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PXIe-5646

ETSync API Reference

This document provides information about configuring hardware for use with the ETSync API and a reference for ETSync VIs, properties, and functions.

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Getting Started

Configuring Your Hardware

An *ETSync pair* is one PXIe-5646 Vector Signal Transceiver (VST) and one PXIe-5451 Waveform Generator. Although not required, NI recommends placing each ETSync pair in the same bus segment.

For example, to use two PXIe-5646 devices (VST0 and VST1) and two PXIe-5451 devices (ARB0 and ARB1), place VST0 and ARB0 in slots 7-12 and VST1 and ARB1 in slots 13-18.

Tip: To specify the slots in a given bus segment in Measurement & Automation Explorer (MAX), select your the PXI chassis under **Devices and Interfaces** and select the **Triggers** tab.



Setting Up Trigger Routing in MAX

The PXI_Trig6 and PXI_Trig7 lines are dedicated to synchronization. Complete the following steps to set up your trigger lines in MAX:

1. Select the checkbox to reserve **PXI_Trig7**.
2. In the drop-down list, route **PXI_Trig7** away from the bus segment containing the PXIe-5646. The PXIe-5646 sends the synchronization pulse to the PXIe-5451 on the PXI_Trig7 line.
Note: If you are synchronizing one or multiple PXIe-5646 VSTs to one or multiple PXIe-5451 arbitrary waveform generators, ensure that you apply this rule to the master device in the ETSync session. The master device is the first session in the array that you pass to niETSync_Configure Synchronization.
3. Route **PXI_Trig6** away from the bus segment containing the master PXIe-5451. The PXIe-5451 distributes the start trigger to the PXIe-5646 on the PXI_Trig6 line.
Note: Do not reserve the PXI_Trig6 in MAX. The PXIe-5451 automatically reserves the PXI-Trig6 line. Manually reserving it results in an error from the niFGEN driver.

In the example from *Configuring Your Hardware*, VST0 and ARB0 are the master devices in Trigger Bus 2. The start trigger is routed away from the bus on PXI_Trig6, but it is not reserved, as shown in the following figure. The synchronization pulse is routed away from the bus on PXI_Trig7 and reserved.

	Reservations			Routing
	Bus 1	Bus 2	Bus 3	
PXI_Trig0	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Dynamic
PXI_Trig1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Dynamic
PXI_Trig2	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Dynamic
PXI_Trig3	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Dynamic
PXI_Trig4	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Dynamic
PXI_Trig5	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Dynamic
PXI_Trig6	<input checked="" type="checkbox"/>	← <input type="checkbox"/>	→ <input checked="" type="checkbox"/>	Away From Bus 2
PXI_Trig7	<input checked="" type="checkbox"/>	← <input checked="" type="checkbox"/>	→ <input checked="" type="checkbox"/>	Away From Bus 2

Legend

- Trigger Bus 1: PXI Slots 1-6
- Trigger Bus 2: PXI Slots 7-12
- Trigger Bus 3: PXI Slots 13-18

Figure 1: Example Trigger Routing in MAX

API Reference

niETSync_ConfigureSynchronization

Creates an ETSync session from niRFSG and niFGEN sessions. The first call initializes a new ETSync session for your hardware configuration. Subsequent calls obtain the currently open session. To minimize execution time, only initialize a session once.

Single ETSync Pair

Accepts a single niRFSG session and a single niFGEN session that you specify as **niRFSG rfsgSession** and **niFGEN fgenSession**. Returns an **niETSync handle** that you use to synchronize one PXIe-5646 to one PXIe-5451.

Multiple ETSync Pairs

Accepts an array of niRFSG sessions and an array of niFGEN sessions that you specify as **niRFSG[] rfsgSession** and **niFGEN[] fgenSession**. Returns an **niETSync handle** that you use to synchronize multiple PXIe-5646 and PXIe-5451 pairs.

Note: Each array must contain at least one initialized session.

niETSync_Synchronize

Synchronizes and delays one or more PXIe-5646 VSTs to one or more PXIe-5451 arbitrary waveform generators.

Range: $\pm 1 \mu\text{s}$

Note: You must call this function at least once after calling niETSync_ConfigureSynchronization.

You must call this function again if any of the following device parameters change:

- Sample clock rate of the niFGEN device(s)
- I/Q rate of the niRFSG device(s)
- Reference clock source

Tip: A call to niETSync_Synchronize is relatively time consuming (around 150 ms for a single ETSync pair). Minimize the number of times you call the function by minimizing sample clock and I/Q rate changes, and use niETSync_AdjustRFDelay to adjust the **RFDelay** unless you also want to synchronize the devices.

Note: This function implicitly reenables ETSync if you disabled it with a call to niETSync_Enable(false). The PXIe-5646 VST(s) will expect a start trigger from the master PXIe-5451.

Single ETSync Pair

Synchronizes the devices in the session you initialized with niETSync_ConfigureSynchronization with a delay of the PXIe-5646 relative to the PXIe-5451 that you specify as **double RFDelay**.

Multiple ETSync Pairs

Synchronizes one or more PXIe-5646 VSTs to one or more PXIe-5451 arbitrary waveform generators and sets delays between PXIe-5451 arbitrary waveform generators. You can use this function to set the RF to

ARB delays when you synchronize your devices. Once you have synchronized your devices, NI recommends using `niETSync_AdjustRFDelay` to adjust the RF to ARB delay.

Devices synchronize in the order that you pass them to `niETSync_ConfigureSynchronization`. The first element in each array is the master device. If there is an unequal number of VSTs and arbitrary waveform generators, any unpaired VST synchronizes and delays relative to the master arbitrary waveform generator. For example, if you synchronize three PXIe-5646 VSTs to two PXIe-5451 arbitrary waveform generators, the third PXIe-5646 session synchronizes and delays relative to the first PXIe-5451 that you pass to `niETSync_AdjustRFDelay`. You can delay unpaired arbitrary waveform generators relative to the master arbitrary waveform generator.

Parameters

- **niETSync Handle**—An initialized ETSync Session.
- **double RFDelay**—Specifies the delay of a single PXIe-5646 relative to a single PXIe-5451.
- **double[] RF to ARB Delays**—An array that specifies the delay to apply to each RF signal generator relative to the synchronized arbitrary waveform. The length of this array must equal the number of niRFSG sessions used to create the ETSync session.
- **double[] ARB to ARB Delays**—An array that specifies the delay to apply to each slave arbitrary waveform generator relative to the master waveform generator. The length of this array should be one less than the number of niFGEN sessions used to create the ETSync session. The master arbitrary waveform generator implicitly does not delay relative to itself.

`niETSync_AdjustRFDelay`

Delays one or more PXIe-5646 VSTs relative to paired PXIe-5451 arbitrary waveform generators.

Range: $\pm 1 \mu\text{s}$

Note: You must call `niETSync_Synchronize` before calling this function.

Single ETSync Pair

Delays one PXIe-5646 relative to one PXIe-5451.

Multiple ETSync Pairs

Delays multiple PXIe-5646 devices relative to multiple PXIe-5451 devices.

Parameters

- **niETSync Handle**—An initialized ETSync Session.
- **double RFDelay**—Specifies the delay of a single PXIe-5646 relative to a single PXIe-5451.
- **double[] RFDelay**—An array that specifies the delay to apply to each VST relative to the synchronized arbitrary waveform generator. The length of this array must equal the number of niRFSG sessions used to create the ETSync session.

`niETSync_Initiate`

Initiates synchronous generation with the instruments you initialized as **niETSync Handle** with `niETSync_ConfigureSynchronization`. At a low level this function makes calls to **niRFSG_Initiate** and **niFGEN_initiate**.

Note: You must call `niETSync_Synchronize` at least once before using this function, and the `ETSync` session must still be enabled.

`niETSync_Abort`

Aborts synchronous generation of the instruments you initiated as **niETSync Handle** with `niETSync_Initiate`. This function does not disable the `ETSync` session. You can re-initiate synchronous generation with a call to `niETSync_Initiate`.

Tip: The PXIe-5451 keeps the last output sample played in the script, which is likely non-zero. You can force the PXIe-5451 to output zero by making a call to `niFGEN_OutputEnable` with argument `False`.

`niETSync_Enable`

Enables or disables the `ETSync` session. Use this function to avoid the time-consuming operation of restarting your session when switching between envelope tracking (ET) generation and RF-only generation

Note: When the `ETSync` session is enabled, either by a call to this function or implicitly by a call to `niETSync_Synchronize`, you can only initiate the PXIe-5646 VST(s) and PXIe-5451 arbitrary waveform generator(s) with a call to `niETSync_Initiate`. Call this function with a `False` argument to disable the `ETSync` session and return to regular operation.

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