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Find the *National Instruments PXI-6653* at our website: *Click HERE*

PXI Timing and Synchronization Control

NI PXI-665x

- Works with all PXI modules
- Multichassis PXI synchronization
- Onboard routing of internal or external clock and trigger signals
- PXI slot 2 star trigger controller
- Onboard high-stability references
  - OCXO, 50 ppb (6653)
  - TCXO, 1 ppm (6652)
- Reference clock import and export with PLL capabilities
- DC to 105 MHz, 1 µHz resolution DDS clock generation
- Software trigger generation
- Frequency measurement capabilities
- LabVIEW FPGA targets (PXI-6653, PXI-6652)

Operating Systems

- Windows 2000/XP
- LabVIEW Real-Time

Recommended Software

- LabVIEW
- LabWindows/CVI

Driver Software (included)

- NI-SYNC

NEW



Overview and Applications

The National Instruments PXI-665x timing and synchronization control modules use the trigger bus, star trigger, and system reference clock features of PXI to implement advanced multidevice or multichassis synchronization. You can vastly improve the accuracy of measurements, implement advanced triggering schemes, or synchronize multiple devices and/or multiple chassis to act as a single system for high-channel-count applications.

Features	NI PXI-6651 Slave Module	NI PXI-6652 Master Module	NI PXI-6653 Master Module
Front Panel Connectivity			
CLK10 in	✓	✓	✓
CLK10 out	–	✓	✓
General-purpose PFI lines	2 SMB	6 SMB	6 SMB
Programmable voltage threshold	–	✓	✓
Trigger Routing			
Star trigger source (PXI_STAR)	✓	✓	✓
PXI trigger bus (PXI_TRIG)	✓	✓	✓
Onboard Clock Sources			
10 MHz time base	–	TCXO (1 ppm)	OCXO (50 ppb)
DDS programmable clock	–	DC to 105 MHz	DC to 105 MHz
Software			
NI-SYNC	✓	✓	✓
LabVIEW FPGA target	–	✓	✓

Table 1. NI PXI-665x Features

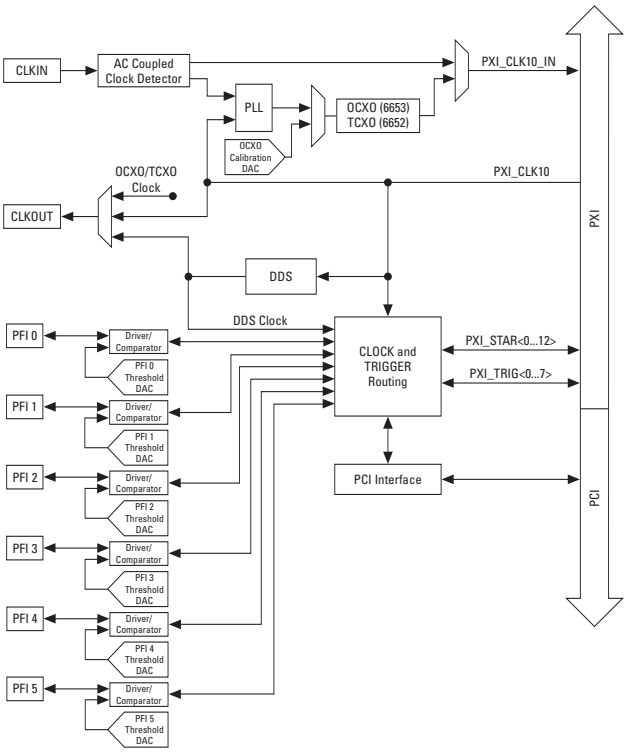


Figure 1. Block Diagram of PXI-6652 and PXI-6653 Master Modules

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PXI Timing and Synchronization Control

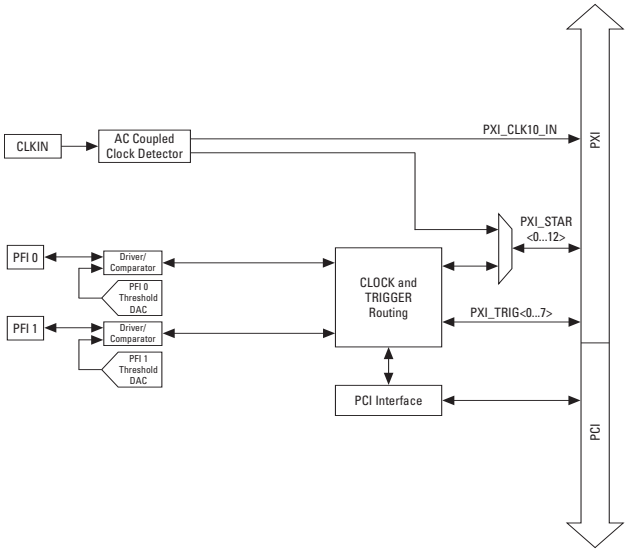


Figure 2. Block Diagram of PXI-6651 Slave Module

PXI Backplane Overview

PXI-665x modules provides full control of the following timing and synchronization features of the PXI backplane. To act as a PXI star trigger controller or to provide a high-accuracy 10 MHz reference clock, the PXI-665x module must be installed in slot 2 of the PXI chassis, as shown below in Figure 3.

- Star trigger (PXI_STAR) – 13 equal-trace-length, point-to-point lines for providing low-skew (<1 ns) trigger or clock signals from slot 2 to slots 3 through 15.
- Trigger bus (PXI_TRIG) – 8 bused TTL lines for general-purpose routing of triggers, clocks, and handshaking signals.
- 10 MHz clock (PXI_CLK10) – capable devices, such as the NI PXI-5xxx modular instruments, can phase-lock to the high-accuracy, low-jitter 10 MHz reference clock for improved accuracy.

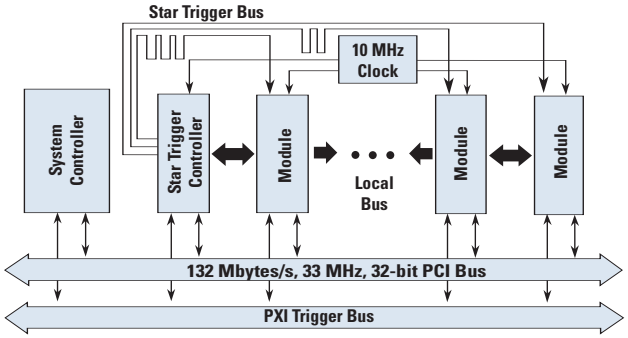


Figure 3. Diagram of Synchronization Features in the PXI Backplane

High-Stability 10 MHz Time Base

When installed in slot 2 of a PXI chassis, the PXI-6652 and PXI-6653 modules can override the built-in 10 MHz reference clock on a PXI chassis. Typically, most PXI chassis provide a 10 MHz reference clock with 25 ppm accuracy (10 MHz ±250 Hz). This accuracy is improved to 1 ppm with the PXI-6652, and to 50 ppb with the PXI-6653. Many modules, such as the PXI-5xxx modular instruments, have phase-lock-loop (PLL) circuitry to synchronize with the 10 MHz reference clock.

High-Resolution DDS Clock

The onboard direct digital synthesis (DDS) clock of the PXI-6652 and PXI-6653 modules provides an extremely high-resolution programmable clock source that can generate clocks from DC to 105 MHz in frequency with 1 µHz resolution. Use this clock as a common time base for data acquisition modules. For example, the DDS clock can be used to provide a 13.1 MHz oversampling clock for synchronization of multiple NI PXI-4472 dynamic signal acquisition modules.

NI-SYNC Software

NI-SYNC driver software, included free, provides powerful yet easy-to-use control of PXI-665x modules. NI-SYNC includes many examples for synchronization of data acquisition modules, arbitrary waveform generators, digitizers, and dynamic signal acquisition (DSA) modules in both LabVIEW and LabWindows/CVI.

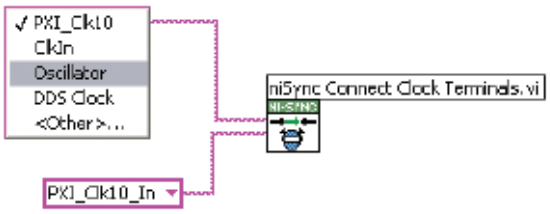


Figure 4. The NI-SYNC driver software provides an easy-to-use interface to PXI-665x modules.

LabVIEW FPGA Module

The LabVIEW FPGA Module provides LabVIEW developers with the ability to define their own hardware by targeting their LabVIEW block diagrams to the FPGAs on supported National Instruments hardware. The LabVIEW FPGA Module can target the FPGA on the PXI-6652 and PXI-6653 modules to develop custom, user-defined applications.

Multichassis Synchronization

Using a combination of master PXI-6652 and PXI-6653 modules, in conjunction with slave PXI-6651 modules, multiple PXI chassis can be tightly synchronized. Each master module can synchronize up to three slave modules. With these modules, you can create very high-channel-count synchronized data acquisition systems.

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PXI Timing and Synchronization Control



Figure 5. In this example, three PXI chassis containing 13 PXI-4472 8-channel 102.4 kS/s simultaneous-sampling dynamic signal acquisition modules are synchronized. The result is a 312-channel synchronized acquisition system.

Ordering Information

NI PXI-6653 (Master, OCXO).....778715-01
NI PXI-6652 (Master, TXCO) 778726-01
NI PXI-6651 (Slave).....778725-01

Cables

SMB-210 188858-01
Dual SMB Plug to Dual SMB Plug Coax, 50 Ω, 1 m

SMB-200 188859-01
SMB Plug to SMB Plug Coax, 50 Ω, 1 m

BUY ONLINE!

For complete product specifications, pricing, and accessory information, call (800) 813-3693 (U.S. only) or go to ***ni.com/pxi***

Specifications

CLKIN Input Characteristics

Fundamental frequency range ..... 1 MHz to 105 MHz sine or square
Input impedance..... 50 Ω, nominal
Input coupling..... AC
Voltage range ..... 400 mV_{PP} to 5 V_{PP}
Absolute maximum input voltage ..... 6 V_{PP}
CLKIN to PXI_CLK_IN delay
  Uncompensated..... 14 ns to 14.7 ns, typical
  PLL compensated..... ±1 ns, maximum
CLKIN frequency accuracy requirement
  PLL and OCXO (PXI-6653) ..... ±1.5 ppm
  PLL and TCXO (PXI-6652)..... ±5.0 ppm
  Replacing PXI_CLK10 ..... ±100 ppm
Jitter added to CLKIN
  Without PLL ..... 0.5 ps_{rms}, 10 Hz to 100 kHz
  With PLL ..... 0.6 ps_{rms}, 10 Hz to 100 kHz
Duty cycle distortion of CLKIN
  to PXI_CLK10_IN without PLL..... ±1%, maximum
Required input duty cycle when using PLL..... 45 to 55%

CLKOUT Output Characteristics

Output frequency
  From PXI_CLK10 ..... 10 MHz
  From OCXO (PXI-6653)..... 10 MHz
  From TCXO (PXI-6652) ..... 10 MHz
  From DDS (PXI-6652/6653)..... 1 Hz to 105 MHz
Duty cycle..... 40 to 60%
Output impedance ..... 50 Ω, nominal
Output coupling..... AC
Clock amplitude software configurable to two voltage levels (low and high drive)
  Open load, low drive ..... 2.0 V_{PP}
  Open load, high drive ..... 5.0 V_{PP}
  50 Ω load, low drive..... 1.0 V_{PP}
  50 Ω load, high drive..... 2.5 V_{PP}
Clock rise/fall time (10 to 90%)
  Low drive ..... 0.5 ns, 2.5 ns max
  High drive ..... 0.5 ns, 2.5 ns max

PFI <0…5> Input Characteristics

Frequency range..... DC to 105 MHz
Input impedance..... 50 Ω, nominal, or 1 kΩ
  ±10% ll 35 pF, software-selectable
Input coupling..... DC
Voltage level..... 0 to 5 V
Absolute maximum input voltage..... ±5.25 V, max
Input threshold
  Voltage level..... 0 to 4.3 V, software-selectable
  Voltage resolution ..... 16.8 mV (8-bit)
  Error ..... ±50 mV
Hysteresis..... 50 mV
Asynchronous delay tpd
  PFI <0…5> to PXI_TRIG<0…7>..... 15 to 23 ns, typical
  PFI <0…5> to PXI_STAR<0…12> ..... 10 to 19 ns, typical
Synchronized trigger input setup time..... 11.2 ns, typical relative to PXI_CLK10
Synchronized trigger input hold time..... -10.8 ns, typical relative to PXI_CLK10

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PXI Timing and Synchronization Control

Specifications

PFI <0…5> Output Characteristics

Frequency range	DC to 105 MHz
Output impedance	50 Ω, nominal
Output coupling	DC
Voltage level	0 to 1.6 V into 50 Ω 0 to 3.3 V into open circuit
Absolute maximum applied voltage	±5.25 V
Synchronized trigger clock to out time	8.4 ns, relative to PXI_CLK10
Output-to-output skew, synchronous	500 ps, typical

PXI_STAR Trigger Characteristics

PXI_STAR<0...12> to PXI_STAR<0...12>	300 ps, typical output skew at NI PXI-665x backplane connector
Asynchronous delays, tpd	
PXI_STAR<0...12> to PFI<0...5>	7 to 11 ns, typical
PXI_STAR<0...12> to PXI_TRIG<0...7>	13 to 19 ns, typical

PXI Trigger Characteristics

PXI_TRIG<0...7> to PXI_TRIG<0...7> output skew	5 ns, typical
Asynchronous delay, tpd	
PXI_TRIG<0...7> to PFI<0...5>	11 to 17 ns, typical

OCXO Characteristics (PXI-6653 Only)

Frequency	10 MHz
Warm-up time	3 minutes
Initial accuracy	±3.2 ppb
Long-term stability	±50 ppb/year
Temperature stability	
0 to 40 °C	±5 ppb
0 to 55 °C	±10 ppb
Jitter	
to CLKOUT	2.0 ps_{rms}
to CLK10IN	1.5 ps_{rms}

TCXO Characteristics (PXI-6652 Only)

Frequency	10 MHz
Initial Accuracy	±2.5 ppm
Long-term stability	±1 ppm
Temperature stability (0 to 55 °C)	±2 ppm

DDS Characteristics

Frequency range	1 Hz to 105 MHz
Frequency resolution	<1.1 µHz
Frequency accuracy	Inherits PXI_CLK10 accuracy

Power Requirements

+ 5 V	2 A, maximum
+3.3 V	600 mA, maximum
+12 V	500 mA, maximum
-12 V	0 A, maximum

Physical

Dimensions (1 slot, 3U)	10 by 16 cm (3.9 by 6.3 in.) Install in PXI Slot 2 for full functionality
Front panel connectors	SMB male, 50 Ω
Front panel indicators	2 tricolor LEDs
Maximum cable length, direct connections (no splitter)	
PFI/CLKOUT, DC to 10 MHz	200 m
CLKOUT high gain, 105 MHz	100 m
PFI/CLKOUT low gain, 105 MHz	30 m

Operating Environment

Ambient temperature	0 to 55 °C
Relative humidity	10 to 90%, noncondensing
Maximum altitude	2000 m (at 25 °C ambient)

Storage Environment

Ambient temperature	-20 to 70 °C
Relative humidity	5 to 95%

Shock and Vibration

Operational shock	30 g peak, half-sine, 11 ms pulse
Random vibration	
Operating	5 to 500 Hz, 0.3 g_{rms}
Nonoperating	5 to 500 Hz, 2.4 g_{rms}

Safety

The product is designed to meet the requirements of the following standards of safety

- UL 3111-1
- IEC 61010-1, EN 61010-1
- CAN/CSA C22.2 No. 1010.1

Electromagnetic Compatibility

Emissions	EN 55011 Class A at 10 m FCC Part 15A above 1 GHz
Immunity	EN 61326-1:1997 + A1:1998, Table I
EMC/EMI	CE, C-Tick, and FCC Part 15 (Class A) Compliant

CE Compliance CE

This product meets the essential requirements of applicable European Directives, as amended for CE marking, as follows:

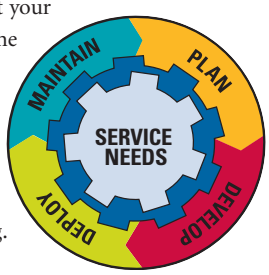
Low voltage directive (safety)	73/23/EEC
Electromagnetic Compability	89/336/EEC Directive (EMC)

Specifications subject to change without notice.

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Hardware Services

NI Factory Installation Services

NI Factory Installation Services (FIS) is the fastest and easiest way to use your PXI or PXI/SCXI™ combination systems right out of the box. Trained NI technicians install the software and hardware and configure the system to your specifications. NI extends the standard warranty by one year on hardware components (controllers, chassis, modules) purchased with FIS. To use FIS, simply configure your system online with *ni.com/pxiadvisor*.

Calibration Services

NI recognizes the need to maintain properly calibrated devices for high-accuracy measurements. We provide manual calibration procedures, services to recalibrate your products, and automated calibration software specifically designed for use by metrology laboratories. Visit *ni.com/calibration*.

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