IA-860m

Getting Started Guide

IA-860m Getting Started Guide

Document Revision: 1/9/2025
Hardware Revision: Rev 0, Rev 1, Rev 2, Rev 3

BittWare
45 South Main Street, Suite L100
Concord, NH 03301 USA
+1 (603) 226 0404

Intellectual Property

Contents

1 Introduction

This guide provides a sequence of steps for installing and setting up the IA-860m card. It provides instructions for the following tasks:

- Unpacking the IA-860m
- Installing the IA-860m
- Connecting to the IA-860m
- Working with the BMC

1.1 About this Guide

1.1.1 Purpose of This Document

This guide covers hardware revisions 0, 1, 2, and 3 of the IA-860m, which is an Intel Agilex AGM039 PCIe board. The purpose of this document is to provide a sequence of steps to help customers get their boards physically installed in their system. This document also outlines common tasks and capabilities and points towards the associated documentation. Last, it provides instructions on verifying the card using the Card Test software and FPGA design.

1.1.2 Document History

Release Date	Document Revision	Notes/Changes
27-Feb-2024	0.0	Initial release
10-May-2024	1.0	Update for Hardware Rev 1
03-Oct-2024	2.0	Update for Hardware Rev 2
13-Dec-2024	3.0	Update for Hardware Rev 3
09-Jan-2025	3.1	Update for SDK 2024.4.1 release

1.2 Contacting BittWare

BittWare is dedicated to providing customers with superior technical support:

- **BittWare Developer Site:** The BittWare Developer Site provides online access to our technical support resources. Go to developer.bittware.com to register for an account. Once you have set up an account, you will have access to BITTS (the BittWare Issue Tracking and Technical Support site), BittWare product documentation, software downloads, release notes, and examples. When you are logged into the Developer Site, follow the "Issue Tracking" link at the top right of the screen to access BITTS.

- **BittWare's website:** Our website at www.bittware.com provides a variety of literature, including whitepapers, datasheets, and articles.

- **Phone**: You can also call us directly at +1 (603) 226 0404 between the hours of 8:30 a.m.– 5:00 p.m. (US Eastern Time) or +44 (0) 1236 373500 between the hours of 8:30 a.m. – 5:00 p.m. (UK GMT).

1.3 Customer Feedback

Thank you for using BittWare products. We appreciate you choosing BittWare for your FPGA development.

If you have a few minutes to spare, we would love to hear from you about your experience with our products or our staff. We know your time is valuable; we would be grateful for any comment at all.

- Please email us at support@bittware.com for any type of feedback

- Or, let us know about a recent Technical Support inquiry at http://koch.link/bwsupportfeedback

2 Installation

This section explains how to prepare the host system for use with the IA-860m and then how to handle and install the card into the system. To work with FPGA files the host system will need the necessary Intel Quartus Prime FPGA development tools. The IA-860m also leverages the BittWare Software Development Kit (SDK) and IA-860m Card Support Package* (CSP) for card monitoring and access to the Board Management Controller (BMC).

Once the system has been configured with the necessary software, the card can be unboxed and installed in the system.

2.1 Installing the FPGA Development Tools

We recommend installing Intel's FPGA development tools. Intel's Quartus Prime development software provides the FPGA application development environment for the Agilex FPGA. We also recommend using BittWare's Software Development Kit and Card Support Package*, which are available on the Developer Site.

- To install Quartus, follow the instructions in the *Intel FPGA Software Installation and Licensing Quick Start* document (available on the Intel website: Intel FPGA Software Installation and Licensing Quick Start).

2.2 Installing the BittWare SDK and IA-860m CSP

Before installing the IA-860m in the host system, you will need to install the Software Development Kit (SDK) and the associated IA-860m Card Support Package (CSP).

- Download the BittWare SDK installer from the BittWare Developer Website.
- Run the BittWare SDK setup program and follow the instructions in the SDK Reference Guide
- Once the SDK is installed, install the IA-860m CSP following the Card Support Package Installation instructions.

Note: If you are using SDK v 2024.4 and onwards the Card Support Packages have been rolled into one download and are therefore included within the SDK install.

2.3 Handling the IA-860m

When handling the IA-860m adhere to the following instructions to avoid damage to the card:

- Follow ESD-safe workspace practices, see below for details
- Handle the card along the edges of the PCB when possible. This helps to prevent contamination from the oils on skin.
- Avoid picking up the card by or applying pressure to components (connectors, etc.).

2.3.1 ESD Handling Tips

Warning: Before handling the IA-860m, review the ESD handling suggestions. Effective ESD control and proper ESD handling will maintain the reliability of your BittWare products. Please follow the guidelines listed below to avoid ESD damage to the IA-860m.

- Transport the board only in ESD shielding bags or shielding containers.
- Do not remove the board from its static shielding bag when outside an EPA (ESD Protected Area).
- Wear a grounding wrist strap when handling the board. BittWare also recommends using foot/heel straps incombination with static dissipative flooring.
- When handling the board, hold it by its edges, being careful not to touch any of its components.
- All work benches should be properly grounded and have a conductive surface to eliminate ESD. Placing theboard on top of the static shielding bag does not offer any ESD protection.

2.4 Unpacking the IA-860m

To unpack the IA-860m board:

Carefully remove the board from the shipping box following the BittWare handling suggestions.

Note: Save the box and packing materials in case the card needs to be reshipped. The box and packaging the IA-860m is shipped in is specifically targeted for the mechanical design of the card. Reusing the included box and packaging mitigates the chance of damage during shipping.

1. Observe all precautions described in the warning above to prevent damage from electro-static discharge (ESD).
2. Carefully examine the board, checking for damage. If the board is damaged, do not install it. [Contact BittWare technical support](#).

2.5 Installing the IA-860m

After installing the desired software, install the IA-860m in your system.

1. Power down the host system.
2. Install the IA-860m in an available x16 PCIe slot. See below for installation instructions.
3. Plug in the -USB cable (Bittware USB to Pico-Lock custom cable (2221000079, optionally shipped with the card[1]) to the USB port on the rear of the card (J7).
4. Connect the power cable and adapter to the power connector (J2) on the rear of the card.
   - **Only use the supplied PCIe 12V_2X6 cable adaptor or ATX3.0 standard power supply** with 12V-2x6 (12pin CEM5 compliant power connector) cable.
   - Cards have been tested against the supplied 8 pin PCIe power cable adapter (note both PCIe 8 pin connectors must be supplied from same 12-volt rail) and ATX3.0 standard supply with direct 12V-2x6 (12pin CEM5 compliant power connector) cables; only use either of the above
5. Power up the PC.

Installing in a PCIe Slot: When installing the card in a x16 PCIe slot, be sure to handle the card along the edges of the PCB. Avoid putting pressure on any components when installing the card.

Ensure the PCIe slot is clear of debris before inserting the card. When the card has been placed in the slot, firmly press down to confirm the card is fully seated correctly.


Now that the card is installed in a fully configured system, it can be verified using the BittWare Card Test utility.

---

[1] See the "Accessories" section in the Hardware Reference Guide for details on available cables.

3 Cooling the IA-860m

Be sure to provide adequate cooling for the IA-860m using either of the two methods shown below.

Figure 1: IA-860m Airflow Methods

Normal airflow direction

Reverse airflow direction
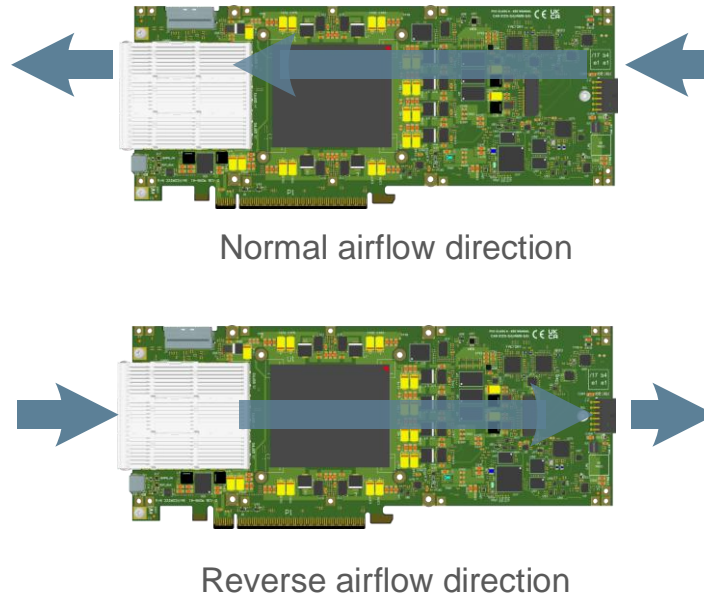
BittWare cards can operate at high temperatures depending on the power draw of the application in the FPGA. The Board Management Controller will power down the card to prevent damage if components reach above a certain temperature threshold. Monitor the temperature of your card to ensure it is running consistently within the supported temperature range. If the card powers down suddenly, this is often an indication that the BMC powered down due to overheating. BittWare recommends altering the card cooling to address this. The factors that affect the thermal performance of a card are:

- Power consumption of the card/FPGA
- Ambient temperature
- Airflow through the heatsink

Power consumption and ambient temperature are typically static. Therefore, if a card is overheating, BittWare recommends ensuring the chassis fans are oriented to blow through the card heatsink and altering fan speed to increase airflow through the heatsink.

Note: BittWare has seen issues cooling cards in desktop and workstation environments. This is due to the typical placement of fans relative to the card heatsink. If a desktop chassis must be used, additional fans will likely be required to adequately cool the card. This can be additional chassis fans positioned to blow through the heatsink or standalone desk fans oriented to move air over the FPGA.

See BittWare's Lab and Open Bench Environment Card Cooling white paper for a how-to on BittWare's solution for cooling cards in an open-bench lab environment.

4 Verifying the IA-860m with the Card Test

The Card Test is a combination of FPGA firmware and software provided by BittWare to aid in testing, development, and debugging of the IA-860m**. The IA-860m card is shipped with the FPGA Card Test design written into the FPGA boot flash.** The software for running the Card Test is found in the IA-860m CSP (or SDK), which you can download from the IA-860m Support Center page on the Developer Site.

The Card Test software includes the following:

- `bw-cardtest` – A Python module containing the test runner
- `bw_card_test` – The Card Test utility

4.1 Configuring the Card Test Software

The tests for the IA-860m card is pre-configured within test plan file(s). The IA-860m -card_test.yaml file contains the default plan for testing the card outside of the factory environment. By default, any tests requiring external equipment are disabled. The suggested way to configure the tests is to copy the default test plan and modify the options within the copy.

- To **turn tests on** that are disabled, comment out the `state: Disabled` line by adding a # symbol to the start of the line.
- To **turn tests off**, remove the # symbol.

See the Card Support Package documentation for more details about configuring Card Test.

The IA-860m Card Test software contains the following tests:

Test	Description
Clocks	Checks clock frequencies. External clocks are disabled by default.
Sensors	Checks that all sensors are within the normal range.
DDR4	Runs a DDR4 memory checker.
QSFP-DD	Runs a SerDes link checker. This test requires QSFP-DD loopbacks to be installed.

Also view all the possible tests with,

`bw_card_test tests`

To see all the options for running bw_card_test,

`bw_card_test --help`

To view all the options for a particular test,

`bw_card_test TEST_NAME –help`

4.2 Running Card Tests

The Card Test software requires that the FPGA is configured with the Card Test FPGA firmware.

4.2.1 SDK version 2023.3 – version 2024.3

To run the card tests,

```
bw_card_test -p $BWSDK_ROOT/csps/ia860m/test_plans/IA-860m-card_test.yaml
```

4.2.2 SDK version 2024.4 and Future Releases

To run the card tests,

Locate the test plan using the command `bw_product IA-860M test_plans`

Run the card tests `bw_card_test -p <location>`

4.3 Working with the Card Test FPGA Design

The Card Test FPGA design is available to download on the BittWare developer site.

1. Download the provided cardtest package from the developer site. Within the archive (tgz) there is a src package (ia860m_cardtest_src_<version>.zip) that contains the Quartus project file (qpf).
2. Unpack the zipped-up project (`ia860m-cardtest_<version>_src.zip`), then open the project (`build\card_test01.qpf`).
3. In the Quartus Prime Pro GUI, compile the design. This runs through all the necessary compilation steps: IP Generation; Analysis and Synthesis; Fitter, Timing Analysis and Assembler.
4. When compilation is complete (it could take 3 to 4 hours), the Assembler should have generated a SOF in the `build\output_files` folder of the project.

Note that building the Card Test across different PCs and operating systems will give minor variations in results. Therefore, some compilations will be timing clean, while others will be slightly out. As with any large FPGA design where the performance is pushing the limits of the technology, it is probable that several compiles with different seeds will be needed to achieve a timing clean result. Refer to the FPGA Reference Guide for more information.

5 Running IA-860m CSP and SDK Tools

Besides Card Test, the SDK and IA-860m CSP provide other useful tools for working with the IA-860m card. To list all tools, open a terminal window and enter "`bw_ls`". For any of the tools listed, get quick command-line help for the tool by entering "`<tool name> --help`". Note that specific utilities may only be supported for specific BMC generations and SDK releases. For example, bw_bmc_fpga_load is only relevant to newer BMC architectures such as on IA-860m. Refer to SDK release specific documentation for details of support for each of these utilities.

From SDK version 2024.3 onwards the BW PCIe driver has been replaced by a VFIO[2] driver. For any PCIe based commands use the *Italicized* command.

Tool	Supported Interfaces	Description
bw_ls	N/A	List the BittWare tools
bw_bmc_fpga_load	USB	Write an FPGA image to flash memory on new BMC implementations (BMC3.0)
bw_fpga_i2c_peek_poke	PCI	Show the available I2C buses and devices to access Read from an I2C device Write to an I2C device
bw_pci_peek_poke (*bw_vfio_peek_poke)*	PCI	List the card's PCI-e BAR memory spaces Read from the card's PCI-e BAR memory space Write to the card's PCI-e BAR memory space
bw_bmc_configure	PCI or USB	View FPGA configuration status (Re-)configure FPGA from Flash memory Show/clear the BMC's last error value View and update the BMC's PCIe SMBus configuration View card power state or turn on/off card power Reboot the BMC
bw_bmc_clock_programmer	PCI or USB	Display clock frequencies and information for the card's programmable clocks Reprogram the card's programmable clocks[3]
bw_bmc_upgrade	PCI or USB	Reboot the BMC Upgrade the BMC's firmware
bw_card_list	PCI and USB	List the cards found in the system Display manufacturing information for the cards
bw_card_monitor	PCI or USB	Monitor sensors on the card
bw_card_test	PCI, USB, or USB-JTAG	Run a suite of tests on the card
bw_bmc_get_logs	USB	BMC log access for BittWare BMCs based on BMC 3.0 architecture
bw_bmc_file_utility	USB	Control the BMC3.0 flash-based file system Manage configuration boot flash files

---

[2] The user must configure the BIOS and change Linux grub settings to successfully bind to the VFIO driver. Refer to the release specific SDK documentation for more details.

5.1 List the Cards and their Connections to the System

Use the bw_card_list tool to list all compatible BittWare devices installed on the system. The bw_card_list will list the cards found by serial number and show their PCIe and USB connections. Their ID's and location information for both interfaces are displayed. bw_card_list in verbose mode will read the manufacturing information for each card.

```
$ bw_card_list
IA-860M 123456
  Interface(s)
   USB
     Index               : 0
     Vendor ID           : 9512
     Device ID           : 7
     Location            : 1-11.1
   PCI
     Index               : 0
     Vendor ID           : 4794
     Device ID           : 118
     Location            : 01:00.0
     Slot UID            : 0:1|0
     Link Status         : Enabled, Not Saved PCIe Gen5x16


$ bw_card_list -v
IA-860M 8190061
  Interface(s)
   USB
     Index               : 0
     Vendor ID           : 9512
     Device ID           : 7
     Location            : 1-11.1
   PCI
     Index               : 0
     Vendor ID           : 4794
     Device ID           : 118
     Location            : 01:00.0
     Slot UID            : 0:1|0
     Link Status         : Enabled, Not Saved PCIe Gen5x16
  Manufacturing Info
     Manufacture Date    : 2023-12-11 6:53:55
     Part Number         : IA-860m-S-F391E2W-4-S0-X-32-22-8-E-9
     Version             : 0.6.0.0.0
     Asset Tag           : 860238914
  Firmware Version Info
     CPLD Version        : Not implemented
     BMC Version Full    : 0.8.0-16
     BMC Version         : 0.8.0-16
     FPGA Firmware Ver   : 0.2
     FPGA Design ID      : 1.0
     FPGA Timestamp      : 2024-01-22 19:21:20
  Card Status
     Power               : On
```

5.2 Programming the FPGA Boot Flash

The bw_agilex_flash_programmer that was provided for previous Agilex series products is not supported on the IA-860m. For the BMC 3.0 based architecture used on IA-860m a new specific utility has been added.

```
$ bw_bmc_fpga_load --help
usage: bw_bmc_fpga_load [-h] [-i PCI] [-c CARD] <command> ...

BMC FPGA Load Utility

optional arguments:
  -h,      --help          show this help message and exit
  -i PCI,  --interface PCI  BMC interface to use
  -c CARD, --card CARD      Card number of the card

subcommands:
  <command>


The following commands are supported:
   program    - program FPGA image into flash
   table      - display table of FPGA flash usage
   rename     - rename FPGA image in flash
   delete     - remove FPGA image from flash table
   erase      - erase (overwrite with FFs) FPGA image from flash
   default    - make named FPGA image the one that is loaded by default
   priority   - set priority of a named FPGA image
```

The bw_bmc_fpga_load is now used to load a flash image into the IA-860m. The FPGA configuration flash is 256MBytes in size and can contain multiple flash images. The program sub command is used to load a flash RBF file into the BMC FPGA flash storage at a specified address. When you program in the RBF the filename label is used to name the file in the BMC internal file system. The table subcommand lets you see the currently stored images.

For example:

```
$ bw_bmc_fpga_load table
0x00000000: 'ia860m_cardtest01_bbrev0_es_std_v0.2rc3.rbf' (22.2 MiB) <-- priority
0
0x01635000: 'ia860m_cardtest02_bbrev0_es_std_v0.2.rbf' (21.4 MiB)
0x02ba4000: <unused> (212.4 MiB)
```

The BMC 0.4.0 based release supports only a single default selection. Further releases have supported a full priority scheme. The use of the default subcommand sets the default (priority 0) image for the BMC to boot from on a cold boot. Please refer to the release specific SDK documentation for further details.

5.3 Working with the FPGA over PCIe

FPGA registers can be accessed over PCIe using the bw_pci_peek_poke tool. See the FPGA Developer Reference Guide for a memory map and descriptions of the FPGA registers.

View the PCIe memory spaces available,

```
> bw_pci_peek_poke -c 0 list
 Memory space sizes:
    bar0: 0x10000000
```

For SDK version 2024.3 onwards use the VFIO command

```
> bw_vfio_peek_poke list
 Memory space sizes:
    bar0: 0x100000
    bar1: 0x200000
    bar2: 0x100000
    bar3: 0x200000
```

Note: Read and write access to specific registers in specific BARs is design dependent. Consult the SDK and FPGA Developer guide for details on the relevant commands and memory map.

Virtual PCIe hot-swap, using the bw_pci_link utility is not currently supported for IA-860m. We recommend reviewing the other tool agnostic hot-swap methods documented by BittWare on our Developer Site Knowledge Base (See "Enable PCIe hot-swap").

5.4 Monitor the Card Sensors

Use the bw_card_monitor tool to view live card telemetry. The card monitor tool has advanced display options and can use either a PCIe or a USB connection to the BMC. For detailed information on the card's sensors and the BMC microcontroller that monitors them, see the *IA-860m BMC Reference Guide.*

Note –For bw_card_monitor to communicate with the BMC over PCIe, BittWare's "Card Test" FPGA image must be loaded. You can also supply your own Python BMC handler.

```
Opened USB:0, discover components
Found card info for USB:0 IA860M - 8190061
USB:0 IA860M - 8190061, Run time 0.00 seconds, 1 readings
ID    Sensor Name          Value         Units Status
--- ----------------------------- --------- --------- --------------------
1 FPGA Temperature         42.498        Degrees C enabled,Normal
2 QSFP0 Temperature -      128.000       Degrees C unavailable,Unknown
3 QSFP1 Temperature -      128.000       Degrees C unavailable,Unknown
4 QSFP2 Temperature -      128.000       Degrees C unavailable,Unknown
```

```
5  Front Temperature       42.187      Degrees C enabled,Normal
6  Rear Temperature        33.374      Degrees C enabled,Normal
7  FPGA FabricTemperature  42.125      Degrees C enabled,Normal
8  FPGA FTILE Temperature  46.374      Degrees C enabled,Normal
9  BMC Temperature         38.032      Degrees C enabled,Normal
10 VCC 12V0 PCIe Voltage   11.911      Volts enabled,Normal
11 VCC 12V0 PCIe Current   1.574       Amps enabled,Normal
12 VCC 12V0 PCIe Power     18.747      Watts enabled,Normal
13 VCC 12V0 EXT Voltage    11.835      Volts enabled,Normal
14 VCC 12V0 EXT Current    5.687       Amps enabled,Normal
15 VCC 12V0 EXT Power      67.304      Watts enabled,Normal
16 Total Input Power       86.030      Watts enabled,Normal
17 VCC Core Voltage        0.811       Volts enabled,Normal
18 VCC Core Current        15.354      Amps enabled,Normal
41 VCC QSFP Current        0.000       Amps enabled,Normal
42 VCC QSFP Voltage        3.298       Volts enabled,Normal
43 SmartVID Voltage        0.811       Volts enabled,Normal
```

5.5 Programming Clocks

The IA-860m is populated with the SiT95148. The SiT95148 is programmed at power on by the card's BMC. The BMC clock programmer utility has a display option for viewing the current clock configuration.

To display the clock information,

```
> bw_bmc_clock_programmer display
 SiT95148 0:
    Information:
        IN0: ['Unused']
        IN1: ['Unused']
        IN2: ['Unused']
        IN3: ['Unused']
        Output 0: ['100 MHz', 'Enabled', 'LVDS 1.8V']
        Output 0B: ['Output 0T', 'Enabled', 'LVDS 1.8V']
        Output 1: ['125 MHz', 'Enabled', ' 1.8V']
        Output 1B: ['25 MHz', 'Enabled', ' 1.8V']
        Output 2: ['100 MHz', 'Enabled', ' 1.8V']
        Output 3: ['100 MHz', 'Enabled', ' 1.8V']
        Output 4: ['100 MHz', 'Enabled', 'LVDS 1.8V']
        Output 5: ['100 MHz', 'Enabled', 'LVDS 1.8V']
        Output 6: ['100 MHz', 'Enabled', 'LVDS 1.8V']
        Output 7: ['100 MHz', 'Enabled', 'LVDS 1.8V']
    Frequency:
        0: 100 MHz
        1: 133.3333 MHz
        2: 125 MHz
        3: 25 MHz
        4: 100 MHz
        5: 100 MHz
        6: 100 MHz
        7: 100 MHz
        8: 100 MHz
```

```
        9: 100 MHz
 SiT95148 1:
    Information:
        IN0: ['39.0625 MHz', 'Differential']
        IN1: ['39.0625 MHz', 'Differential']
        IN2: ['10 MHz', 'Single Ended AC']
        IN3: ['39.0625 MHz', 'Differential']
        Output 0: ['Output 0B', 'Enabled', 'LVDS 3.3V']
        Output 1: ['100 MHz', 'Enabled', 'HCSL 1.8V']
        Output 1B: ['156.25 MHz', 'Enabled', 'LVDS 3.3V']
        Output 2: ['100 MHz', 'Enabled', 'HCSL 1.8V']
        Output 3: ['100 MHz', 'Enabled', 'HCSL 1.8V']
        Output 4: ['100 MHz', 'Enabled', 'LVDS 3.3V']
        Output 5: ['100 MHz', 'Enabled', 'LVDS 3.3V']
        Output 6: ['156.25 MHz', 'Enabled', 'LVDS 3.3V']
        Output 7: ['']
    Frequency:
        0: 156.25 MHz
        1: 100 MHz
        2: 156.25 MHz
        3: 100 MHz
        4: 100 MHz
        5: 100 MHz
        6: 100 MHz
        7: 156.25 MHz
```

Different revisions of the IA-860m may have different default programmable clock configurations.

Use the bw_bmc_clock_programmer utility if a new clock program is required in the BMC non-volatile memory. The clock program will load on the next boot. This will overwrite the current clock program. The default clock programming file is available on the BittWare developer site. A newly written clock program will take effect on the next power cycle. The utility can also load the newly written clock program into the clocks immediately.

To write a new programmable clock program to the card,

```
> bw_bmc_clock_programmer -i USB -c 1 program --clock-name SiT95148
/path/to/file
```

The SiT95148 configuration software is available directly from the SiTime website. (https://www.sitime.com/support/resource-library/software/cascade-sit9514x-gui-software-version-1329 is the current release at time of documenting.) Please consult the SiTime website for further part information and latest software.

Note: The output of bw_bmc_clock_programmer may differ depending on the installed SDK version and loaded BMC version on the IA-860m. This does not affect the core operation the utility will report the clocks on the card.

---

6 Continuing IA-860m Development

BittWare provides additional in-depth documentation for further development with the IA-860m hardware and accompanying software. All documentation is available on the [BittWare Developer Site](#).

- **IA-860m Hardware Reference Guide**: the main point of reference for details on the components and interfaces on the IA-860m.

- **IA-860m FPGA Developer Reference Guide**: provides FPGA-related detail on integrating any BittWare-provided IP into user designs. It also provides details on the Card Test design, which is the main reference design for the IA-860m

- **BMC 3.0 Reference Guide:** provides the details needed for communicating with the BMC at a low level. The IA-860m CSP contains utilities and libraries for communicating with the BMC at a higher, more abstract level.

- **BittWare SDK and IA-860m CSP Reference Guide**: provides installation instructions for the SDK and CSP and describes the libraries and utilities included with the SDK.

7 Troubleshooting the IA-860m

The following section outlines common issues and how to address them.

IA-860m card is not enumerated on the PCIe bus	
Possible Cause	**Resolution**
IA-860m is not powered	Confirm the card is getting all necessary power by verifying the PCIe slot is providing power.
IA-860m is not correctly plugged into the PCIe Slot	Power down the system and verify the card is fully seated in a PCIe x16 capable slot.
IA-860m detected a temperature alert and shut itself down as a precaution	Verify that there is sufficient airflow over the heatsink. This can depend on the FPGA application, system chassis, and ambient temperature of the environment. In the case of an active heatsink, verify that the fan is spinning. In the event of a damaged or inoperable heatsink, reach out to BittWare Support to arrange an RMA to replace the part.
FPGA is not configured or design does not implement PCIe	The IA-860m requires the FPGA to be configured with a design that implements a PCIe endpoint to enumerate over PCIe. Confirm the FPGA is programmed with a working PCIe design.

JTAG chain is not accessible	
Possible Cause	**Resolution**
IA-860m card is not powered	Confirm the card is correctly powered on before scanning the JTAG chain with the Quartus Programmer. Confirm the card is getting all necessary power by verifying the PCIe slot is providing power.
USB cable is not plugged in or issue with the USB cable	Ensure the cable is plugged in and works as intended. If the issue persists when the cable is seated correctly, confirm the behavior with another cable.
JTAG frequency is not set correctly	Set the JTAG clock frequency to 16MHz. See the IA-860m Hardware Reference Guide for more details

Card does not behave consistently	
Possible Cause	**Resolution**
Cooling requirements of the IA-860m are not met	Ensure there is adequate airflow through the heatsink on the IA-860m card. Increase fan speed if possible to verify if the behavior continues. See the Hardware Reference Guide for additional details.
	If the inconsistency continues after checking cooling, reach out to BittWare Support for further assistance.