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GETTING STARTED GUIDE

ATCA-3671

FPGA Module for ATCA

This document describes how to install, configure, and test the ATCA-3671 FPGA Module for ATCA. The ATCA-3671 is programmable both through LabVIEW using LabVIEW FPGA and through BEEcube Platform Studio (BPS).

Note If you are using BPS, visit *ni.com/info* and enter the Info Code `BPSsupport` to access BPS-related resources within the BPS Support Community.

This icon denotes a caution, which advises you of precautions to take to avoid injury, data loss, or a system crash.

Caution You can impair the protection provided by the ATCA-3671 if you use it in a manner not described in this document.

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Electromagnetic Compatibility Guidelines

This product was tested and complies with the regulatory requirements and limits for electromagnetic compatibility (EMC) stated in the product specifications. These requirements and limits provide reasonable protection against harmful interference when the product is operated in the intended operational electromagnetic environment.

This product is intended for use in industrial locations. However, harmful interference may occur in some installations, when the product is connected to a peripheral device or test object, or if the product is used in residential or commercial areas. To minimize interference with radio and television reception and prevent unacceptable performance degradation, install and use this product in strict accordance with the instructions in the product documentation.

Furthermore, any changes or modifications to the product not expressly approved by National Instruments could void your authority to operate it under your local regulatory rules.

Caution To ensure the specified EMC performance, operate this product only with shielded cables and accessories. Fiber optic cables connected to SFP+ and QSFP+ ports do not require shielding.

Caution To ensure the specified EMC performance, the length of any cable connected to the Ethernet port and the Mini-SAS HD ports must be no longer than 30 m (100 ft.). The lengths of fiber optic cables connected to the SFP+ or QSFP+ ports are not controlled. The length of any cable connected to any other port must be no longer than 3 m (10 ft.).

Verifying the System Requirements

To use the NI ATCA FPGA Modules instrument driver, your system must meet certain requirements.

Refer to the product readme, which is available online at *ni.com/manuals*, for more information about minimum system requirements, recommended system, and supported application development environments (ADEs).

Unpacking the Kit

Caution To prevent electrostatic discharge (ESD) from damaging the device, ground yourself using a grounding strap or by holding a grounded object, such as your computer chassis.

1. Touch the antistatic package to a metal part of the computer chassis.
2. Remove the device from the package and inspect the device for loose components or any other sign of damage.

Caution Never touch the exposed pins of connectors.

Note Do not install a device if it appears damaged in any way.

3. Unpack any other items and documentation from the kit.

Store the device in the antistatic package when the device is not in use.

Verifying the Kit Contents

- ATCA-3671 module
- Ethernet cable
- ATCA I/O slot blockers (x4)
- *ATCA-3671 Getting Started Guide* (this document)

Note Your ATCA-3671 kit may contain additional NI ATCA products.

Other Equipment

Required Items

In addition to the kit contents, you must provide the following additional items:

- A chassis from the following list:
  - Single-Module ATCA Chassis[1]
  - 14-Slot ATCA Chassis

  Note If your kit does not include a chassis, you can purchase one from *ni.com* or by contacting your local NI sales representative.
- Rear transition module (RTM) from the following list:
  - (Recommended) RTM-3661 PCI Express Rear Transition Module for ATCA[1]
  - RTM-3662 High-Speed Serial Rear Transition Module for ATCA

    Note The RTM-3662 is supported only in BPS. To access BPS-related resources and documentation for the RTM-3662 within the BPS Support Community, visit *ni.com/info* and enter the Info Code `BPSsupport`.
- DC power supply[1] as described in the device specifications
- Number 2 Phillips screwdriver
- Number 1 Phillips screwdriver
- Small flat-blade screwdriver
- Host PC or laptop

ATCA I/O Modules (Optional)

In addition to the required items, you may choose to provide one or more of the following ATCA I/O modules.

- AIO-3681 Digitizer Module for FMC, with the following components:
  - Riser card (x1)
  - Male-to-female M2.5 standoffs (10 mm hex length, 6 mm thread length) (x2)
  - Male-to-female M2.5 standoffs (12.5 mm hex length, 3.5 mm thread length) (x2)
  - M2.5x8 screws (x2)
  - M2.5x6 screws (x2)
- AIO-3682 Signal Generator Module for FMC, with the following components:
  - Riser card (x1)
  - Male-to-female M2.5 standoffs (x4)

[1] Included in some ATCA-3671 kits.

  - M2.5x8 screws (x2)
  - M2.5x6 screws (x2)
- AIO-3691 High-Speed Serial Adapter Module[2], with the following components:
  - Female-to-female standoffs (x2)
  - M2.5x8 screws (x2)
  - M2.5x6 screws (x4)

Preparing the Environment

Ensure that the environment you are using the ATCA-3671 in meets the following specifications.

Ambient temperature range (IEC 60068-2-1, IEC 60068-2-2)	0 °C to 40 °C
Operating temperature range	
Used with a Single-Module ATCA Chassis	0 °C to 25 °C
Used with a 14-Slot ATCA Chassis	Dependent on final system installation

Note Operating temperatures are valid only when the ATCA-3671 module is used with the specified chassis.

Operating humidity (IEC 60068-2-56)	10% to 90% RH, noncondensing
Pollution Degree	2
Maximum altitude	2,000 m at 25 °C ambient temperature

Indoor use only.

Caution Electrostatic Discharge (ESD) can damage the AIO-3681/3682 and AIO-3691. To prevent damage, use industry-standard ESD prevention measures during installation, maintenance, and operation.

Installing the Software

You must be an Administrator to install NI software on your computer.

1. Install an ADE, such as LabVIEW.
2. If you chose to install LabVIEW in step 1, install LabVIEW FPGA.
3. Visit *ni.com/info* and enter the Info Code `atcadriver` to access the driver download page for the latest NI ATCA FPGA Modules software.
4. Download the NI ATCA FPGA Modules driver software.

[2] Included in some ATCA-3671 kits.

5. Follow the instructions in the installation prompts.

Note Windows users may see access and security messages during installation. Accept the prompts to complete the installation.

6. When the installer completes, select **Restart** in the dialog box that prompts you to restart, shut down, or restart later.

Installing the Hardware

Protection Impairment

Caution You can impair the protection provided by the ATCA-3671 if you use it in a manner not described in this document.

Caution Do not operate the ATCA-3671 in a manner not specified in this document. Product misuse can result in a hazard. You can compromise the safety protection built into the product if the product is damaged in any way. If the product is damaged, return it to NI for repair.

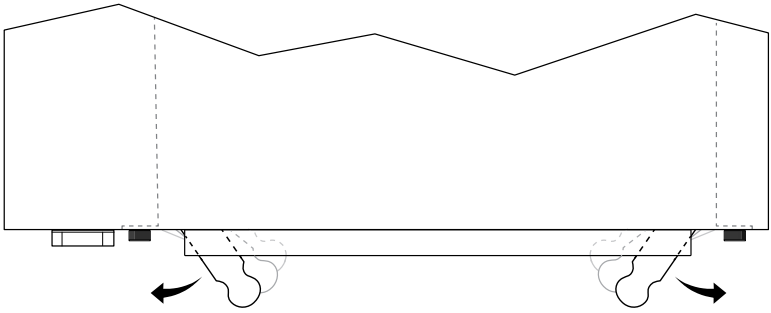
Caution Observe all instructions and cautions in the user documentation. Using the model in a manner not specified can damage the model and compromise the built-in safety protection. Return damaged models to NI for repair.

Installing the RTM

Caution Install the RTM before installing the ATCA-3671. Installing the ATCA-3671 before installing the RTM can damage the connectors of both modules.

1. Gently guide the module into the chassis module guides and slide the module into the chassis until it is fully inserted.
2. Close the module ejector handles to fully seat the module and latch it to the chassis, as shown in the following figure.

Figure 1. Using the Ejector Handles to Install the RTM



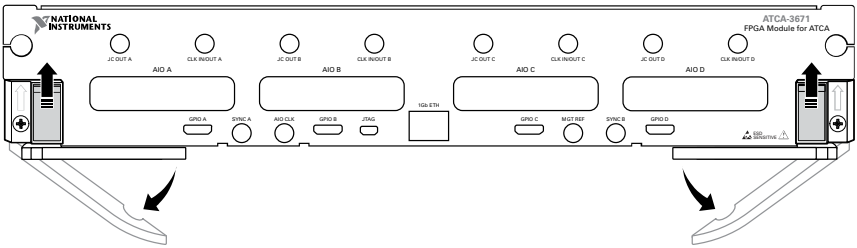
3. Tighten the four captive screws on the panel to secure the module.

Installing the ATCA-3671 Module

Caution Install the RTM before installing the ATCA-3671. Installing the ATCA-3671 before installing the RTM can damage the connectors of both modules.

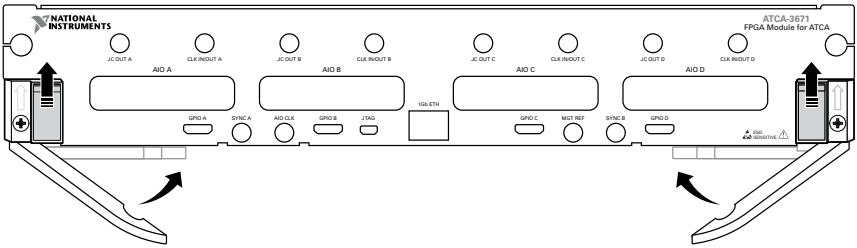
1. Ensure that the module ejector handles are in the open position, as shown in the following figure.

Figure 2. Opening the Module Ejector Handles



2. Gently guide the module into the chassis module guides and slide the module into the chassis until it is fully inserted.
3. Close the module ejector handles to fully seat the module and latch it to the chassis, as shown in the following figure.

Figure 3. Closing the Module Ejector Handles



4. Tighten the four captive screws on the panel to secure the module.

Installing AIO-3681/3682 Modules

Install one or more AIO-3681/3682 modules to enable analog-to-digital and digital-to-analog conversion of RF signals.

Determine how many modules you are installing and choose the appropriate number of empty slot(s) in the ATCA-3671. If hardware is present in the slot(s) you choose, remove the installed ATCA I/O module(s), riser card(s), and additional components from the slot(s).

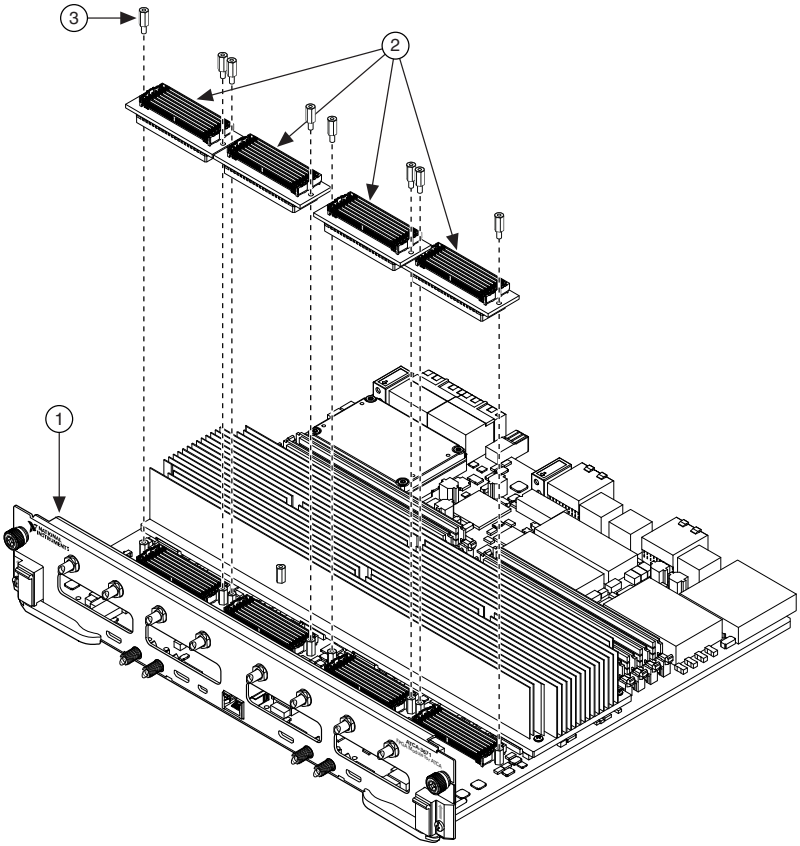
Ensure you have the following components for each AIO-3681/3682 module:

- Riser card (x1)
- Male-to-female M2.5 standoffs (10 mm hex length, 6 mm thread length) (x2)
- Male-to-female M2.5 standoffs (12.5 mm hex length, 3.5 mm thread length) (x2)
- M2.5x8 screws (x2)
- M2.5x6 screws (x2)

Complete the following steps to install one to four AIO-3681/3682 modules, depending on your chosen hardware configuration.

1. Install a riser card into the ATCA-3671 motherboard mating connector. Secure with two male-to-female M2.5 standoffs (10 mm hex length, 6 mm thread length), as shown in the following figure.

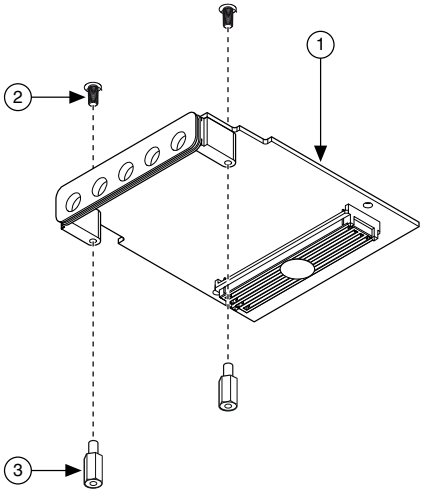
Figure 4. Installing Riser Card(s)



1. ATCA-3671 Module
2. Riser Cards
3. Male-to-Female M2.5 Standoff (10 mm Hex Length, 6 mm Thread Length)

2. Install two male-to-female standoffs into the AIO-3681/3682 module with two male-to-female M2.5 standoffs (12.5 mm hex length, 3.5 mm thread length), as shown in the following figure.

Figure 5. Installing Standoffs into the AIO-3681/3682 Module(s)

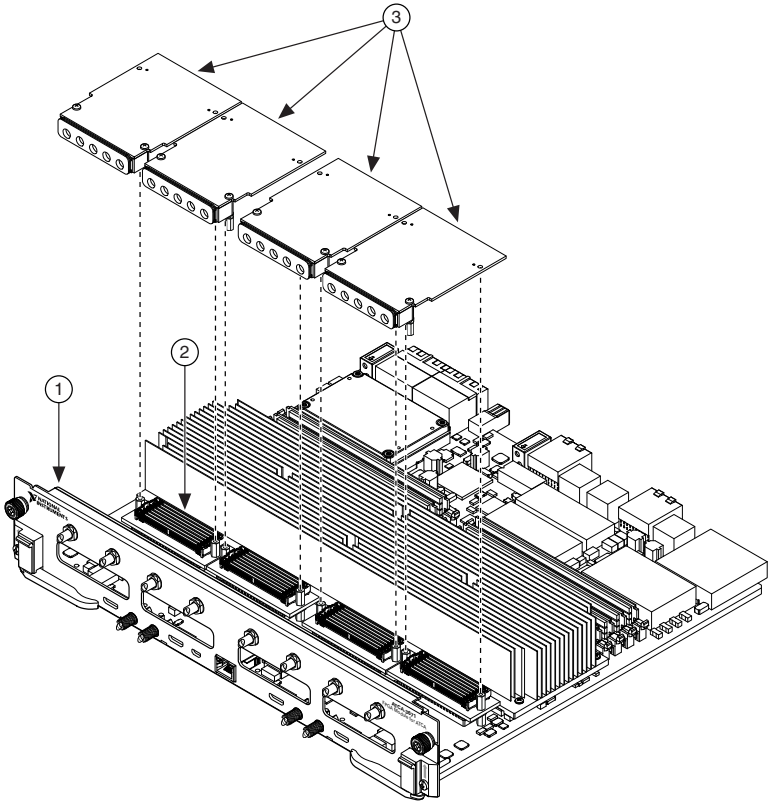


1. AIO-3681/3682 Module
2. M2.5x6 Screw, Preinstalled
3. Male-to-Female M2.5 Standoff (12.5 mm Hex Length, 3.5 mm Thread Length)

3. Align the AIO-3681/3682 module with the riser card connector and gently mate the connectors, as shown in the following figure.

Note The AIO-3681/3682 module must be centered on the riser card connector so that the holes for the screws are aligned.

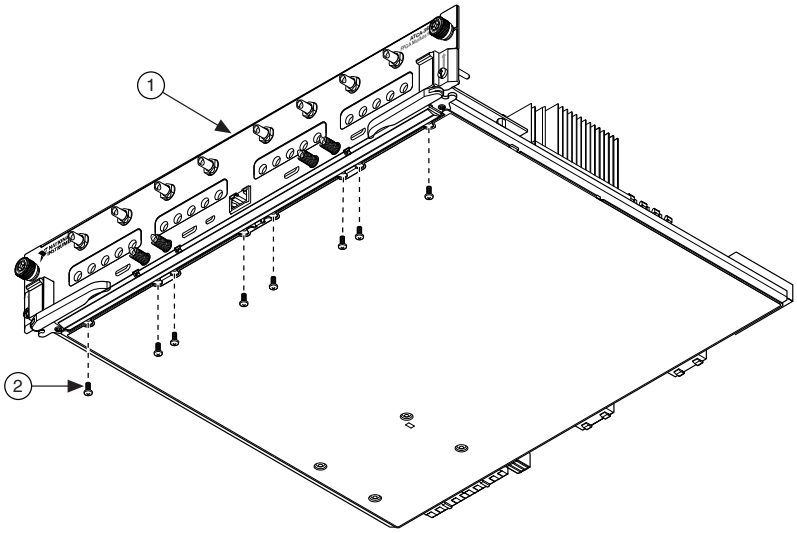
Figure 6. Aligning the AIO-3681/3682 Module(s) with the Riser Card(s)



1. ATCA-3671 Module
2. Riser Card
3. AIO-3681/3682 Modules

4. Secure the AIO-3681/3682 module to the ATCA-3671 module with two M2.5x8 screws from the underside of the ATCA-3671 module, as shown in the following figure.

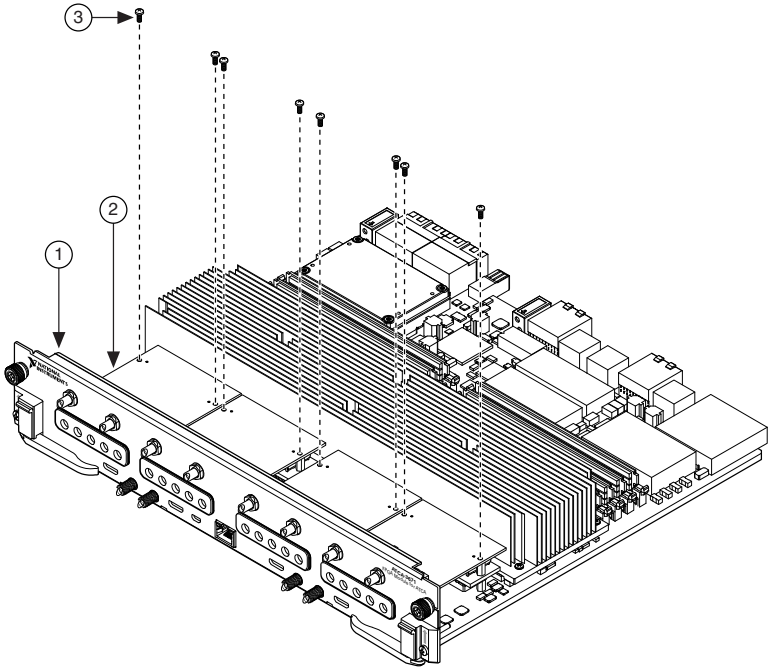
Figure 7. Securing the AIO-3681/3682 Module(s) to the ATCA-3671 Module and Riser Card(s)



1. ATCA-3671 Module
2. M2.5x8 Screw

5. Secure the AIO-3681/3682 module to the riser card with two M2.5x6 screws into the riser card standoffs, as shown in the following figure.

Figure 8. Securing the AIO-3681/3682 Module(s) to the Riser Card(s)



1. ATCA-3671 Module
2. AIO-3681/3682 Module
3. M2.5x6 Screw

Related Information

Removing the ATCA I/O Module on page 19

Installing AIO-3691 Modules

Install one or more AIO-3691 modules to enable high-speed serial connectivity between each FPGA and the ATCA-3671.

Determine how many modules you are installing and choose the appropriate number of empty slot(s) in the ATCA-3671. If hardware is present in the slot(s) you choose, remove the installed ATCA I/O module(s), riser card(s), and additional components from the slot(s).

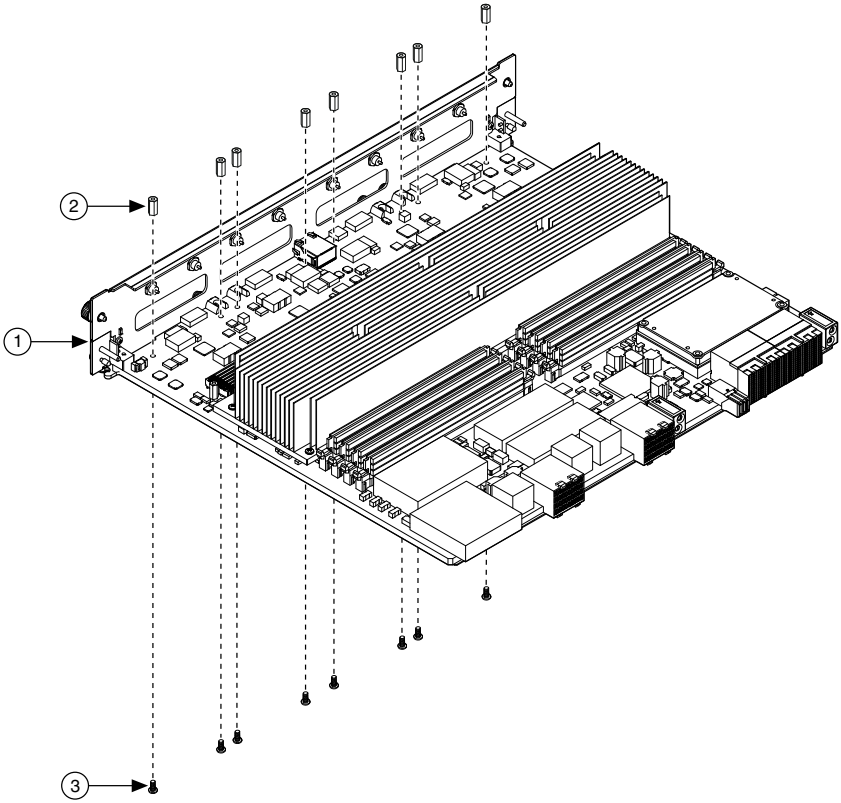
Ensure you have the following components for each AIO-3691 module:

- Female-to-female standoffs (x2)
- M2.5x8 screws (x2)
- M2.5x6 screws (x4)

Complete the following steps to install one to four AIO-3691 modules, depending on your chosen hardware configuration.

1. Install two female-to-female standoffs in the ATCA-3671 module with two M2.5x8 screws installed from the underside of the ATCA-3671 module as shown in the following figure.

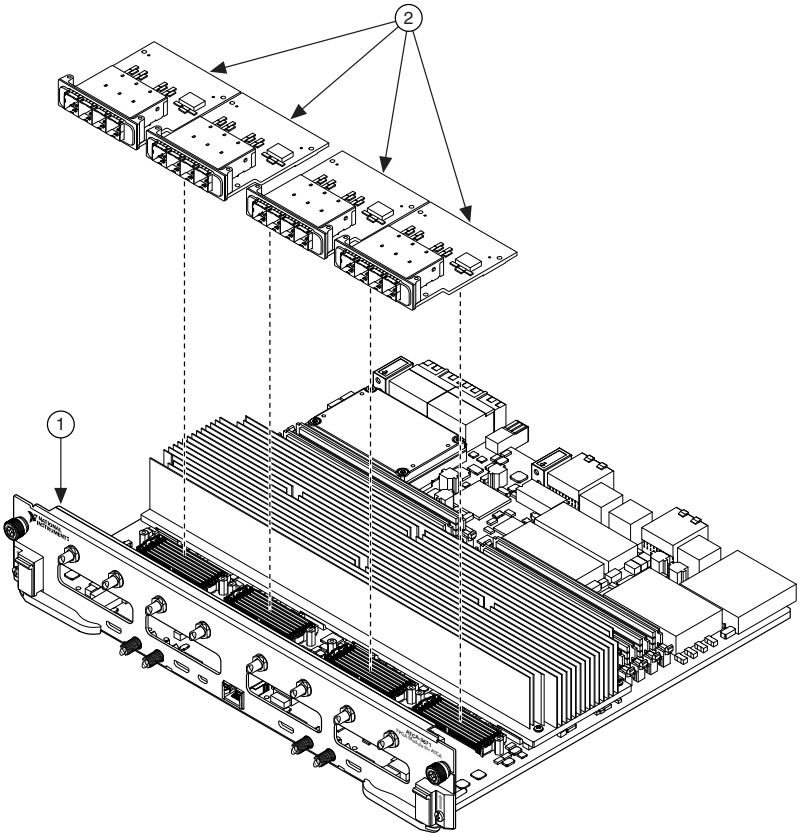
Figure 9. Installing Standoffs



1. ATCA-3671 Module
2. Female-to-female Standoff
3. M2.5x8 Screw

2. Align and install the FMC+ connector of the AIO-3691 module to the ATCA-3671 motherboard, as shown in the following figure.

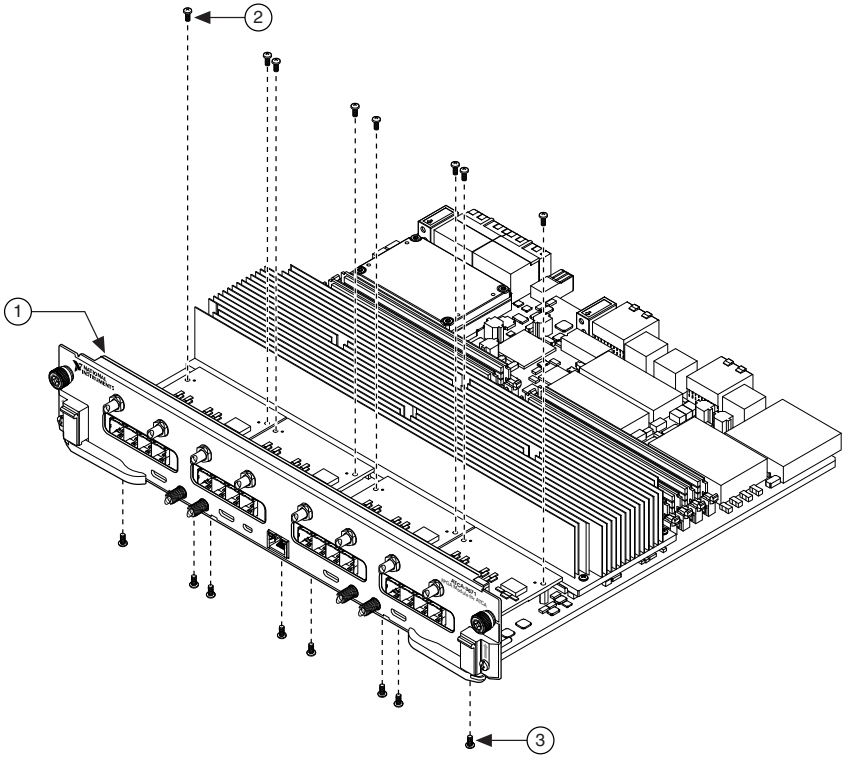
Figure 10. Aligning the AIO-3691 Module(s)



1. ATCA-3671 Module
2. AIO-3691 Modules

3. Secure the AIO-3691 module with two M2.5x6 screws installed from the underside of the ATCA-3671 module and two M2.5x6 screws installed from the top of the AIO-3691 module, as shown in the following figure.

Figure 11. Securing the AIO-3691 Module(s)



1. ATCA-3671 Module
2. M2.5x6 Screw
3. M2.5x6 Screw

Related Information

Removing the ATCA I/O Module on page 19

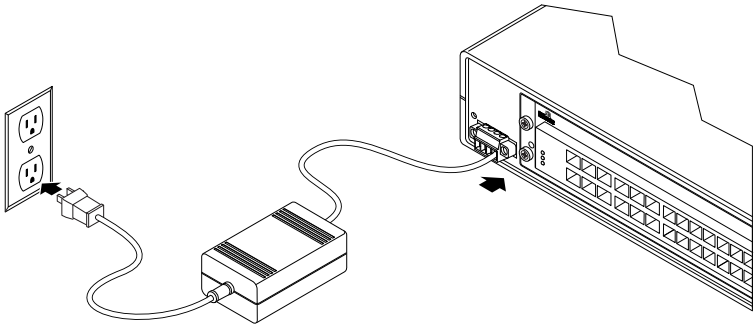
Powering On the ATCA-3671 Module

Complete the following steps to connect a power supply to the ATCA-3671.

Note The ATCA-3671 requires a -48 V external power supply that meets the product specifications.

1. Ensure the power source is turned off.
2. Connect the DC power supply to the ATCA-3671 back panel, as shown in the following figure.

Figure 12. Connecting the ATCA-3671 to Power (RTM-3662 Shown)



The ATCA-3671 powers on automatically once the DC power supply is connected to the power source.

3. Observe the colored LEDs on the front panel of the ATCA-3671 to check the device status, as described in the following table.

Table 1. LED State while Powering On the ATCA-3671

Color	State	Indication	Action
Blue	Off	The module is ready for use.	—
Green	Solid		
Blue	Solid	The module is not fully powered on.	Check that the ATCA-3671 is securely inserted in the chassis and that both ejector handles are fully latched.
Green	Off or blinking		

Related Information

ATCA-3671 Front Panel on page 19

Maximum Power Requirements

Note Power requirements are dependent on the adapter modules installed and contents of the FPGA application.

Power supply	-48 V
Current	9 A

Connecting to a Host Computer

Install all the software you plan to use before you install the hardware.

Note Ensure that the ATCA-3671 is powered on and has finished initializing before connecting the module to the host computer.

Related Information

Installing the Software on page 5
Powering On the ATCA-3671 Module on page 15

Installing MXI Cables

Note You must use an RTM-3661 module with the ATCA-3671 module for host access to the FPGAs from LabVIEW. Direct host access is not supported for other RTMs.

1. Connect one end of a Gen3 MXI x8 cable to the corresponding port on the installed RTM-3661 module for each FPGA.
2. Connect the other end of the Gen3 MXI x8 cable to a compatible Gen3 MXI x8 PCI Express or PXI Express adapter on the host computer. Refer to the Gen3 MXI x8 documentation for any additional connectivity requirements.
3. Power on the host computer after all desired MXI connections are made between the RTM-3661 and host-side adapters.

Note Some host-side MXI adapters, such as the PXIe-8394 Remote Control Module, have a link status LED to indicate that a PCI Express link has successfully been established between the target and host. Refer to the Gen3 MXI x8 documentation to verify whether a link status LED may be used to verify the presence of a host link as the computer starts.

Identifying FPGA Devices in MAX

Complete the following steps to verify that the FPGA devices appear properly in MAX.

1. Launch MAX by navigating to **Start»All Programs»National Instruments»NI MAX** or by clicking the NI MAX desktop icon.
2. In the Configuration pane, expand **Devices and Interfaces** to see the list of installed devices. Installed devices appear under the name of their associated chassis.

Tip Find additional information, such as the model and serial number of the ATCA-3671 main board, as well as the FPGA ID of the connected FPGA, by selecting any ATCA-3671 FPGA device and opening the **Settings** window.

Related Information

Why Doesn't the Device Appear in MAX? on page 24

Network Connection Configuration to the ATCA-3671

An Ethernet connection to the host computer is required to use the ATCA-3671 hardware.

The ATCA-3671 is shipped with the following fixed network configuration:

- IP address: 192.168.0.75
- Subnet mask: 255.255.255.0
- Gateway address: 192.168.0.1

This document assumes that the ATCA-3671 uses the default network configuration above, and that the host computer has been configured with an adapter able to communicate on the same network. For more information on how to change the network configuration of either the ATCA-3671 or the host computer, visit *ni.com/info* and enter the Info Code `exbeh7`.

Programming

You can program the ATCA-3671 FPGA with LabVIEW FPGA.

Note If you are using BPS, visit *ni.com/info* and enter the Info Code `BPSsupport` to access BPS-related resources within the BPS Support Community.

Finding Example VIs

The NI ATCA FPGA Modules examples provide a starting point for programming the ATCA-3671 with LabVIEW. Complete the following steps to browse or search installed example VIs and online example VIs.

1. Within LabVIEW, select **Help»Find Examples** to launch the NI Example Finder.
2. Select the **Browse** tab to locate examples by task at **Hardware Input and Output»ATCA**.

Note If you add LLB or VI files to the `labview\examples` directory, you can select **Help»Find Examples** to browse them by directory structure. To browse examples by functionality or search by keywords, you can prepare example VIs to appear in the NI Example Finder. You must add example VIs to the NI Example Finder as top-level VIs.

Verifying the Device Connection (Optional)

Run a VI to confirm the device is correctly connected to the host computer.

1. Open the `ATCA-3671 Getting Started DRAM.lvproj` example project by navigating to the Start menu at **Start»All Programs»National Instruments»NI ATCA FPGA Modules»NI ATCA Examples»LabVIEW 2016 (32-bit or 64-bit)»External Memory»DRAM - Getting Started**.
2. Open the Getting Started - External Memory (Host) VI in the project.
3. Configure the **RIO Device** input for the FPGA you want to use.
4. Run the VI.

   If the device is working properly, the data written to memory is the data read on the indicators with no errors.

5. Click **STOP** to conclude the test.

Removing Modules

Removing the ATCA-3671 Module

1. Disconnect all cables from the ATCA-3671 module.
2. Loosen the four captive screws on the front panel of the ATCA-3671 module.
3. Push up on the latch and rotate the ejector handle away from the module to unseat the backplane connectors to open the ejector handles.
4. **Caution** Use two hands while removing the module to ensure that the module is not dropped once it is free of the chassis.

   Carefully remove the ATCA-3671 module from the chassis.

Removing the RTM

1. Disconnect all cables from the RTM.
2. Loosen the four captive screws on the back panel of the RTM.
3. Use the ejector handles to unseat the RTM from the chassis.
4. **Caution** Use two hands while removing the module to ensure that the module is not dropped once it is free of the chassis.

   Carefully remove the RTM from the chassis.

Removing the ATCA I/O Module

Complete the following steps to remove an ATCA I/O module from the ATCA-3671.

1. Disconnect all cables to the ATCA I/O module.
2. Power off the ATCA-3671.
3. Unscrew the ATCA I/O module.
4. Remove the ATCA I/O module.

Front Panels and Connectors

ATCA-3671 Front Panel

Figure 13. ATCA-3671 Front Panel

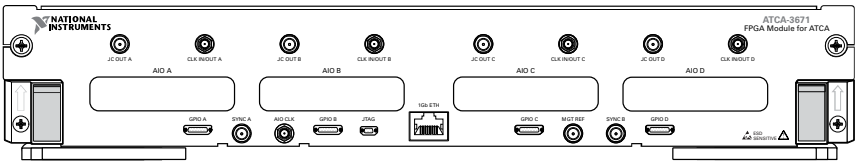


Table 2. Device Front Panel Icon Definitions

	Refer to the user documentation for required maintenance measures to ensure user safety and/or preserve the specified EMC performance.
	The signal pins of this product's input/output ports can be damaged if subjected to ESD. To prevent damage, turn off power to the product before connecting cables and employ industry-standard ESD prevention measures during installation, maintenance, and operation.

Table 3. ATCA-3671 Front Panel Connectors

Connector	Description
JC OUT	Conditioned output clock for CPRI and clock distribution applications.
CLK IN/OUT	General purpose clock to and from the FPGA.
AIO	Daughtercards for RF front-ends and high-bandwidth expansion modules.
GPIO	Low speed, parallel I/O expansion to your module.
SYNC	Low skew trigger and clock distribution to FPGAs.
AIO CLK	Direct clock distribution to AIO modules.
JTAG	JTAG/UART access for system debugging and management.
1Gb ETH	Network connection to ATCA-3671 controller.
MGT REF	Clock input for GTH reference on FPGAs.



Caution To avoid permanent damage to the ATCA-3671, disconnect all signals connected to the ATCA-3671 before powering down the module, and connect signals only after the ATCA-3671 has powered on.



Caution Connections that exceed any of the maximum ratings of any connector on the ATCA-3671 can damage the device and the chassis. NI is not liable for any damage resulting from such connections.

Table 4. ATCA-3671 Front Panel LEDs

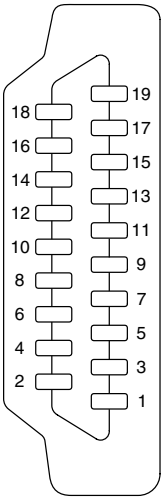
Color	State	Indication
OFF	—	The module is not active.
Green	Blinking	The module is powering on.
	Solid	The module is powered on.

Table 4. ATCA-3671 Front Panel LEDs (Continued)

Color	State	Indication
Red	Blinking	A fault has occurred on the board.
	Solid	The power has failed.
Blue	Blinking	The module is powering off.
	Solid	The module is fully powered off. It is safe to remove the ATCA-3671 from the chassis.

GPIO Connector

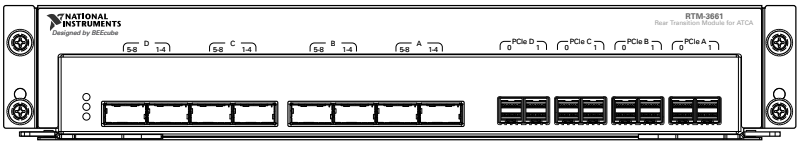
Table 5. ATCA-3671 GPIO Connector Pin Assignments

AUX I/O Connector	Pin	Signal	Signal Description
	1	GND	Bidirectional single-ended (SE) digital I/O (DIO) data channel.
	2	FP_GPIO_CONN0	Ground reference for signals.
	3	GND	Bidirectional SE DIO data channel.
	4	GND	Bidirectional SE DIO data channel.
	5	FP_GPIO_CONN1	Ground reference for signals.
	6	GND	Ground reference for signals.
	7	GND	Bidirectional SE DIO data channel.
	8	GP_GPIO_CONN2	Ground reference for signals.
	9	FP_GPIO_CONN3	Bidirectional SE DIO data channel.
	10	GND	Bidirectional SE DIO data channel.
	11	FP_GPIO_CONN4	Ground reference for signals.
	12	FP_GPIO_CONN5	Bidirectional SE DIO data channel.
	13	GND	Bidirectional SE DIO data channel.
	14	FP_GPIO_CONN6	Bidirectional SE DIO data channel.
	15	FP_GPIO_CONN7	Bidirectional SE DIO data channel.
	16	FP_GPIO_CONN8	Bidirectional SE DIO data channel.
	17	FP_GPIO_CONN9	Ground reference for signals.
	18	VCC_GPIO	+5 V Power (<1.0 A).
	19	GND	Ground reference for signals.

Caution The GPIO connector accepts a standard, third-party Mini HDMI cable, but the GPIO port is not a Mini HDMI interface. Do not connect the ATCA-3671 to another device using the GPIO port as a Mini HDMI connection. NI is not liable for any damage resulting from such signal connections.

RTM-3661 Front Panel

Figure 14. RTM-3661 Front Panel



Caution To avoid permanent damage to the ATCA-3671, disconnect all signals connected to the ATCA-3671 before powering down the module, and connect signals only after the ATCA-3671 has powered on.

Caution Connections that exceed any of the maximum ratings of any connector on the ATCA-3671 can damage the device and the chassis. NI is not liable for any damage resulting from such connections.

ATCA Compatibility vs. Compliance

The ATCA-3671 achieves mechanical and electrical compatibility with the ATCA (Advanced Telecommunications Computing Architecture) 3.0 specification, and it is intended for use with an ATCA 3.0-compliant Shelf. However, the ATCA-3671 is not a fully compliant Front Board implementation. For example, it does not support hardware platform management from a Shelf Manager. In addition, while it implements functions for Ethernet on the Base Interface and clocks on the Synchronization Clock Interface, it does not support Electronic Keying.

Troubleshooting

If an issue persists after you complete a troubleshooting procedure, contact NI technical support or visit *ni.com/support*.

Should I Update Device Firmware and FPGA Images?

ATCA-3671 devices ship with firmware and FPGA images compatible with NI ATCA FPGA Modules driver software.

You may need to update the device for compatibility with the latest version of the software.

Why Doesn't the Device Power On?

- Verify that the power supply is functional by substituting a different adapter.
- Verify that the power switch on the front of the device is engaged.

Why Doesn't the Device Appear in MAX?

If you cannot find the ATCA-3671 in MAX, complete one or more of the following steps.

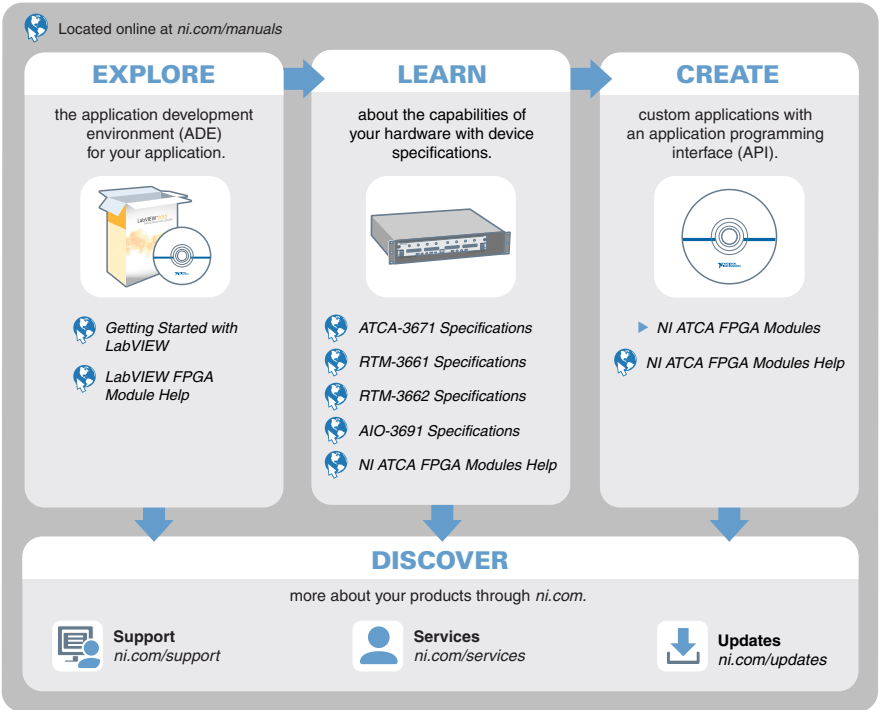
- Restart the host computer to reset the MXI connection.
- Ensure you have the correct version of NI ATCA FPGA Modules installed on the host computer.
- Check the MXI cable connections at the ATCA-3671 and host computer. Check the Ethernet cable connections at the host computer and ATCA-3671.

Related Information

Identifying FPGA Devices in MAX on page 17

Where to Go Next

Refer to the following figure for information about other product tasks and associated resources for those tasks.



Worldwide Support and Services

The NI website is your complete resource for technical support. At *ni.com/support*, you have access to everything from troubleshooting and application development self-help resources to email and phone assistance from NI Application Engineers.

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Visit *ni.com/register* to register your NI product. Product registration facilitates technical support and ensures that you receive important information updates from NI.

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