

SD1 3.x Software

for M31xxA Digitizers, M32xxA AWGs & M33xxA Combos

Startup Guide

Notices

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CAUTION

A CAUTION notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in damage to the product or loss of important data. Do not proceed beyond a CAUTION notice until the indicated conditions are fully understood and met.

WARNING









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Safety Summary

The following general safety precautions must be observed during all phases of operation of this instrument. Failure to comply with these precautions or with specific warnings or operating instructions in the product manuals violates safety standards of design, manufacture, and intended use of the instrument. Keysight Technologies assumes no liability for the customer's failure to comply with these requirements. Product manuals are provided on the Web. Go to www.keysight.com and type in your product number in the Search field at the top of the page.


General	<p>This product is a Protection Class 1 instrument (provided with a protective earth terminal) and has been manufactured and tested according to international safety standards. The protective features of this product may be impaired if it is used in a manner not specified in the operation instructions.</p> <p>All Light Emitting Diodes (LEDs) used in this product are Class 1 LEDs as per IEC 60825-1:2014.</p>
Environment Conditions	<p>This instrument is intended for indoor use in an Overvoltage Category II, pollution degree 2 environment. It is designed to operate at a maximum relative humidity of 85% RH, non-condensing and at altitudes of up to 2000 meters. Refer to the specifications tables for the AC mains voltage requirements and ambient operating temperature range.</p>
Temperature	<p>The instrument should be protected from temperature extremes and changes in temperature that may cause condensation within it.</p> <p>The operating temperature is from 5 °C to +40 °C.</p> <p>The storage temperature is from -40 °C to +70 °C.</p>
Before Applying Power	<p>Verify that all safety precautions are taken. The power cable inlet of the instrument serves as a device to disconnect from the mains in case of hazard. The instrument must be positioned so that the operator can easily access the power cable inlet. When the instrument is rack mounted the rack must be provided with an easily accessible mains switch.</p>
Ground the Instrument	<p>To minimize shock hazard, the instrument chassis and cover must be connected to an electrical protective earth ground. The instrument must be connected to the AC power mains through a grounded power cable, with the ground wire firmly connected to an electrical ground (safety ground) at the power outlet. Any interruption of the protective (grounding) conductor or disconnection of the protective earth terminal will cause a potential shock hazard that could result in personal injury.</p>
Do Not Operate in an Explosive Atmosphere	<p>Do not operate the instrument in the presence of flammable gases or fumes.</p>
Do Not Remove the Instrument Cover	<p>Operating personnel must not remove instrument covers. Component replacement and internal adjustments must be made only by qualified personnel.</p> <p>Instruments that appear damaged or defective should be made inoperative and secured against unintended operation until they can be repaired by qualified service personnel.</p>

Instrument Markings

Instrument Marking	Description
	<p>The instruction manual symbol. The product is marked with this warning symbol when it is necessary for the user to refer to the instructions in the manual.</p>
	<p>Standby supply. Unit is not completely disconnected from AC mains when switch is off.</p>
	<p>The CE mark is a registered trademark of the European Community.</p>
	<p>The CSA mark with the 'c' and 'us' subscript indicates the instrument is certified to the applicable Canadian and United States of America standards respectively.</p>
	<p>The RCM mark is a registered trademark of the Australian Communications and Media Authority</p>
	<p>The KC mark is the Korean certification mark. This equipment is Class A suitable for professional use and is for use in electromagnetic environments outside of the home.</p>
	<p>The recycling symbol indicates the general ease with which the instrument can be recycled.</p>
	<p>China Restricted Substance Product Label. The EPUP (environmental protection use period) number in the center indicates the time period during which no hazardous or toxic substances or elements are expected to leak or deteriorate during normal use and generally reflects the expected useful life of the product.</p>

Compliance and Environmental Information

Table 1 Compliance and Environmental Information

Safety Symbol	Description
	<p>This product complies with WEEE Directive (2002/96/EC) marking requirements. The affixed label indicates that you must not discard this electrical/electronic product in domestic household waste.</p> <p>Product Category: With reference to the equipment types in WEEE Directive Annex I, this product is classed as a "Monitoring and Control instrumentation" product.</p> <p>Do not dispose in domestic household waste.</p> <p>To return unwanted products, contact your local Keysight office, or see http://about.keysight.com/en/companyinfo/environment/takeback.shtml for more information.</p>

Declaration of Conformity

Declarations of Conformity for this product and for the Keysight products may be downloaded from the Web. Go to <http://www.keysight.com/go/conformity>.

You can then search by product number to find the latest Declaration of Conformity.

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1. Overview on Keysight SD1 3.x Software

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Section 1.1: About this document

This document helps you get started with knowing about the key features that have been included in version 3.x of the Keysight SD1 software. It also serves as a guide for the required preliminary setup followed by procedures to install the SD1 3.x software along with its extended components.

Section 1.2: About SD1 3.x software features

The Keysight SD1 3.x Software, which comprises of drivers, programming libraries and Software Front Panel for the M3100A, M3102A, M3201A, M3202A, M3300A and M3302A modules, provides a comprehensive platform to perform the basic operations pertaining to AWGs and Digitizers. The SD1 3.x software also supports the Hardware FPGA reprogramming, which is done using the PathWave FPGA Board Support Package. Moreover, the SD1 API is powered by the KS2201A PathWave Test Sync Executive software for performing real-time operations and HVI sequencing.

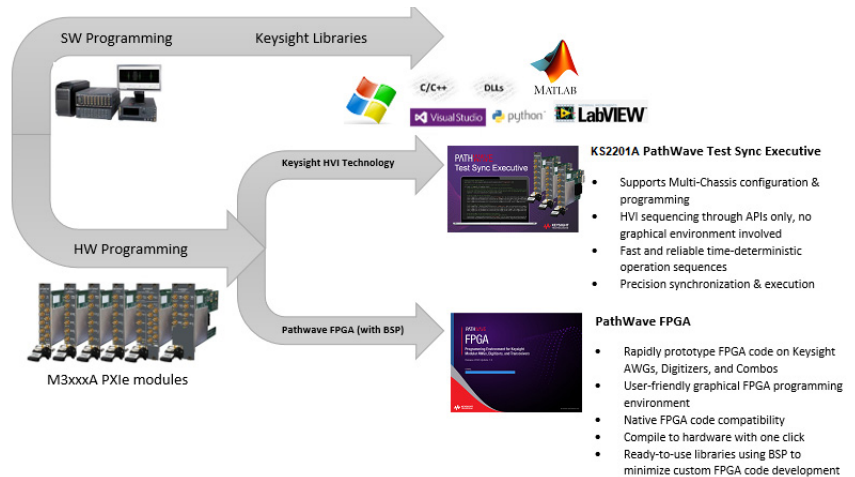


Figure 1 Model depicting the SD1 3.x software capabilities

Other than displaying the differences from its predecessor, [Table 2](#) highlights the new features that are available in Keysight SD1 3.x Software.

Table 2 Differences in SD1 2.x versus SD1 3.x software versions

SD1 software features	Legacy (SD1 2.x)	New (SD1 3.x)
Software		
Design Environment	M3601A HVI design environment (ProcessFlow)	KS2201A PathWave Test Sync Executive software (HVI2 technology)
	M3602A FPGA design environment (FPGAFlow)	KF9000A PathWave FPGA Programming Environment (commonly known as PathWave FPGA)
HVI Technology ¹	<ul style="list-style-type: none"> Graphical M3601A for HVI HVI-C API (through SD1 installer) 	KS2201A PathWave Test Sync Executive software (HVI2 Core API through a separate HVI installer)
FPGA Programming	<ul style="list-style-type: none"> Graphical M3602A FPGA Designing (BSP for SD1 2.x only) 	PathWave FPGA (BSP installer for each supported module is required)
Soft Front Panel (SFP)	Available	Available
Programming Interface	Python ¹ , C++, C#, LabVIEW, MATLAB	Python ¹ , C, C++, C#, LabVIEW, MATLAB
Supported Operating System	Windows 10	Windows 10 (x64 bit)
Hardware Modules		
M3202A (AWG 1G)	FW version <4.0 (CLF / CLV) (CH2* or CH4) (K16, K32, K41) BSP available (K32, K41)	FW version >=4.0 (CLF / CLV**) (CH4) (K16, K32, K41) BSP available (K32, K41)
M3201A (AWG 500)	FW version <4.0 (CLF / CLV) (CH2* or CH4) (K16, K32, K41) BSP available (K32, K41)	FW version >=4.0 (CLF / CLV**) (CH4) (K16, K32, K41) BSP available (K32, K41)
M3102A (DIG 500)	FW version <2.0 (CLF / CLV*) (CH2* or CH4) (K16, K32, K41) BSP available (K32, K41)	FW version >=2.0 (CLF) (CH4) (K16, K32, K41) BSP available (K32, K41)
M3100A (DIG 100)	FW version <2.0 (CLF / CLV*) (CH4 or CH8) (K16, K32, K41) BSP available (K32, K41)	FW version >=2.0 (CLF) (CH4 or CH8) (K32, K41) BSP available (K32, K41)
M3302A (COMBO 500 500)	FW version <4.0 (CLF / CLV*) (CH2 AWG - CH2 DIG) (K32*, K41) BSP available (K32*, K41)	FW version >=4.0 (CLF) (CH2 AWG - CH2 DIG) (K41) BSP available (K41)
M3300A (COMBO 500 100)	FW version <4.0 (CLF) (CH2 AWG-CH4 DIG or CH4 AWG-CH8 DIG) (K16*, K32*, K41) BSP available (K32*)	FW version >=4.0 (CLF) (CH2 AWG-CH4 DIG or CH4 AWG-CH8 DIG) (K41) BSP available (K41)

1. HVI programming is supported with Python version 3.7 only.

* This Hardware Option cannot be procured. Contact [Keysight Support](#) for more information.

** Only Default Clock Speed is supported. Variable Clock is NOT Supported.

Section 1.3: About PathWave FPGA and BSP

1.3.1: Using PathWave FPGA

The SD1 3.x software supports the KF9000A PathWave FPGA Programming Environment (commonly known as PathWave FPGA) to program custom logic into the instrument FPGA.

PathWave FPGA provides a complete FPGA design flow from design creation to simulation to GateWare deployment to Hardware/Gateware verification. This environment provides an easy-to-use GUI, where you may create bitstream images targeted to a sandbox in the Keysight FPGA.

Refer to [Downloading required software](#) on page 27 for information about Keysight's landing page for PathWave FPGA software installer. For more information regarding the PathWave FPGA software, refer to the embedded help file or the [KF9000A PathWave FPGA Programming Environment Document Library](#).

NOTE

The PathWave FPGA 2020 is a licensed software. Contact Keysight Support for more information on procuring the respective licenses.

1.3.2: Using BSP with PathWave FPGA

PathWave FPGA, by itself, does not provide access to any of the waveform and digitizer controls, which are associated with the supported Keysight M3xxxA PXIe modules. You must install the Board Support Package (BSP) to leverage the features within the PathWave FPGA software for your design.

The Board Support Package (BSP) comprises of two parts—an FPGA Support Package (FSP) and a Runtime Support Package (RSP). These are installed separately from PathWave FPGA.

The FSP is that portion of the BSP that allows you to build a bit file for the target FPGA. It is consumed by PathWave FPGA to support design creation and sandbox compilation; everything that is performed without the physical hardware.

The RSP is that portion of the BSP that allows you to control your target FPGA. It provides a C API that you can use to download and verify your FPGA bit image. You may use the RSP to load design images onto hardware and perform simple register and streaming accesses to the one or more sandboxes.

The FPGA design consists of two regions: the static region and the sandbox region. The static region for each supported module is defined within BSP and cannot be modified. This region defines the implementation of the FPGA interfaces to external resources, and defines the interfaces to the sandbox. A static region implementation can define one or more sandbox regions in an FPGA design. The sandbox region contains the user specific FPGA design. The interface of the sandbox depends on the static region implementation. A specific design flow is promoted by PathWave FPGA, called Partial Reconfiguration (PR). In a PR flow, a full FPGA reconfiguration is only necessary once for a given static region version. The sandboxes can be reconfigured anytime, without a full reconfiguration, and without stopping the current operation of the FPGA.

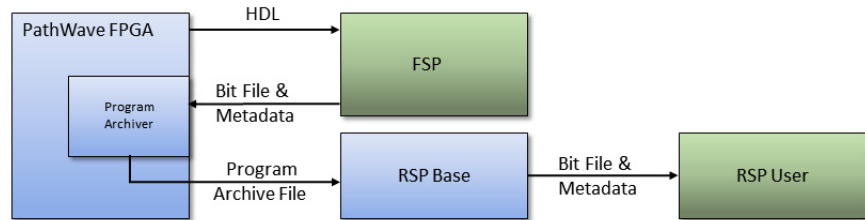


Figure 2 PathWave FPGA compilation flow using BSP

Therefore, each M3xxxA module has a separate BSP installer and you can only perform FPGA designing for those modules that have BSP installed on the same machine as the PathWave FPGA software. Both PathWave FPGA software and the BSP function together and cannot be used individually.

To use front panel analog IO with these modules, it is necessary to use the SD1 API to control the hardware. A second API is provided to work with designs created using PathWave FPGA. This API provides convenient access to the program archive file (the “k7z” file) created by PathWave FPGA.

You may either use both SD1 and RSP APIs in the program, or use only the Keysight SD1 API.

NOTE

The hardware license option -FP1 must be available for the implementation of PathWave FPGA BSP on the applicable modules.

For installation instructions regarding the PathWave FPGA Board Support Package, see [Installing PathWave FPGA BSP](#) on page 49.

For more information regarding the PathWave FPGA Board Support Package corresponding to each M3xxxA module, refer to the respective help file embedded in the PathWave FPGA software.

Section 1.4: About KS2201A PathWave Test Sync Executive software

The KS2201A PathWave Test Sync Executive software is a programming environment based on Keysight's Hard Virtual Instrument (HVI) technology, that enables you to develop and execute synchronous real-time operations across multiple instruments. The real-time sequencing and synchronization capabilities of the PathWave Test Sync Executive software make it a powerful tool for *Multi-Input Multi-Output (MIMO)* applications that require tight synchronization and real-time control and feedback in areas such as Quantum Computing.

NOTE

Beginning with SD1 3.x software release, the M3601A Hard Virtual Instrument (HVI) Design Environment (ProcessFlow) is replaced by the KS2201A PathWave Test Sync Executive Software for HVI integration. Both the GUI elements and the API functions from the former HVI design environment are not supported in the SD1 3.x software.

1.4.1: M3xxxA Firmware version requirements for HVI

The new generation of HVI technology is only programmable by KS2201A PathWave Test Sync Executive and is not backward compatible with the previous generation of HVI technology (M3601A).

Table 3 summarizes the firmware versions required for KS2201A operation on the M3xxxA series of PXI modules. In addition, the SD1 software provides drivers, programming libraries and soft front panels for the M3xxxA series. For operation of the KS2201A software, you can use only version 3.x of the SD1 software.

Table 3 Firmware Version Requirements

Instrument	Drivers, Firmware & Software Page	FW version required for use with M3601A	FW version required for use with KS2201A
M3100A Digitizer	M3100A	< 2.0	>= 2.0
M3100A Digitizer	M3102A	< 2.0	>= 2.0
M3201A AWG	M3201A	< 4.0	>= 4.0
M3202A AWG	M3202A	< 4.0	>= 4.0
M3300A AWG & Digitizer Combo	M3300A	< 4.0	>= 4.0
M3302A AWG & Digitizer Combo	M3302A	< 4.0	>= 4.0

1. Firmware upgrade/downgrade and SD1 upgrade/downgrade can be performed manually. There is no need to return the module to Keysight. By updating the firmware on these Keysight products, support for the older generation (M3601A) may be disabled.

2. Note that option **HV1** on the M3xxxA modules is required for operation with either KS2201A or M3601A.

1.4.2: About HVI Technology

HVI technology enables you to program one or multiple instruments to execute time-deterministic sequences of operations and execute them with precise synchronization. It achieves this by deploying an executable code into each instrument's HW to be executed by the HVI engine or processor included integrated into the instrument. The code executes on these engines in parallel, across multiple instruments. The new user-defined HW operation of the group of instruments is called a Hard Virtual Instrument or just HVI. The sequences of operations or instructions executed by the HVI engines are called HVI sequences. On top of the advantages inherent of the new use model, several other features have been added, such as extended multi-chassis capabilities and expanded product support.

When creating an HVI, you can include any instrument with HVI support. Keysight's M3xxxA family of PXI instruments is one product family with HVI support.

1.4.3: About HVI Application Programming Interface

The HVI Application Programming Interface (API) is the set of programming classes and methods that allows the user to create and program an HVI instance. Refer to the *KS2201A PathWave Test Sync Executive User Guide* to know more about the HVI Python API.

NOTE

HVI programming is supported with Python version 3.7 only.

HVI core functionality is extended by each instrument with an instrument specific API. The core API is common to all products and only the instrument specific HVI API will change (instrument instructions, actions, events), depending on the products. It is important to differentiate between the core HVI features and the instrument specific extensions, which allow a heterogeneous array of instruments and resources to coexist on a common framework.

The HVI Core API exposes all HVI functions and is a common API for all products. It defines the base interfaces and classes that are used to create an HVI, control the hardware execution flow, and operate with data, triggers, events and actions, but it alone does not include the ability to control instrument specific operations. The core API defines the hardware virtual instrumentation framework, and it is the job of the product-specific HVI instrument extensions to enable instrument functionalities in an HVI.

All M3xxxA modules support HVI technology.

NOTE

The hardware license option -HV1 must be available on each module that is required to be programmed using the KS2201A PathWave Test Sync Executive software.

When Keysight SD1 is installed on a PXI system, it installs the drivers required to interact with the M3xxxA series modules. Additionally, the graphical environment for the Keysight SD1 SFP provides a visual representation of most of the SD1 API's features.

The SD1 API classes contains HVI add-on API interfaces provided as an extension of the instrument. These add-on interfaces provide access to instrument specific HVI features such as triggering a digitizer acquisition, outputting a waveform, queuing a waveform, and so on.

For installation and usage instructions regarding the KS2201A PathWave Test Sync Executive software, refer to the *KS2201A PathWave Test Sync Executive User Guide*.

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2. Setting up the SD1 3.x Software

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Section 2.1: Setting up prerequisites

2.1.1: System requirements

- Windows 10 (x64 bit)

2.1.2: Prerequisite software requirements

Table 4 Software to be installed prior to SD1 3.x

Sequence	Prerequisite software	Web Page to download installer from	License
1	Keysight IO Libraries Suite 2018 (version 18.1.23218 or later)	Click this link to be redirected to the page	Free
2	PXle Chassis firmware	–	–
3	PXle Chassis Family Drivers (version 1.7.82.1 or later)	Click this link to be redirected to the page	–
4	M902x PXle System Module Driver (version 1.0.94.1 or later), if using M90xx remote controllers	Click this link to be redirected to the page	–
5	M938x Vector Signal Generator / CW Source Instrument Drivers (version 2.1.150.4 or later)	Click this link to be redirected to the page	–
6	<i>Xilinx Vivado Design Suite (2017.3 or later)</i>	Refer to <i>PathWave FPGA Customer Documentation</i> for installation and licensing information	
7*	<i>Python 64-bit version 3.7.x or later</i>	https://www.python.org/	Free
8*	<i>(optional) Any C# / .NET compiler</i>	–	–
9*	<i>(optional) Any C / C++ compiler</i>	–	–

*Install this programming interface only if it meets your requirements.

General installation steps for prerequisite software

Perform these steps for installing the software in the sequence shown in [Table 4](#).

- 1 Click the download link and save the installer.
- 2 Run the downloaded installer.
- 3 Follow the on-screen instructions.

For PXIe Chassis drivers and firmware

- 1 When installing the Keysight Chassis Family Driver, PXIe Chassis SFP (Software Front Panel) software is automatically installed.
 - Chassis firmware version can be checked and updated using PXIe Chassis SFP.
- 2 For any other chassis model being used, Keysight recommends installing the required firmware version and its compatible chassis driver separately.

Instructions for installing Python

- 1 Double-click the Python installer, which you have downloaded on your local machine.

The Python Setup window appears.

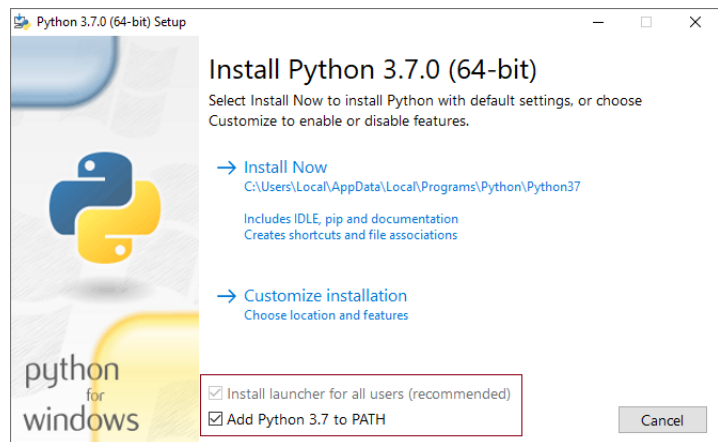


Figure 3 Initial Python Setup window

- 2 Make sure that both options “Install launcher for all users (recommended)” and “Add Python 3.7 to PATH” are checked. By default, the check box for the former option is selected and it is clear for the latter option.
- 3 Click “Install Now” to install the required Python libraries.

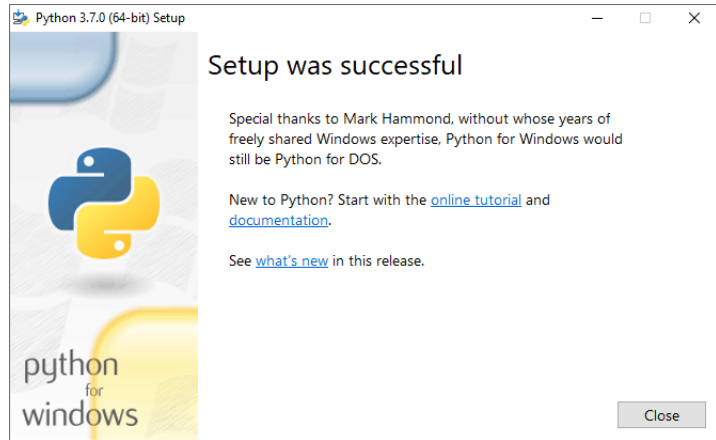


Figure 4 Final Python Setup window

- 4 On the final window pertaining to Python Setup, click "Close" to exit.
- 5 To verify if the Python installation is successful,
 - a Launch the command prompt.
 - b On the root directory, type `python` and press <Enter>. See Figure 5.

The version information of the current Python installation is displayed.

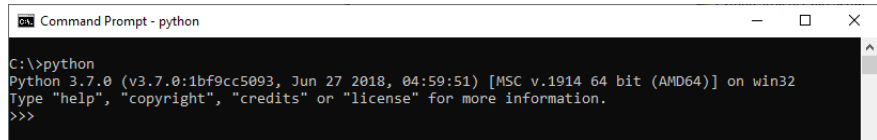


Figure 5 Python installation verification on command prompt window

- c Ensure that Python has been added to the 'PATH' in 'System Variables'. If it does not appear, you must manually add an entry.

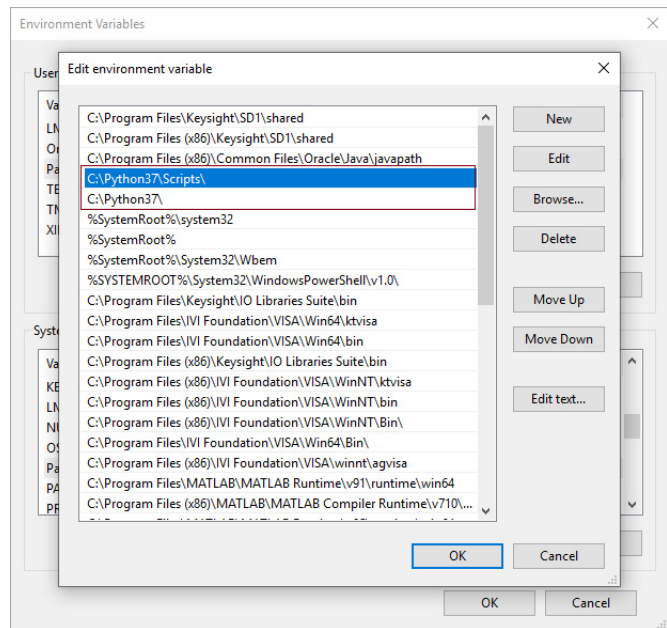


Figure 6 Verifying addition of Python to PATH environment variable

6 On the command prompt window shown in [Figure 5](#), enter the following commands to install the 'NumPy', 'SciPy' and 'Matplotlib' libraries:

- `python -m pip install numpy`
- `python -m pip install scipy`
- `python -m pip install matplotlib`

After each library is installed, you should see a message "Successfully installed...". If you encounter any error, exit the command prompt window and launch a new one to repeat steps 5b and 6.

The procedure for downloading and installing the SD1 3.x Software, PXIe module firmware, PathWave FPGA Board Support Package and KS2201A PathWave Test Sync Executive software are described further in this chapter.

Section 2.2: Obtaining License Options

Keysight SD1 3.x software does not require any license to be installed. However, the software and hardware used with SD1 3.x software require specific license options that you must procure. Visit the respective product page on www.keysight.com for pricing details and purchasing Keysight products.

Table 5 Software License Options required for supported Software (other than SD1 3.x)

Software	License option
PathWave FPGA 2020 Update 1.0 or later	Refer to <i>PathWave FPGA Customer Documentation</i> for licensing info.
KS2201A PathWave Test Sync Executive software	Refer to the <i>KS2201A PathWave Test Sync Executive User Guide</i> for licensing info.
<i>Xilinx Vivado Design Suite (2017.3 or later)</i>	Refer to <i>PathWave FPGA Customer Documentation</i> for licensing info.

Table 6 Hardware License Options Matrix supported by SD1 3.x software

Option description	M3202A-AWG 1G	M3201A-AWG 500	M3102A-DIG 500	M3100A-DIG 100	M3302A-AIO 500+500	M3300A-AIO 500+100
Channels	CH4	CH4	CH4	CH4 or CH8	C22	C24 or C48
Clock (CLF/CLV)	CLF or CLV	CLF or CLV	CLF	CLF	CLF	CLF
Dual Modulation (DM1)	DM1	DM1	DM1	DM1	DM1	DM1
FPGA Programming (FP1*)	FP1	FP1	FP1	FP1	FP1	FP1
HVI Programming (HV1**)	HV1	HV1	HV1	HV1	HV1	HV1
FPGA type***	K16/K32/K41	K16/K32/K41	K16/K32/K41	K32/K41	K41	K41
Memory (M01/M12/M20)	Select either of the memory options available for each module M01 = (16MB, 8MSa) / M12 = (128MB, 60MSa) / M20 = (2GB, 1GSa)					

*support for PathWave FPGA BSP on FPGA type K32 / K41 only

**support for KS2201A PathWave Test Sync Executive software in SD1 3.x

***K32 indicates Xilinx 7K325T and K41 indicates Xilinx 7K410T

Note that for migration to the Keysight SD1 3.x software, your hardware must have the license options listed above for compatibility.

Section 2.3: Downloading required software

The following list points to the web pages on Keysight website, where you can download the respective software installer files from. Install each software in the sequence shown in [Table 7](#). Prior to installing one or more of these software files, you must have installed the software listed under the section, “[Prerequisite software requirements](#)” on page 22.

Table 7 Required software and installer pages

Sequence	Prerequisite software	Web Page to download installer from
1	Keysight SD1 3.x Software	Click here to visit page.
2	SD1 3.x Firmware Update Package	Click module name below to visit respective page. <ul style="list-style-type: none"> ▪ M3201A ▪ M3202A ▪ M3100A ▪ M3102A ▪ M3300A ▪ M3302A
3	KS2201A PathWave Test Sync Executive software	Click here to visit page.
4	KF9000A PathWave FPGA Programming Environment (commonly known as PathWave FPGA 2020 Update 1.0 or later)	Click here to visit page.
5	PathWave FPGA Board Support Package (BSP)	Click module name below to visit respective page. <ul style="list-style-type: none"> ▪ M3201A ▪ M3202A ▪ M3102A ▪ M3100A ▪ M3302A ▪ M3300A

Section 2.4: Installing required software

The following sections show installation procedure for each software in the sequence listed in [Table 7](#). Before you begin installing the SD1 3.x software, you must ensure that all other software listed in “[Prerequisite software requirements](#)” on page 22 are installed on the same machine.

Beginning with version 3.2 onwards, SD1 software supports complete silent installation.

To install SD1 software in silent mode,

- 1 From the **Start** menu, launch the Command Prompt window.
- 2 Change the root folder to the directory where the installer file is placed.
- 3 Run the following command:

```
<SD1-installer-filename> --mode unattended
```

For example, if *SD1software_3.02.08_installer.exe* is the installer filename, the command will be:

```
SD1software_3.02.08_installer.exe --mode unattended
```

2.4.1: Installing Keysight SD1 3.x software

NOTE

1. While installing SD1 version 3.1 or later on a machine, the installer detects and automatically removes any existing version of SD1 software on that machine. However, if SD1 version 3.1 or later is pre-installed, installing SD1 version 2.x / 3.0 does not automatically remove the installed SD1 version. To install an older SD1 software version (2.x / 3.0), you must first manually remove the latest SD1 version using **Add or remove programs** utility in the **Control Panel** in Windows.

2. If you encounter an error, “Unknown error while running C:\Program Files(x86)\Keysight\SD1\uninstall.exe - mode unattended” when installing the SD1 software, a likely cause may be an unsuccessful removal of the previously installed SD1 software. In such cases, manually clean the following directories: *C:\Program Files\Keysight\SD1* and *C:\Program Files (x86)\Keysight\SD1* before trying to install SD1 again.

- 1 After you have downloaded the executable file from Keysight.com, double-click the installer for SD1 3.x Software.



Figure 7 Icon for the SD1 3.x software installer

The following prompt is displayed only if an older version of the SD1 software is installed on your machine. Click **Yes** to continue.

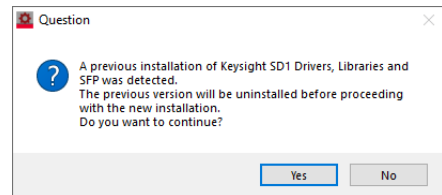


Figure 8 Prompt to remove previous version of SD1 software

The Welcome window on the SD1 Setup Wizard appears.

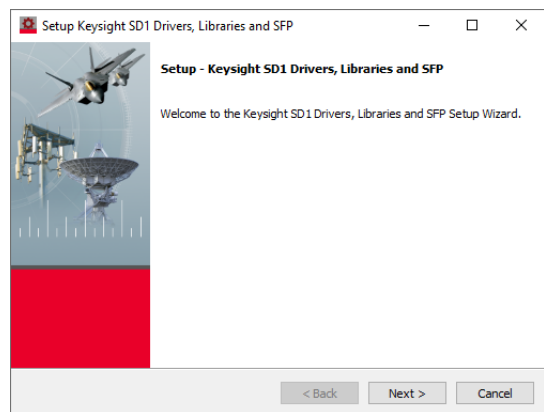


Figure 9 Welcome window on the SD1 Setup Wizard

2 Click **Next >**. The License Agreement window is displayed.

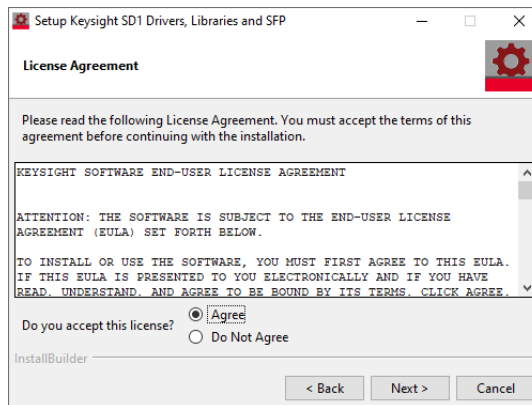


Figure 10 License Agreement window on the SD1 Setup Wizard

3 From the **Do you accept this license?** options, select **Agree**.

4 Click **Next >**. The Select Components window is displayed.

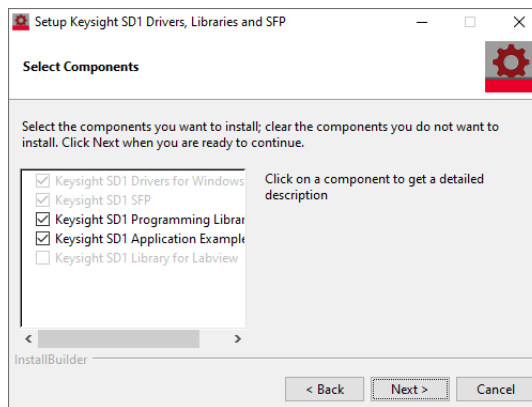


Figure 11 Select Components window on the SD1 Setup Wizard

By default, all options are selected. However, the option “Keysight SD1 Library for Labview” is checked and active only if SD1 installer detects any LabVIEW version installed. Optionally, you may clear the check box if you choose not to install the LabVIEW drivers.

Also, if you wish to opt out of using the SD1 API for the M3xxxA module configuration, you may optionally clear (not recommended) the check box for “Keysight SD1 Programming Libraries” and “Keysight SD1 Application Examples”, respectively.

- 5 Click **Next >**. The Ready to Install window is displayed.

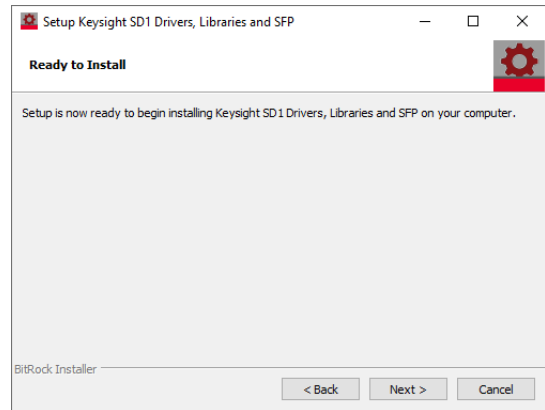


Figure 12 Ready to Install window on the SD1 Setup Wizard

- 6 Click **Next >**. The installation progress window is displayed.

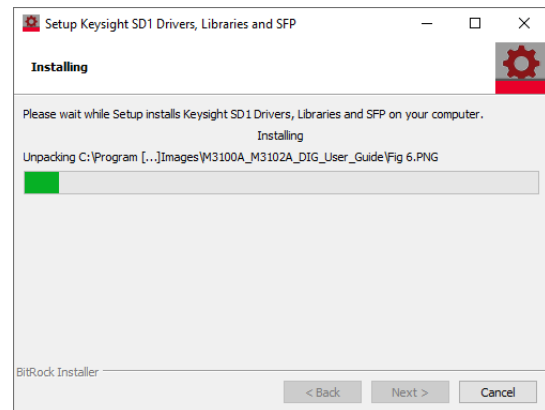


Figure 13 Installation progress window on the SD1 Setup Wizard

During the installation, a separate window appears for the installation of SD1 device drivers for the M3xxxA modules.

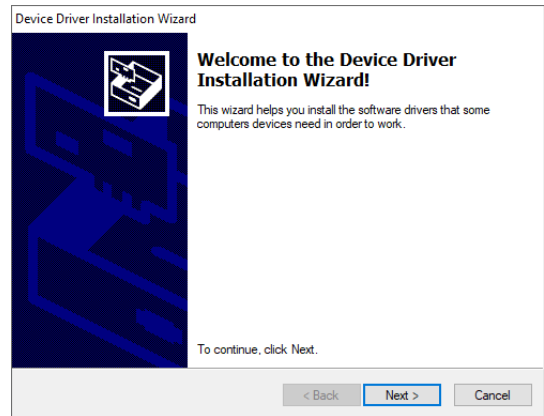


Figure 14 Welcome window on the Device Driver Installation wizard

- 7 Click **Next >**. The completion window on the Device Driver Installation Wizard is displayed.

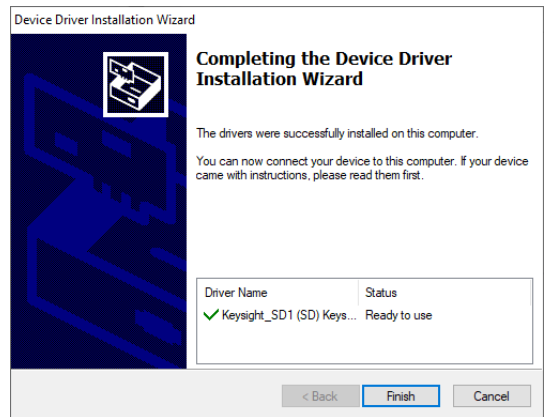


Figure 15 Welcome window on the Device Driver Installation wizard

- 8 Click **Finish**.

The completion window on the SD1 Setup Wizard is displayed.

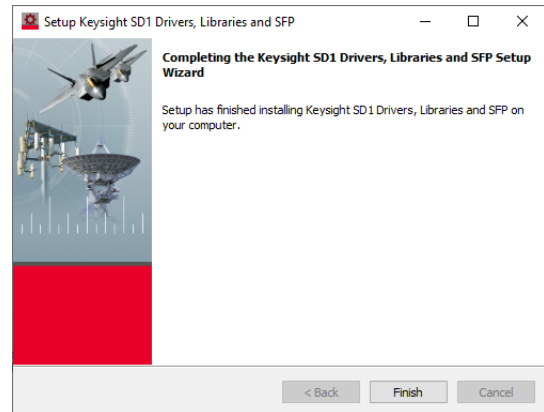


Figure 16 Completion window on the SD1 Setup wizard

- 9 Click **Finish** to complete the software installation and exit the SD1 Setup Wizard.

The following prompt is displayed to restart your machine. Click **Yes** to continue (recommended) or **No** to restart the machine later.

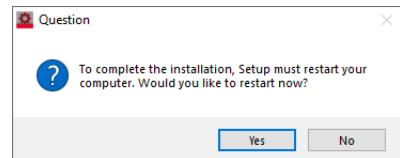


Figure 17 Restart prompt upon completion of setup

Starting with SD1 version 3.2, Python Library will be installed on your machine as a site package, rather than being placed in the “*C:\Program Files\Keysight\SD1\Libraries\Python*” directory. This avoids the need to manually append the file path for *KeysightSD1.py*. If multiple Python versions are installed on your machine, the package is installed for the default version.

The Python wrapper package version for SD1 will be the same as that of the SD1 software version. You can retrieve this by calling the command:

```
keysightSD1.<underscore symbol><underscore symbol>version<underscore symbol><underscore symbol>
```

For example, if the SD1 software version is 3.02.03, the command:

```
keysightSD1.__version__
```

shall return 3.02.03.

A prerequisite to installing Python Library as a site package is that you must have *pip* installed on your machine. It must be functional and added to the system path to avoid any installation failures. See “[Instructions for installing Python](#)” on page 23.

NOTE

Spyder users: In order to import the KeysightSD1 library, you must manually add its path to the Environment Variables. The installation path for the KeysightSD1 Library is “<Python Installation Directory>/Lib/site-packages/KeysightSD1”.

2.4.2: Installing M3xxxA Module Firmware updates

NOTE

Keysight SD1 3.x software does not recognize cards that have Firmware version less than 4.0 (for M32xxA/M33xxA modules) or less than 2.0 (for M31xxA modules). Therefore, updating firmware on your cards is imperative for uninterrupted functionality.

Prerequisite

The Keysight SD1 3.x software must be installed to update your module firmware.

Downloading the Firmware

Online FW updates Firmware updates are available online and the Hardware Manager connects automatically to the FW database to obtain the latest available releases and previous ones as well.

Offline FW updates If the chassis controller has no internet access, you can still perform updates offline. However, you are still required to download, in advance, the desired firmware update from the target module web page on Keysight.com.

- 1 Navigate to your module's 'Technical Support' page
- 2 In the "Drivers, Firmware & Software" tab, click the "Firmware Update Package for M3xxxA" link.
- 3 Click 'Download' corresponding to the latest version to save the file at the desired location on your machine.

Table 8 shows pointers to the Technical Support page for each module.

Table 8 Technical Support for M3xxxxA product family

PXIe M3xxxxA product	Keysight Technical Support page link for Firmware Update file
M3201A AWG 500	Firmware Update Package for M3201A
M3202A AWG 1G	Firmware Update Package for M3202A
M3100A DIG 100	Firmware Update Package for M3100A

PXIe M3xxxxA product	Keysight Technical Support page link for Firmware Update file
M3102A DIG 500	Firmware Update Package for M3102A
M3300A AWG 500 DIG 100	Firmware Update Package for M3300A
M3302A AWG 500 DIG 500	Firmware Update Package for M3302A

Updating the Firmware

- 1 Launch the Keysight SD1 SFP software from the **Start** menu.
- 2 From the main menu of the SD1 software, click **Help** > **Hardware Manager....**

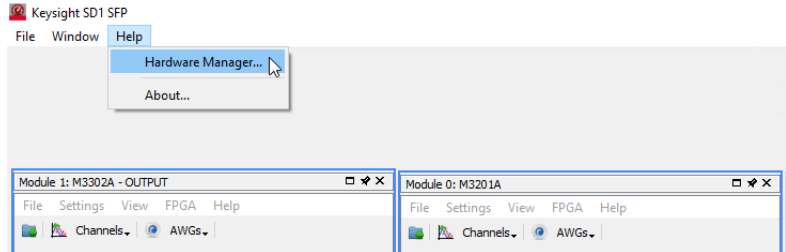


Figure 18 Accessing Hardware Manager menu option in SFP

- 3 Check the module, whose Firmware needs update, in the list of available modules on the Hardware Manager window.
 - If the chassis controller is online with internet connection, the available FW releases are shown automatically. Skip to step 6.

- If the system is offline or for some reason, the connection to the FW server fails and the **Available FW Version** list is displayed as empty or not fully up-to-date. See [Figure 19](#). Proceed with step 4.

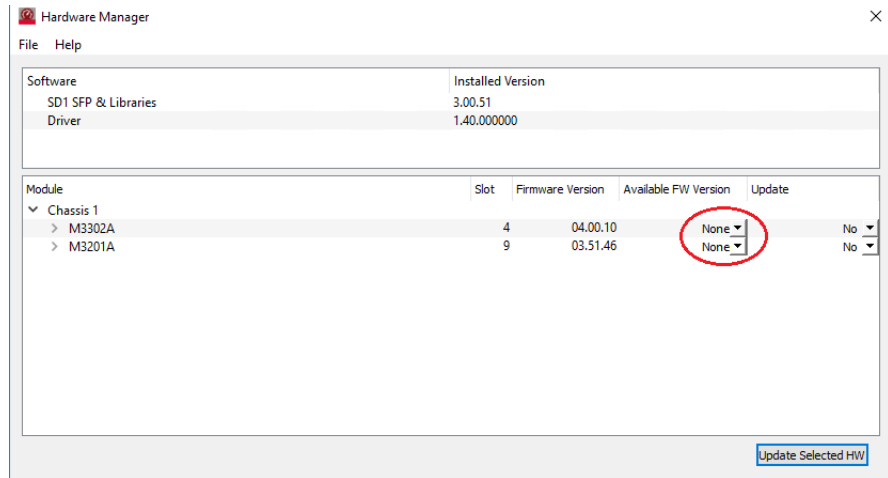


Figure 19 Available FW Version list empty or outdated in offline mode

- For offline updates** 4 From the main menu of the Hardware Manager window, click **File** > **Load update package....**

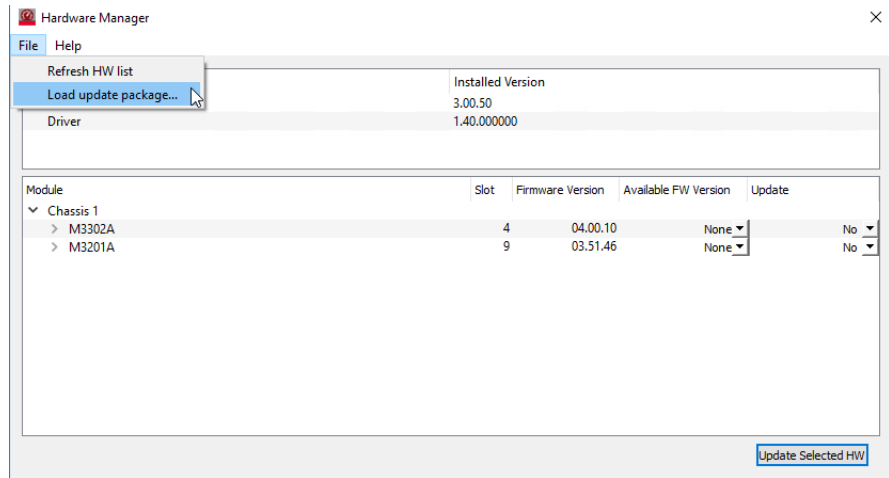


Figure 20 Accessing Load Update Package option in File menu

- From the Load SDM package... window that appears, select the update package file for the required module and click **Open**.

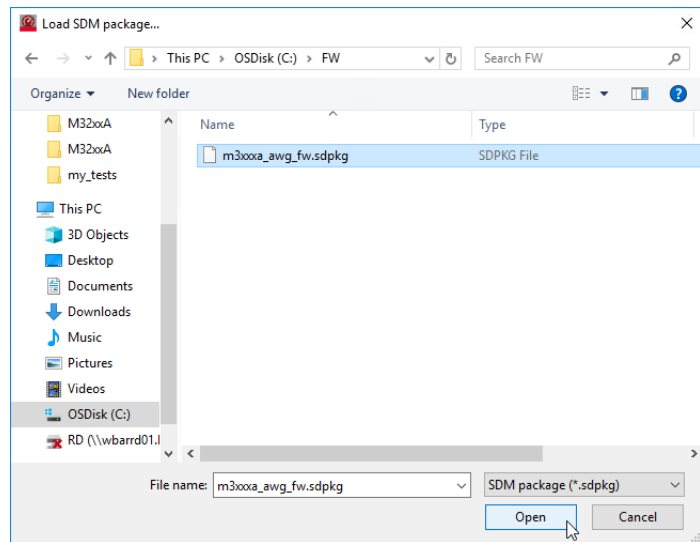


Figure 21 Opening the Firmware update package for the module

For both online & offline updates

- 6 The **Available FW Version** list in the Hardware Manager window is refreshed and available versions are displayed. Select **Yes** from the **Update** drop-down options for the module that requires updates.

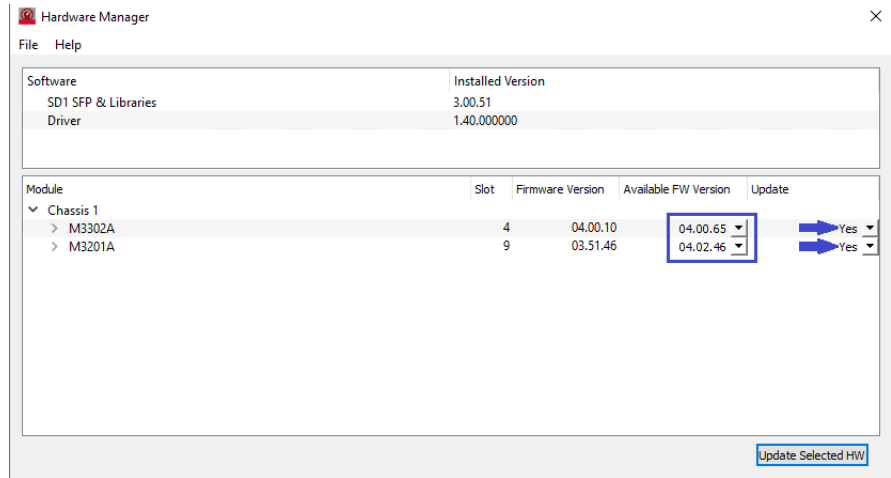


Figure 22 Latest FW versions displayed for HW update

- 7 Click **Update Selected HW**.
- 8 An **Update Confirmation dialog** is displayed. Click **Yes** to continue.
- 9 When the firmware programming process finishes, you must SHUTDOWN your machine (and not restart) if you want to use the new version of your firmware in your module.
- 10 Start your machine to check the new uploaded firmware version of your module in the Hardware Manager window of the SD1 Software Front Panel. You would see the current module firmware version as the desired updated firmware version.

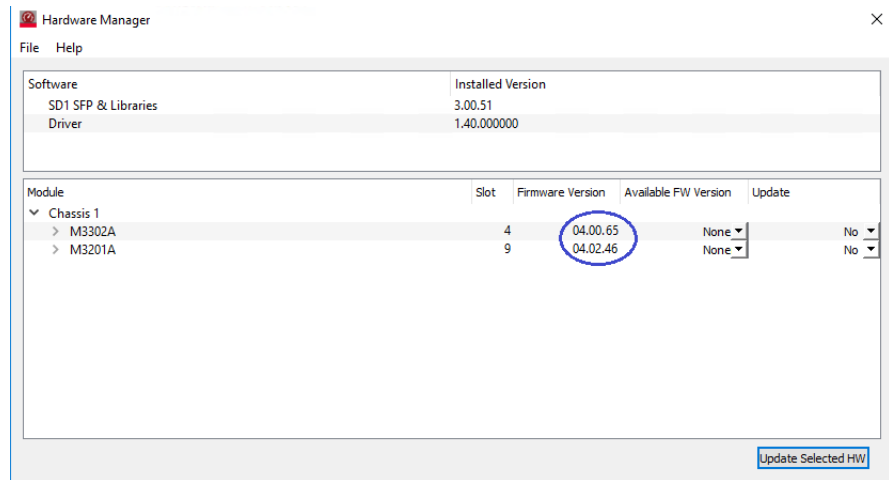


Figure 23 Latest FW versions displayed for HW update

While launching, if the SD1 SFP detects an incompatible firmware version for any module against the installed version of the SD1 software, the SD1 SFP prompts the following error for the module:

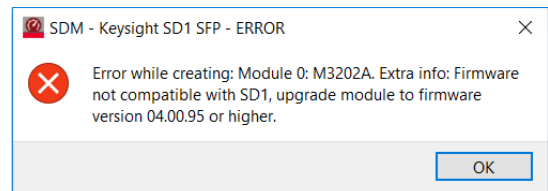


Figure 24 SD1 SFP Error for incompatible FW version

Similarly, for the supported firmware version on the module, if the SD1 SFP fails to open the card, it prompts the following error:

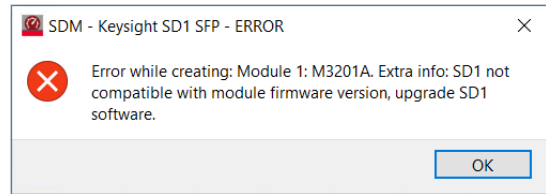


Figure 25 SD1 SFP Error for incompatible SW version

2.4.3: Installing KS2201A PathWave Test Sync Executive software

NOTE

All M3xxxA modules support HVI technology. However, the hardware license option *-HVI* must be available on each module that is required to be programmed using the KS2201A PathWave Test Sync Executive software and for usability with SD1 3.x software.

Note that the KS2201A PathWave Test Sync Executive software is not a standalone software. It enhances the Keysight SD1 API to support HVI technology by adding the DLLs required for programming libraries. Therefore, the Keysight SD1 3.x software must already be installed on the same machine.

Refer to the *KS2201A PathWave Test Sync Executive User Guide* for installation instructions and to know about the licenses that you must procure for the KS2201A PathWave Test Sync Executive software.

2.4.4: Installing PathWave FPGA software

NOTE

The PathWave FPGA 2020 is a licensed software. Also, the hardware license option *-FP1* must be enabled on the supported modules for FPGA programming using PathWave FPGA BSP and for usability with SD1 3.x software. Contact Keysight Support for more information on procuring the respective licenses.

- 1 After you have downloaded the executable file from Keysight.com, double-click the installer for PathWave FPGA software.

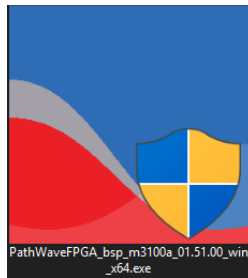


Figure 26 Icon for the PathWave FPGA software installer

The Welcome window on the PathWave FPGA 2020 Update 1.0 Setup Wizard appears.

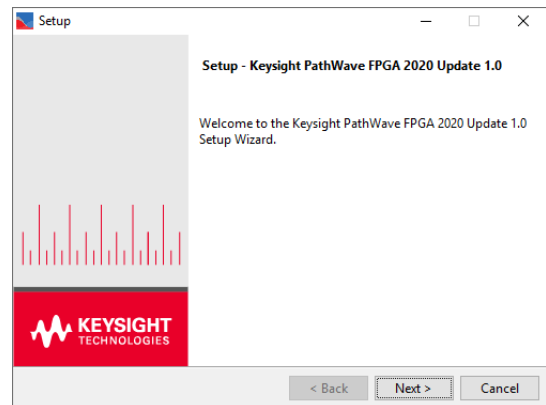


Figure 27 Welcome window in the PathWave FPGA Setup Wizard

2 Click **Next >**. The License Agreement window is displayed.

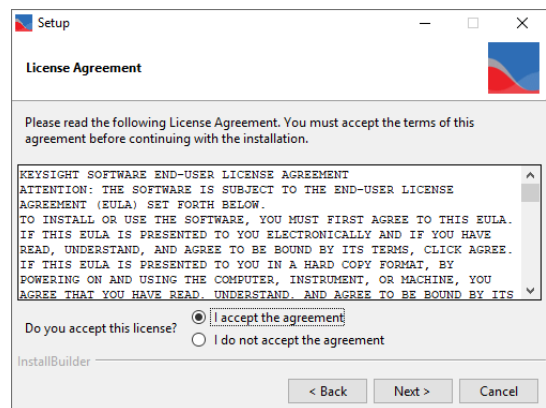


Figure 28 License Agreement window in the PathWave FPGA Setup Wizard

3 From the **Do you accept this license?** options, select **I accept the agreement**.

4 Click **Next >**. The Installation Directory window is displayed.

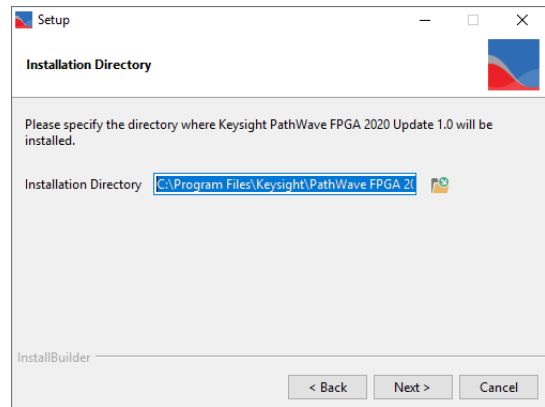


Figure 29 Select Components window in the PathWave FPGA Setup Wizard

If required, modify the installation directory path (not recommended).

- 5 Click **Next >**. The Ready to Install window is displayed.

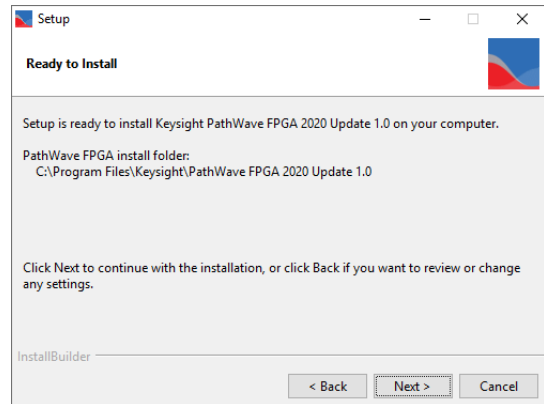


Figure 30 Ready to Install window in the PathWave FPGA Setup Wizard

- 6 Click **Next >**. The installation progress window is displayed.

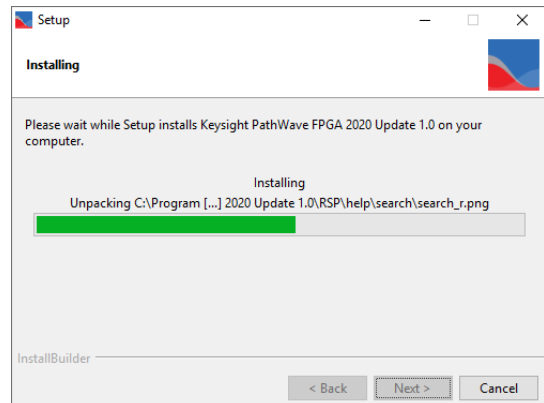


Figure 31 Installation progress window in the PathWave FPGA Setup Wizard

The completion window in the PathWave FPGA Setup Wizard is displayed.

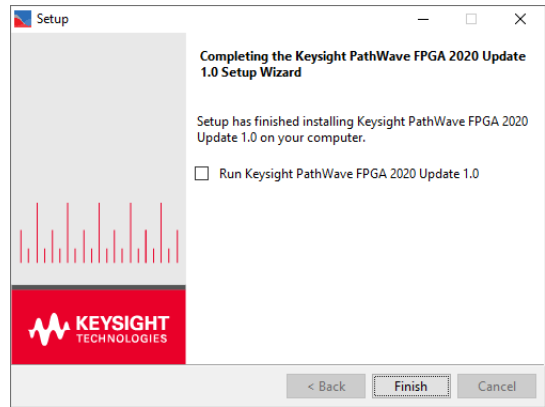


Figure 32 Completion window in the PathWave FPGA Setup wizard

- 7 Click **Finish** to complete the software installation and exit the PathWave FPGA Setup Wizard.

2.4.5: Installing PathWave FPGA BSP

Besides selecting the Channel configuration during procurement, you must also choose to include one of the two possible Xilinx FPGAs on your M3xxxA PXIe module:

1. xc7k410tffg676-2
2. xc7k325tffg676-2

The xc7k410tffg676-2 part offers you a substantial increase in the amount of FPGA resources required for custom logic.

Along with the Xilinx FPGAs, the hardware license option *-FP1* must be available for the implementation of PathWave FPGA BSP on the applicable modules.

NOTE

Keysight SD1 3.x software supports PathWave FPGA BSP on all M3xxxA modules, with the condition that the license option *-FP1* must be enabled for FPGA programming using PathWave FPGA BSP.

As mentioned earlier, each M3xxxA module has a separate BSP installer, which can be downloaded from the PathWave FPGA Board Support Package web page on Keysight.com and you can only perform FPGA designing for those modules that have BSP installed on the same machine as the PathWave FPGA software. Both PathWave FPGA software and the BSP function together and cannot be used individually.

Other than the prerequisite software listed earlier, before you begin installing the PathWave FPGA BSP utility for any module, you must ensure that the PathWave FPGA 2020 software (along with *Xilinx Vivado Design Suite*) are installed on the same machine.

The captured images displayed here pertain to BSP package (2.55.0) for FW2.01.15 of M3102A. For the other supported modules (that is, M3201A and M3202A), the corresponding BSP package version and FW version are different but each of them follow the same prerequisites and installation procedure.

- 1 After you have downloaded the executable file from Keysight.com, double-click the installer for SD1 3.x Software.



Figure 33 Icon for the SD1 3.x software installer

The Welcome window on the BSP Setup Wizard appears.

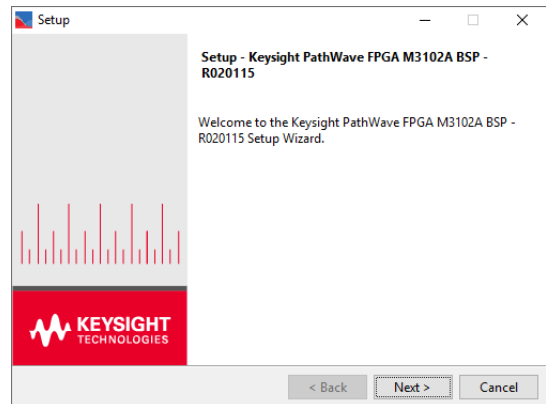


Figure 34 Welcome window on the BSP Setup Wizard

- 2 Click **Next >**. The License Agreement window is displayed.

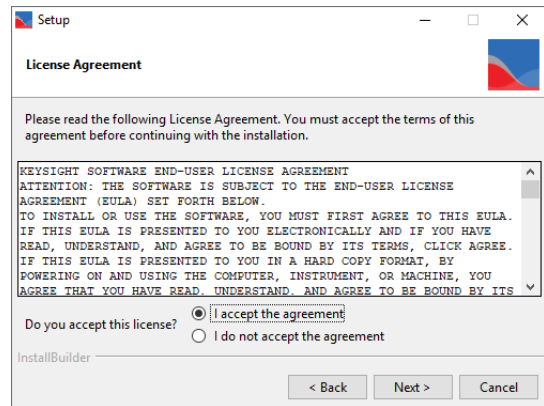


Figure 35 License Agreement window on the BSP Setup Wizard

- 3 From the **Do you accept this license?** options, select **I accept the agreement**.
- 4 Click **Next >**. The Installation Directory window is displayed.

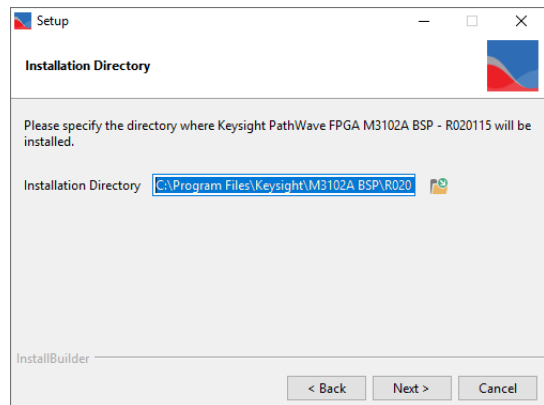


Figure 36 Installation Directory window on the BSP Setup Wizard

A default location appears in the Installation Directory field.

If you wish to change the directory location, click the associated folder icon to navigate and to select the desired folder.

- 5 Click **Next >**. The Ready to Install window is displayed.

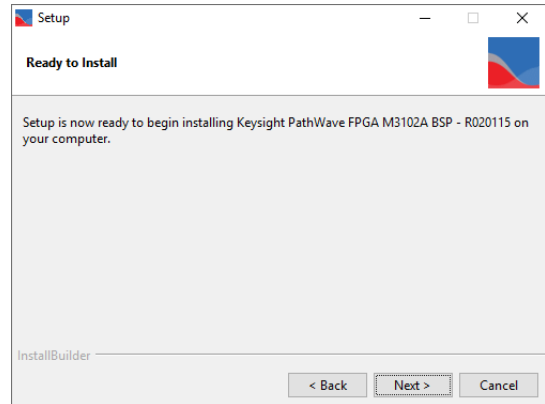


Figure 37 Ready to Install window on the BSP Setup Wizard

- 6 Click **Next >**. The installation progress window is displayed.

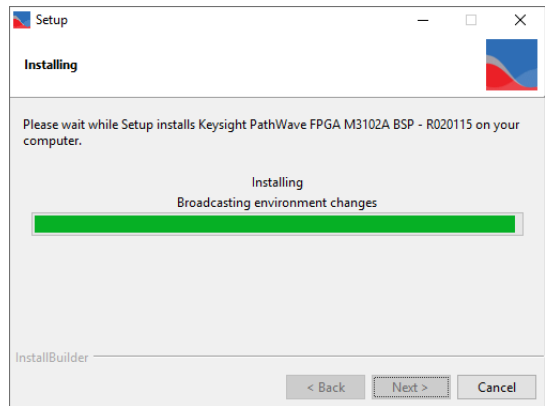


Figure 38 Installation progress window on the BSP Setup Wizard

The completion window on the BSP Setup Wizard is displayed.

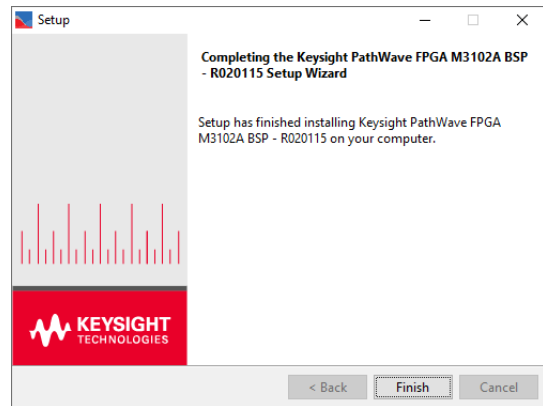


Figure 39 Completion window on the BSP Setup wizard

- 7 Click **Finish** to complete the software installation and exit the BSP Setup Wizard for the corresponding module.
- 8 Repeat the steps above to install BSP for the other supported modules.
- 9 To verify that the BSP has been properly installed, navigate to “C:\Program Files\Keysight” folder and look for the “M3xxxA BSP” folder, which corresponds to the module for which BSP is installed.

The sub-folder “R0n0abc” indicates the BSP version installed, where $n = 2$ (for M3102A) and $n = 4$ (for M3201A/M3202A) and abc = any value greater than 0. In this example, the BSP files are installed in C:\Program Files\Keysight\M3102A BSP\R020115.

- 10 Alternatively, launch the PathWave FPGA software and create a new project to verify that the installed BSP module appears as an option. See “[Launching the PathWave FPGA BSP](#)” on page 58 for details.

Section 2.5: Launching the Software

2.5.1: Launching the SD1 SFP user interface

Once you have installed the Keysight SD1 3.x SFP software, you can launch the Soft Front Panel (SFP) from the **Start** menu.

- 1 On your Win10 OS, click **Start** > **Keysight** > **Keysight SD1 SFP**.

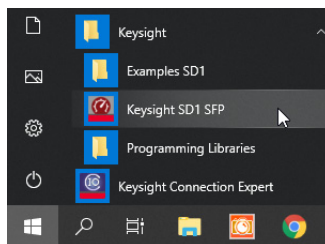


Figure 40 Launching SFP from the Start Menu

While launching, the Keysight SD1 SFP software auto-detects all M3xxxA cards that are connected and auto-assigns Module numbers to each of them. A main window is displayed along with a panel for each PXIe M3xxxxA card that is connected.

For example, in [Figure 41](#), the M3201A AWG card and M3302A (AWG + Digitizer) Combo cards are inserted in the machine and the SFP software has assigned Module numbers as shown.

All offline modules can be accessed via the **Window** menu of the Keysight SD1 SFP software.

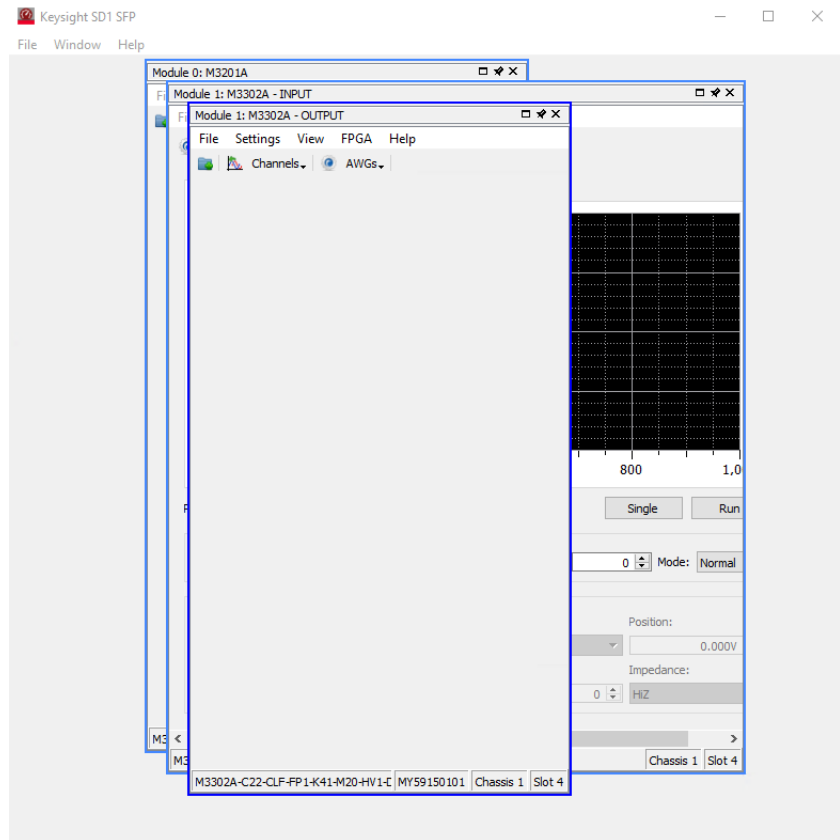


Figure 41 Modules displayed in the default window of SD1 SFP software

For more information regarding the features and functionality of the Keysight SD1 SFP software, refer to the corresponding Module User Guide, which can be accessed via the **Help** menu for each module's panel.

2.5.2: Launching SD1 Core API

You may access the SD1 Core API to control and configure the connected instruments using the 'keysightSD1' Library available in Python, C/C++ and .NET programming languages.

To invoke an API function for the connected instrument,

- 1 Launch the interface for the programming language of your choice.
- 2 Import the SD1 library along with the AWG/Digitizer commands.
- 3 Proceed with creating objects and defining values based on your requirements.

The following work flow, using Python commands, shows how to use Keysight SD1 Programming Libraries:

- 1 Import required system components and python libraries (as needed).

Examples:

```
import sys
import os
import matplotlib.pyplot as plt
import numpy as np
```

- 2 Import the SD1 Python library for AWG/Digitizer commands.

Example:

```
import keysightSD1 as key
```

- 3 Proceed with creating module objects and defining other AWG/Digitizer functions

For more information regarding SD1 API programming functions, refer to the User Guide for M31xxA/M32xxA and M33xxA modules, which can be accessed from the Document Library page for each product on Keysight.com.

2.5.3: Launching an HVI Application

As mentioned earlier, the KS2201A PathWave Test Sync Executive software is not a standalone software. It enhances the Keysight SD1 API to support HVI technology by adding the DLL files required for Python libraries. After you install the KS2201A PathWave Test Sync Executive software, you can find these files in *C:\Program Files\Keysight\Pathwave Test Sync Executive 2020\api\python*.

The HVI API within the KS2201A PathWave Test Sync Executive software consists of classes that provide native HVI functionalities that are common across any measurement instrument deployed within an HVI system.

NOTE

HVI programming is supported with Python version 3.7 only.

To use the HVI API in Python, import the HVI API Python package that is included with the HVI installer. This will be your first part of your code in each of your files. Unless this package is imported, the HVI API will not be found.

The following work flow, using Python commands, shows how to add HVI library to an application and create an HVI instance.

- 1 Import required system components and python libraries (as needed).

Examples:

```
import sys
import os
import time
import matplotlib.pyplot as plt
import numpy as np
```

- 2 Import the SD1 Python library for AWG/Digitizer commands.

Example:

```
import keysightSD1 as key
```

- 3 Import the HVI library to create an HVI instance.

Example:

```
import keysight_hvi as kthvi
```

- 4 Create KtHvi instance

Example:

```
module_resource_name = 'KtHvi'
hvi = kthvi.Hvi(module_resource_name)
```

- 5 Add each engine to the KtHvi instance

Example:

```
hvi.engines.add(module.hvi.engines.main_engine, "engine_name")
```

- 6 Based on your requirements, you may proceed with defining HVI resources (actions, events, triggers), programming HVI sequences and compiling, loading and executing the HVI application.

The HVI functions corresponding to SD1 API can be found in the SD1 3.x Software User Guide (for M32xxA/M33xxA AWGs and for M31xxA/M33xxA Digitizers).

The complete description of the HVI Python API can be found in the help file that is provided with the HVI installer, available in:

```
C:\Program Files\Keysight\Pathwave Test Sync Executive 2020\api\python\Help
```

2.5.4: Launching the PathWave FPGA BSP

The PathWave FPGA 2020 software and the Board Support Package (BSP) are inter-dependent and must be brought together to achieve the desired output.

Once you have installed the PathWave FPGA 2020 software, you can launch its user interface from the **Start** menu.

- 1 On your Win10 OS, click **Start > Keysight PathWave FPGA 2020 Update 1.0 > Keysight PathWave FPGA 2020 Update 1.0**.

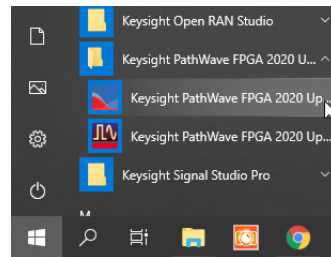


Figure 42 Launching PathWave FPGA 2020 from the Start Menu

The PathWave FPGA 2020 Update 1.0 software's main window appears as displayed in [Figure 43](#).

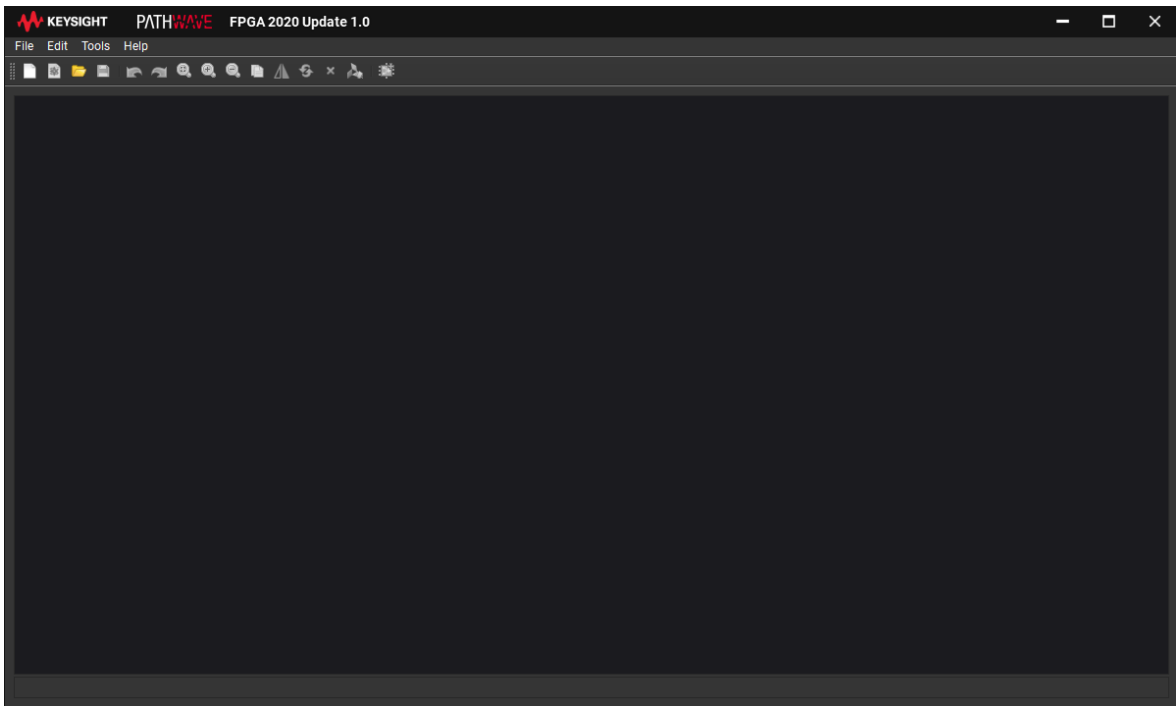


Figure 43 Default window of the PathWave FPGA 2020 software

If, at this point, the BSP software for either of the supported modules is not installed, the PathWave FPGA prompts the error shown in [Figure 44](#), when you try to create a new project.

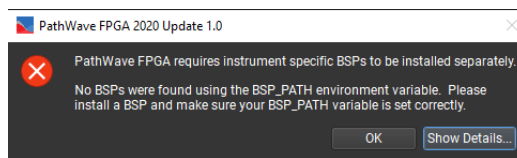


Figure 44 Error prompted by PathWave FPGA 2020 if no BSP is installed

Therefore, BSP for one or more supported modules must be installed even to proceed further with creating a new project in PathWave FPGA.

After you install BSP for one or more modules, you can proceed with creating a new project to design the sandbox region for the corresponding modules. In this way, you can verify if the BSP is installed successfully or not.

- 1 On the main window of the PathWave FPGA 2020 software, click the icon for new project.

A new sandbox project dialog appears.

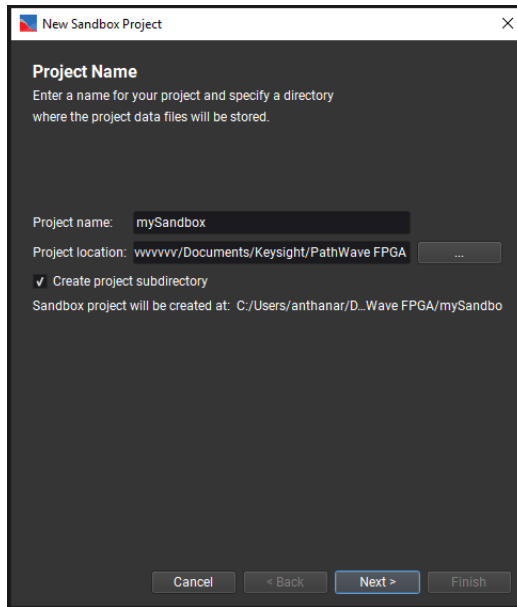


Figure 45 Creating a new Sandbox project

- 2 Click **Next >**.

- For the Project Type, choose the BSP corresponding to one of the modules whose FPGA you wish to update. If the module name corresponding to the installed BSP appears here, it indicates that the BSP is successfully installed.

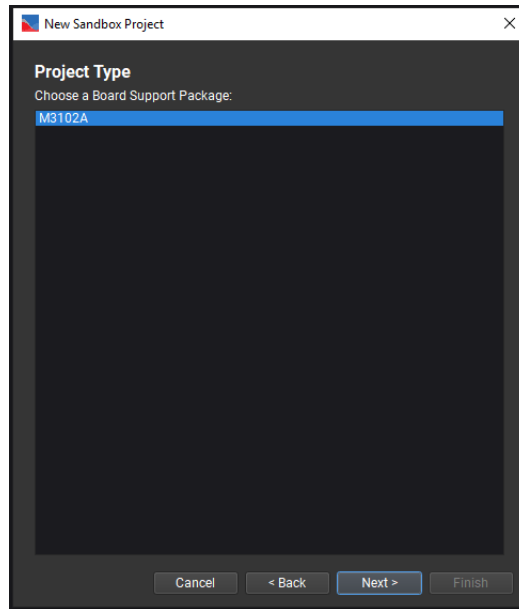


Figure 46 Selecting the module-specific BSP

Additional Steps

Once you design your custom FPGA logic on the selected module, you may generate the Bitstream file (k7z file), which can then be loaded onto the FPGA module using either the SD1 API or the **Load Firmware** feature (under FPGA menu of the Module panel in the SFP software) for compatibility verification.

For detailed instructions on generating the Bitstream file and to understand the features of the PathWave FPGA 2020 software, refer to the PathWave FPGA Help file accessible via the Help menu of the software.

Following steps give you a quick glance into generating a bitstream file for an M3102A module using the PathWave FPGA BSP software.

- Towards the end of a new project creation, verify all information displayed in the Project Summary. To make any amendments, click

Back. If the selected options for the corresponding BSP are satisfactory, click **Finish**.

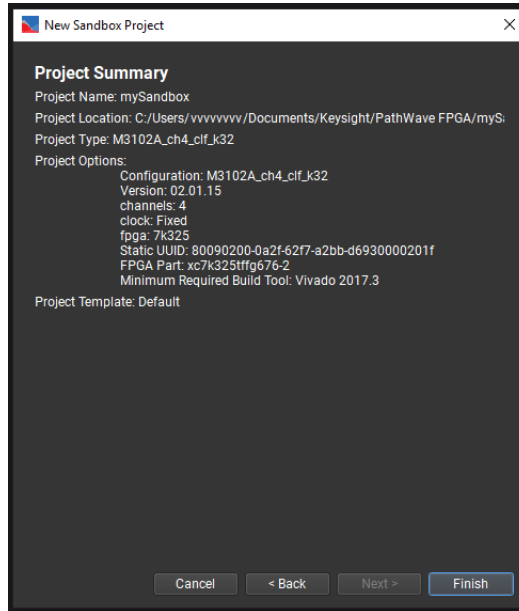


Figure 47 Viewing the project summary information

- 2 Customize the configuration as per your requirements using one or more elements from the Design Interfaces and IP Catalog panels.
- 3 After you have designed your FPGA logic, you can proceed with the k7z file generation. Click the **Generate Bit File...** icon as shown in Figure 48.

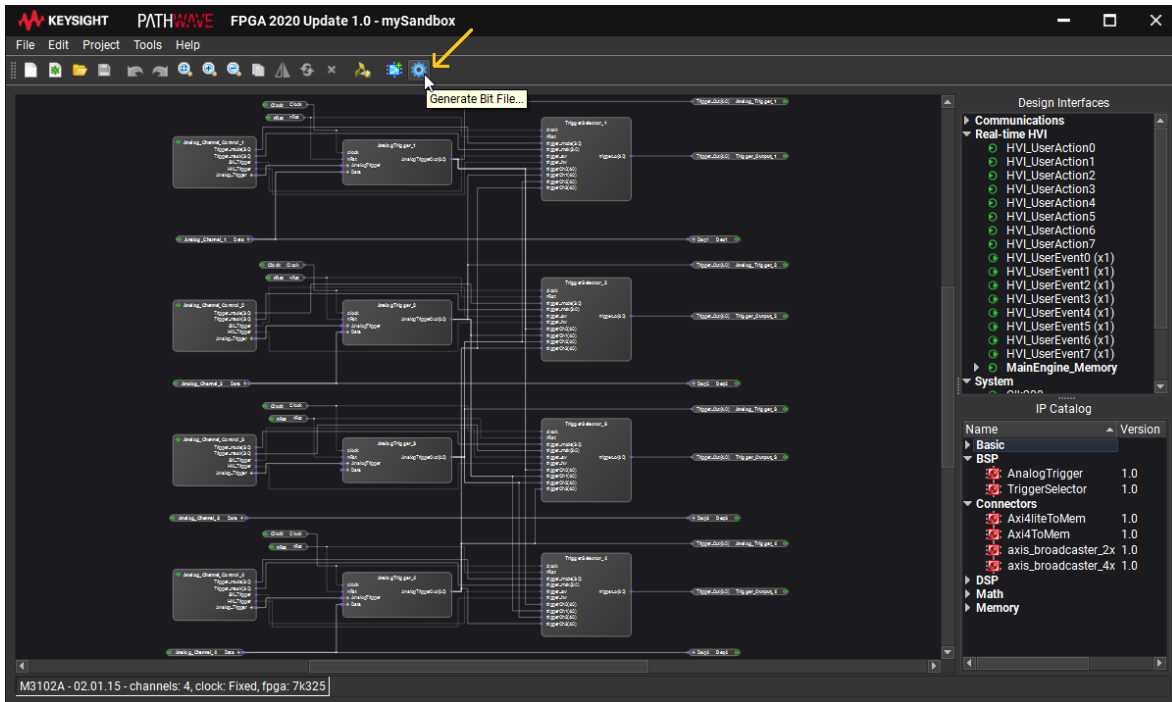
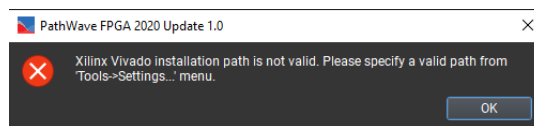


Figure 48 Initiating Bit File generation for the selected module

If you do not have the *Xilinx Vivado Design Suite* on the same machine where PathWave FPGA 2020 software and BSP are installed, the following error is prompted when you click the **Generate Bit File...** icon.



4 On the FPGA Hardware Build window that appears, click **Run**.

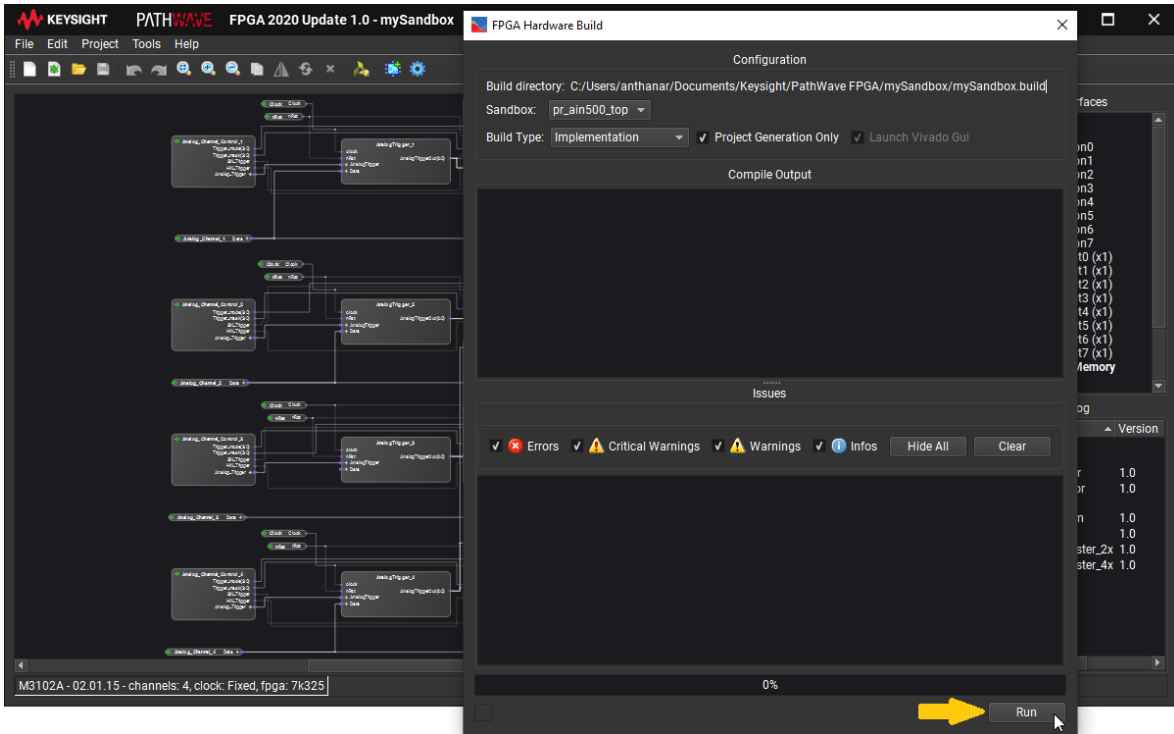


Figure 49 Generating FPGA Hardware Build

Depending on the configuration, the software takes some time before finishing the process of k7z file generation.

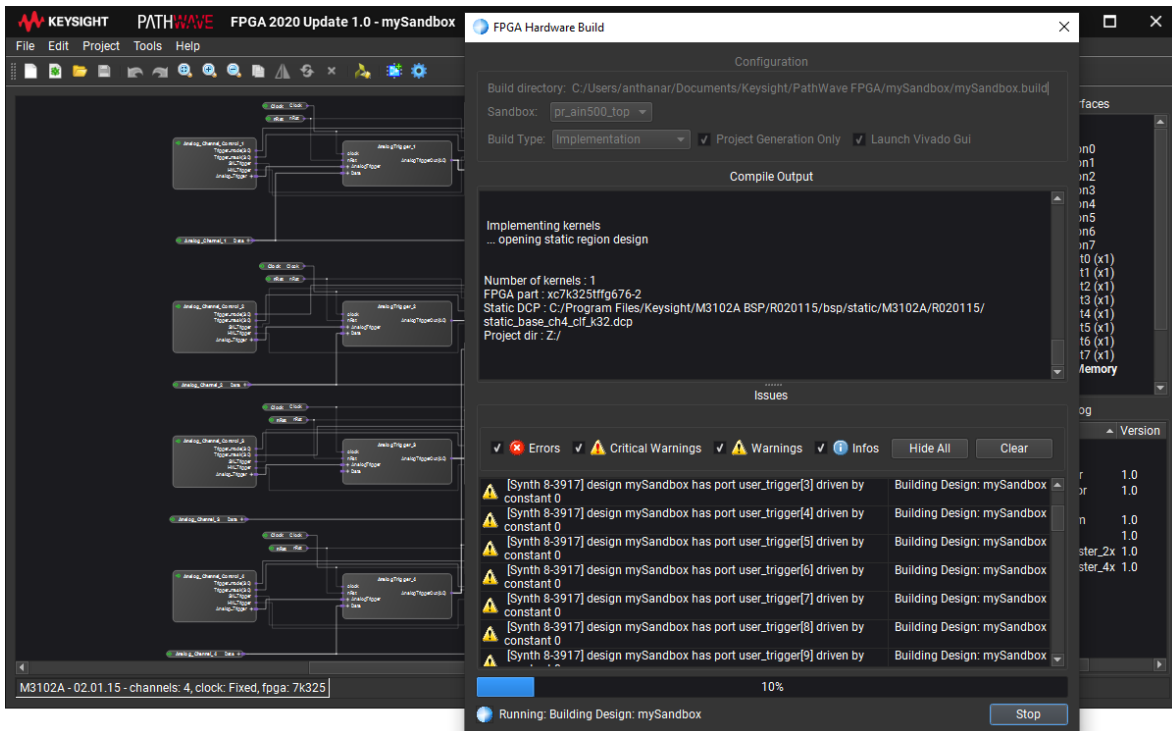


Figure 50 Progress status for the k7z file generation

Thereafter, you may use the SD1 API or the SFP GUI to load the k7z file on the hardware.

To know about loading the k7z file, Refer to the BSP User Guide for the corresponding modules, which can be accessed via **Help > BSPs Help** menu options in the PathWave FPGA 2020 software.

SD1 3.x Software

Startup Guide

3. Troubleshooting

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Section 3.1: Troubleshooting Installation

- If installing the complete/hardware install and the installer is stalling for long periods or failing installing Keysight IO Libraries, try downloading and installing Keysight IO Libraries directly from:
 - <http://www.keysight.com/find/iolib>
 - Select the 2019 U1 version (Build 18.1.24715.0)
- For Keysight support for help with tools and documentation or to connect with a technical support expert for product and service support, see <http://www.keysight.com/find/support>.

Section 3.2: FAQs

Question 1 I installed KS2201A PathWave Test Sync Executive software but i am unable to use it for my M3xxxA products. What should I do?

Answer

- 1 Check if you have Keysight SD1 SFP software version 3.x or later installed on your machine.
- 2 Upgrade the Firmware of the cards to a version greater than or equal to 4.0 (for M32xxA / M33xxA) or 2.0 (for M31xxA).
- 3 The license option *-HV1* must be enabled to support programming using KS2201A PathWave Test Sync Executive software.

Question 2 Does Keysight SD1 SFP software version 3.x or later recognize M3xxxA products that have Firmware versions less than 4.0 (for M32xxA / M33xxA) or 2.0 (for M31xxA)?

Answer No. Keysight SD1 SFP software version 3.x or later will not recognize the older cards. You may:

- 1 Upgrade the Firmware of the cards to a version greater than or equal to 4.0 (for M32xxA / M33xxA) or 2.0 (for M31xxA).
- 2 Contact Keysight Sales to upgrade your hardware.

Question 3 Can I still use M3601A HVI design environment (ProcessFlow) and M3602A FPGA design environment (FPGAFlow) after upgrading my M3xxxA products?

Answer No.

- The KS2201A PathWave Test Sync Executive software will be supported on modules for SD1 3.x software that have firmware version greater than or equal to 4.0 (for M32xxA / M33xxA) or 2.0 (for M31xxA) and each card must have the license option *-HV1* enabled.
- The PathWave FPGA BSP software will be supported on cards with firmware version greater than or equal to 4.0 (for M3201A / M3202A) or 2.0 (for M3102A) and each card must have the license option *-FP1* enabled for FPGA programming.

Question 3 Can I use components of Keysight SD1 SFP software version 3.0 or later along with the legacy version on the same machine?

Answer No. The installer for Keysight SD1 SFP software version 3.0 (or later) removes all legacy (SD1 2.x.x) components. Hence, both versions cannot co-exist on the same machine.

Question 4 Why don't I have the option to upgrade Firmware version from SD1 2.x to that compatible with SD1 3.x software?

Answer You must have the M3xxxA Hardware Options as listed in [Table 6](#), "Hardware License Options Matrix supported by SD1 3.x software", which is supported by SD1 3.x Software. Not all Hardware options supported on SD1 2.x software are now supported on SD1 3.x software.

Question 5 Why is the PathWave FPGA software prompting me a license error regarding existing Firmware/BSP compatibility with SD1 3.x software, where the same Firmware/BSP used to work with SD1 2.x software?

Answer You must upgrade the supported M3xxxA modules with hardware license option *-FP1*. Earlier, this hardware license option was included as a Zero dollar (free) option for SD1 2.x software. Now, the Zero dollar scheme has been discontinued. You must have a valid *-FP1* license option for support with PathWave FPGA functionality.

Section 3.3: References to other documents

Table 9 Reference document titles and access links

Document Reference	Reference location
SD1 3.x Software for M320xA/M330xA PXIe Arbitrary Waveform Generators User's Guide	http://literature.cdn.keysight.com/litweb/pdf/M3XXX-90003.pdf
SD1 3.x Software for M310xA/M330xA PXIe Digitizers User's Guide	http://literature.cdn.keysight.com/litweb/pdf/M3XXX-90004.pdf
KS2201A PathWave Test Sync Executive User Guide	Visit KS2201A Document Library .
KF9000A PathWave FPGA Customer Documentation	Visit KF9000A PathWave FPGA Programming Environment Document Library . <i>PathWave FPGA Customer Documentation</i> can be accessed from the Help menu of the design environment.
BSP Guides	
M3102A PXIe Digitizer	Accessed from the Help menu of the <i>PathWave FPGA 2020 Update 1.0</i> design environment.
M3100A PXIe Digitizer	Accessed from the Help menu of the <i>PathWave FPGA 2020 Update 1.0</i> design environment.
M3201A PXIe Arbitrary Waveform Generator	Accessed from the Help menu of the <i>PathWave FPGA 2020 Update 1.0</i> design environment.
M3202A PXIe Arbitrary Waveform Generator	Accessed from the Help menu of the <i>PathWave FPGA 2020 Update 1.0</i> design environment.
M3302A PXIe AWG & Digitizer Combination	Accessed from the Help menu of the <i>PathWave FPGA 2020 Update 1.0</i> design environment.
M3300A PXIe AWG & Digitizer Combination	Accessed from the Help menu of the <i>PathWave FPGA 2020 Update 1.0</i> design environment.
Data Sheets	
M3100A PXIe Digitizers with Optional Real-Time Sequencing and FPGA Programming	https://www.keysight.com/us/en/assets/7018-05400/data-sheets/5992-1806.pdf
M3102A PXIe Digitizers with Optional Real-Time Sequencing and FPGA Programming	https://www.keysight.com/us/en/assets/7018-05399/data-sheets/5992-1805.pdf
M3201A PXIe Arbitrary Waveform Generator with Optional Real-Time Sequencing and FPGA Programming	https://www.keysight.com/us/en/assets/7018-05391/data-sheets/5992-1797.pdf

Document Reference	Reference location
M3202A PXIe Arbitrary Waveform Generator with Optional Real-Time Sequencing and FPGA Programming	https://www.keysight.com/us/en/assets/7018-05392/data-sheets/5992-1798.pdf
M3300A PXIe Arbitrary Waveform Generator/Digitizer with Optional Real-Time Sequencing & FPGA Programming	https://www.keysight.com/us/en/assets/7018-05403/data-sheets/5992-1809.pdf
M3302A PXIe Arbitrary Waveform Generator/Digitizer with Optional Real-Time Sequencing & FPGA Programming	https://www.keysight.com/us/en/assets/7018-05402/data-sheets/5992-1808.pdf

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