



Model 74630 Model 73630



## General Information

Models 72630, 73630 and 74630 are members of the Cobalt® family of high performance CompactPCI boards based on the Xilinx Virtex-6 FPGA. They consist of one or two Model 71630 XMC modules mounted on a cPCI carrier board.

Model 72630 is a 6U cPCI board while the Model 73630 is a 3U cPCI board; both are equipped with one Model 71630 XMC. Model 74630 is a 6U cPCI board with two XMC modules rather than one.

These models include one or two 1 GHz A/D and D/A converters and four or eight banks of memory

## The Cobalt Architecture

The Pentek Cobalt architecture features a Virtex-6 FPGA. All of the board's data and control paths are accessible by the FPGA, enabling factory installed functions including data multiplexing, channel selection, data packing, gating, triggering and memory control. The Cobalt architecture organizes the FPGA as a container for data processing applications where each function exists as an intellectual property (IP) module.

Each member of the Cobalt family is delivered with factory-installed applications ideally matched to the board's analog interfaces. The factory-installed functions of these models include one or two A/D acquisition and one or two D/A waveform playback IP module. IP modules for either DDR3 or QDRII+ memories, controllers for all data

clocking and synchronization functions, a test signal generator and a PCIe interface complete the factory-installed functions and enable these models to operate as complete turnkey solutions, without the need to develop any FPGA IP.

## Extendable IP Design

For applications that require specialized functions, users can install their own custom IP for data processing. Pentek GateFlow FPGA Design Kits include all of the factory installed modules as documented source code. Developers can integrate their own IP with the Pentek factory-installed functions or use the GateFlow Design Kit to completely replace the Pentek IP with their own.

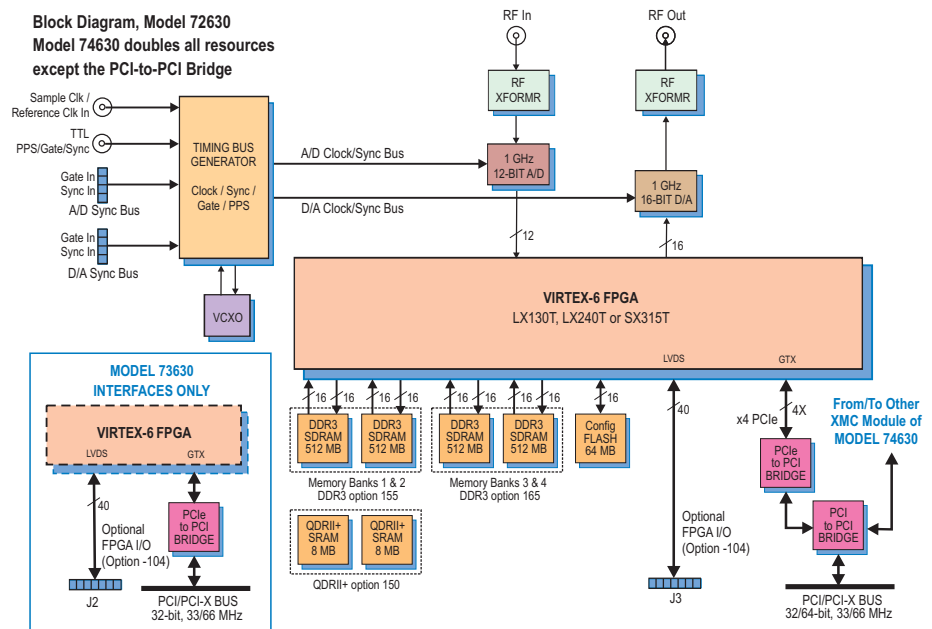
## Xilinx Virtex-6 FPGA

The Virtex-6 FPGA site can be populated with a variety of different FPGAs to match the specific requirements of the processing task. Supported FPGAs include: LX130T, LX240T, or SX315T. The SXT part features 1344 DSP48E slices and is ideal for modulation/demodulation, encoding/decoding, encryption/decryption, and channelization of the signals between transmission and reception. For applications not requiring large DSP resources, one of the lower-cost LXT FPGAs can be installed.

Option -104 provides 20 LVDS pairs between the FPGA and the J2 connector, Model 73630; J3 connector, Model 72630; J3 and J5 connectors, Model 74630. ➤

## Features

- Complete radar and software radio interface solution
- Supports Xilinx Virtex-6 LXT and SXT FPGAs
- One or two 1 GHz 12-bit A/D
- One or two 1 GHz 16-bit D/A
- Up to 2 or 4 GB of DDR3 SDRAM; or: 16 MB or 32 MB of QDRII+ SRAM
- Sample clock synchronization to an external system reference
- Dual-μSync clock/sync bus for multiboard synchronization
- Optional LVDS connections to the Virtex-6 FPGA for custom I/O



### A/D Acquisition IP Module

These models feature one or two A/D Acquisition IP Modules for easy capture and data moving. The IP module can receive data from the A/D, a test signal generator, or from the D/A Waveform Playback IP Module in loopback mode. The IP module has associated memory banks for buffering data in FIFO mode or for storing data in transient capture mode. The memory banks are supported with a DMA engine for moving A/D data through the PCIe interface.

This powerful linked-list DMA engine is capable of a unique Acquisition Gate Driven mode. In this mode, the length of a transfer performed by a link definition need not be known prior to data acquisition; rather, it is governed by the length of the acquisition gate. This is extremely useful in applications where an external gate drives acquisition and the exact length of that gate is not known or is likely to vary.

For each transfer, the DMA engine can automatically construct metadata packets containing a sample-accurate time stamp, and data length information. These actions simplify the host processor's job of identifying and executing on the data.

### D/A Waveform Playback IP Modules

The factory-installed functions include one or two sophisticated D/A Waveform Playback IP modules. A linked-list controller allows users to easily play back waveforms stored in either on-board memory or off-board host memory to the D/A.

Parameters including length of waveform, delay from playback trigger, waveform repetition, etc. can be programmed for each waveform.

Up to 64 or 128 individual link entries can be chained together to create complex waveforms with a minimum of programming.

### ► A/D Converter Stage

The front end accepts one or two analog HF or IF input on front panel SSMC connectors with transformer coupling into one or two Texas Instruments ADS5400 1 GHz, 12-bit A/D converters.

The digital outputs are delivered into the Virtex-6 FPGA for signal processing, data capture or for routing to other module resources.

### D/A Converter Stage

The 71630 features one or two TI DAC5681Z 1 GHz, 16-bit D/As. The converters have an input sample rate of 1 GSps, allowing them to accept full rate data from the FPGA. Additionally, the D/As include a 2x or 4x interpolation filter for applications that provide 1/2 or 1/4 rate input data. Analog output is through front panel SSMC connectors.

### Clocking and Synchronization

Two internal timing buses provide either a single clock or two different clock rates to the A/D and D/A signal paths.

Each timing bus includes a clock, sync and a gate or trigger signal. An on-board clock generator receives a sample clock either from the front panel SSMC connector or from an on-board programmable VCXO (Voltage-Controlled Crystal Oscillator). In this latter mode, the front panel SSMC connector can be used to provide a 10 MHz reference clock to phase-lock the VCXO.

Either clock source (front panel or VCXO) can be used directly or can be divided independently by 2, 4, 8, or 16 to provide different lower frequency A/D and D/A clocks.

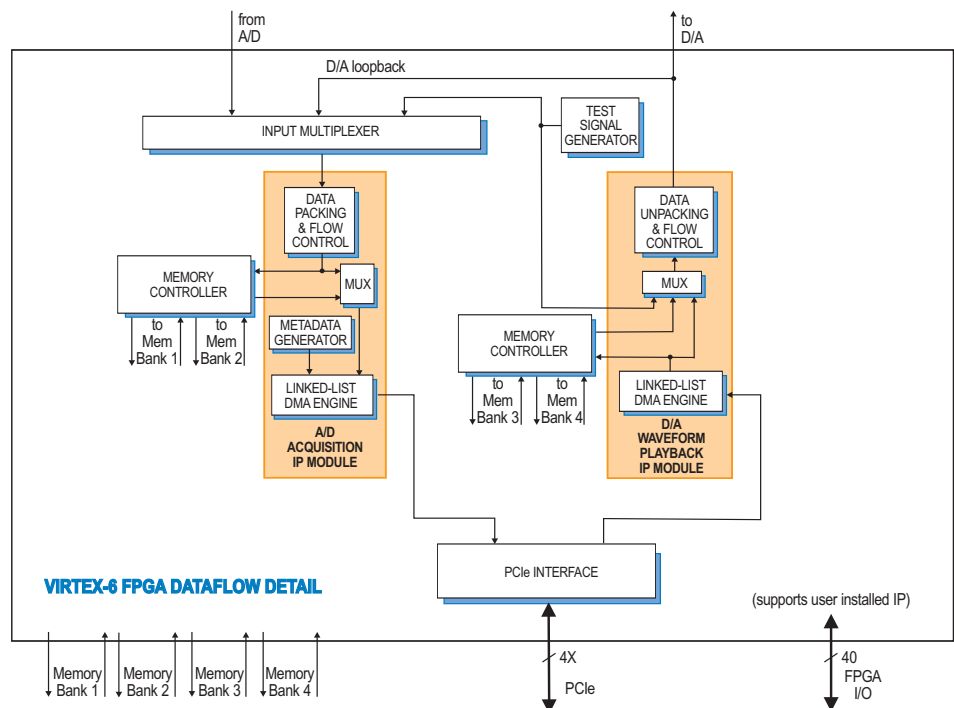
A pair of front panel  $\mu$ Sync connectors allows multiple boards to be synchronized. They accept CML inputs that drive the board's sync and gate/trigger signals.

The Pentek Model 7292 and Model 9192 Cobalt Synchronizers can drive multiple  $\mu$ Sync connectors enabling large, multi-channel synchronous configurations. Also, an LVTTTL external gate/trigger input is accepted on a front panel SSMC connector.

### Memory Resources

The Cobalt architecture supports up to four or eight independent memory banks which can be configured with all QDRII+ SRAM, DDR3 SDRAM, or as combination of two banks of each type of memory. Each QDRII+ SRAM bank can be up to 8 MB deep and is an integral part of the module's DMA capabilities, providing FIFO memory space for creating DMA packets. For applications requiring deep memory resources, DDR3 SDRAM banks can each be up to 512 MB deep. Built-in memory functions include an A/D data transient capture mode and D/A waveform playback mode.

In addition to the factory-installed functions, custom user-installed IP within the FPGA can take advantage of the memories for many other purposes. ►



### ► PCI-X Interface

These models include an industry-standard interface fully compliant with PCI-X bus specifications. The interface includes multiple DMA controllers for efficient transfers to and from the board. Data widths of 32 or 64 bits and data rates of 33 and 66 MHz are supported. Model 73630: 32 bits only.

### Specifications

**Model 72630 or Model 73630: 1 A/D, 1 D/A**  
**Model 74630: 2 A/Ds, 2 D/As**

#### Front Panel Analog Signal Inputs (1 or 2)

**Input Type:** Transformer-coupled, front panel female SSMC connectors

#### A/D Converters (1 or 2)

**Type:** Texas Instruments ADS5400

**Sampling Rate:** 100 MHz to 1 GHz

**Resolution:** 12 bits

#### D/A Converters (1 or 2)

**Type:** Texas Instruments DAC5681Z

**Input Data Rate:** 1 GHz max.

**Interpolation Filter:** bypass, 2x or 4x

**Output Sampling Rate:** 1 GHz max.

**Resolution:** 16 bits

#### Front Panel Analog Signal Outputs (1 or 2)

**Output Type:** Transformer-coupled, front panel female SSMC connectors

#### Sample Clock Sources (1 or 2)

On-board clock synthesizer generates two clocks: one A/D clock and one D/A clock

#### Clock Synthesizers (1 or 2)

**Clock Source:** Selectable from on-board programmable VCXO or front panel external clock

**VCXO Frequency Ranges:** 10 to 945 MHz, 970 to 1134 MHz, and 1213 to 1417 MHz

**Synchronization:** VCXO can be phase-locked to an external 4 to 200 MHz system reference, typically 10 MHz

**Clock Dividers:** External clock or VCXO can be divided by 1, 2, 4, 8, or 16, independently for the A/D clock and D/A clock

#### External Clocks (1 or 2)

**Type:** Front panel female SSMC connector, sine wave, 0 to +10 dBm, AC-coupled, 50 ohms, accepts 100 MHz to 1 GHz divider input clock, or PLL system reference

**Timing Bus:** 19-pin µSync bus connector includes sync and gate/trigger inputs, CML

#### External Trigger Input

**Type:** Front panel female SSMC connector, LVTTTL

**Function:** Programmable functions include: trigger, gate, sync and PPS

#### Field Programmable Gate Arrays (1 or 2)

**Standard:** Xilinx Virtex-6 XC6VLX130T-2

**Optional:** Xilinx Virtex-6 XC6VLX240T-2 or XC6VSX315T-2

#### Custom I/O

**Option -104:** Provides 20 LVDS pairs between the FPGA and the J2 connector, Model 73630; J3 connector, Model 72630; J3 and J5 connectors, Model 74630

#### Memory Banks (1 or 2)

**Option 150:** Two 8 MB QDRII+ SRAM memory banks, 400 MHz DDR

**Option 155 or 165:** Two 512 MB DDR3 SDRAM memory banks, 400 MHz DDR

#### PCI-X Interface

**PCI-X Bus:** 32 or 64 bits at 33 or 66 MHz  
Model 73630: 32 bits only

#### Environmental

**Operating Temp:** 0° to 50° C

**Storage Temp:** -20° to 90° C

**Relative Humidity:** 0 to 95%, non-cond.

**Size:** Standard 6U or 3U cPCI board

### Ordering Information

Model	Description
72630	1 GHz A/D and D/A, Virtex-6 FPGA - 6U cPCI
73630	1 GHz A/D and D/A, Virtex-6 FPGA - 3U cPCI
74630	Two 1 GHz A/D and D/A, Virtex-6 FPGA - 6U cPCI

#### Options:

-002*	-2 FPGA speed grade
-062	XC6VLX240T FPGA
-064	XC6VSX315T FPGA
-104	LVDS I/O between the FPGA and J2 connector, Model 73630; J3 connector, Model 72630; J3 and J5 connectors, Model 74630
-160	Two 8 MB QDRII+ SRAM Memory Banks (Banks 3 and 4)
-155	Two 512 MB DDR3 SDRAM Memory Banks (Banks 1 and 2)
-165	Two 512 MB DDR3 SDRAM Memory Banks (Banks 3 and 4)

\* This option is always required