QUANTIFI PHOTONICS®

HARDWARE TRIGGERING OF OPTICAL PXI MODULES

APPLICATION NOTE

QP PXI Modules in NI Chassis

quantifiphotonics.com

Contents

Why Use Hardware Triggering?

PXI's integrated timing and hardware triggering capabilities offer a number of advantages over more traditional software-initiated measurements.

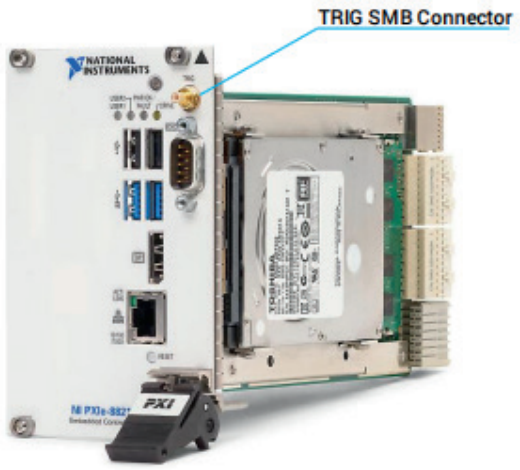
- True parallel measurements of multiple devices under test allows you to scale your manufacturing as required and decrease the test time per DUT.
- Extremely low latency allows you to capture fast events or measure your DUTs very quickly.
- Very precise timing alignment between PXI/PXIe module allows you to control the trigger events to occur exactly when you need them.

This application note explains how to make the best use of hardware triggering capability present in many of Coherent Solutions' PXIe photonics modules and assumes the reader has some familiarity with the PXI platform.

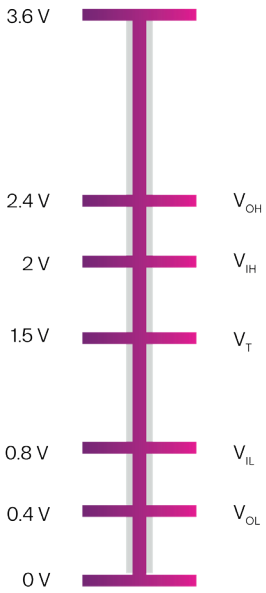
Advantage	Example Application
Can offer significant speed improvements for most multi-instrument system setups	Sweeping a laser source and measuring the insertion loss over wavelength of the device under test (DUT) would be time consuming it you had to step the wavelength then send a remote control command to a power meter to query the average power.
Can enable parallel measurements that would otherwise not be possible	Measuring the optical power from up to 68 VSCELs all at the same instance in time, using just one PXIe mainframe.
Can significantly improve test reliability	Hardware triggering means that measurement events are controlled by unambiguous predetermined conditions. Hardware triggering eliminates communication delays and makes the test system consistent and reliable.
Can easily synchronise multiple events	By ANDing or ORing trigger events, measurements can easily be synchronized to ensure all conditions are properly met before a measurement is performed.

Trigger Sources

- Triggers can be generated externally and connected to the TRIG SMB connector on your controller (if supported by your controller).



- Input and output is LV TTL.



V_{IH} : Input High Level Voltage

V_{IL} : Input Low Level Voltage

V_{OH} : Output High Level Voltage

V_{OL} : Output Low Level Voltage

VT : Threshold Voltage

- Triggers can also be generated by modules within your PXI chassis and routed along the PXI_Trig bus to other modules and the TRIG SMB connector.

Trigger Capability of the PXI Chassis

In each PXIe chassis there are 8 PXI trigger lines which are shared between all slots.

PXI_Trig0, PXI_Trig1, … , PXI_Trig7

Each slot can create a trigger and the trigger event can be transferred through each PXI Trigger line.

There is also a PXI Star Trigger that can be generated from Slot 2 and distributed to all other slots in the chassis. At this time, the PXI Star Trigger is not supported by Coherent Solutions PXI modules.

How Trigger Input Works

Configure which PXI_Trig line you want the module to listen to. You can listen to any, all or any combination of the 8 PXI_Trig lines.

If listening to multiple PXI_Trig Lines, you can configure if these lines are OR'ed or AND'ed:

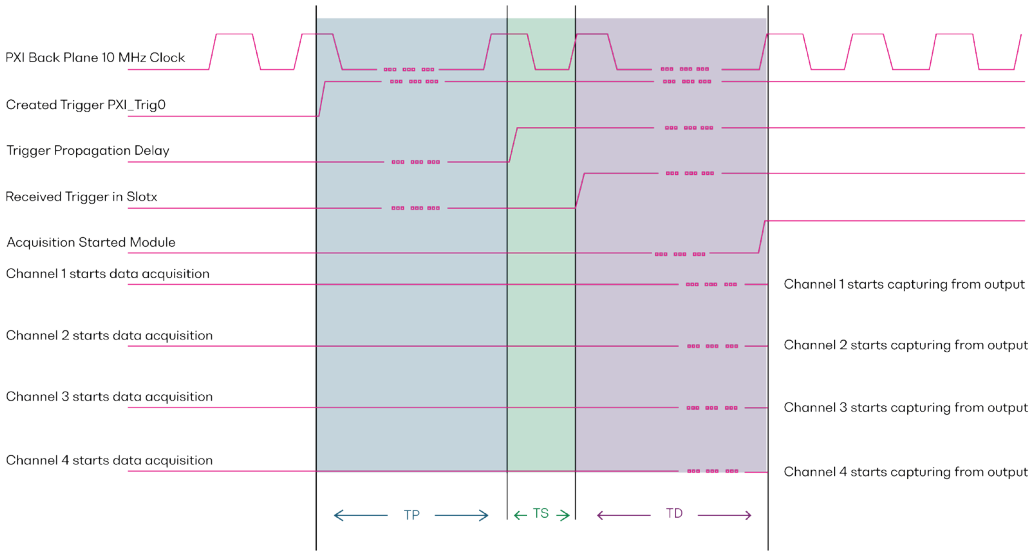
- OR: A triggering signal on any of the lines the module is listening to will cause the module to react to the trigger.
- AND: A trigger must be present on all the lines the module is listening to cause the module to react to the trigger.

Arm the trigger: the module will wait for trigger once armed.

Timing Diagram

Figure 1:

The delay from a trigger event happens on PXI trigger line until the module gets that event and starts data aquisition.



TP: the propagation delay which includes (maximum 1 micro second):

- The backplane delay
- Bridge propagation from one segment to another segment
- The glitch removal segment

TS: one 10MHz clock period (0.1 micro second) in the worst case scenario for module to detect trigger event in the next rising edge of the clock.

TD: user programmed delay (default is zero).

Modules that Support Hardware Triggering

QP **O2E PXIe** - 1XXX

QP **POWER PXIe** - 14XX

QP **POWER PXIe** - 15XX

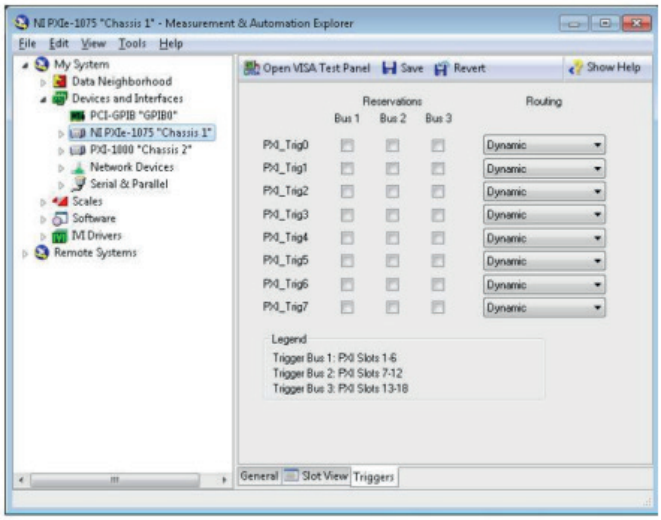
QP **VOA PXIe** - 1XXX

Setting Up Triggers on a PXI Chassis

In a PXIe chassis (depending on the number of slots), there can be up to three PXI Bus Segments. To propagate a trigger from a source in one segment to a slot in another segment, the user needs to use NI-MAX to define how the chassis should distribute the trigger event.

Figure 2:

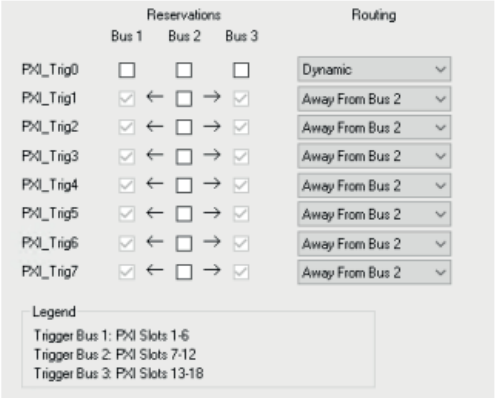
NI-MAX control panel.



For example, in the configuration below, PXI_Trig0 will be used only locally in all three segments. This means the trigger event would not be passed to other segments. However, for other PXI_Trig1 to PXI_Trig7, if the source is located in Bus 2 (slot7 to slot12), the PXIe chassis will propagate the trigger to other Buses.

Figure 3:

Bus configuration example.

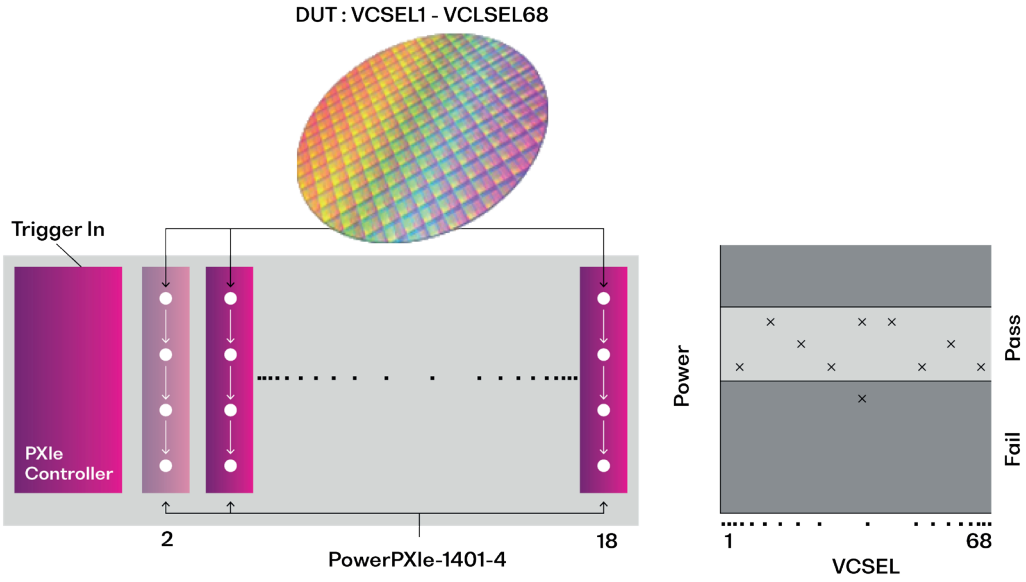


Important Notes

- Trace capabilities (# of points, triggering mode, sample rate) are module specific.
- All channels in a module will react to a trigger with same sample rate and number of points. You cannot configure different channels to have different setups.

Figure 4:

Parallel PowerPXIe measurements using SCPI commands. In this example, we have an 18 Slot PXIe chassis with 17 x 4 channel PowerPXIe-1401 modules performing concurrent testing of optical power from 68 VCSELs.



1) Setup channel buffer (TRACE) to capture power meter data:

SENS3:TRACE:PTS 1024	# setup module in slot 3 to capture 1024 pts
SENS3:TRACE:RATE 1e3	# setup sample rate to 1kS/s
SENS3:TRACE:TRIG HWEXT	# setup Channel to capture a trace on hardware trigger event and use the 10MHz PXIe backplane clock

2) Repeat for all other modules:

SENS4:TRACE:PTS 1024	# setup module in slot 4 to capture 1024 pts
SENS4:TRACE:RATE 1e3	# setup sample rate to 1kS/s
SENS4:TRACE:TRIG HWEXT	# setup Channel to capture a trace on Hardware trigger event

and,

3) Setup hardware trigger on modules in Slot 3 and 4:

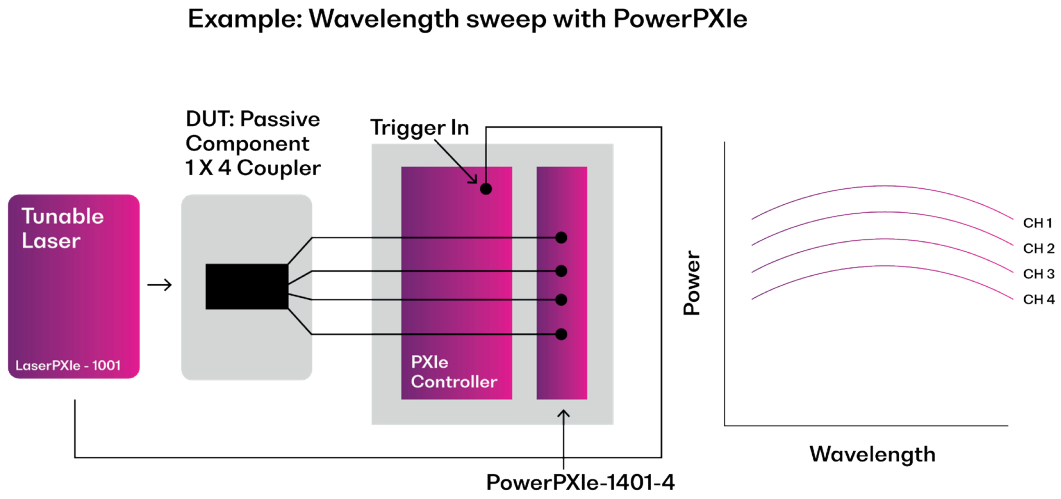
TRIGGER3:SOURCE 1	# tell module in slot 3 to listen to PXI_Trig1 Bus
TRIGGER4:SOURCE 1	# tell module in slot 4 to listen to PXI_Trig1 Bus
TRIGGER3:MODE AND	# AND all trigger lines that we are listening to
TRIGGER4:MODE AND	# AND all trigger lines that we are listening to
TRIGGER3:DELAY 0.0	# each module will trigger after this delay [in seconds]
TRIGGER4:DELAY 0.0	# each module will trigger after this delay [in seconds]
TRIGGER3:ARM ENABLE	# to ARM the modules to listen to a defined PXI_Trig line(s)
TRIGGER4:ARM ENABLE	# to ARM the modules to listen to a defined PXI_Trig line(s)

4) Get data after event occurs:

SENS3:TRACE:COMPLETE?	# check if the operation is complete on all channels
SENS3:TRACE?	# get 4x1024 power pts (data from all 4 channels)
SENS4:TRACE:COMPLETE?	# check if the operation is complete on all channels
SENS4:TRACE?	# get 4x1024 power pts (data from all 4 channels)

Figure 5:

PXIe chassis with a 4 channel Power PXIe-1401 and single channel LaserPXIe-1001 modules.



1) Setup channel buffer (TRACE) to capture power meter data:

SENS3:TRACE:PTS 1024	# setup module in slot 3 to capture 1024 pts
SENS3:TRACE:TRIG HWCLK	#Setup channel to capture a sample on every hardware trigger rising or falling edge

2) Setup hardware trigger on modules in slot 3 and 4:

TRIGGER3:SOURCE 0	# tell module in slot 3 to listen to PXI_Trig0 Bus
TRIGGER3:DELAY 0.0	# each module will trigger after this delay [in seconds]
TRIGGER3:ARM ENABLE	# to ARM the modules to listen to a defined PXI_Trig line

At this point, the power meter waits for triggers from the tunable laser. We can now acquire a power sample with every trigger.

3) Get data after event occurs:

SENS3:TRACE:COMPLETE?	# check if the operation is complete on all channels
SENS3:TRACE?	# get 4x1024 power pts (data from all 4 channels)

Test.
Measure.
Solve.™

Quantifi Photonics is transforming the world of photonics test and measurement. Our portfolio of optical and electrical test instruments is rapidly expanding to meet the needs of engineers and scientists around the globe. From enabling ground-breaking experiments to driving highly efficient production testing, you'll find us working with customers to solve complex problems with experience and innovation.

To find out more, get in touch with us today.

General Enquiries	sales@quantifiphotonics.com
Technical Support	support@quantifiphotonics.com
Phone	+64 9 478 4849
North America	+1-800-803-8872

quantifiphotonics.com

QUANTIFI PHOTONICS®