using the System Management Bus driver, an application layer fetches the data and presents it to the user. ADLINK provides a ready-made application that shows the data in user-friendly graphic interfaces, suitable for supervision and troubleshooting.

1.1 Introduction

At the heart of SEMA is the Board Management Controller (BMC) supporting SEMA functions. The SEMA Extended EAPI provides access to all functions and can be integrated into the user's own applications. The SEMA GUI and SEMA Command Line Interface allow monitoring, control and use of the SEMA parameters and functions directly on your device for test and demonstration purposes. Optionally SEMA supports also remote procedure calls – please refer to SEMA Software Installation Guide. SEMA is comprised of the following components:

- SEMA Board Management Controller HW and FW
- SEMA Extended EAPI Library
- SEMA GUI
- SEMA Command Line Interface (CLI)

SEMA supports and provides the following functions and information:

- CPU Operation Modes
- Memory Information
- Network Information
- ACPI Power Management

- HDD S.M.A.R.T
- BIOS Updates
- Heartbeat
- Power Consumption
- User Area Access
- Alerts for Power and Temperature Consumption
- I2C Bus Control
- Temperatures(CPU and Board)
- Board Information (Serial Number, Part Number, Firmware Version…)
- Fan Control
- GPIO Control
- 1-Wire Bus
- A/D Conversion

Detailed forensic information is available after system or module failures. The BMC Power-Up Error Log function provides detailed information about history of failures that may have occurred during power-up sequences. Log information includes e.g. error number, flags, restart event, power cycles, boot count, status, CPU temperature and board temperature. Moreover minimum and maximum temperature of the CPU and system is available, as well as HDD S.M.A.R.T information- all of which can be used to analyze system or module failure in detail.

SEMA is available for Linux and Windows operating systems and for various HW platforms.

1.2 SEMA Software

SEMA includes three software components: SEMA Extended EAPI, Graphical User Interface tool and the Command Line tool.

- **SEMA Extended EAPI**

  SEMA includes an API (SEMA Extended EAPI) that allows customers to easily integrate all SEMA functions into their applications. The SEMA Extended EAPI is the core functionality of the SEMA release package. Please refer to the document “SEMA Software Installation Guide” to install it and the document “SEMA Extended EAPI Programming Guide” for detailed information about the API.

- **Graphical User Interface tool**

  The SEMA GUI is part of the SEMA release package. Please refer to the document “SEMA Software Installation Guide” to install it. Instructions on how to use the SEMA GUI are explained in Chapter 2 of this document.

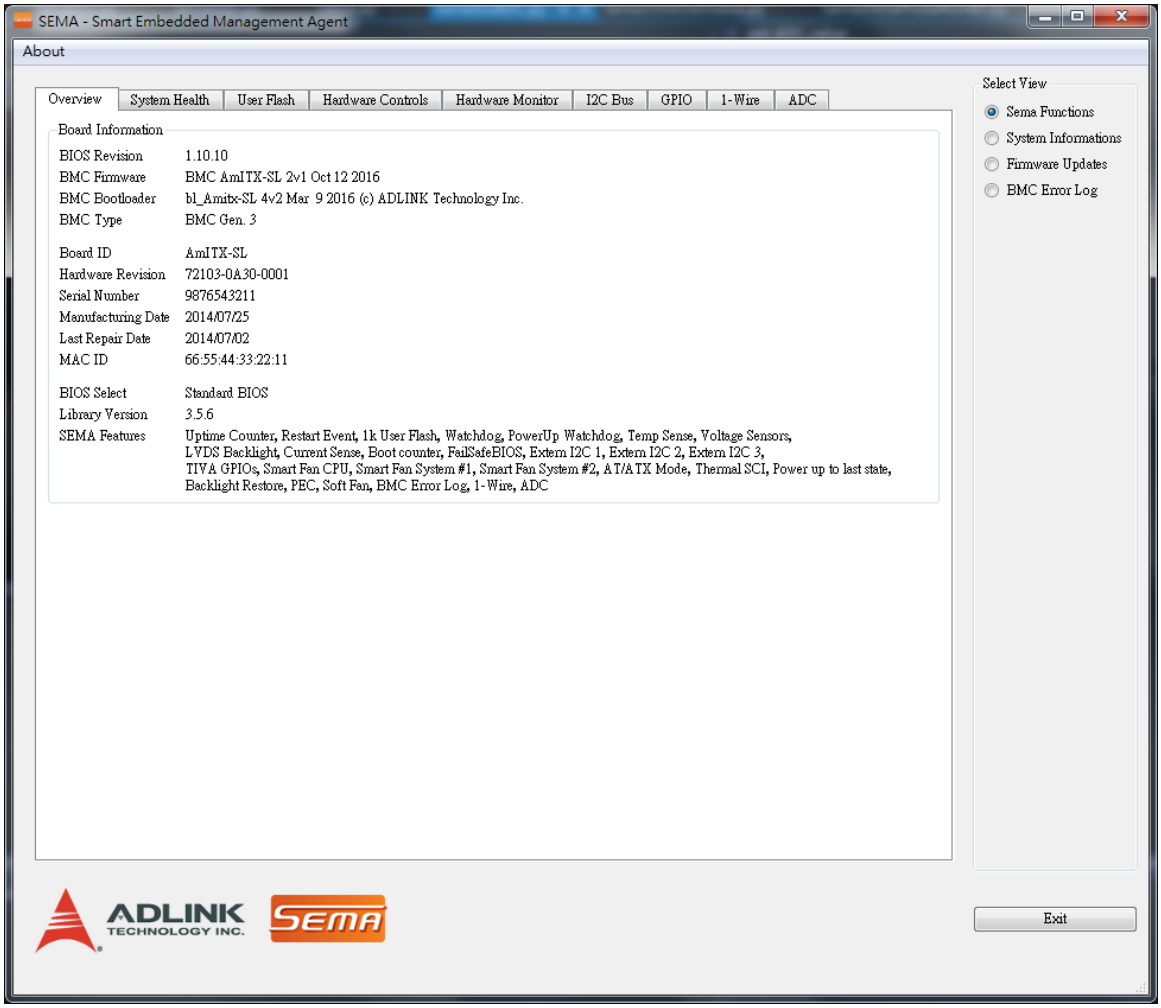
- **Command Line tool**

  The SEMA CLI is also a core part of the SEMA release package and is installed by default. Please refer to the document “SEMA Software Installation Guide” for further information. Instructions on how to use the SEMA CLI are explained in Chapter 3 of this document.

2 Graphical User Interface

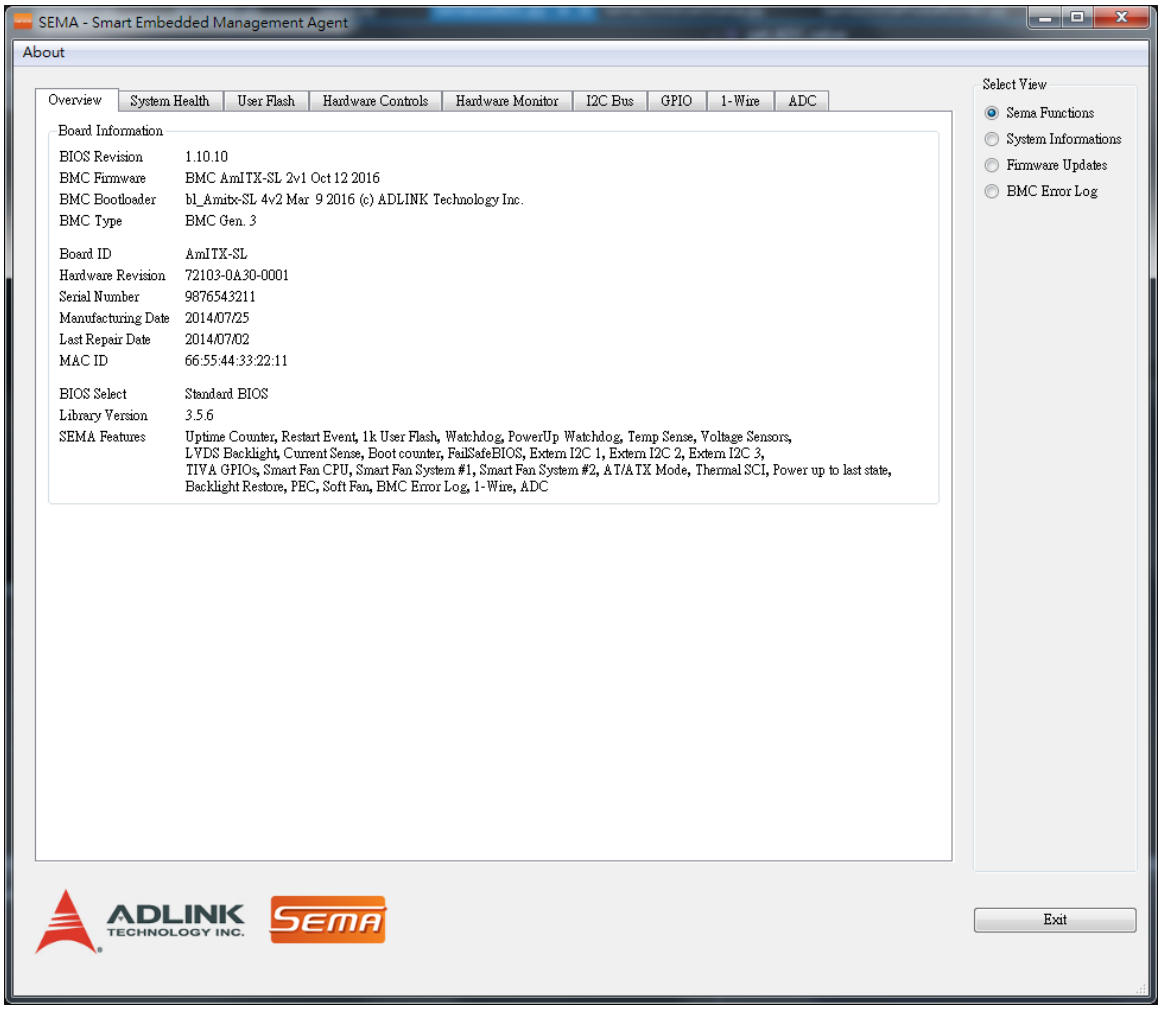
The SEMA GUI graphical interface is available for Windows and Linux operating systems. To get started, simply run semagui.exe (Windows) or SEMA_GUI.sh (Linux). In Windows, the shortcut for SEMA GUI will be located on the desktop. In Linux, the SEMA GUI files will be located at /usr/local/SEMA/bin. You can execute the GUI by using SEMA_GUI.sh

There are four views that can be selected at the right side of the GUI: *SEMA Functions, System Information*, *Firmware Update* and *BMC Error Log*. In the *SEMA Functions* view the following tabs that can be selected: System Overview, System Health, User Flash Memory, Hardware Controls, Hardware Monitor, I2C Bus, GPIO, 1-Wire and ADC (A/D conversion). In the *System Information* view tabs for CPU and Memory Information, Network Information and Hard Disk and S.M.A.R.T Information are available. Users can update the BIOS or BMC firmware in the *Firmware Updates* view and users can observe BMC's power-up sequence error logs in the *BMC Error Log* view.


SEMA - Smart Embedded Management Agent
About
Overview
System Health
User Flash
Hardware Controls
Hardware Monitor
I2C Bus
GPIO
1-Wire
ADC
Board Information
BIOS Revision 1.10.10
BMC Firmware BMC AmITX-SL 2v1 Oct 12 2016
BMC Bootloader bl_Amitx-SL 4v2 Mar 9 2016 (c) ADLINK Technology Inc.
BMC Type BMC Gen. 3
Board ID AmITX-SL
Hardware Revision 72103-0A30-0001
Serial Number 9876543211
Manufacturing Date 2014/07/25
Last Repair Date 2014/07/02
MAC ID 66:55:44:33:22:11
BIOS Select Standard BIOS
Library Version 3.5.6
SEMA Features Uptime Counter, Restart Event, 1k User Flash, Watchdog, PowerUp Watchdog, Temp Sense, Voltage Sensors, LVDS Backlight, Current Sense, Boot counter, FailSafeBIOS, Extern I2C 1, Extern I2C 2, Extern I2C 3, TIVA GPIOs, Smart Fan CPU, Smart Fan System #1, Smart Fan System #2, AT/ATX Mode, Thermal SCI, Power up to last state, Backlight Restore, PEC, Soft Fan, BMC Error Log, 1-Wire, ADC
Select View
Sema Functions
System Informations
Firmware Updates
BMC Error Log
ADLINK TECHNOLOGY INC.
SEMA
Exit

2.1 SEMA Functions

2.1.1 System Overview Tab

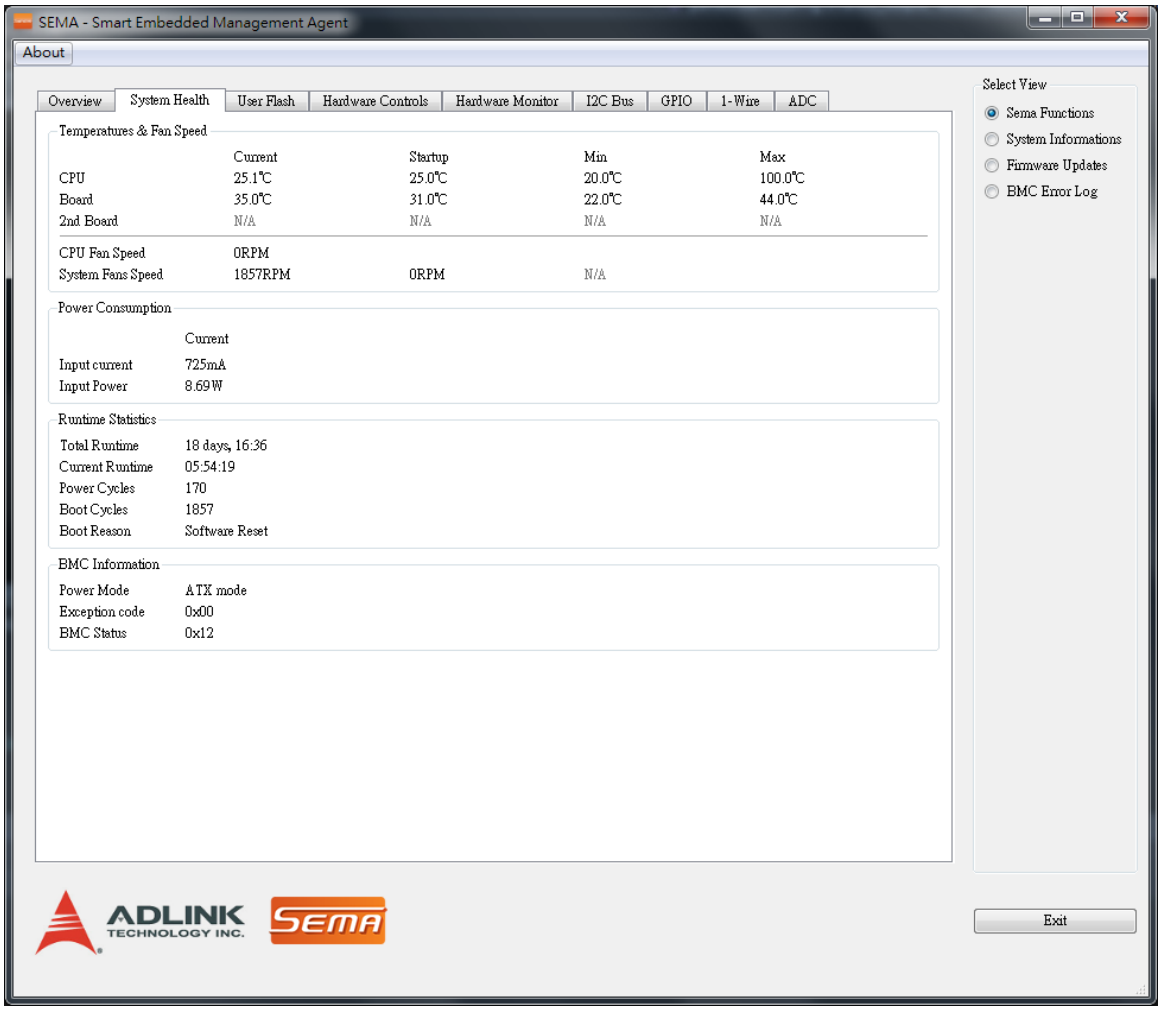


Board Information

This section shows general information about the board, BIOS, firmware and SEMA information.

The first three lines show the firmware versions of the board. The BMC versions each contain an ID-string and the respective build date. The fourth line shows BMC types. The next lines show the board ID, hardware revision, serial number, manufacturing/repair date and MAC ID of the board. The last three lines show BIOS selected (Standard BIOS or Fail Safe BIOS), SEMA library version and all supported SEMA features of the board.

2.1.2 System Health Tab



Temperatures & Fan Speeds

This section displays the current, start-up, minimum and maximum temperatures of the CPU and environment (board and 2nd board). The data is displayed in degrees Celsius and is updated every second. The current speed of the CPU fan and system fans 1 to 3 are displayed in RPM. Please note that not all platforms supply all information shown above. If any information is unavailable, "N/A" will be displayed.

Power Consumption

The power consumption section displays information about the main power supply. These readings are displayed in milliamperes (mA) for current, and watts (W) for power consumption, and are updated every second.

Runtime Statistics

The following runtime statistics are displayed: total runtime, current runtime, power cycles, boot cycles and boot reason.

Total Runtime	The total uptime of the system in hours and minutes.
Current Runtime	Uptime since last boot in hours, minutes and seconds.
Power Cycles	Number of power cycles.
Boot Cycles	Number of HW/SW resets and successful power-ups.
Boot Reason	The event that caused the last reboot. (e.g. power loss, power down, HW reset, etc.)

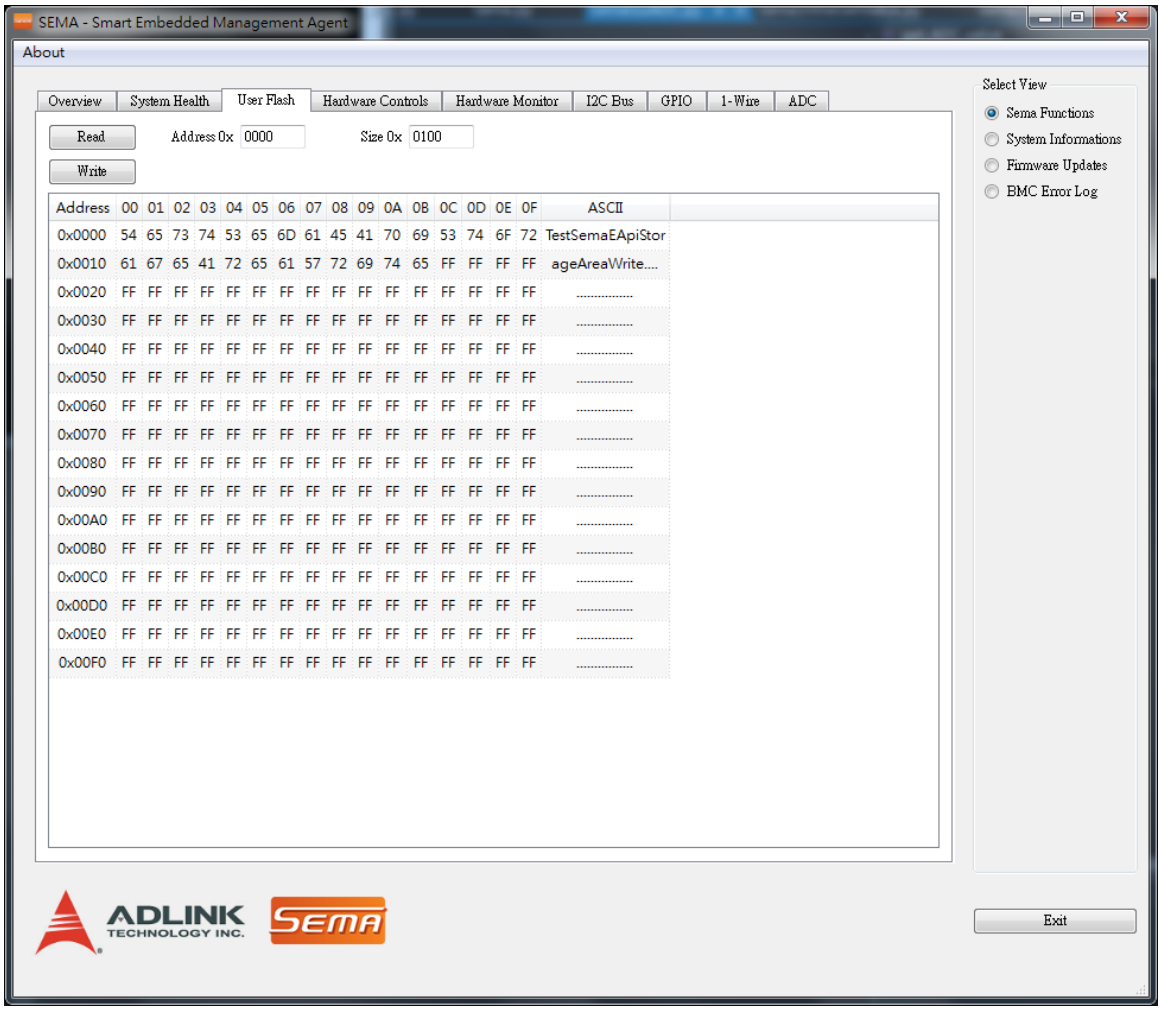
BMC Information

BMC Status refers to the BMC Flags displaying information about the internal status of the BMC. The content is board-specific. Please refer to your HW manual for details.

Additionally, this section provides information about:

- The power mode of the system: AT or ATX mode
- Exception code: board specific error code of last detected power-up error. (Note: errors are logged with BMC Power-Up Error Log function. See also respective paragraph.)

2.1.3 User Flash Memory Tab



Read Memory

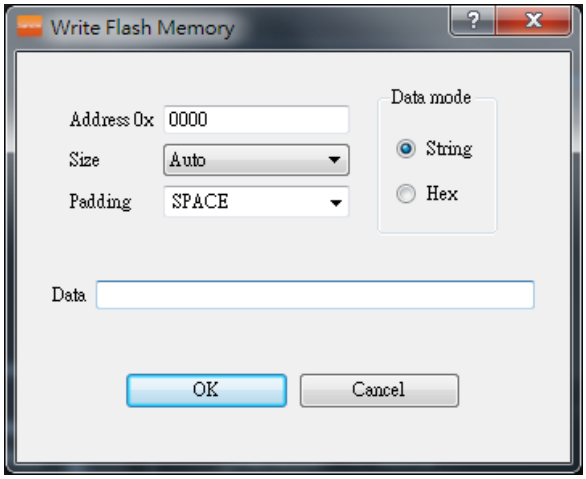
Address and size values are entered as hexadecimal values. Valid start addresses are multiples of 16 within the range 0x0000 - 0x01F0 for 512 byte variants and 0x0000 - 0x03F0 for 1024 byte variants. The size can be any multiple of 16 bytes (up to the total memory size).

Example: To display the first 32 bytes from user flash memory, enter “0000” as the address, “20” (hex 20 equals decimal 32) as the size, and press the [Read] button. The memory content is transferred from the BMC and displayed in the output window.

Each line contains the address of the first byte of the respective line, followed by 16 data bytes (displayed as hexadecimal values, prefixes “0x” omitted for better readability) followed by the corresponding printable ASCII characters.

Write Memory

The [Write] button opens the Write Flash Memory dialog box.



Address

The address is entered as a hexadecimal value within the range of 0x0000 - 0x01FC (0x03FC for 1k board variants).

Size

The size can be any multiple of four, up to 32 bytes or “Auto”.

In Auto-mode, the number of bytes to write is determined by the amount of data entered in the data field of the Write Flash Memory dialog box (max 32 bytes).

Padding

If the data length is not a multiple of four, the required number of pad (or fill) characters is appended.

In String-mode, a valid pad character can be any printable ASCII character or one of the predefined pad characters:

- SPACE character (ASCII character 0x20)
- NULL character (ASCII character 0x00)

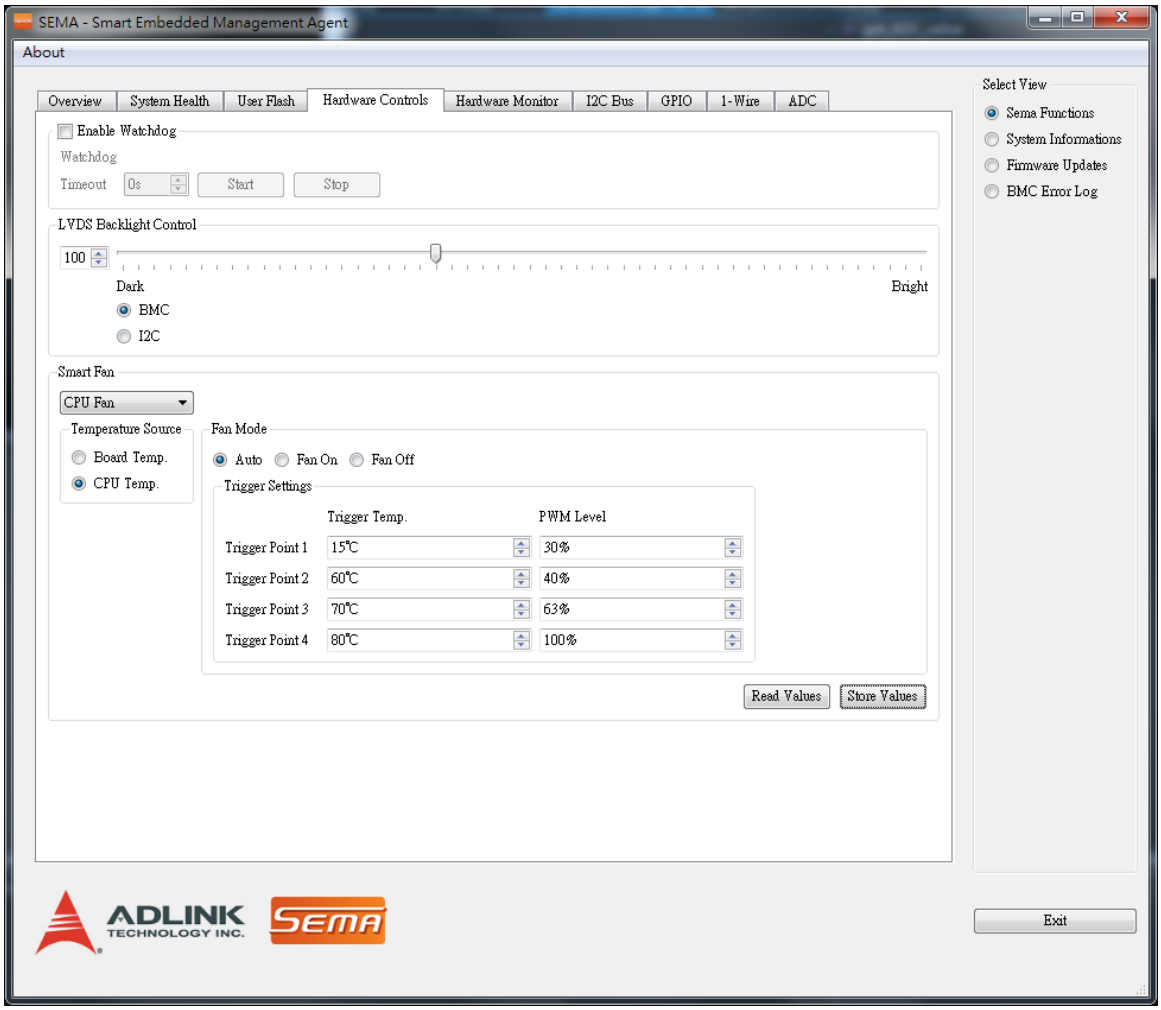
In Hex-mode, any eight bit hex value (00...FF) is valid.

Data Mode

Currently supported modes are String and Hex.

- String mode: The entered text (up to 32 characters) is converted to a byte stream. Please note that no termination character is appended.
- Hex mode: Up to 64 hex digits (0...9, A...F) can be entered, resulting in up to 32 bytes of data.

2.1.4 Hardware Control Tab



Watchdog

The watchdog timeout value is given in seconds and can be set from 1 to 65535 seconds. The [Start] button starts the watchdog. The [Stop] button disables the watchdog.

Please note that not all platforms support watchdog functionality. If unavailable, the watchdog section will be grayed out.

Notes:

- When using the watchdog feature, be sure to have all partitions mounted read-only. Otherwise file system corruption and data loss may occur.
- It is NOT advisable to use the watchdog feature under Windows since it is recommended to restart a Windows environment using a safe shutdown procedure.

Backlight Control

Enables or disables the backlight of a display connected via LVDS. The backlight value can be adjusted by a slider or entered as a numerical value. Allowed values range from 0 to 255.

Please note that not all platforms support the necessary circuitry. If unavailable, this section will be grayed out.

The radio boxes select if the backlight is controlled by the BMC or the LVDS I2C interface.

Smart Fan

The Smart Fan section provides control of the CPU and system fans (if applicable). The available fans can be also seen in the System Health Tab.

All fans can have an independent temperature source, which determines which temperature sensor will be used for calculating the PWM level.

If the Fan Mode is set to "Auto", the fan will be controlled using the Trigger Settings described below. If the Fan Mode is set to “Fan Off” the fan is turned off completely. If the Fan Mode set to “Fan On” the fan runs at maximum RPM (PWM level 100%).

The Trigger Settings consist of four Trigger Points, each with a “Trigger Temp.” and “PWM Level”, which determine the characteristic curve of the fan control. According to the settings in the screen capture shown above, the fan will:

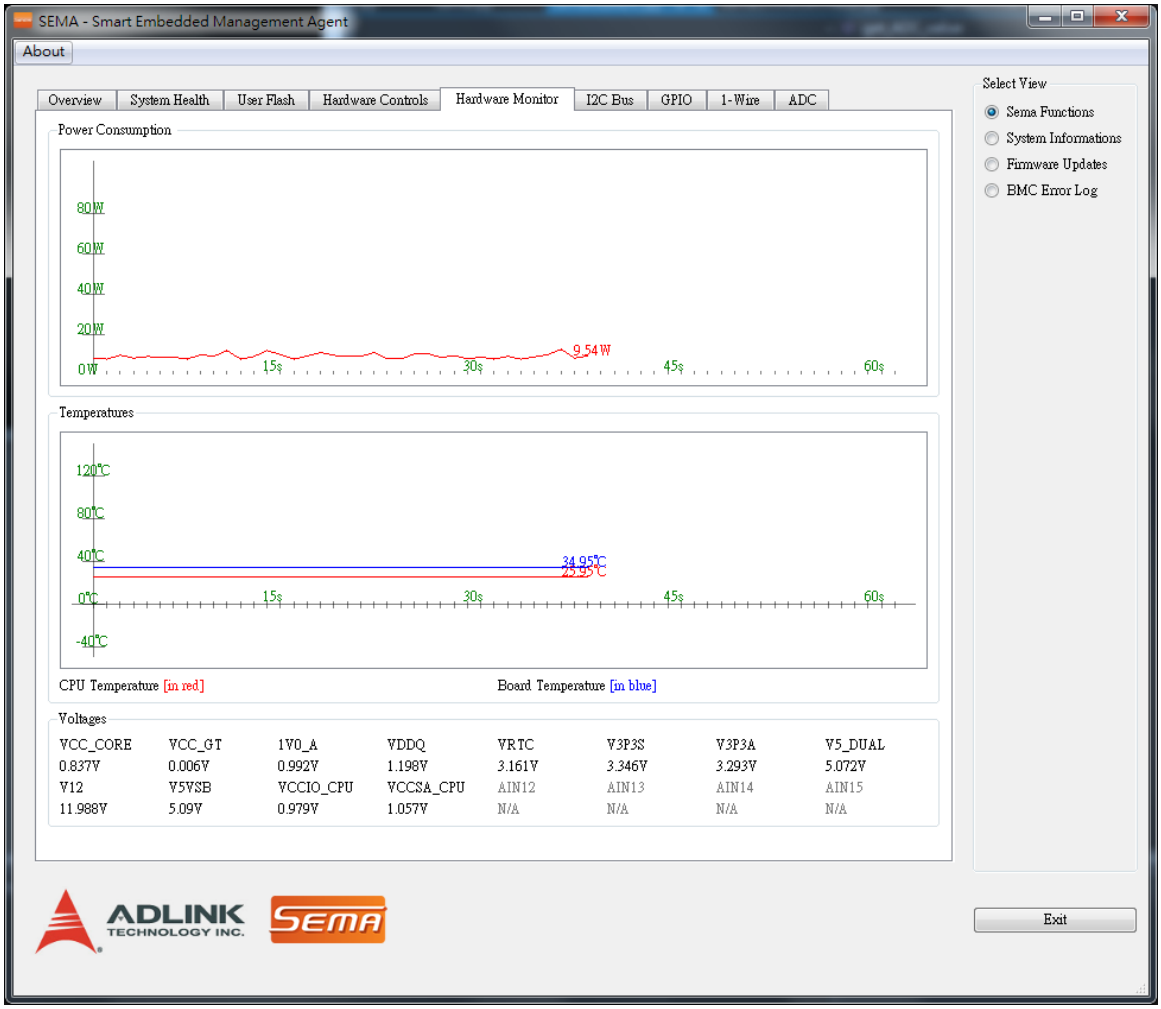
- be turned off when the temperature drops below 15°C
- run with a PWM level of 30% if the temperature is above 15°C but below 60°C
- run with a PWM level of 40% if the temperature is above 60°C but below 70°C
- run with a PWM level of 63% if the temperature is above 70°C but below 80°C
- run with a PWM level of 100% if the temperature exceeds 80°C

If the temperature drops below one of the trigger points, the PWM level of the preceding trigger point will be applied.

The [Read Values] button reads out the current values of the board management controller and displays them in Trigger Settings.

The [Store Values] button stores the new settings to the board management controller.

2.1.5 Hardware Monitor Tab



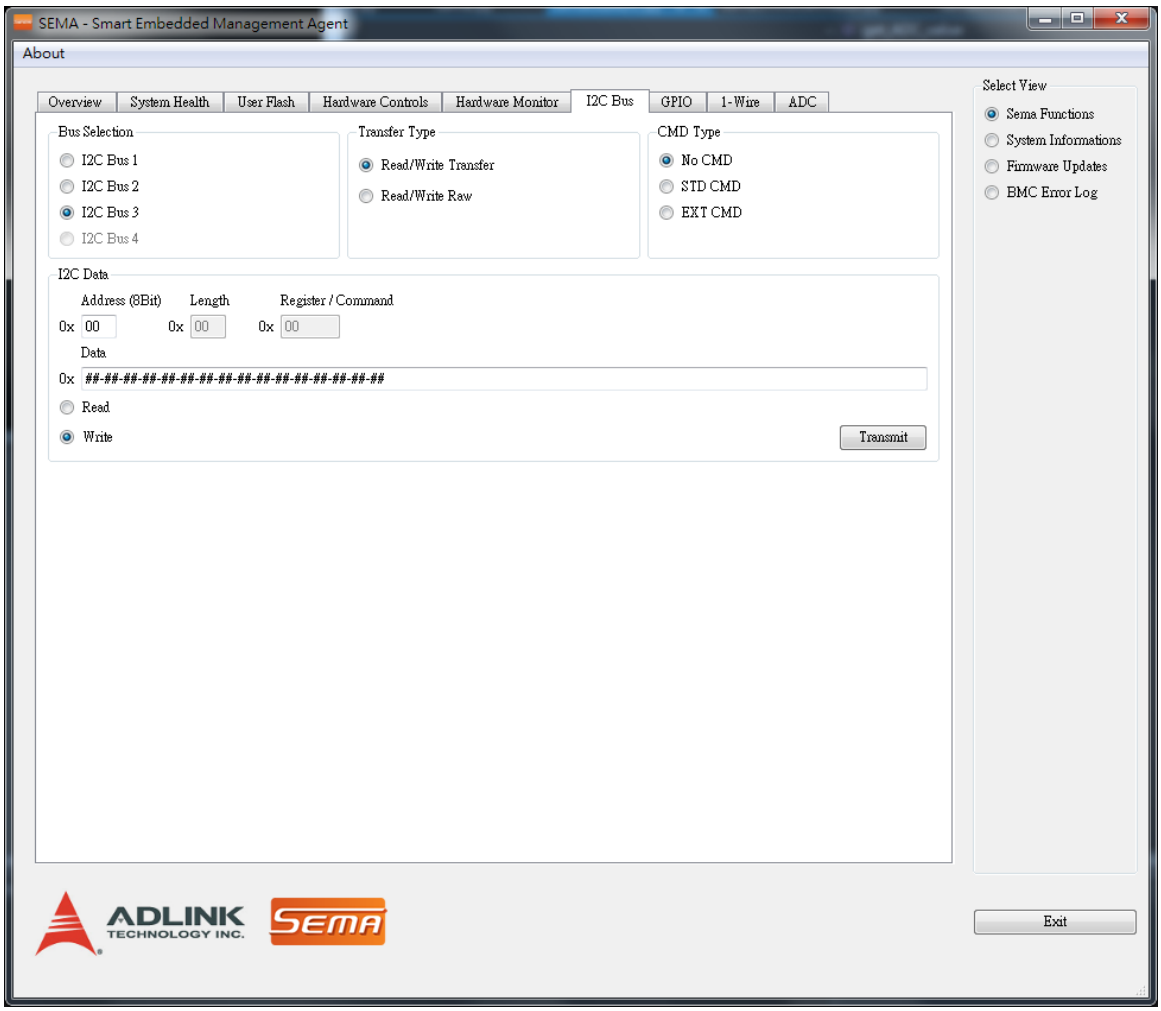
Power Consumption / Temperatures

The Hardware Monitor tab displays the “Power Consumption” and “Temperatures” information from the “System Health” tab in a graphical format. The y-axes are watts and degrees Celsius respectively, and the x-axis is seconds. The most recent 60 seconds of data are displayed with the current values above the “60” marker.

Voltages

This section displays all voltage information on the board.

2.1.6 I2C Bus Tab



The board management controller (BMC) can access up to four external I2C busses. Byte and raw access for read and write are implemented.

To read data from or write data to the BMC, an address (8-bit) must be given as well as the amount of data to be transferred (length) plus the register offset.

Data then has to be handed over in hex values forming a hex string.

Transfer Type

The available transfer types and the resulting I2C bus activity are described below.

Read/Write Transfer

- Write: Start + Address/Write + Register /Command + Length + Data[1] + Data[2] + … + Data[Length] + Stop
- Read: Start + Address/Write + Register /Command + Start + Address/Read + Length + Data[1] + Data[2] + … + Data[Length] + Stop

Read/Write Raw

- Write: Start + Address/Write + Data[1] + Stop
- Read: Start + Address/Read + Data[1] + Stop

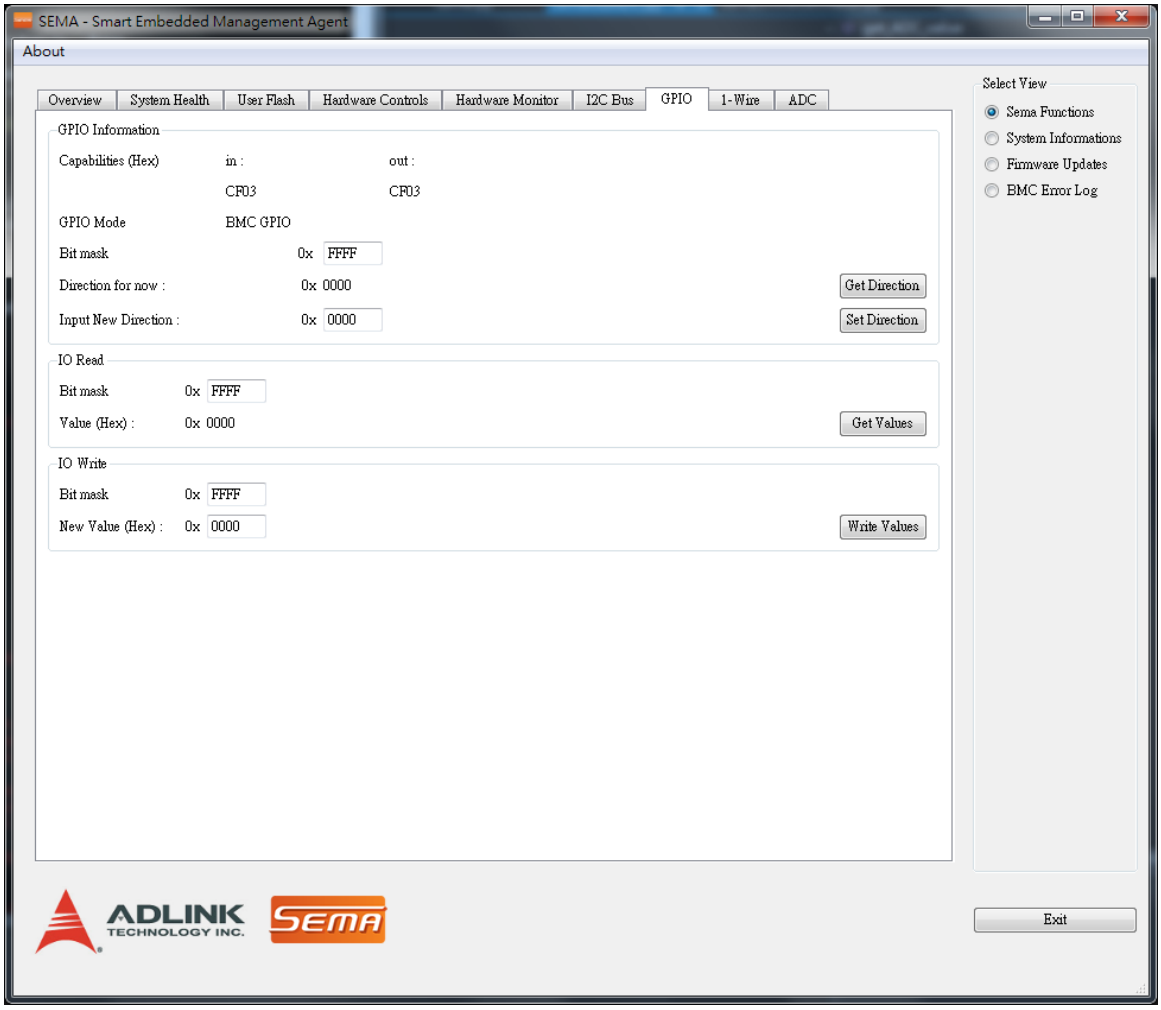
CMD Type

Select the “Read/Write Transfer”, the CMD Type can be selected.

The available command types are described below.

- No CMD: no command. The Register/Command will be grayed out.
- STD CMD: standard command. The Register/Command will show 1-byte.
- EXT CMD: extend command. The Register/Command will show 2-byte.

2.1.7 GPIO Tab



GPIO Information

This section controls the GPIO direction. Each bit in the byte shown represents a GPIO. To set a GPIO for output the bit must set to 0, and for input it must be 1.

The bit mask means the specific GPIOs/bits are selected or unselected. Selected bit is 1. Unselected bit is 0. Only selected bits are returned for getting direction or changed for setting direction.

The [Get Direction] button reads the current configuration and the [Set Direction] button sets the configuration to the value entered in the “Input New Direction” field.

IO Read

This section shows the current input values for all GPIOs. GPIOs configured as output will show their current output value.

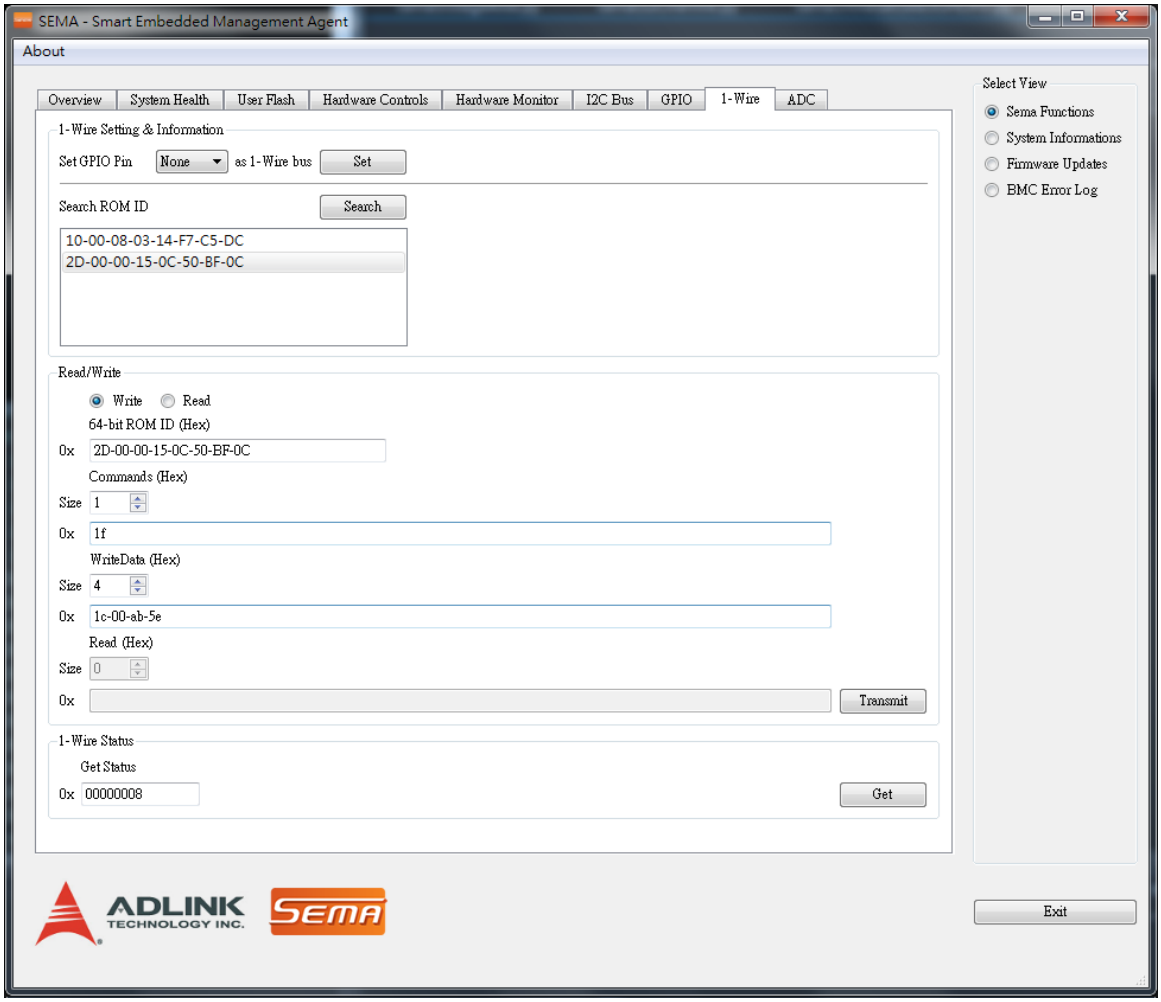
The bit mask means the specific GPIOs/bits are selected or unselected. Only selected bits (1) are returned.

IO Write

This section sets the outputs. GPIOs configured as input will not be affected.

The bit mask means the specific GPIOs/bits are selected or unselected. Only selected bits (1) are changed. Unselected bits (0) remain unchanged.

2.1.8 1-Wire Tab



1-Wire is a device communications bus system that provides low-speed data, signaling, and power over a single signal. SEMA 1-wire function provides an easy to use interface to connect and use 1-wire capable sensors or crypto chips. SEMA BMC will act as bus master and communicate with one or more 1-wire slaves. A BMC controlled GPIO pin can be defined to act as physical connector. The 1-Wire Tab allows to configure it and to send data to or receive data from connected 1-Wire Devices using the 1-Wire protocol.

1-Wire Setting & Information

This section displays the current GPIO pin which is selected as 1-Wire bus when users select the tab. If the selection shows “None”, it means no GPIO pin as 1-Wire bus.

Select GPIO pin and click [Set] button to set it as 1-Wire bus.

The [Search] button probes the 1-Wire bus and shows all available connected 1-Wire Device’s unique ROM IDs.

Double-click the selected ROM ID, it will show at “64-bit ROM ID (Hex)” automatically.

Read / Write

The [Transmit] button can read or write 1-Wire data according to the selection of the “Read” and ”Write”.

Select “Write”, please input the size and data of the “Command (Hex)” and “Write data (Hex)”, respectively.

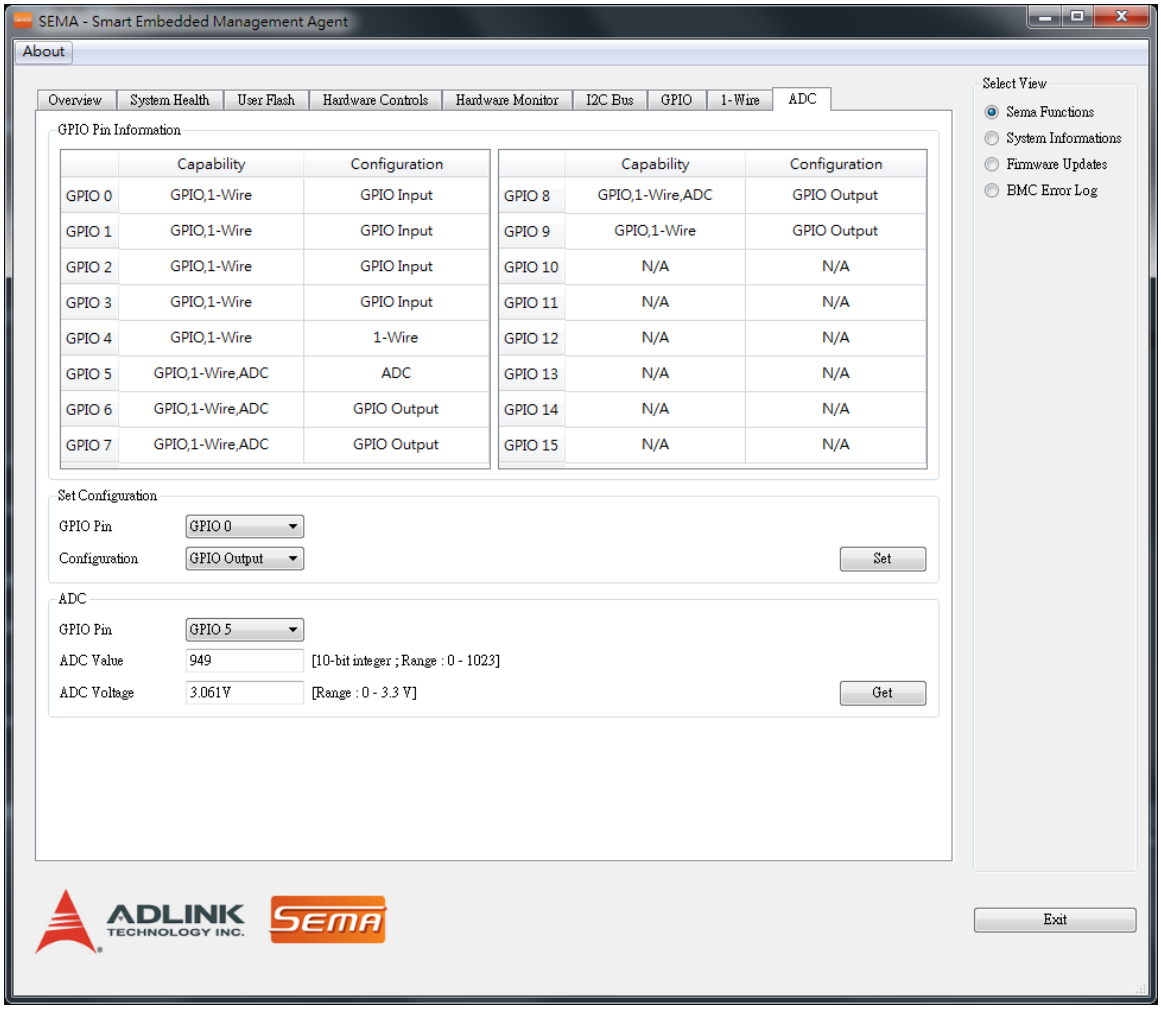
Select “Read”, please input the size and data of the “Command (Hex)” and “Write data (Hex)” respectively, and choose the size of “Read (Hex)”.

1-Wire Status

The [Get] button can get current status of the 1-Wire bus.

Please note that not all platforms support 1-Wire functionality. If unavailable, the 1-Wire sections will be grayed out.

2.1.9 ADC Tab



GPIO Pin Information

This section displays the capability and the current configuration of GPIO pins (GPIO 0 ~ GPIO 15).

All kind of the capability of GPIO pins includes GPIO, 1-Wire and ADC. If GPIO pins support “GPIO”, it can be set “GPIO Input” or “GPIO Output” in the Set Configuration section.

Set Configuration

This section can set the configuration of GPIO pins.

Select GPIO pin and configuration type. And click [Set] button to set it.

While setting the configuration type, the GPIO pin information will be updated automatically.

ADC

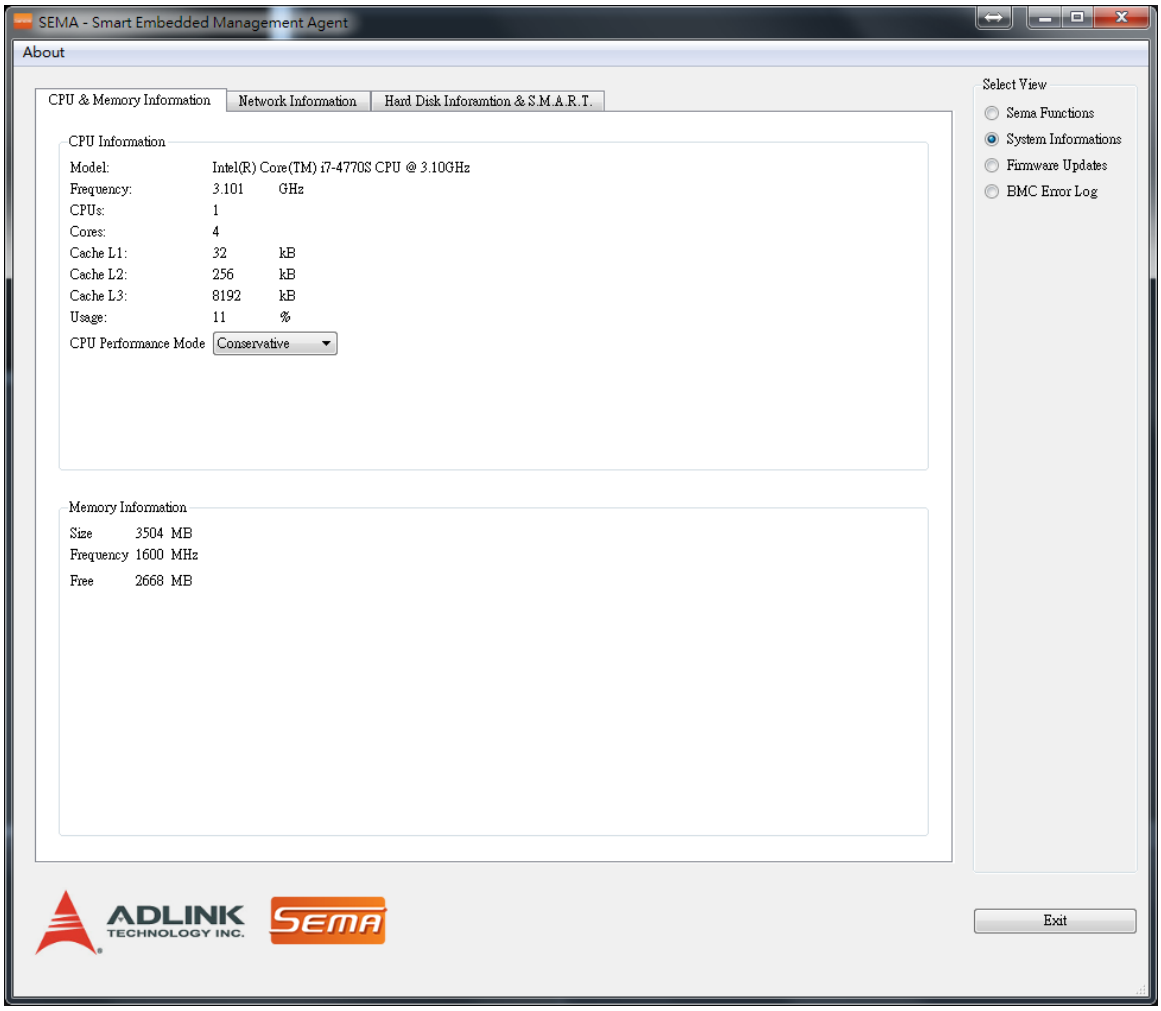
This section displays the A/D conversion value of the pins for which the selected GPIO capability is ADC type. The ADC value is 10-bit and its range is in 0~1023. The ADC voltage range is 0~3.3V.

Select GPIO pin and click [Get] button to show the ADC value and ADC voltage.

Please note that not all platforms support ADC functionality. If unavailable, the ADC sections will be grayed out.

2.2 System Information

2.2.1 CPU & Memory Information Tab



CPU Information

This section shows all information about the CPU, including model, frequency, the number of CPUs, the numbers of cores of each CPU, L1/L2/L3 cache size, the current CPU usage and CPU performance mode.

The CPU Performance Mode can set to the following four modes:

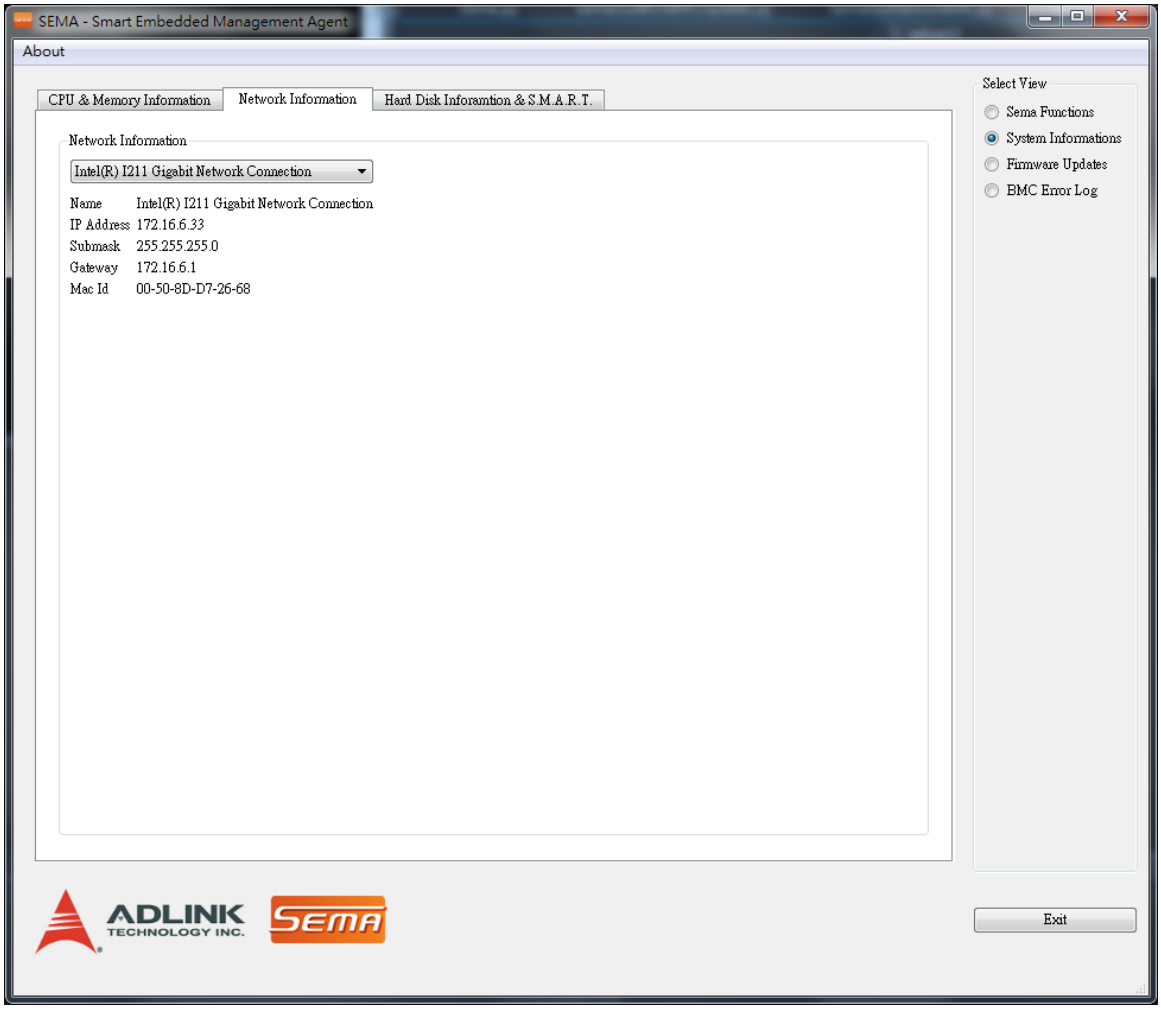
- High Performance: set the CPU statically to the highest frequency
- Powersave: set the CPU statically to the lowest frequency

- On Demand: set the CPU frequency depending on the current usage
- Conservative: set the CPU frequency depending on the current usage. It differs in behavior to On Demand in that it gradually increases and decreases the CPU speed rather than jumping to maximum speed as soon as there is any load on the CPU.

Memory Information

This section displays the memory size, frequency and free memory space.

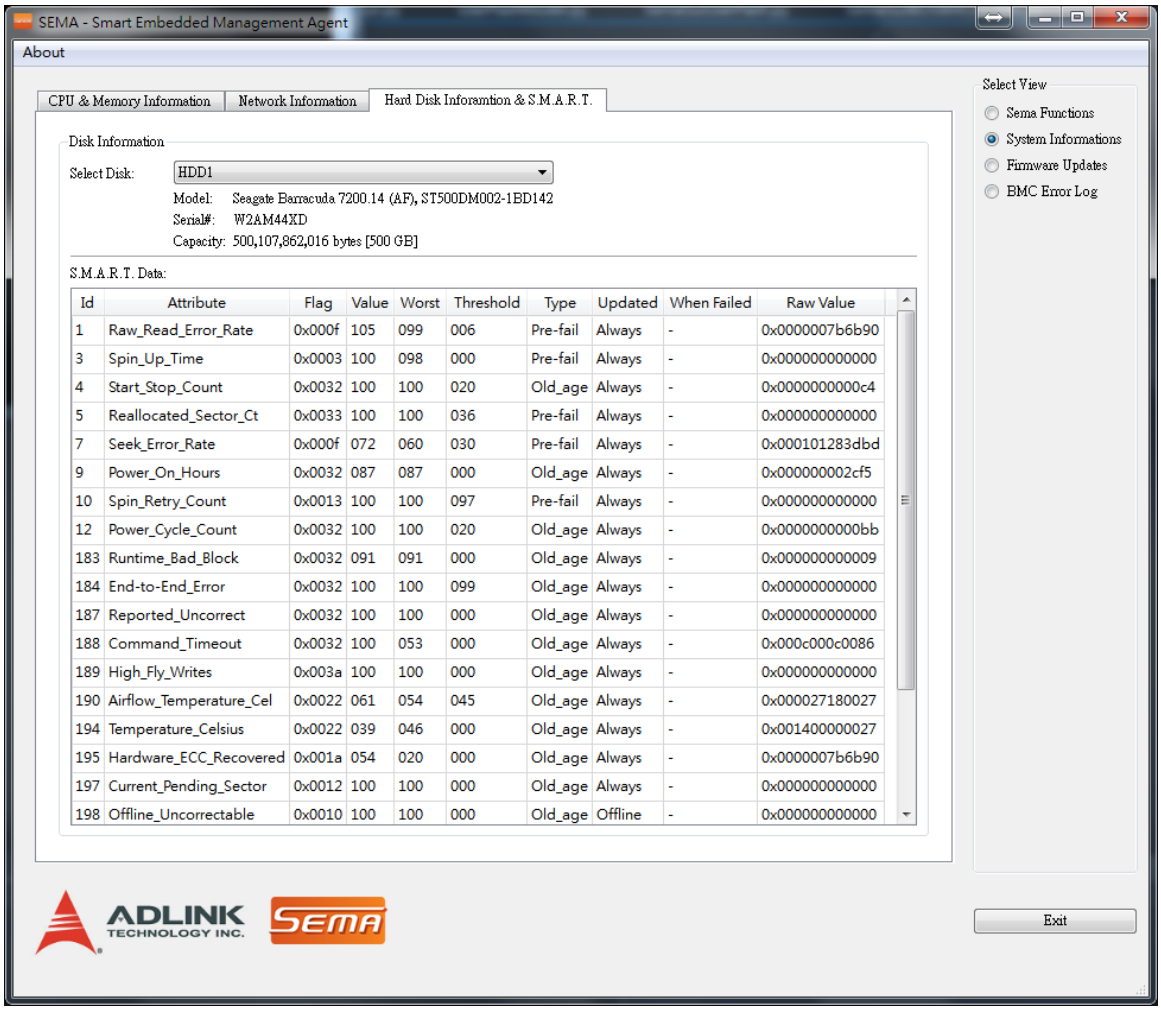
2.2.2 Network Information Tab



This tab displays all network information, including the Ethernet controller, IP address, subnet mask, gateway and MAC address.

If there are two or more Ethernet controllers, the drop-down menu can be used to select the desired Ethernet controller.

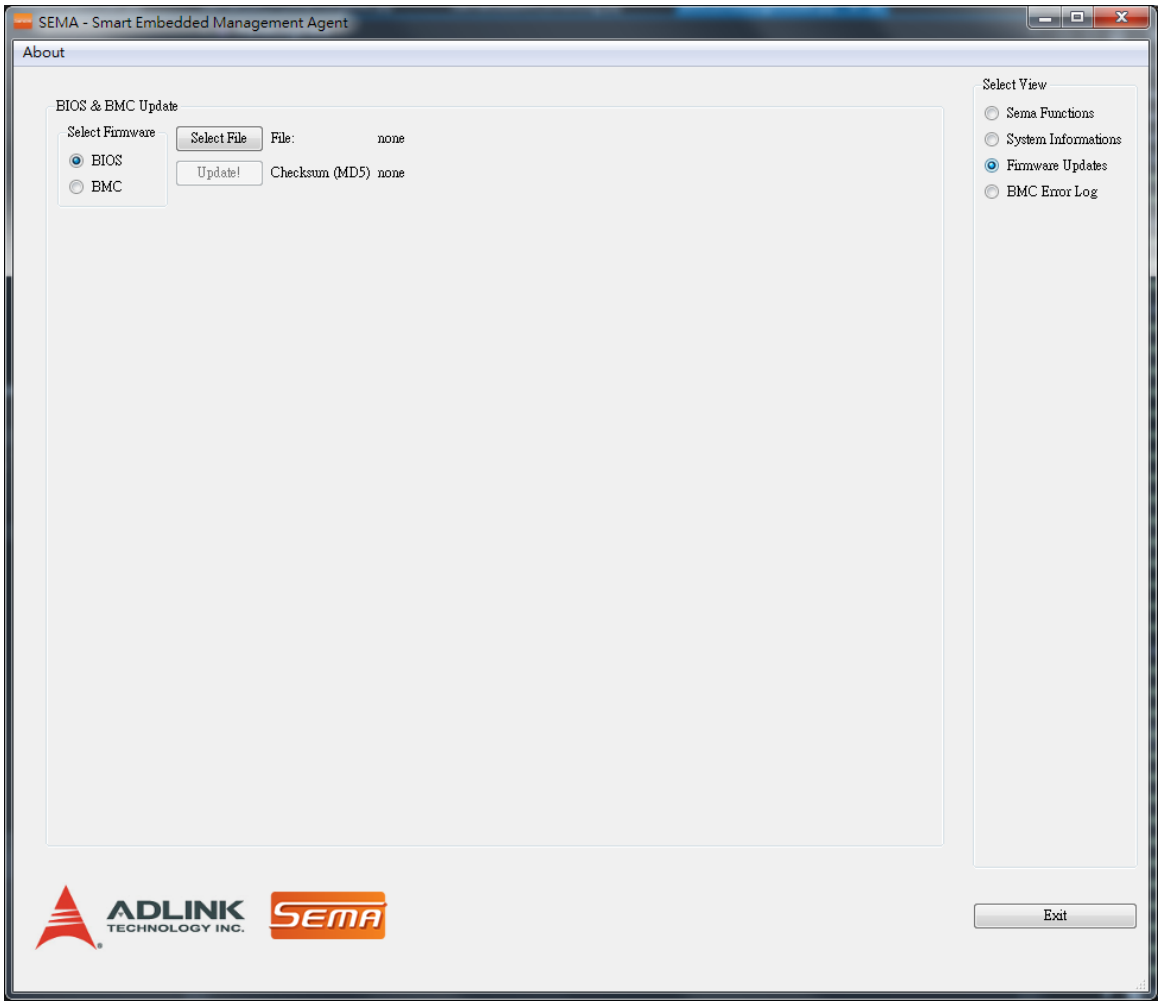
2.2.3 Hard Disk Information & S.M.A.R.T. Tab



This tab displays hard disk information, including hard disk model, serial number, capacity and S.M.A.R.T. data.

If there are two or more hard disks, the drop-down menu can be used to select the desired hard disk.

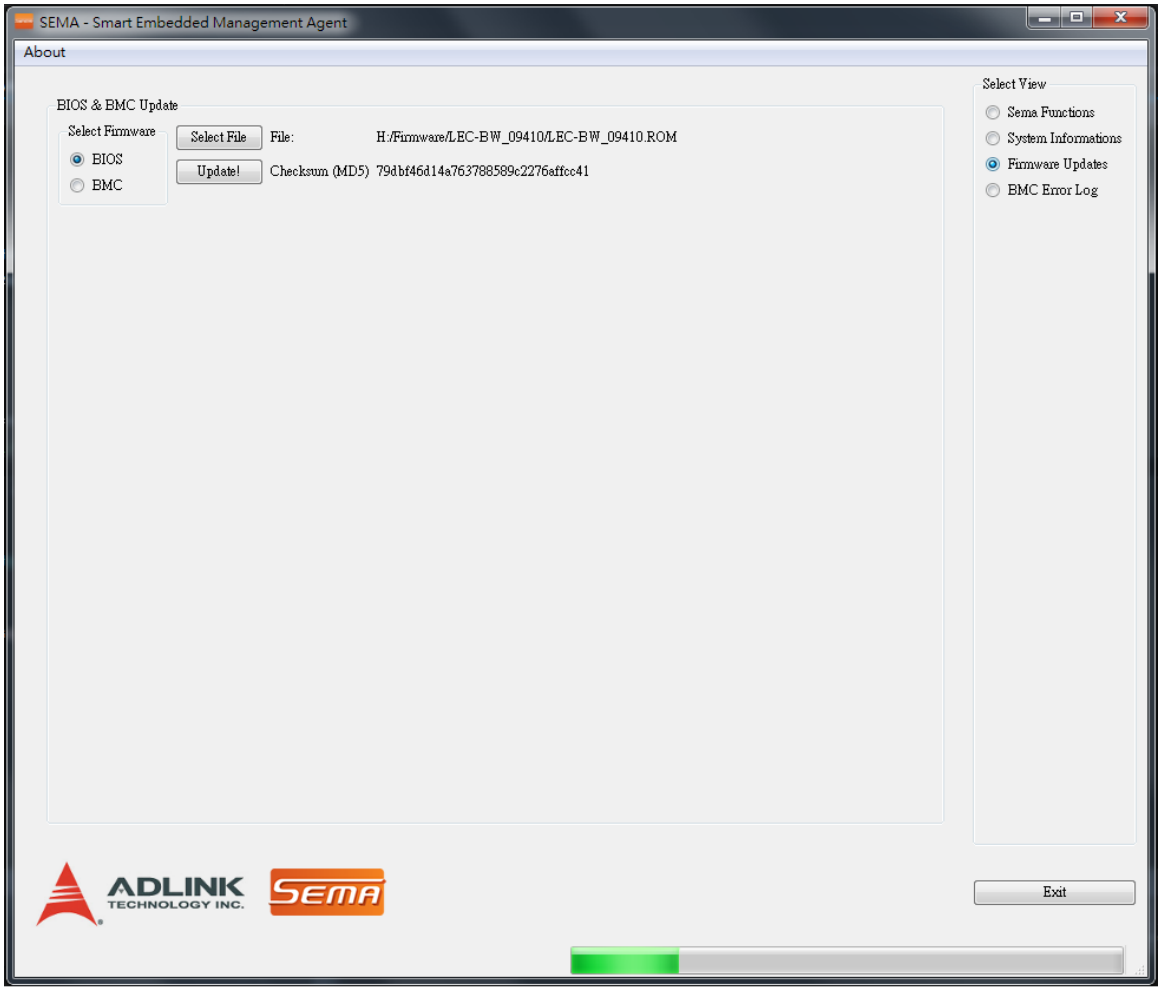
2.3 Firmware Update



This view is used to update the BIOS and BMC firmware.

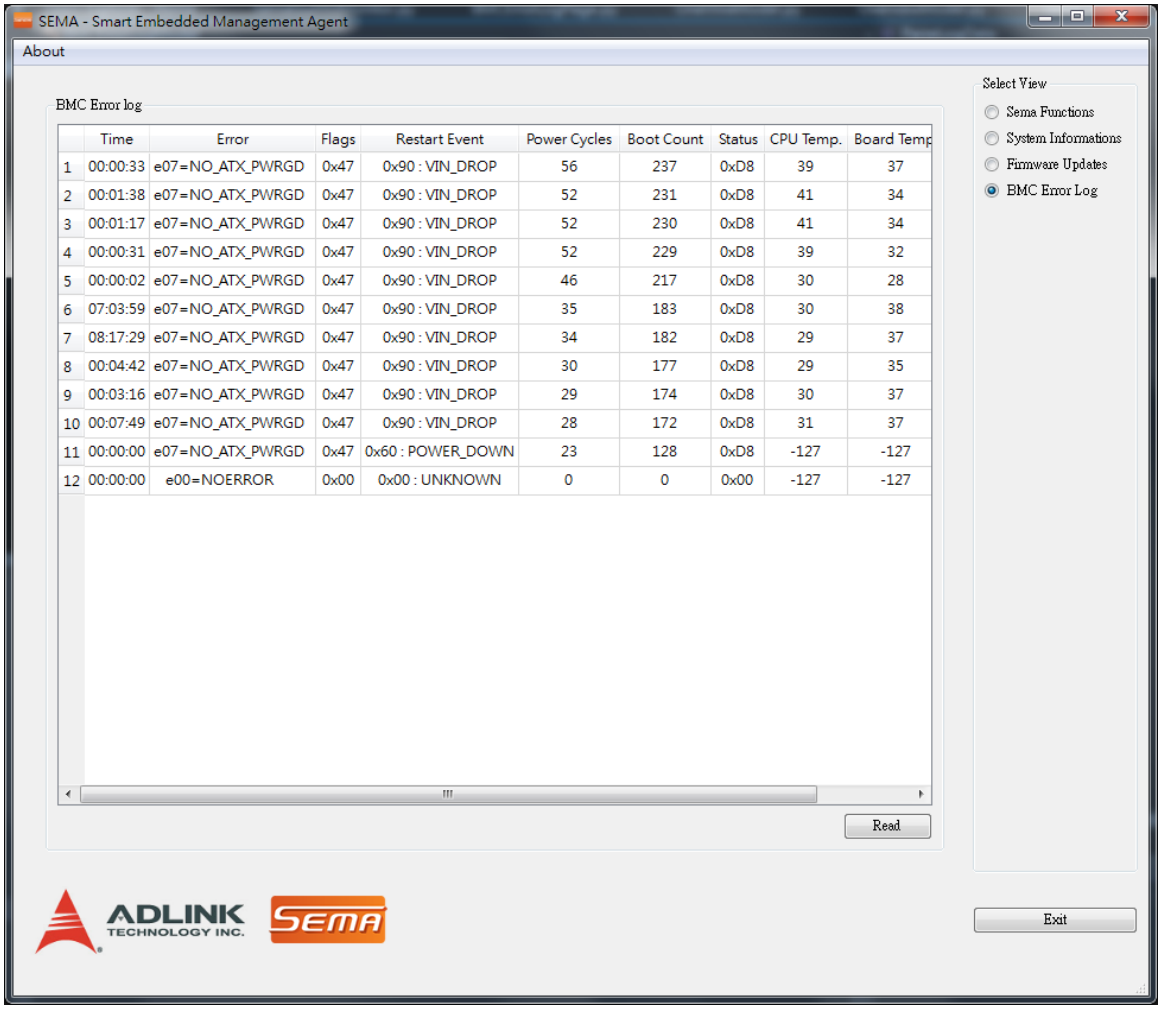
Select “BIOS” or “BMC”, and then select the desired file using the [Select File] button. The [Update!] button will then be enabled; click it to update the firmware.

Caution: Before you perform an update, please make sure that you have the correct file for BIOS or BMC update!



During the update, do NOT close the window. A progress bar will be displayed in the lower right corner of the window. When the updated has finished, a message box will be displayed.

2.4 BMC Error Log



This view is used to display the BMC Power-Up Error Log.

Click [Read] button to show the error log.

The information of the error log includes time, error, flags, restart event, power cycles, boot count, status, CPU temperate and board temperate.

Parameters like error, flags, restart_event and status are HW specific. Please refer to your HW manual for details. “Error” refers to the Exception Code list and the respective error messages, “flags” refer to the BMC Flags, “restart_event” refers to the Boot Reason or System Restart Cause, “status” refers to the BMC Status.

Restart Events

0x00: UNKNOWN

Unknown Reason of Restart

0x20: SW_RESET

A reset by Software caused the Restart of the system

0x30: HW_RESET

A reset by Hardware caused the Restart of the system (e.g. Reset-Button)

0x40: WATCHDOG

The Watchdog has restarted the system

0x50: BIOS_FAULT

Main-BIOS is corrupted -> boot from Backup BIOS

0x60: POWER_DOWN

The system was shut down (e.g. Power-Button, ACPI Shutdown)

0x70: POWER_LOSS

The system is restarted after a Power-loss (e.g. external Power supply instable or switched off while the system was running)

0x80: POWER_CYCLE

The system is restarted after a Power-cycle (e.g. internal Power supply has failed)

0x90: VIN_DROP

The system is restarted after a Voltage Drop of the Main-Input-Voltage

0xA0: PWR_FAIL

The system is restarted after a PWRFAIL detection of an internal power supply circuit

0xB0: CRIT_TEMP

The system was shut down by ACPI Watchdog (CPU reached critical temperature)

Please note that not all platforms support error log functionality. If unavailable, the error log sections will be grayed out.

3 Command Line Interface

The SEMA command line interface is available for both Linux and Windows versions. To use it please open a Linux Console or the Windows Command Line tool, respectively. For a description of the supported SEMA command line options, refer to the following sections.

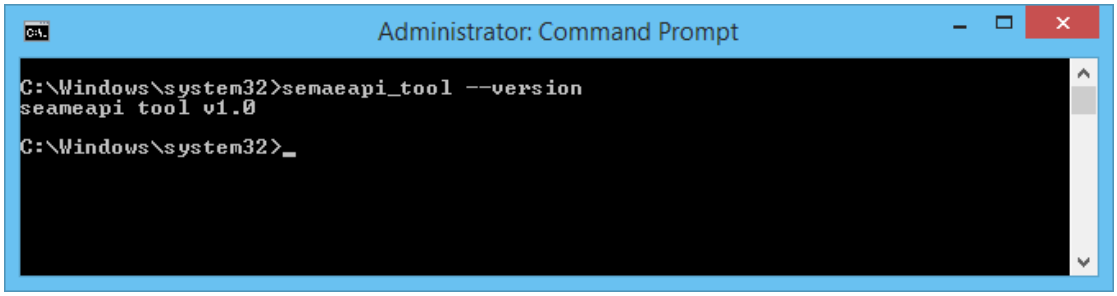
3.1 General Options

Display the help screen with a brief list of available options:

- semaeapi_tool --help
- semaeapi_tool -h

Display the version of the command line tool:

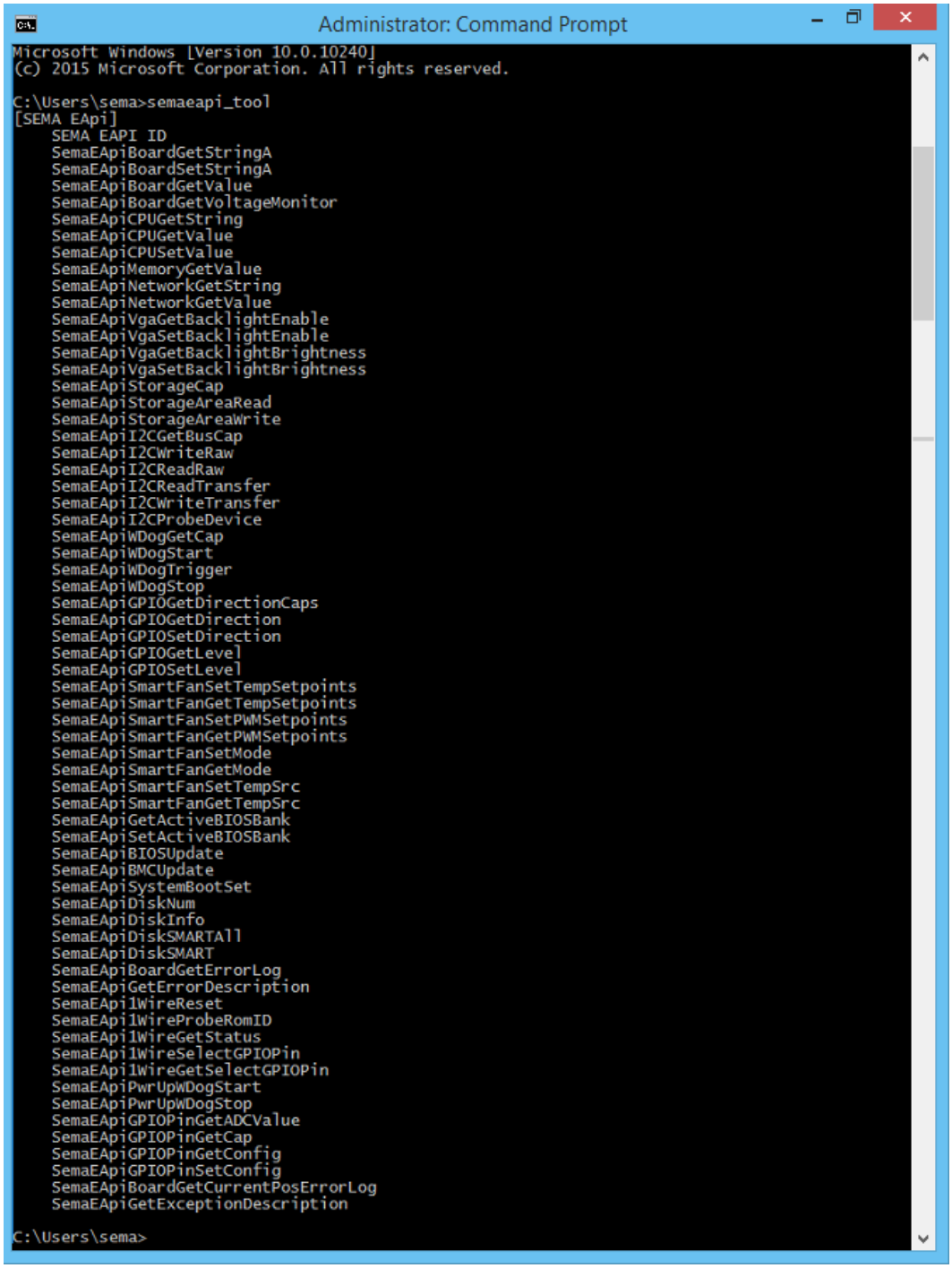
- semaeapi_tool --version
- semaeapi_tool -V



3.2 Executing Commands

Display the entire SEMA Extended EAPI command set:

- semaeapi_tool



Show the usage of a command:

- semaeapi_tool -a [SEMA Extended EAPI command]

  e.g. semaeapi_tool –a SemaEApiBoardGetStringA

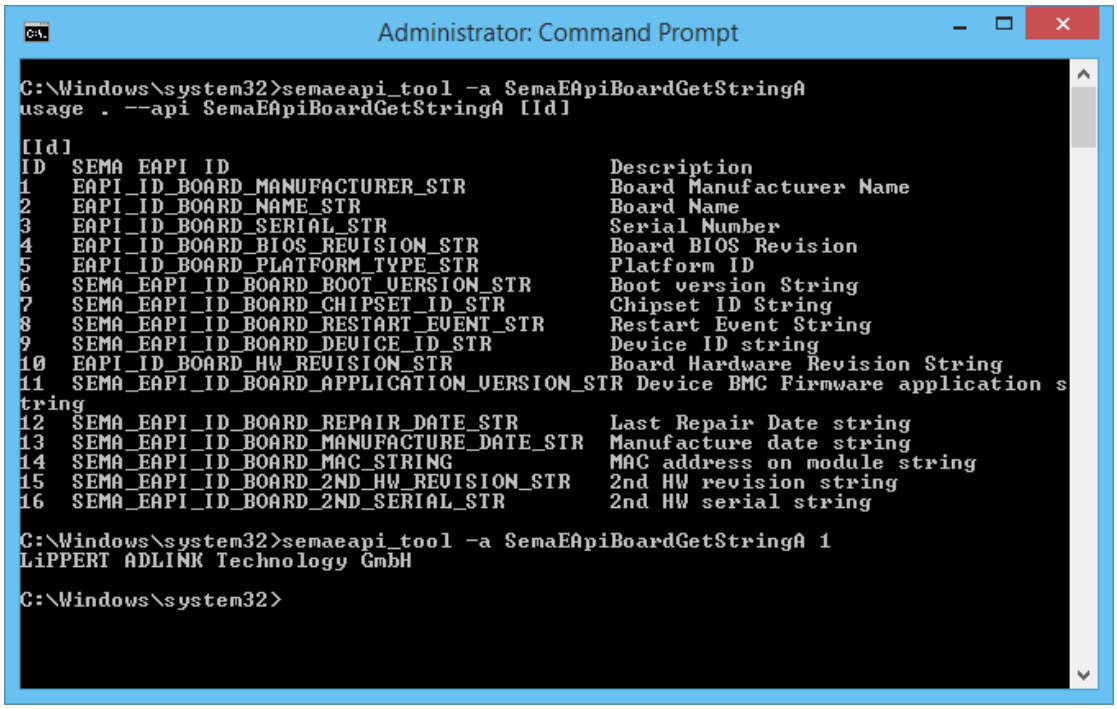
  Shows the usage and more detailed information about the command (see below).

Show the value of one or more parameters:

- semaeapi_tool -a [SEMA Extended EAPI command] [parameter(s)]

  e.g. semaeapi_tool -a SemaEApiBoardGetStringA 1

  The [parameter(s)] must be valid for the SEMA EAPI command.



Execute tool by remote:

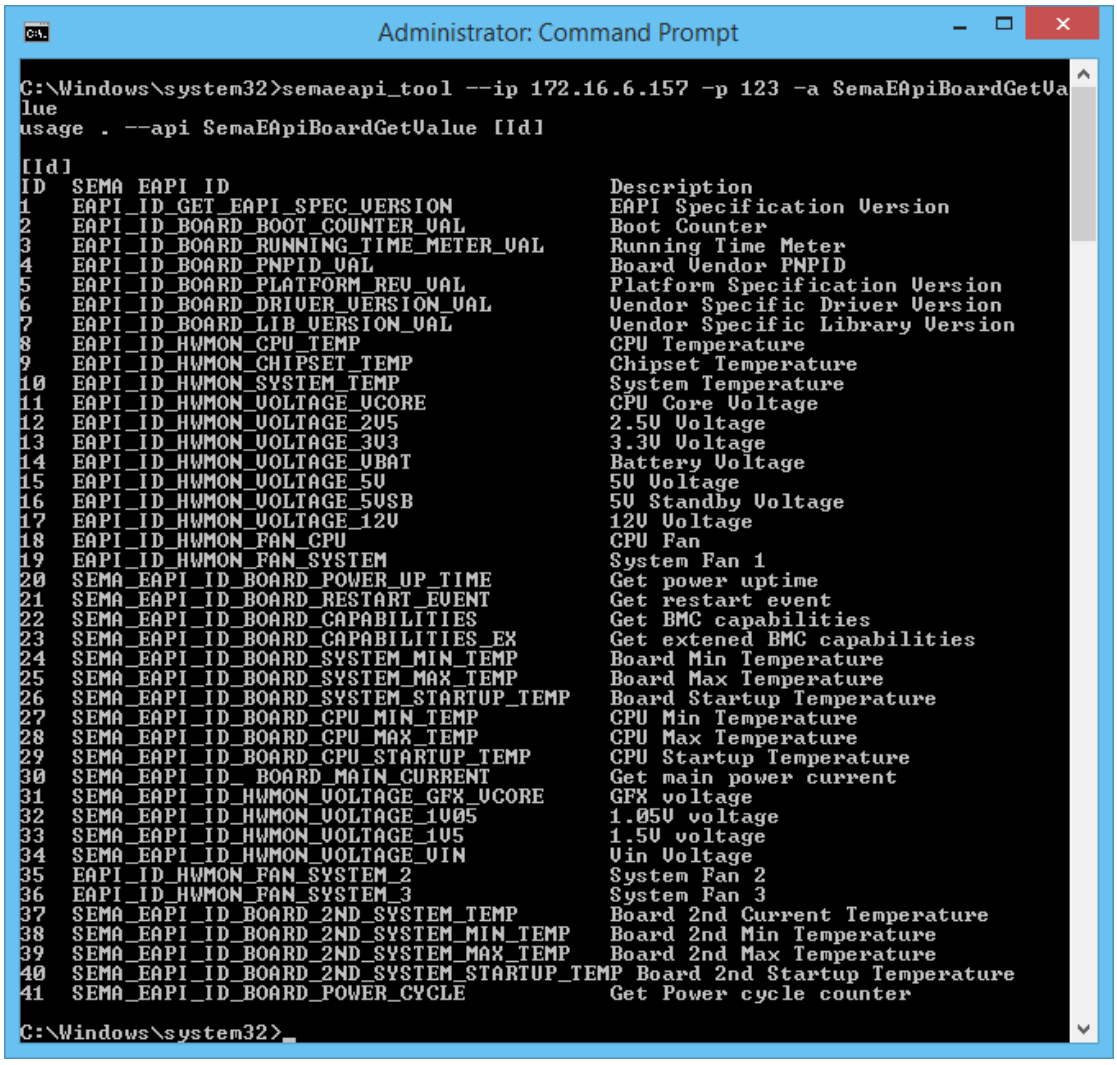
- semaeapi_tool --ip [IP] -p [pwd] -a [SEMA Extended EAPI command] [parameter(s)]

  e.g. semeapi_tool --ip 172.16.6.157 -p 123 –a SemaEApiBoardGetValue 1

  The [parameter(s)] needs to refer to the usage of the SEMA EAPI.

  The [IP] is the IP address of the target device that was monitored.

  The [pwd] is the password to access the remote target board.



Note: SEMA Extended EAPI remote procedure calls are possible only when the remote computer/board is configured accordingly. Please refer to the SEMA Software Installation Guide for details.

Getting Service

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