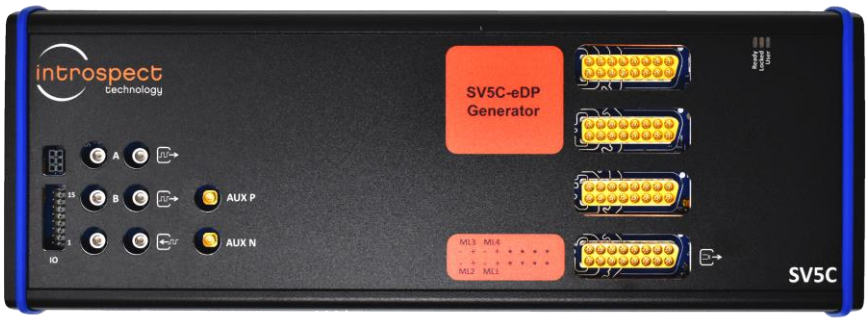
QUICK START GUIDE

SV5C-eDP Generator

Embedded DisplayPort Generator

C SERIES



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Introduction

OVERVIEW

The SV5C-eDP Embedded DisplayPort Generator is an ultra-portable, high-performance instrument that enables exercising and validating Embedded DisplayPort receiver ports. Capable of generating any traffic and being completely data-rate agile, the Embedded DisplayPort generator includes analog parameter controls that enable gaining deep insights into receiver sensitivity performance, as well as skew and jitter tolerance.

The SV5C-eDP Embedded DisplayPort Generator operates using Introspect's highly versatile software environment, Pinetree™. This environment allows for automating receiver tests such as voltage sensitivity or clock-to-data setup and hold times. The environment covers DisplayPort 2.1 and Embedded DisplayPort 2.0, and includes advanced features such as programmable DPCD registers and MST 128b132b transport mode.

QUICK START DOCUMENTATION

This Quick Start Guide will provide the information required for a user to get up and running with the SV5C-eDP Generator. Basic hardware and software installation instructions are included followed by a step-by-step procedure to start generating and manipulating Embedded DisplayPort signals using Introspect's software, Pinetree.

Quick Start Hardware Description

REQUIREMENTS

The full list of hardware requirements for this Quick Start Guide is provided below:

- 1 x SV5C-eDP Embedded DisplayPort Generator
- 1 x 12V 15A AC / DC power supply
- 1 x personal computer connected to the SV5C-eDP Generator via a USB2.0 mini-B and a USB3.0 micro B cable
- 1 x MXP to SMA Cable Assembly
- 2 x SMP to SMA for the AUX channel
- 1 x SMA to DisplayPort Adapter
- 8 x SMA High-Speed DC blocks
- Optional: 1 x 4 GHz oscilloscope or higher for signal visualization

HARDWARE DESCRIPTION

Figure 1 shows the physical ports of the SV5C-eDP Embedded DisplayPort.

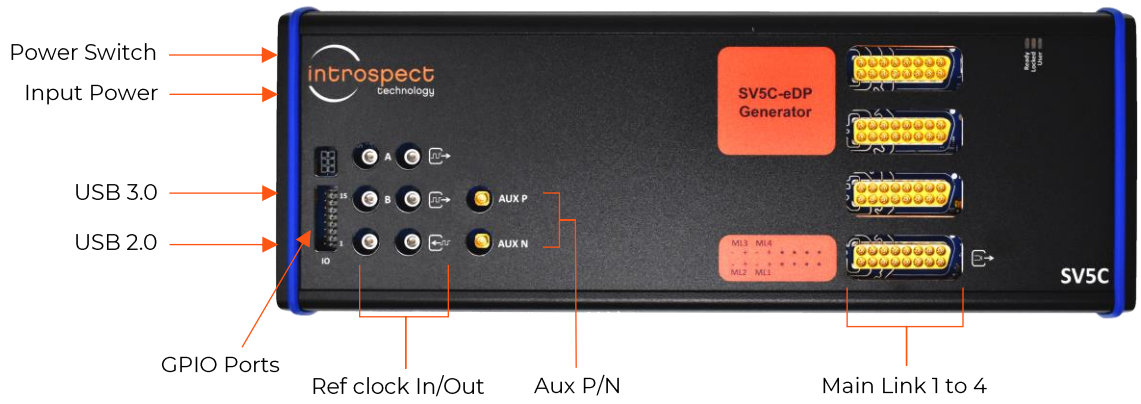
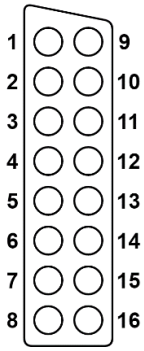


Figure 1: Illustration of the SV5C-eDP Embedded DisplayPort Generator.

The SV5C-eDP Generator module has four MXP connectors, as shown in Figure 1, however only one is used for DisplayPort. The pin mapping for this connector is provided in Table 1 below.

TABLE 1: LOWER MXP CONNECTOR PINOUT

CONNECTOR	PIN	LANE
	13, 14	Main Link 1 (P, N)
	15, 16	Main Link 2 (P, N)
	7, 8	Main Link 3 (P, N)
	5, 6	Main Link 4 (P, N)
	1, 2, 3, 4, 9, 10, 11, 12	NC

The other pins are NC and should not be used.

Pinetree™ Software Installation

SYSTEM REQUIREMENTS

Pinetree provides an easy-to-use environment for device characterization and test-plan development. To run the software, the following components are required:

- A PC installed with Windows 10
- The Pinetree software install executable
- USB device drivers (refer to the driver installation instructions later in this document)

NOTE

A fully functional command line version of Pinetree is also available for MacOS and Linux. However, this Quick Start Guide will focus on the Windows version of the software.

INTROSPECT'S PINETREE INSTALLATION

1. INSTALLATION PREPARATION

Quit any Pinetree instances before starting the installation.

2. SOFTWARE INSTALLATION

a) From the directory containing the installation files, double-click the "IntrospectESP_Installer.exe" executable and follow the on-screen instructions.
b) The file will install a local Python environment, and it has no dependence and will not affect any Python installation that already exists on your PC.
c) When prompted, specify the location where you want to install Pinetree. The default location is the "Introspect" folder under the Windows "Program Files" folder. The application will be installed into a sub-folder with a name that includes the version number. It will create a folder called "Introspect" under the "My Documents" folder of your account. This folder is where test procedures are typically stored.

NOTE

It is recommended to install the software under C:\Introspect to keep all versions in one place. It must be a new location and not a location of a previous installation.

3. INSTALL THE LICENSE FILE

a) Towards the end of the installation, you will be asked to provide either an activation key or a license file for the software.

b) If you have a valid activation key, simply select the "Use Activation Key" option, and continue with the installation. You will be asked to enter the Activation Key code when you start the GUI for the first time.
c) If you were provided with a license file instead, or if you have valid license files from a previous installation, select the "Use Existing License" option, and the installer will help you copy the license file into the new installation folder.
d) If you do not have any of the above, select the "Get a New License" option, and the installer will provide you with information that needs to be sent to Introspect Technology. Before continuing, you will need to send this information to license_support@introspect.ca to request a license. Then, upon receipt of the valid license files, place them into the following directory:

```
C:\[Your Introspect Installation Folder]\Licenses
```

NOTE

The installer creates a folder called "Introspect" under the "My Documents" folder of your Windows account. This folder is where test procedures are saved by default.

4. RUNNING THE PINETREE SOFTWARE

a) Double-click on the "Pinetree" shortcut on your Desktop and you should see the first "welcome" window of the GUI. Specify the form factor as "SV5C_4L12G_DP" and Press "Next" to continue.

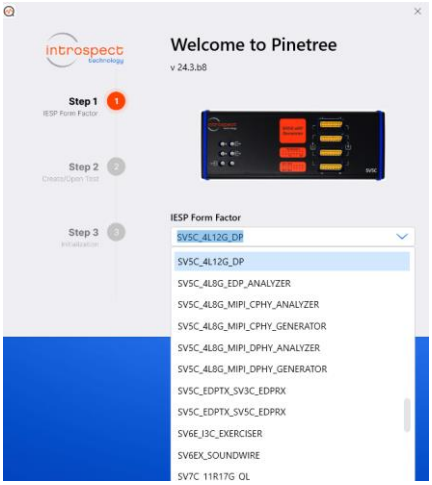


Figure 2: The welcome window of Pinetree.

b) Select the option "Create a new Test" and click the "Next" button.

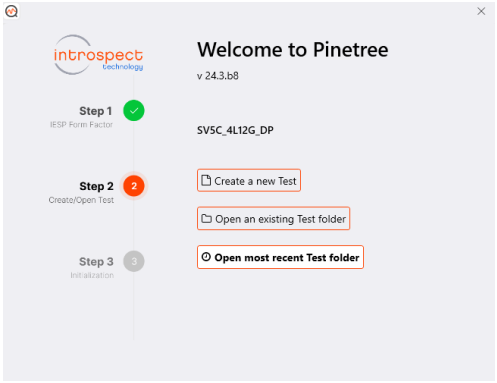


Figure 3: "Create a new Test" option of the welcome menu.

c) With a valid license in the "Licenses" directory, the following GUI screen should come up, which indicates that the software has been successfully installed.

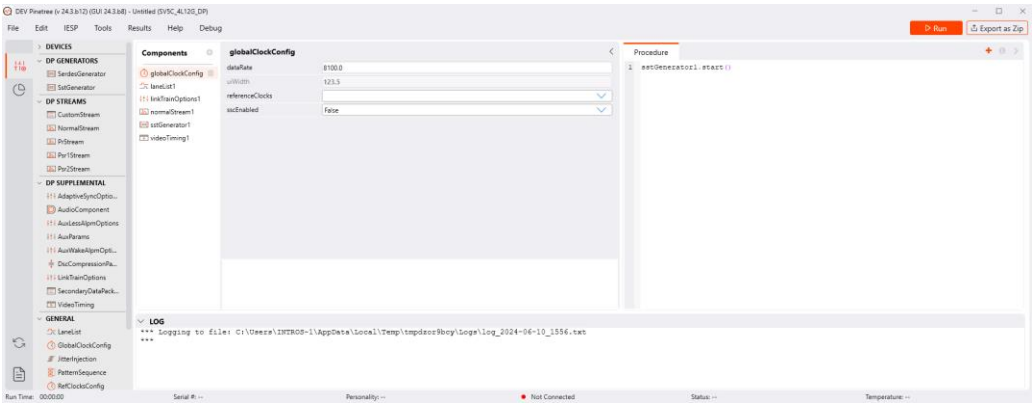


Figure 4: Window indicating that Pinetree has been successfully installed.

5. FURTHER DOCUMENTATION

The Help menu contains the following items, giving some information on the software:

- "User Manual" is the manual for Pinetree and is recommended reading for all users. Clicking on this item will open the document in your default PDF viewer.
- Clicking on "Documentation Index" will open a local documentation page correlating to the solution you are working with. A list of API documentation will be listed. The most useful for you are:
    - Components
    - Test Procedure API

From the "Components" list, you may right-click on any component, and a short menu will open. Select "Help" to view more information on the given component.

USB Driver Installation

The following procedure will allow for automated FTDI driver installation.

1. HARDWARE SETUP

For this procedure, connect the SV5C-eDPTX to the PC using both a USB2.0 mini B and a USB3.0 micro-B cable, as shown in Figure 5 below, and power on the module. To allow for driver installation, the PC should be connected to the internet as well.

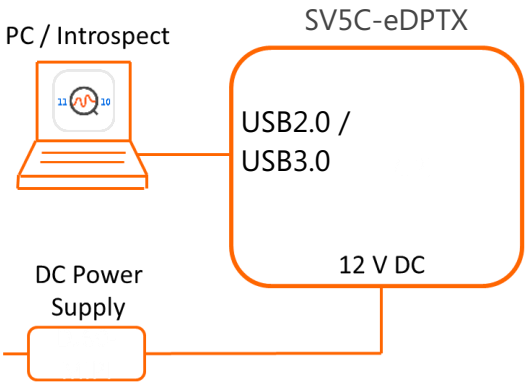


Figure 5: Connection for the automated FTDI driver installation.

2. WAIT FOR NEW HARDWARE DETECTION

The PC should display the message “New drivers successfully installed” once the installation process is complete. If this does not occur, see the troubleshooting notes at the end of this section.

3. VERIFY DRIVER INSTALLATION

a) If it is not yet open, launch Pinetree and select the "SV5C_4L12G_DP" form factor. From the main GUI window, click the "IESP" drop-down menu and click "Connect", as shown here. Establishing the connection should take a couple of seconds. If this fails, an error message will pop-up.

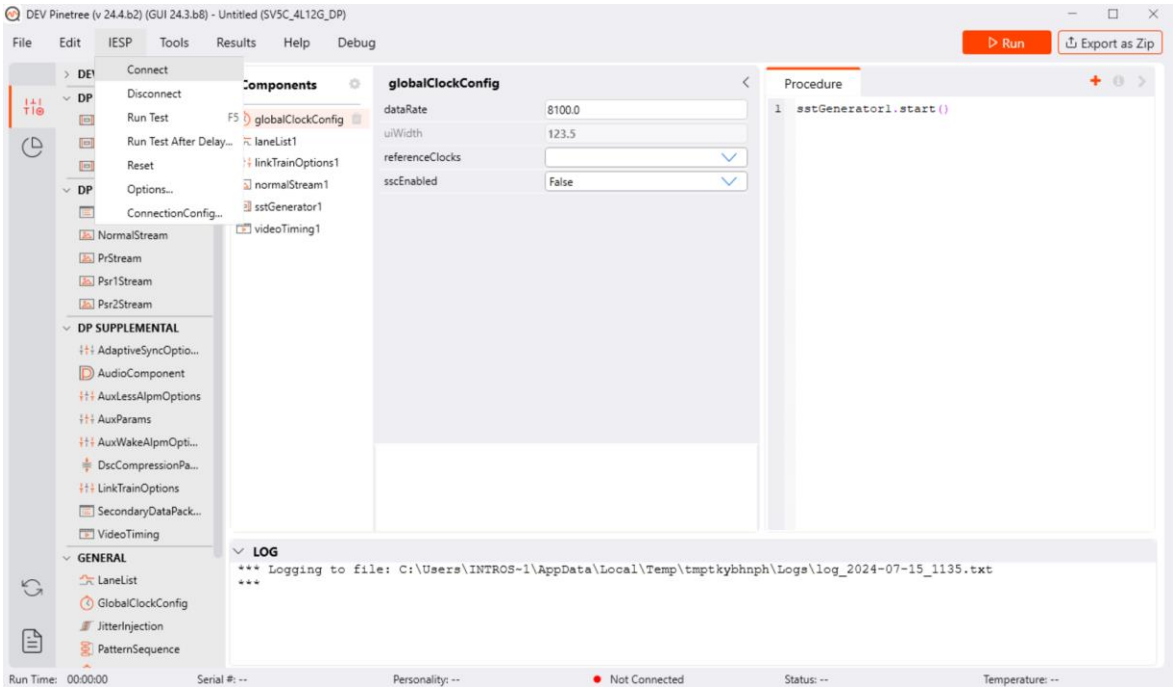


Figure 6: "Connect" sub-menu item under IESP.

b) When connected to the unit, the software will display useful information at the bottom of the GUI window: serial number, firmware revision and personality, the form factor in use, a status number and the unit's emperature. The "Connected" message also appears as well as a solid green status indicator.

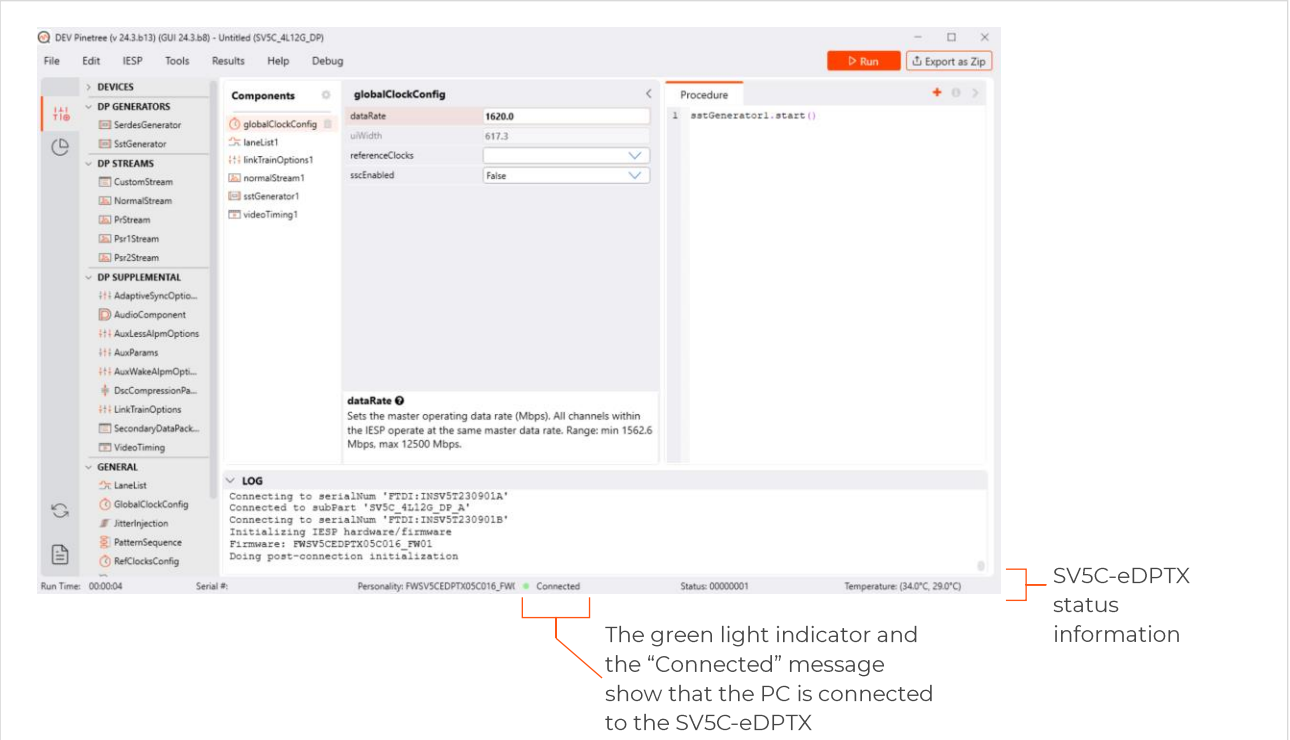


Figure 7: Screen capture of the GUI with the indicator showing that the SV5C-eDPTX is connected to the PC.

4. TROUBLESHOOTING

If the connection cannot be established, or if the drivers cannot be found or automatically installed, please refer to the "FTDI Driver Manual Installation" Appendix to install the required drivers.

SV5C-eDP Generator Demonstrations

STEP-BY-STEP GUIDE: GENERATING VIDEO FRAMES

The following step-by-step guide will allow the user to set up the SV5C-eDP Generator module to send streams, as well as demonstrate how to visualize the generated frames using an oscilloscope. A receiver DUT can also be used in lieu of the oscilloscope. The following procedure is intended to provide an overview of how to use the Pinetree GUI and highlight several of its key features.

1. CONNECT THE HARDWARE COMPONENTS

To visualize the generated streams, connect Main Link Lane 1 P and N to the first two channels of the oscilloscope and Lane 2 P and N to the second two channels of the oscilloscope. Note that the pinout for all lanes of the SV5C-eDP Generator module is depicted in Table 1.

2. GETTING TO KNOW THE PINETREE GUI

a) If you have not done so previously during the USB driver installation procedure, launch Pinetree, select the "SV5C_4L12G_DP" form factor, and create a new test procedure. Connect the SV5C-eDPTX to your PC using both a USB 2.0 mini B cable and a USB 3.0 micro B cable and power up the module.

NOTE

The USB 3.0 cable is used to accelerate data transfers between the SV5C-eDPTX and the host PC. A USB 3.0 connection is not mandatory for operating the module, but it is highly recommended, especially when generating large video frames.

b) By default, when started in the "SV5C_4L12G_DP" form factor, the GUI contains a single command in the "Test Procedure" pane and six pre-populated components in the "Components" windowpane. When executed, the sstGenerator1.start() generates a stream that is compliant with the attributes associated with the sstGenerator1 component as shown below.

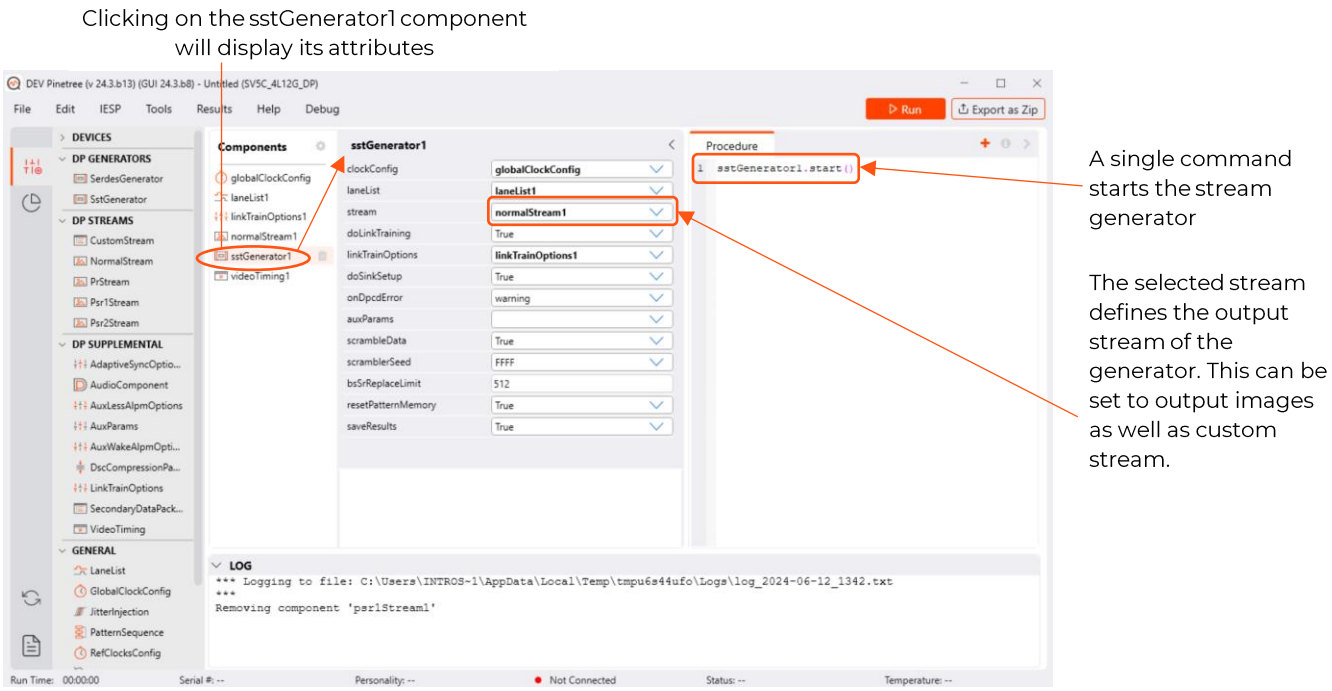


Figure 8: Screen capture showing the sstGenerator1 component and its properties.

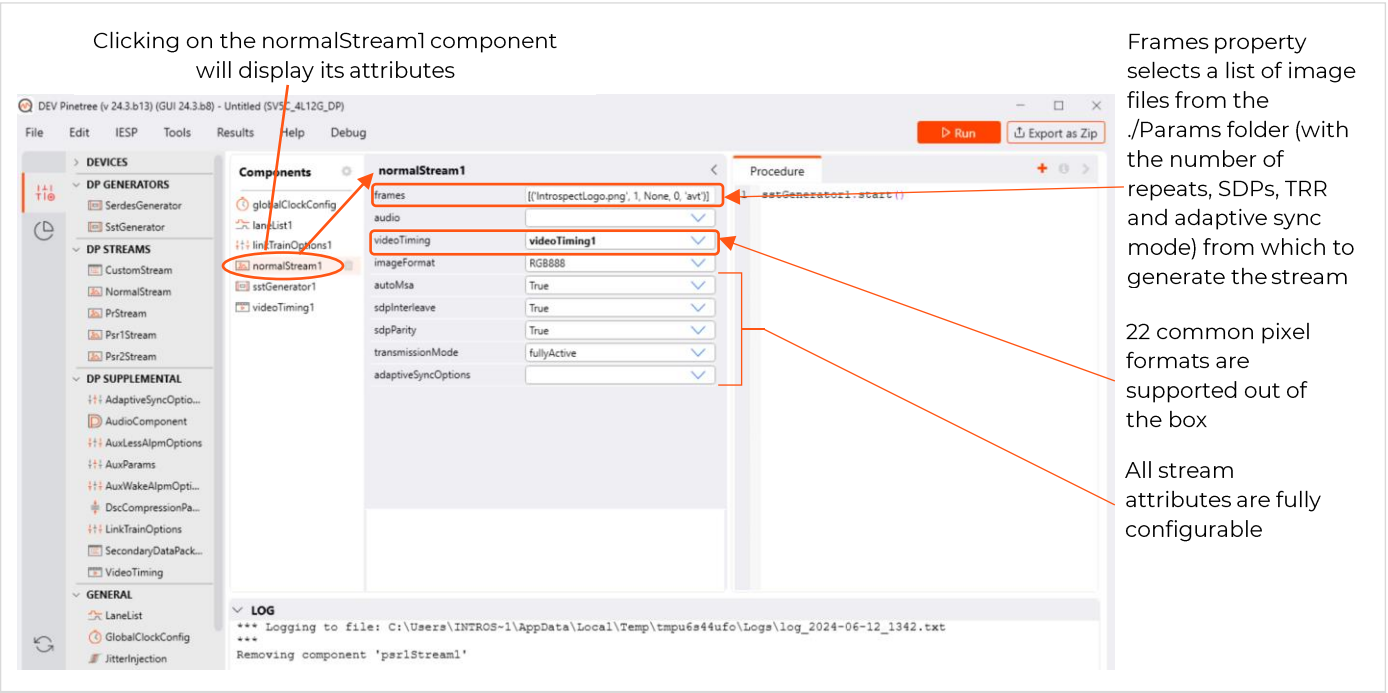


Figure 9: Screen capture showing the normalStream1 component and its properties.

c) One of the attributes of the sstGenerator1 component shown above is the stream. It is used to define the kind of stream that is generated by the SV5C-eDPTX module. In the previous picture, the normalStream1 component was selected as the desired stream. By selecting the normalStream1 component from the "Components" windowpane, the properties of the various custom and standard streams that will be generated can be modified.

NOTE

The default pattern is a .png image file of the Introspect logo, but this can be changed to any list of image files located in the .\My Documents\Introspect\Images folder.

d) A property of the normalStream1 component shown in Figure 8 is the videoTiming, used to modify all stream timing attributes. By default, this attribute is pre-filled with the

videoTiming1 component. Selecting the videoTiming1 component in the "Components" windowpane reveals the list of properties it provides, as shown in Figure 10.

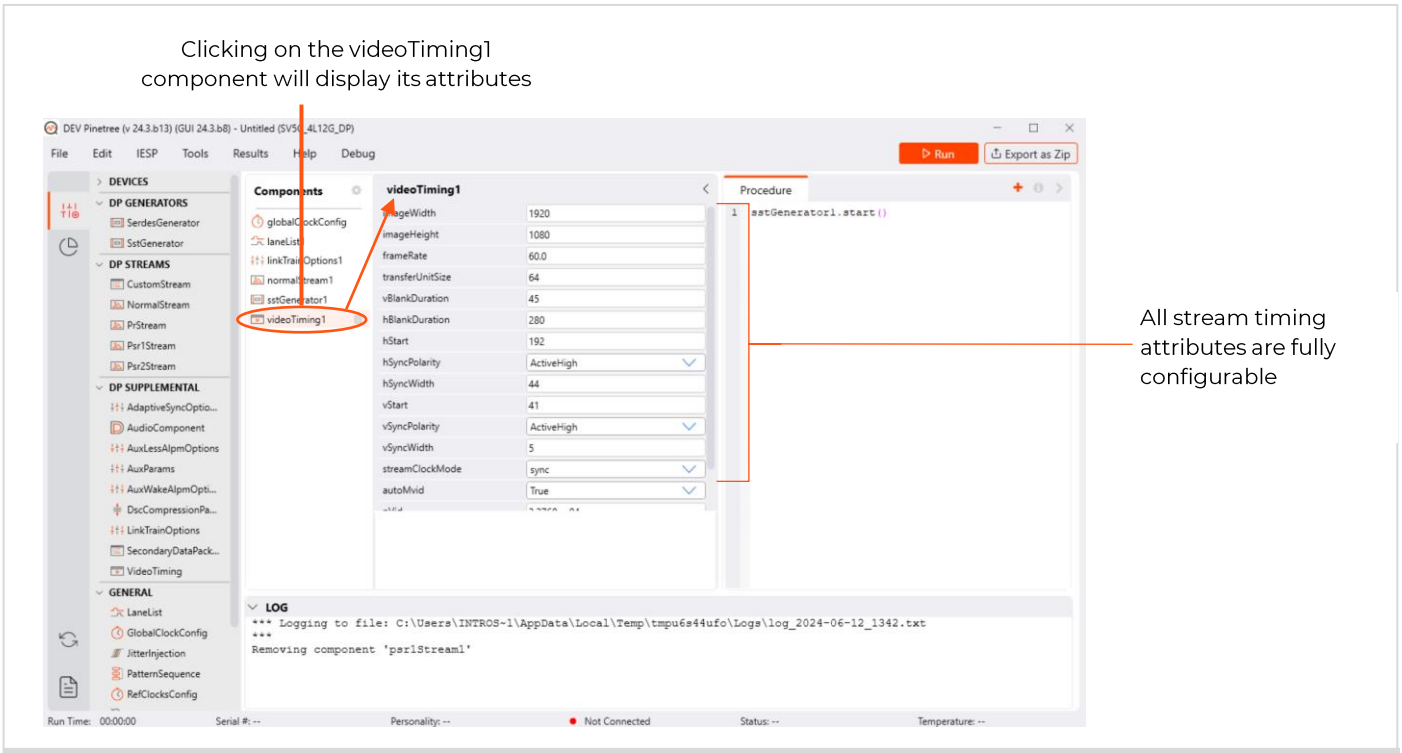


Figure 10: Screen capture showing the videoTiming1 component and its properties.

3. EXECUTING THE TEST PROCEDURE

Up until this point, you have selected a desired stream and configured the sstGenerator1 component. However, no stream is being produced by the generator yet. Users must run the test procedure to start the stream generation. If the PC has not connected to the SV5C-eDPTX already, there is no need to do so manually. The connection will be performed automatically when the test procedure is run for the first time.

a) Set doSinkSetup and doLinkTraining attributes of sstGenerator1 to False and click run or F5 shortcut key.

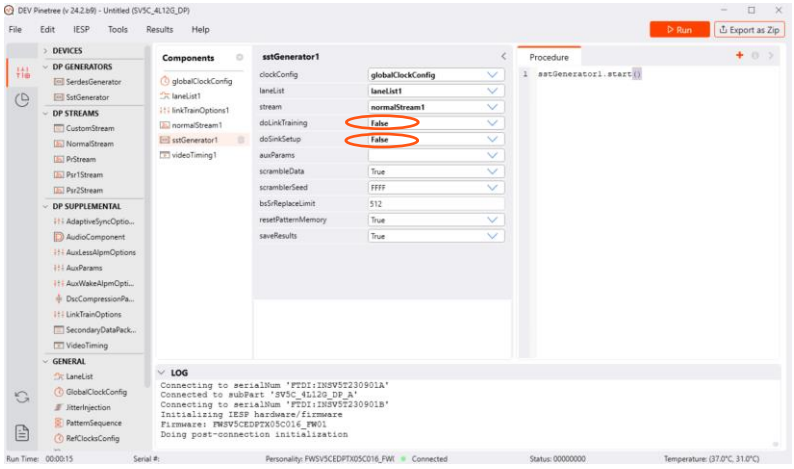


Figure 11: Set doSinkSetup and doLinkTraining attributes to False.

b) Observe the waveform on the scope. This is the default amplitude on scope.

Figure 12: Default amplitude on scope.

4. MODIFYING VOLTAGE SWINGS

Now that you have successfully generated your first stream with the SV5C-eDPTX Generator, let's experiment with changing some attributes of the generator and observe its effect on the generated signal.

a) Select the laneList1 component in the "Components" windowpane, as shown here.

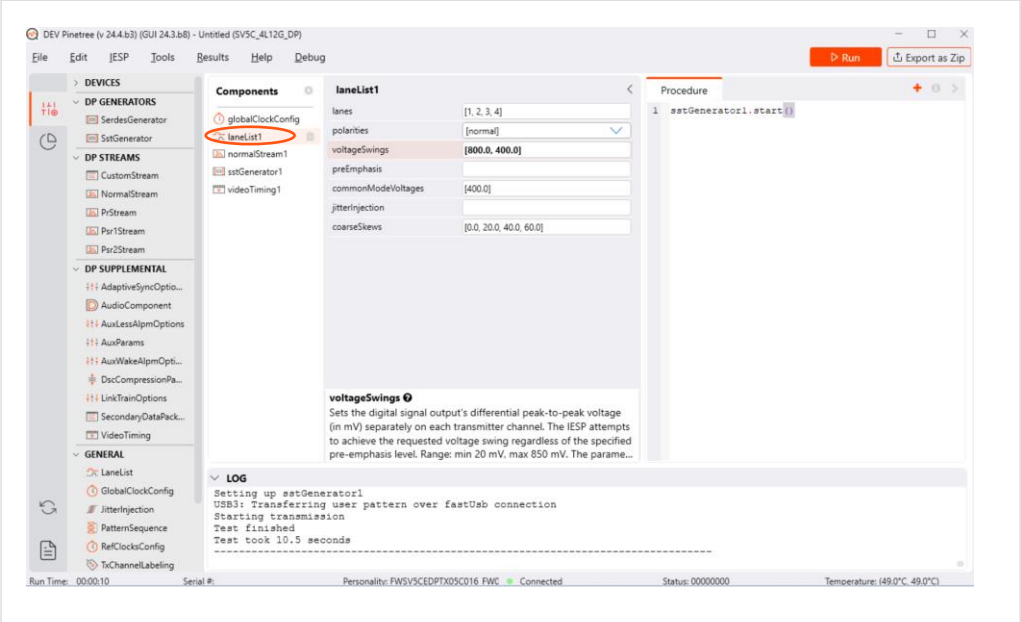


Figure 13: Selecting the laneList1 component.

b) Change amplitudes to 400 mV and execute the test again by clicking on “Run.” Observe on the scope the different applied amplitudes.

Figure 14: Results of changing amplitudes on the scope.

NOTE

To modify a component property, a user can either manually edit the corresponding field in the “Properties” view, or programmatically via the “Test Procedure“ editor tab. For example, if a user wants to change the voltage swings of the Main Link lanes during the test run, they can add the following two lines to the “Test Procedure” tab:

```
laneList1.voltageSwings = [400.0, 700.0]
sstGenerator1.laneList = laneList1
sstGenerator1.start()
```

This allows on-the-fly change of the properties during a test run for greater flexibility.

STEP-BY-STEP GUIDE: LINK TRAINING WITH PANEL

Next, we will describe how to drive a real DisplayPort panel using the SV5C-eDP Generator. Here we will be performing link training and observe results and the image on the screen.

1. CONNECT THE HARDWARE COMPONENTS

The SV5C-eDP Generator's main links (ML) and AUX channel shall be **directly connected** to the monitor according to the diagram in Figure 15.

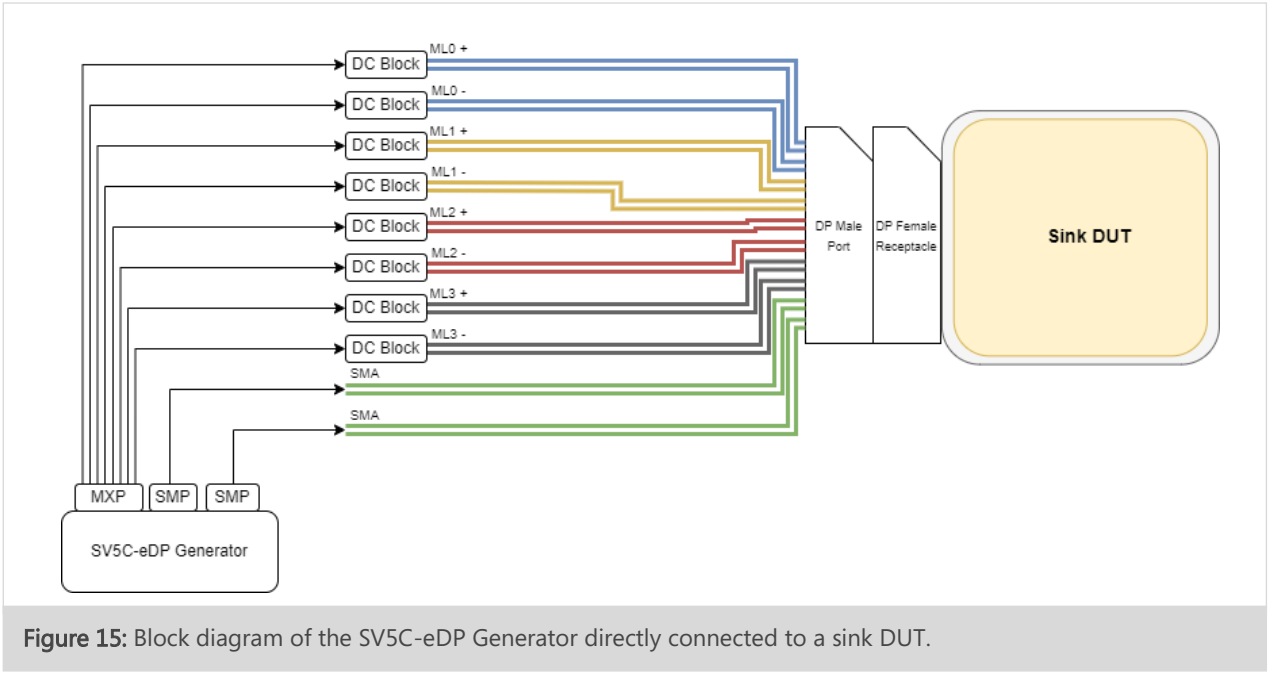


Figure 15: Block diagram of the SV5C-eDP Generator directly connected to a sink DUT.

Connect the SMA outputs of the MXP cable assembly to an SMA-to-DisplayPort adapter and connect the DisplayPort plug into the display panel. Table 2 shows the connection mapping when using a Wilder Technologies cable, a common test fixture adapter.

TABLE 2: SV5C-EDP GENERATOR MXP CONNECTIONS MAPPED TO WILDER TECHNOLOGIES CABLE

SV5C-EDP GENERATOR	WILDER TECHNOLOGIES CABLE
ML0 +	R0_P
ML0 -	R0_N
ML1 +	R1_P
ML1 -	R1_N
ML2 +	R2_P
ML2 -	R2_N
ML3 +	R3_P
ML3 -	R3_N
AUX +	AUX_P
AUX -	AUX_N

2. USING PINETREE

Launch Pinetree and select the “SV5C_4L12G_DP” form factor and open a new test procedure. Connect the SV5C-eDP Generator to your PC using both a USB 2.0 mini B cable and a USB 3.0 micro B cable, and power up the module.

3. EXECUTING THE TEST PROCEDURE

a) Edit video timings. Select videoTiming1 from the Components list. Default settings of imageWidth and imageHeight are set to HD – 1920 x 1080 which will work for our test. It can be modified if needed.

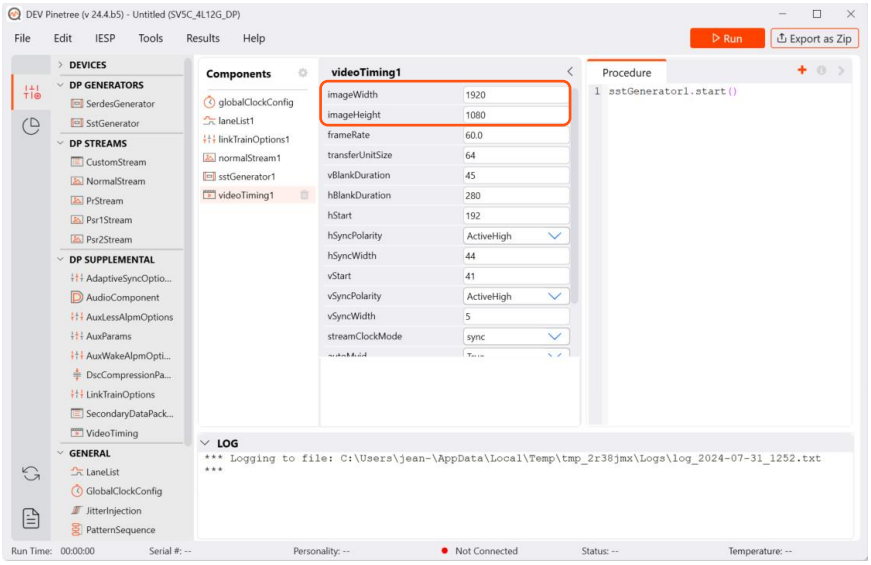


Figure 16: Default settings of videoTiming1.

b) Click “Run”. Observe the LinkTrainingResult in the Results tab of the GUI.

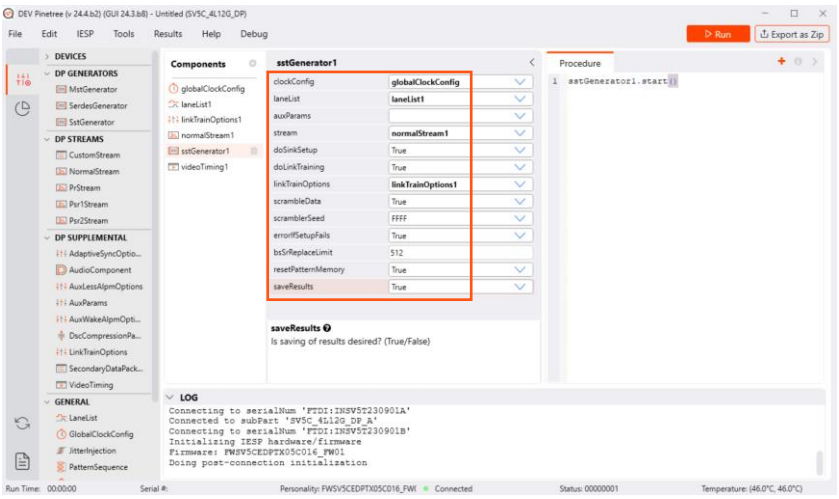


Figure 17: Default settings of sstGenerator1.

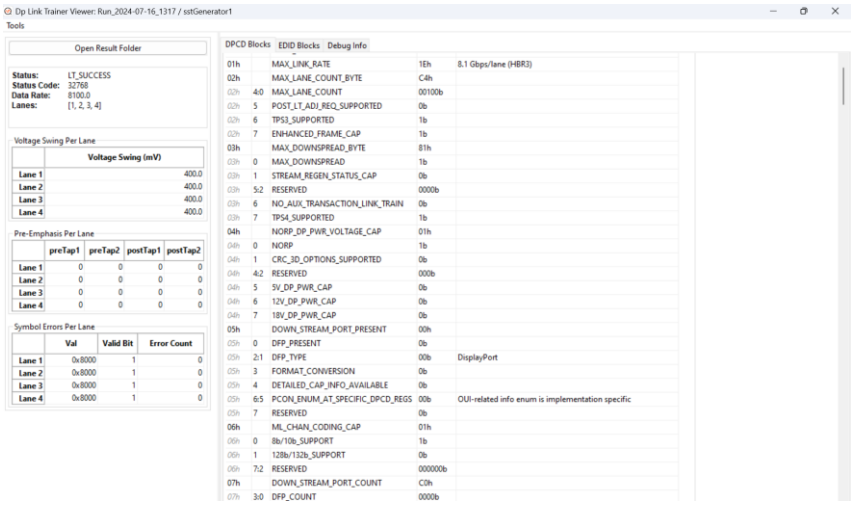


Figure 18: After clicking on “Run” - results observed.

c) Observe the Introspect logo on the screen.

Figure 19: Introspect logo shown.

4. MODIFYING PARAMETERS

Now that you have successfully generated your first link training with the SV5C-eDP Generator, let's experiment with changing some parameters of the generator and observe its effect on the DisplayPort link.

a) Select the linkTrainOptions1 component from the components list. The default setting is [4, 2, 1], meaning that the generator will first attempt to train the link with 4 lanes, and if it fails, downshift to 2 lanes and 1 lane as prescribed by the specification. Change this attribute to [2, 1] to configure the generator to begin link training with 2 lanes.

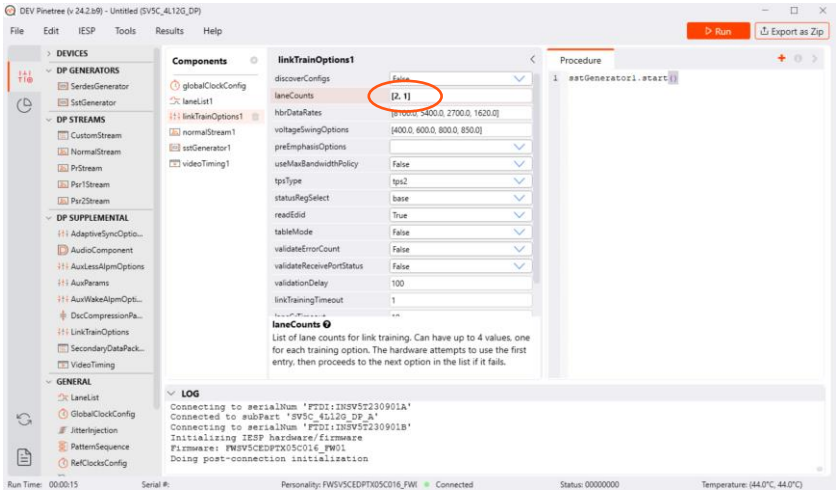


Figure 20: Selecting and changing the linkTrainOptions1 attributes.

b) Click "Run" and observe the LinkTrainingResult in the GUI and the image on the screen.

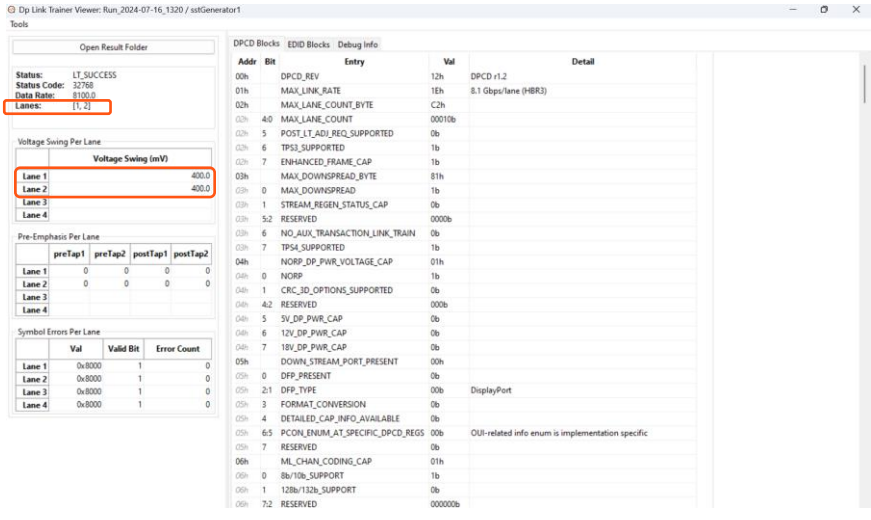


Figure 21: LinkTrainingResult with reduced lane count.

Further Help

HOW TO ADD TEST COMPONENTS

To illustrate how to add new components, we will demonstrate setting up a PSR1 stream. Double-click the “Psr1Stream” component on the list of available components on the far-left of the GUI window. This will instantiate a “psr1Stream1” component in the “Components” windowpane. Another way of doing this is to drag-and-drop the “Psr1Stream” component from the list of available components into the “Components” windowpane.

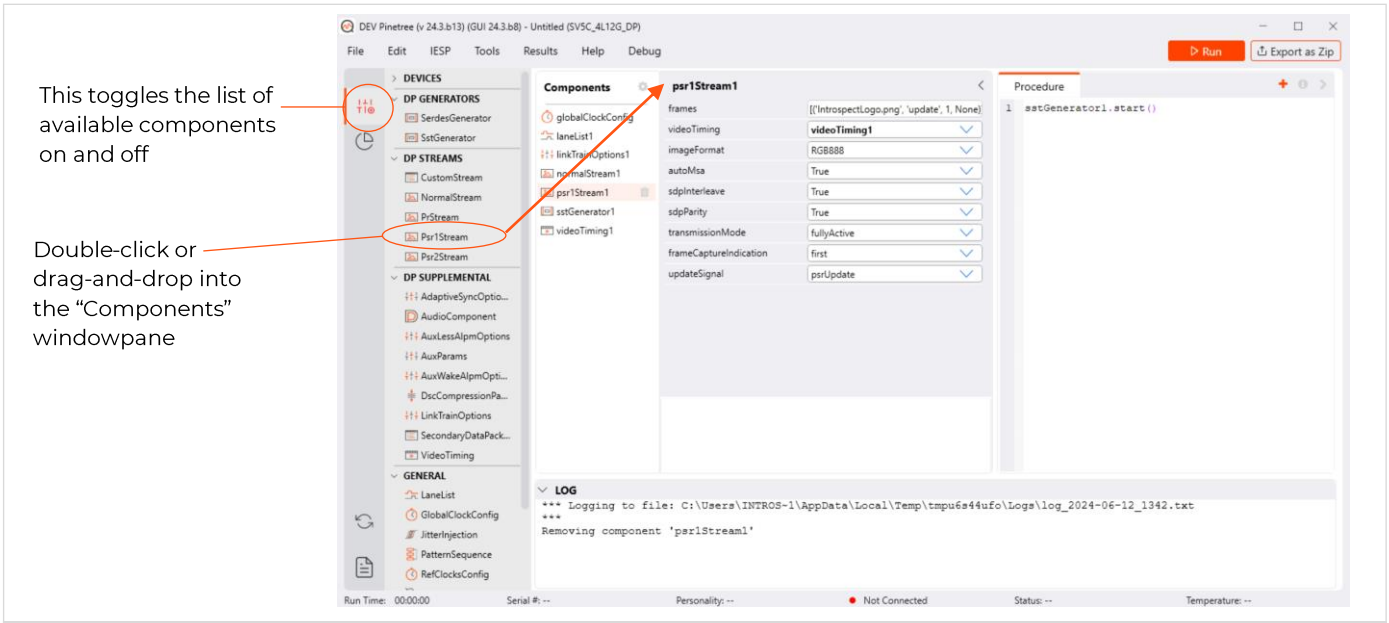


Figure 22: Adding the psr1Stream1 component.

By selecting the newly created psr1Stream1 component from the “Components” windowpane, its parameters can be viewed and edited, as shown below.

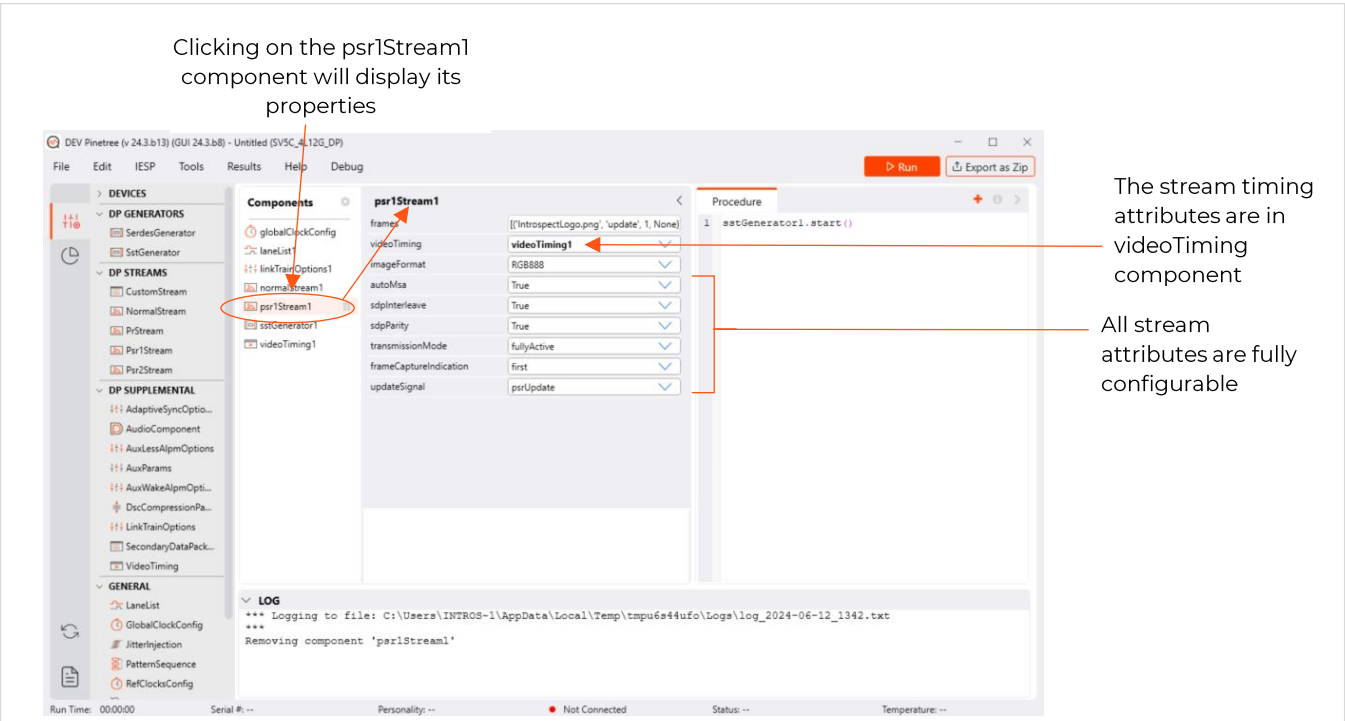


Figure 23: Selecting and editing the properties of the psr1Stream1 component.

NOTE

Other than NormalStream and Psr1Stream, different kind of streams are available, such as CustomStream, PrStream and Psr2Stream. Any of these streams may be selected for the test execution.

To make the psr1Stream1 the active pattern used by the generator, select the sstGenerator1 component from the “Components” windowpane, select the pattern property, and click on "psr1Stream1" from the pull-down menu, as shown in Figure 23.

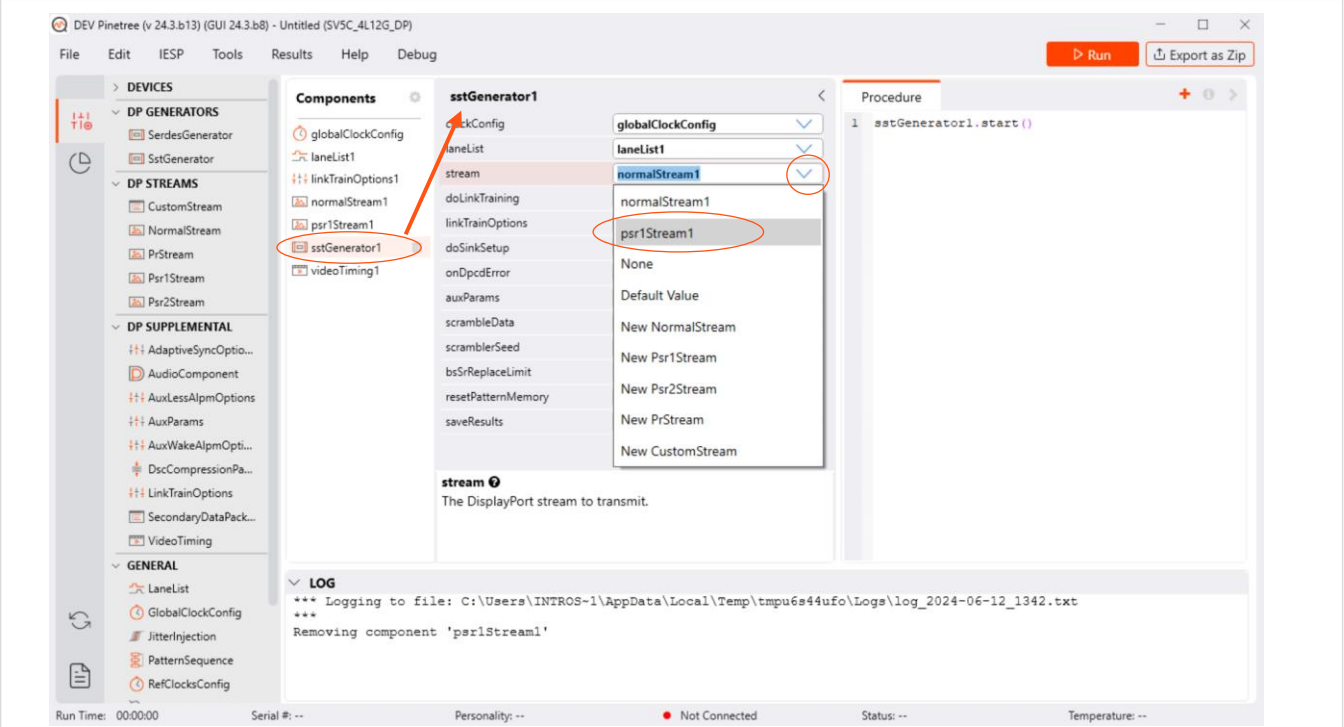


Figure 24: Selecting the psr1Stream as the pattern of the sstGenerator1 component.

Appendix

FTDI DRIVER MANUAL INSTALLATION

Pinetree communicates with the SPI Controller via an FTDI device (connected via USB). If you don't already have required FTDI drivers installed on your Windows computer, or if the automated driver detection presented earlier in this document was unsuccessful, you will need to download them from the FTDI web site. To do this, follow the instructions found at:

http://www.ftdichip.com/Documents/InstallGuides.htm

The latest drivers can be found at:

http://www.ftdichip.com/Drivers/D2XX.htm

http://www.ftdichip.com/Drivers/D3XX.htm

You may wish to use the "usbview" utility program linked to on the following FTDI page:

http://www.ftdichip.com/Resources/Utilities.htm

This program will allow you to check that your computer can "see" the FTDI device over USB.

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1.0	Document Release	August 8, 2024

The information in this document is subject to change without notice and should not be construed as a commitment by Introspect Technology. While reasonable precautions have been taken, Introspect Technology assumes no responsibility for any errors that may appear in this document.

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