# MIL-STD-1553

## Windows BSP

**AIM**
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Solutions

**Getting
Started**

Version 14.4.2
September, 2023

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AIM NO. 60-11200-35-14.4.2

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# TABLE OF CONTENTS

# 1   Introduction

## 1.1   About This Manual

This Getting Started Manual has been developed to assist first time users of the following boards with software installation, hardware set up, and starting a sample project for the MIL-STD-1553 boards.

Step by step instructions cover MIL-STD-1553 Windows Board Software Package (BSP) installation, board installation, and driver adaptation. The BSP provides users with current documentation, board drivers, and sample development projects. Additionally, the BSP provides utility files that are used to upgrade the MIL-STD-1553 on-board firmware, which is also described in this manual. The current version of all BSP is available from the download area of the AIM website.

AIM is also a leading designer and manufacturer of other high performance test and simulation modules, data bus analyzer software and systems for MIL-STD-1553 A/B, AFDX/ARINC664, ARINC429, MIL-STD-1760 and CAN/ARINC825 Applications, PANAVIA Serial Link and Fibre Channel. Supported hardware platforms include Peripheral Component Interconnect (PCI), PCI Express (PCIe), Compact PCI (cPCI), Versa Module Eurocard (VME), VME eXtensions for Instrumentation (VXI), PC104+, PC-Card, PCI Mezzanine Card (PMC), Express Card and Universal Serial Bus (USB). Information about all AIM products can be found at http://www.aim-online.com.

## 1.2   How This Manual Is Organized

This manual is organized as follows:

Section 1 "Introduction" contains an overview of this manual.

Section 2 "Installation And Preparation" describes the procedure used to install the BSP software and the MIL-STD-1553 hardware on a system that does not have a previous MIL-STD-1553 Windows BSP installed.

Section 3 "Connecting the AIM device to the Milbus" contains a description and diagrams of the different methods used to connect the AIM 1553 card to the Milbus.

Section 4 "Compiling And Running The Sample Project" contains the procedure used to open, build, and run a sample project included in the BSP.

## 1.3   Applicable Documents

AIM has developed several documents that may be used to aid the user with other aspects of the MIL-STD-1553 bus interface card. These documents and a summary of their contents are listed below (including this document):

**MIL-STD-1553 Application Programming Interface (API) Reference Manual** provides the MIL-STD-1553 application developer with detailed information about all functions provided by MIL-STD-1553 API. This guide is to be used in conjunction with the MIL-STD-1553 Programmer's Guide.

**STANAG3910 API Reference Manual** provides the STANAG3910 application developer with detailed information about all functions provided by STANAG3910 API that are additional to the MIL-STD-1553 functions.

**MIL-STD-1553 API Programmer's Guide** provides the MIL-STD-1553 application developer with high level s/w development information including user application system design concepts, function call guidelines, and sample programs. This guide is to be used in conjunction with the Reference Manual.

**MIL-STD-1553 Windows BSP Getting Started Manual** assists the first time users of the AIM boards with software installation, hardware set up and starting a sample project for a Windows BSP. Each BSP has its own dedicated Getting Started manual.

**PBA.pro Bus Analyzer User Manual** provides instruction on how to use the PC based MIL-STD-1553 bus analyzer software package, PBA.pro, to set up and control the MIL-STD-1553 Bus Interface Module.

**Hardware Manuals** – provide the hardware user manual for the specified modules. The documents cover the hardware installation, the board connections the technical data and a general description of the hardware architecture. The following hardware manuals are available:

- AVX1553 Hardware Manual (VME bus module)
- APX1553 Hardware Manual (PCIx module)
- ACX1553 Hardware Manual (PXI module)
- AEC1553 Hardware Manual (Express Card)
- AMCX1553 Hardware Manual (PMC module)
- AMCE1553 Hardware Manual (PMC module)
- AXC1553 Hardware Manual (XMC module)
- AXE1553 Hardware Manual (XMC module)
- APE1553 Hardware Manual (PCIe module)
- ACE1553 Hardware Manual (PXIe module)
- ACXX1553 Hardware Manual (PXI module)
- ASC1553-1 Hardware Manual (USB-A 2.0 smart cable)
- ASC1553-2 Hardware Manual (USB-C 3.0 smart cable)
- AME1553 Hardware Manual (PCIe mini card)
- AME1553-AP Hardware Manual (PCIe mini card)
- AMEE1553 Hardware Manual (PCIe mini card)
- ANET1553 Users Manual (Ethernet module)

# 2 Installation And Preparation

Follow the steps in this section for information on how to install the BSP software on your system and preparing your MIL-STD-1553 devices for use.

## 2.1 Hardware Installation

Please insert the MIL-STD-1553 devices into your system according to the description within the corresponding hardware manual. Then power-on your system and boot your Windows Operating System (OS) installation.

> **Note:**
> **ESD Warning!!!**
> The AIM interface modules are typical electronic devices that are sensitive to electrostatic discharge. It is important to observe normal precautions when handling the board to prevent damage.

## 2.2 BSP Installation

**Running The BSP Installer**

To install the BSP software, run the installer application called *Setup.exe* from the AIM provided DVD or download it from www.aim-online.com. Once the installer application has started, step through the install wizard to complete the installation.

You will be prompted for a destination folder where to install the BSP to (See figure 1). All documentation, device drivers, sample development projects and firmware update utilities will be installed to this location which is later on referred to as *BSP installation directory*.
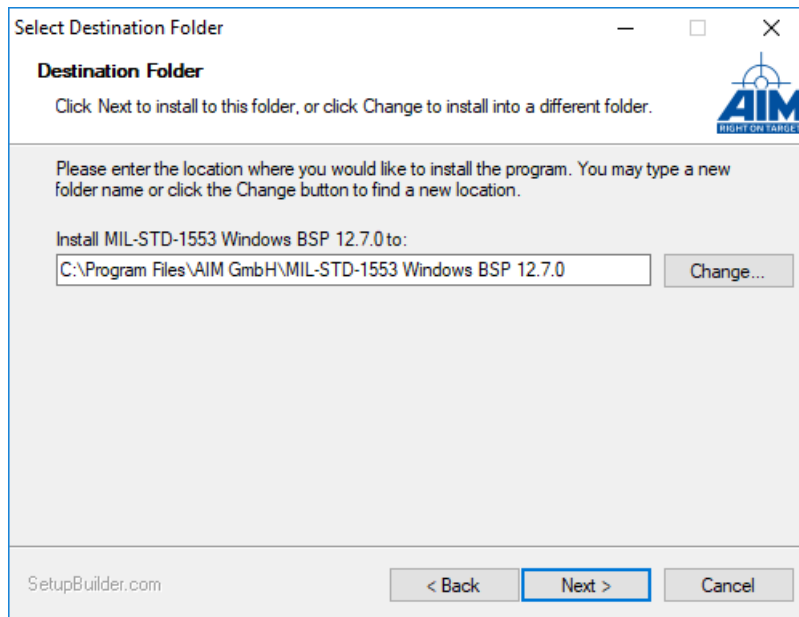
Figure 1: BSP Installation Directory

After successful BSP installation the installer application offers to update all the device drivers, API libraries and Firmware of your installed MIL-STD-1553 devices (See figure 2). Running this procedure is highly recommended. If skipped, it can be run manually later on by executing setup_bsp.bat as administrator.
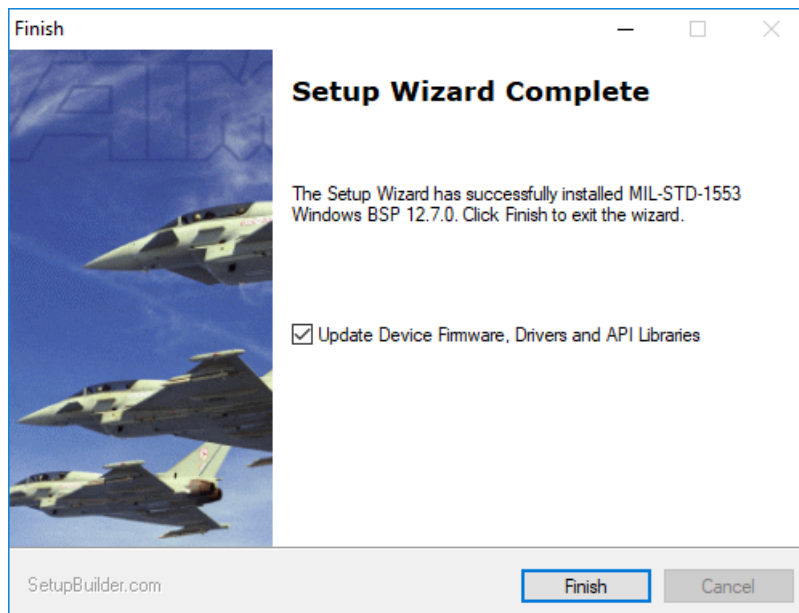


Figure 2: Automatic Firmware/Driver/API Update

Now a command shell will open that displays progress of the update procedure (See figure 3). Follow all other instructions you're given via this shell or via installation dialogues opened by this shell.
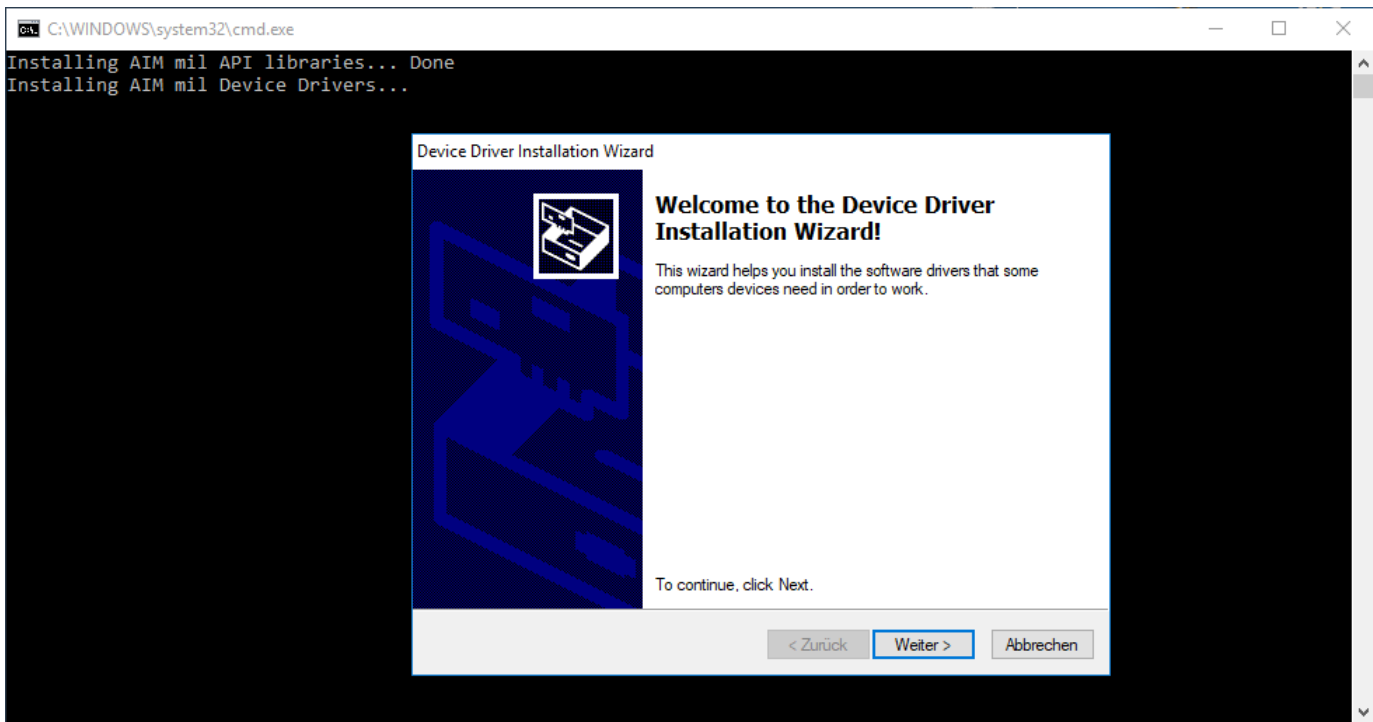
Figure 3: Update Procedure Command Shell

Confirm any reboot of your computer you are prompted for e.g. by message boxes. The update procedure may also automatically restart or shut down your computer several times.

**Note:**
Automatic firmware update is only supported for AIM MIL-STD-1553 devices that are connected to your host via a local system bus. If you own network based hardware (ANET1553 ), you have to perform the Firmware update manually. (See Section 2.3 "Integrating New Hardware Later On")

**BSP Components**

The BSP installation will result in the creation of a Start Menu entry which can be located by going to *Start | All Apps | AIM GbmH | MIL-STD-1553 Windows BSP x.y.z* (See figure 4). Clicking on this entry will open a Windows Explorer instance that will point to the BSP installation directory.
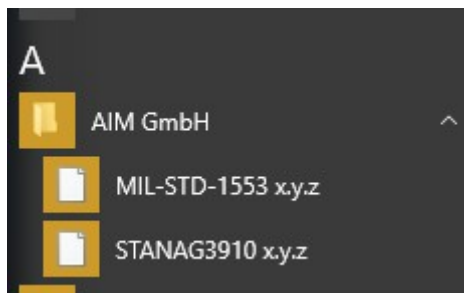


Figure 4: New entries in the start menu

The default location *C:\Program Files\AIM_GmbH\MIL-STD-1553 Windows BSP x.y.z* will contain the following directories:

**Add-ons** Additional software and tools provided with the BSP.

**Doc** Software Library Reference manual, Release notes and other documents

**include** Header files used during compilation.

**lib32** DLL and Import Library required to develop an 32 bit application for 32 and 64 bit Windows systems.

**lib64** DLL and Import Library required to develop an 64 bit application for Windows systems.

**Onboard-SW** Update utilities that are used for updating the on-board firmware.

**Sample** Sample project and source files for Microsoft Visual Studio 2013.

**SysDrv32** 32 Bit Windows drivers for supported MIL-STD-1553 devices.

**SysDrv64** 64 Bit Windows drivers for supported MIL-STD-1553 devices.

**Verifying Proper Installation Of The Device Drivers**

To verify proper installation of Windows driver:

1. Open the Windows Device Manager. (e.g. via *Control Panel->Device Manager*)

2. In the Device Manager window, expand the *AIM Components* entry by double clicking on it.

3. Then right click on the AIM Board entry and select Properties.

4. In the Properties window you will get status information that will show if the driver reported any errors at this point.

> **Note:**
> You will not see network based MIL-STD-1553 devices in the device manager. Use the *Net-Detection-Tool* located in the Add-ons directory of the BSP in order to verify if these devices are correctly integrated in your local network

## 2.3 Integrating New Hardware Later On

If you install new AIM MIL-STD-1553 devices in a system where the BSP installation procedure as described in Section 2.2 "BSP Installation" has already been run, you have to update the Firmware of these devices before you're able to use them. There are several different procedures depending on the device platform you want to update.

> **Note:**
> Never abort the board update process. Should the update appear to hang, please contact support@aim-online.com or your AIM sales representative.

**Updating devices that are locally connected to a host**

This method can be used for devices that are connected to the host via a local system bus (e.g. PCIe/USB).

Open a file manager and navigate to the subdirectory *Onboard-SW* of your BSP that is by default located in *C:\Program Files\AIM GbmH\MIL-STD-1553 Windows BSP x.y.z\Onboard-SW*

Then execute the batch file *update.bat*. A DOS prompt will appear and the board update will now start. Please follow the instructions printed to the screen.

For some boards an additional reboot may be required. Please check the output on command prompt and (if requested ) reboot and run the update.bat again. When the download is finished, a cold boot is required to start the new on-board software.

**Updating network based devices**

ANET1553 devices can be updated using the web browser based *ANET Web Configuration* utility. Here, go to the *Update* tab and choose *'Reboot to maintenance system'*.

After the device rebooted to maintenance system, login to the web configuration interface and go back to the *Update* tab. Choose the update package (*.tar.gz) suitable for your device and start the update.

The update package is located in the *Onboard-SW\update-components* folder of your BSP installation directory. Usually this is at *C:\Program Files\AIM GmbH\MIL-STD-1553 Windows BSP x.y.z.\Onboard-SW\update-components*

The update procedure might take some time. Please leave the browser window open until the update is finished.

For a detailed description of this procedure, find more information in the *ANET1553 User's Manual* that is delivered with this BSP.

# 3   Connecting the AIM device to the Milbus

The MIL-STD-1553 Specification clearly defines the process of coupling subsystems to the bus. This connection, called a stub, has two coupling options: Direct and Transformer Coupled. In addition to these two methods of connecting to the bus, a Direct to Device (Network) Coupling configuration is also an option. All three methods are described in this section.

## 3.1   Direct coupling

**Direct Coupling** connects the subsystem/terminal device directly to the bus and can only be used in connections under one foot in length.

Since a Direct Coupled stub provides only limited isolation in the event of a device (subsystem or terminal) short, Transformer Coupling is normally the recommended method of connecting to the bus.
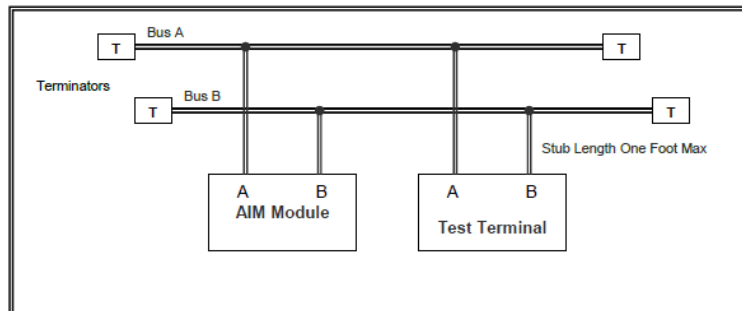


Figure 5: Direct coupling

## 3.2   Transformer coupling

**Transformer Coupling** utilizes a bus coupler that contains an isolation transformer and isolation resistors. Transformer Coupling extends the stub length to 20 feet and provides electrical isolation, better impedance matching and higher noise rejection characteristics than Direct Coupling. The electrical isolation prevents a terminal fault or stub impedance mismatch from affecting bus performance.

Connecting to the bus using Transformer Coupling requires a Coupler for each subsystem/terminal device and proper termination on the bus.

## 3.3   Direct to device (Network) coupling

**Direct to Device (Network) Coupling** is an option with AIM modules. The AIM design includes on-board Bus Network circuitry that is software selectable. This allows the user to connect directly to a single terminal device without the need for any bus coupling. The Network Coupling mode, selected by the user via software controls, provides a terminated MILbus network simulation on the AIM module for direct connection between the AIM module/PBA Analyzer and the terminal under test.
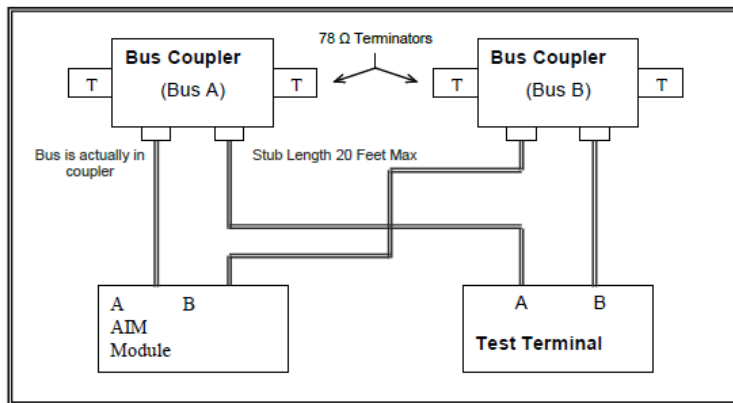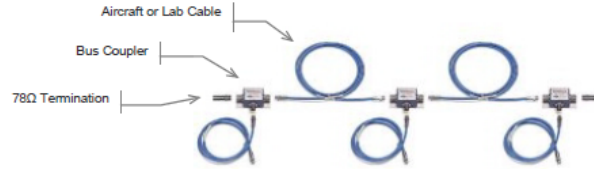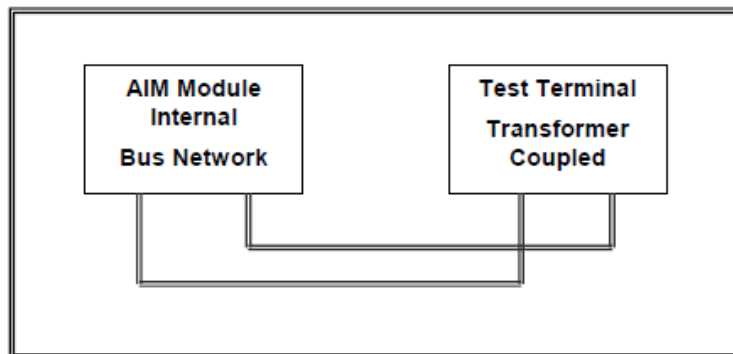
Figure 6: Transformer coupling



Figure 7: Direct to device (Network) coupling

# 4    Compiling And Running The Sample Project

## 4.1    Precompiled Sample

To execute a pre-compiled sample program already included in the BSP run:
*C:\Program Files\AIM GmbH\MIL-STD-1553 BSP x.y.z\Sample\Sample.exe* The sample program opens
a board and provides a selection of a sub-sample functions to execute.

For further information regarding development of a MIL-STD-1553 application software program to in-
terface to the module see the API Reference Manual and the MIL-STD-1553 API Programmer's Guide.

## 4.2    Compiling The Sample

The procedures in this section assume that the BSP was copied into a directory with full read and
write access and also assume the use of Microsoft Visual Studio 2013.  If a different version is used,
the procedure may differ slightly.  The processes involved in compiling and running a sample program
include:

**Open Sample Workspace**

To open the sample solution which contains all the sample function, start Visual Studio, then select **File |
Open Project/Solution** and navigate to *c:\Program Files\AIM GmbH\MIL-STD-1553 BSP x.y.z\Sample\*
and open the project *sample.sln*

**Add include search paths**

To add the proper search paths for the include files:

1. Right click the project and selecting Properties

2. Select **C++** / **General**

3. Additional include directories must contain the include directory

4. In **Configuration Properties | C/C++ | General** add the directory
   *c:\Program Files\AIM GmbH\MIL-STD-1553 BSP x.y.z\include*.

5. Then select the OK button

**Add preprocessor definitions**

To add the proper preprocessor definition

1. Right click the project and select Properties

2. Select **C/C++ | Preprocessor**

3. Under preprocessor definitions (if not already included) enter _AIM_WINDOWS then select OK.

**Add library**

To add the proper preprocessor definition

1. Right click the project and select Properties

2. Select linker / Input

3. Under Additional dependencies (if not already included) enter api_mil.23.lib then select OK.

**Add library path**

To add the proper preprocessor definition

1. Right click the project and select Properties

2. Select Linker / General

3. Under Additional library directories (if not already included) enter
   *c:\Program Files\AIM GmbH\MIL-STD-1553 BSP x.y.z\lib32* for 32bit applications and
   *c:\Program Files\AIM GmbH\MIL-STD-1553 BSP x.y.z\lib64* for 64bit applications.

# 5 Using The LabVIEW VI Interface

## 5.1 Install the LabView VIs and examples

The VIs and examples are delivered in the BSP as VIP package. This package needs to be installed in order to be accessed by LabView. The installation by using the JKI VI Package Manager is as follows:

1. Open the JKI VI Package Manager and select open package file. Choose the VIP file from the installed BSPs Add-Ons\LabView folder.
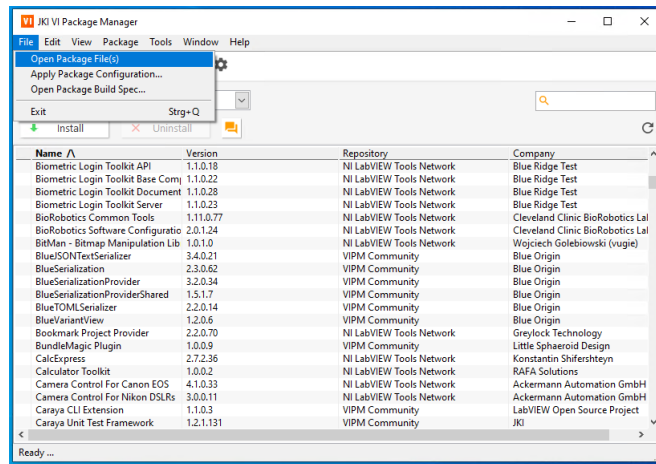


Figure 8: JKI VI Packet Manager Open File

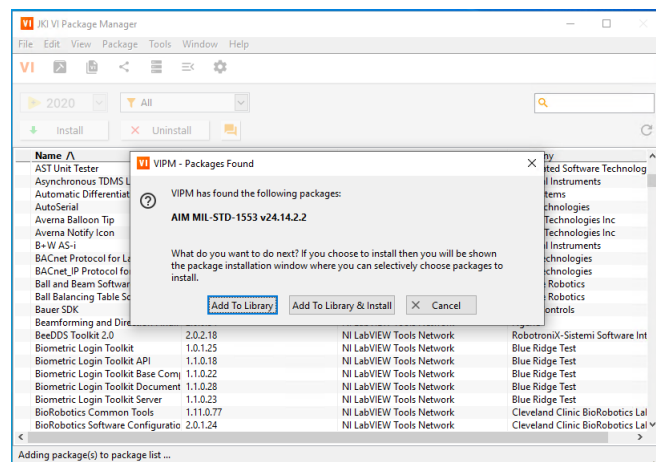2. Select Add to Library & Install



Figure 9: JKI VI Packet Manager Install
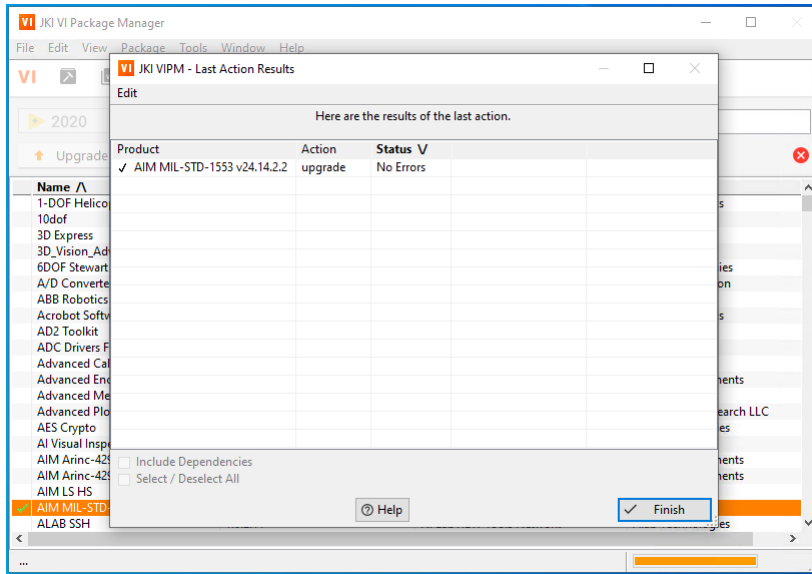
3. Select Finish



Figure 10: JKI VI Packet Manager Finish

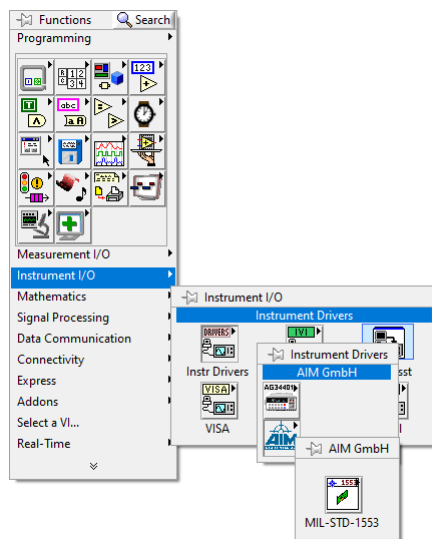4. The VIs can be found in the Instrument I/O section



Figure 11: Path to AIM MIL-STD-1553 VIs

5. The AIM Examples can be found in LabView under "Help > Find Examples...". Search e.g. for "1553" or "AIM".

## 5.2   Using The Reference Manual

If information about a LabVIEW Virtual Instrument (VI) is required, the help of it shows the API function name. Searching for the name of the function in the Reference Manual will bring you to the description of the function.

The VI have connections with the same name for every parameter of the described function and one for each member of every struct used.

Now an example: the fictive function
**AiReturn ApiGetValueFromStruct( AiHandle module, struct somestruct element_in, AiUInt32 \*pul_Value)**, where somestruct consists of **AiUInt32 a** and **AiUInt32 b** would have **moduleHandle**, **a** and **b** as input parameters for the VI, in addition to **error in**. The output parameters would be **value** in addition to **error out** and optionally the return value.

# List of Abbreviations

**API** Application Programming Interface

**BSP** Board Software Package

**cPCI** Compact PCI

**OS** Operating System

**PCI** Peripheral Component Interconnect

**PCIe** PCI Express

**PMC** PCI Mezzanine Card

**USB** Universal Serial Bus

**VME** Versa Module Eurocard

**VXI** VME eXtensions for Instrumentation

**VI** LabVIEW Virtual Instrument

# LIST OF FIGURES