General Standards Corporation

High Performance Bus Interface Solutions

cPCI6U64-20AOF16C500KR

20-Bit 16-Output 500KSPS Precision Wideband cPCI 6U Analog Output Board

With Rear-Panel I/O and 8th-Order reconstruction output filters

Features Include:

- **16 Single-ended or optional 3-Wire Differential 20-Bit analog output channels**.
- **Simultaneous Clocking; Individual R-2R 20-Bit DAC per output channel.**
- **Clocking rates from zero to 500KSPS.**
- Software-selectable fullscale output ranges: ±6V and ±3V, or optionally ±10V and ±5V.
- 8th-Order reconstruction filter in each output channel.
- 256K-sample output FIFO buffer.
- Internal sample rate generator with 24-Bit rate divider.
- Hardware trigger and clock I/O for multiboard synchronization.
- Eight Bidirectional digital TTL I/O lines.
- Conforms to PCI Bus Specification, Revision 2.3, 66/33 MHz 64-Bits, with Universal Signaling. PCI burst rates to 400MB/sec.
- Standard cPCI-6U form factor. (Call for availability in PCI and PCI-Express form factors).
- DMA Engine supports block-mode and demand-mode transfers in two DMA channels.
- Remote ground sensing to minimize sindle-ended errors.
- Software-controlled Front-Panel LED indicator.
- Rear-Panel system I/O connections.
- On-demand autocalibration of all channels.

Applications:

✓ Precision Voltage Source	✓ Acoustic Research	✓ Waveform Synthesis
✓ Audio Synthesis	✓ Process Control	✓ Industrial Robotics

REV: 060712

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FUNCTIONAL DESCRIPTION

The cPCI6U64-20AOF16C500KR is a precision 20-Bit analog output product that provides 16 simultaneously clocked output channels in a 6U cPCI form factor. Outputs can be clocked at rates up to 500 KSPS per channel, and are supported by a 256K-Sample FIFO data buffer. Both continuous and burst clocking modes are supported, and voltage ranges are software-selectable as ±6V and ±3V, or optionally as ±10V and ±5V. Clocking and triggering rates can be derived from an internal rate generator, or from external clock and trigger sources to support the synchronous operation of multiple boards.

Each analog output channel implements a weighted-DAC R-2R configuration, which minimizes latency and has no minimum clocking rate. An 8th-order lowpass reconstruction filter in each channel suppresses harmonics and undesirable artifacts in output functions. The outputs can be factory-configured for single-ended operation or for 3-wire differential operation.

On-demand autocalibration determines and applies error correction for all output channels. Eight bidirectional digital I/O lines are programmable as inputs or outputs.

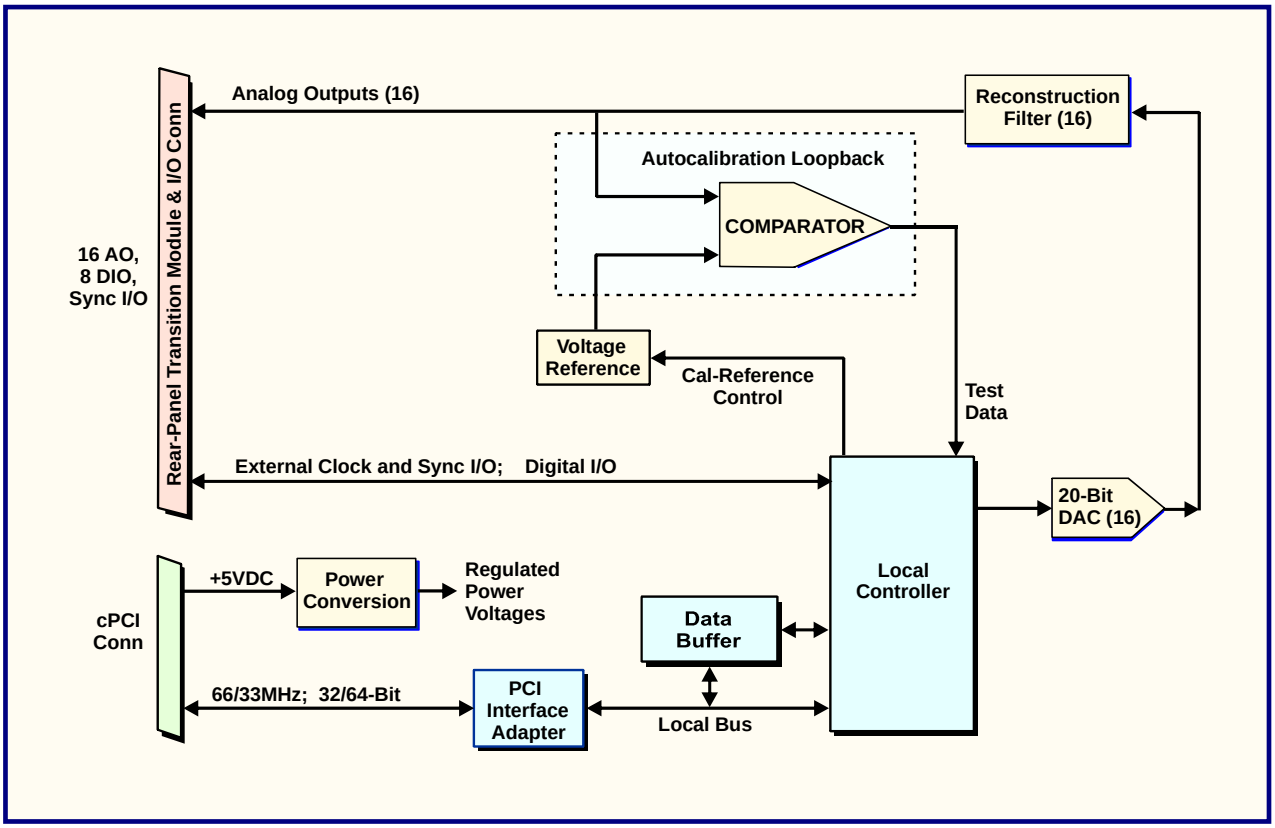

Figure 1. cPCI6U64-20AOF16C500KR; Functional Organization

This product complies with the IEEE PCI local bus specification Revision 2.3. System connections are made at the rear panel. Power requirements consist of +5 VDC in compliance with the PCI specification, and analog power voltages are generated internally. Operation over the specified temperature range is achieved with conventional air cooling.

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PERFORMANCE SPECIFICATIONS

At +25 ^{O}C, with specified operating voltages

Analog Output Characteristics:

Configuration:	16 simultaneously clocked single-ended output channels with a dedicated 20-Bit R-2R DAC per channel. Optionally available as 3-wire balanced differential. Eight and four-Channel versions also available.
Voltage Ranges:	Software-selectable as ±6V and ±3V, or optionally as ±10V and ±5V.
Output Resistance:	1.0 Ohm maximum at I/O connector pins.
Output protection:	Withstands sustained short-circuiting to ground
Loading:	Zero to ±10ma, any single channel. *Maximum total of 80mA on all outputs.* Stable with any load capacitance up to 20,000 PFD.
Line Imbalance:	(With optional 3-Wire differential output configuration) ±15mV max.
Signal/Noise Ratio (SNR):	90dB typical on ±10V range; 10Hz - 250kHz.
Glitch Impulse:	10 nV-s, typical on the ±6V range

Analog Output Transfer Characteristics:

Resolution:	20 Bits (0.0001 percent of FSR)
Output Access:	256 K-Sample FIFO buffer.
DC Accuracy: (Max error, no-load)	S.E. Range / S.E. Zero Accuracy / S.E. ±Fullscale Accuracy ±6V / ±1.0mV / ±2.0mV ±3V / ±0.8mV / ±1.5mV Diff Range* / Diff Zero Accuracy / Diff +Fullscale Accuracy ±6V / ±2.0mV / ±4.5mV ±3V / ±1.5mV / ±3.0mV * Differential output is measured between OUTPUT-XX-HI and OUTPUT-XX-LO.
Settling Time:	11us to 0.1 percent of step, typical with halfscale step, no-load, filters disabled.
Bandwidth:	See 'Output Filters' below.
Crosstalk Rejection:	90 dB minimum, DC-100 kHz
Integral Nonlinearity:	±0.002 percent of FSR, maximum
Differential Nonlinearity:	±0.001 percent of FSR, maximum

Analog Output Operating Modes and Controls

Output Data Buffer:	256 K-sample FIFO
Sample Clock Sources:	Internal rate generator; External Clock I/O, Software clock. 500kHz max.
Triggering Sources:	Internal rate generator, TTL external trigger I/O, Software trigger.
Clocking Modes:	Continuous or periodic. Supports triggered functions.
Internal Rate Generator:	Programmable from 3 to 500,000 output clocks per second. Divides Master Clock frequency to clocking rate using a 24-bit divider.
Output Filters:	Selectable as enabled (filtered) or disabled (nonfiltered). The filters are 8th Order continuous-time lowpass, with 75dB typical stopband attenuation at 1.5Fc for elliptic response. and are available with corner frequencies up to 300kHz. See "Ordering Options" for details.
External Sync I/O:	Clock and trigger, software-selectable as TTL or LVDS.
LED Indicator:	Software-controlled front-panel red LED indicator. Defaults to ON.
Output Data Format:	20 Bits, selectable as offset binary or two's complement coding, with attached end-of-function flag and channel number.

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Remote Ground Sense (Single-ended outputs only):

Single input to correct for differences in ground potentials between single-ended outputs and their loads.

Accuracy:	±1% (E.g.: 100mV potential difference is corrected to within ±1mV).
Input impedance:	5K ±0.1K
Compliance (range):	±2.0V.
Bandwidth:	800Hz, typical.

If not used, may be left disconnected or connected to OUT RTN.

Digital Input/Outputs:

Eight TTL I/O lines in two groups of four bits, group-configurable as inputs or outputs. 0.2ma maximum input loading as current source, 8ma output loading as either source or sink. Direct register control.

PCI Compatibility:

Conforms to PCI Specification 2.3: D32/64, 33/66MHz, 64-bit /32-Bit, universal (3.3V/5V) signaling.

Conforms to PICMG Specification Version 2.0, Revision 3.0.

Provides Two-Channel DMA as bus master in block and demand modes.

Geographic addressing and Hot-Swap functions are not supported.

Power Requirements:

+5.0 VDC ±0.25 VDC at 4.5 Amps typical, 5.5 Amps, maximum. All outputs loaded with 5mA.

Physical Dimensions (cPCI 6U):

Height:	233.3 mm
Depth:	21.6 mm
Width:	160.0 mm .

Environmental Specifications:

Ambient Temperature Range:

Standard Temperature:	Operating: 0 to +70 Degrees Celsius * Storage: -40 to +85 Degrees Celsius
Extended Temperature:	Operating: -40 to +80 Degrees Celsius * Storage: -40 to +85 Degrees Celsius
	* Air temperature at board surface.
Relative Humidity:	0 to 95%, non-condensing
Altitude:	Operation to 10,000 ft.
Cooling:	Conventional air cooling; 150 LFPM

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Ordering Information:

Specify the basic product model number followed by an option suffix "-A-B-C-D-E-F", as indicated below. For example, model number **cPCI6U64-20AOF16C500KR-16-49.152M-F1-SE-6V-0** describes a 6U CPCI module with 16 single-ended output channels, a 49.152MHz master clock frequency, Type-F1 filters, ±6V/3V output ranges, and no custom features

Table 1. Ordering Options

Optional Parameter	Value	Specify Option As:
Number of Channels:	16 output channels	A = 16
	12 output channels	A = 12
	8 output channels	A = 8
	4 output channels	A = 4
Master Clock Frequency [1]	Standard 49.152MHz [2]	B= 49.152M
	---	---
Reconstruction Filters (One per channel)	See Filter Characteristics; Table 2, below:	C= F1
		C= F2
		C= F3
Output Configuration	Single-Ended	D = SE
	3-Wire Differential	D = DF
Output Ranges:	Software-selectable ±6V, ±3V Output Ranges	E = 6V
	Software-selectable ±10V, ±5V Output Ranges	E = 10V [3]
Custom Features:	---	F = 0

[1] Contact factory for custom frequencies.
[2] Supports an exact clocking rate of 327.68KSPS (within the clock oscillator frequency tolerance of 25PPM).
[3] Contact factory for availability.

Table 2. Filter Characteristics

		Passband		Stopband [1]	
Option	**Type** [2]	**Frequency** [3] (20kHz to 200kHz)	**Maximum Attenuation at Corner Frequency**	**Frequency** [3]	**Minimum Attenuation In Stopband**
F1	Elliptic	DC - 140kHz	3dB	210kHz	75dB
F2	(TBD)	---	---	---	---
F3		---	---	---	---

[1] Extends beyond 1.0 MHz.
[2] Specify **Elliptic, Chebyshev or Butterworth**; all are 8th order with lowpass response.
[3] ±5%.

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Table 3. System I/O Connectors (50-Pin D-Sub)

	RP-P1		RP-P2
Pin	Function	Pin	Function
1	OUT CH 00 HI [1]	1	OUT CH 10 HI [1]
34	OUT CH 00 LO [1]	34	OUT CH 10 LO [1]
18	OUT RTN	18	OUT RTN
2	OUT RTN	2	OUT RTN
35	OUT CH 01 HI	35	OUT CH 11 HI
19	OUT CH 01 LO	19	OUT CH 11 LO
3	OUT RTN	3	OUT RTN
36	OUT RTN	36	OUT RTN
20	OUT CH 02 HI	20	OUT CH 12 HI
4	OUT CH 02 LO	4	OUT CH 12 LO
37	OUT RTN	37	OUT RTN
21	OUT RTN	21	OUT RTN
5	OUT CH 03 HI	5	OUT CH 13 HI
38	OUT CH 03 LO	38	OUT CH 13 LO
22	OUT RTN	22	OUT RTN
6	OUT RTN	6	OUT RTN
39	OUT CH 04 HI	39	OUT CH 14 HI
23	OUT CH 04 LO	23	OUT CH 14 LO
7	OUT RTN	7	OUT RTN
40	OUT RTN	40	OUT RTN
24	OUT CH 05 HI	24	OUT CH 15 HI
8	OUT CH 05 LO	8	OUT CH 15 LO
41	OUT RTN	41	OUT RTN
25	OUT RTN	25	OUT RTN
9	OUT CH 06 HI	9	OUT RTN
42	OUT CH 06 LO	42	OUT RTN
26	OUT RTN	26	OUT RTN
10	OUT RTN	10	OUT RTN
43	OUT CH 07 HI	43	OUT RTN
27	OUT CH 07 LO	27	OUT RTN
11	OUT RTN	11	OUT RTN
44	OUT RTN	44	OUT RTN
28	OUT CH 08 HI	28	OUT RTN
12	OUT CH 08 LO	12	OUT RTN
45	OUT RTN	45	OUT RTN
29	OUT RTN	29	OUT RTN
13	OUT CH 09 HI	13	OUT RTN
46	OUT CH 09 LO	46	OUT_RTN
30	OUT RTN	30	OUT RTN
14	REM GND SENSE [2]	14	OUT RTN
47	OUT RTN	47	OUT RTN
31	DIGITAL GND	31	DIGITAL GND
15	DIO 00	15	DIO 04
48	DIGITAL GND	48	DIGITAL GND
32	DIO 01	32	DIO 05
16	DIGITAL GND	16	DIGITAL GND
49	DIO 02	49	DIO 06
33	DIGITAL GND	33	DIGITAL GND
17	DIO 03	17	DIO 07
50	DIGITAL GND	50	DIGITAL GND

[1] In single-ended mode, 'HI' indicates signal, and 'LO' indicates no-connect.

[2] Active for single-ended configurations only.

System Cable Mating Connectors:

50-Pin D-Subminiature IDC connector:
Tyco # 1658607-1,
with strain-relief: Tyco # 746785-1.

15-Pin D-Subminiature IDC connector:
Tyco # 1658608-3,
with strain-relief: Tyco # 747275-3.

Table 4. Sync I/O Connector RP-P3 (15-Pin D-Sub)

Pin	Signal
1	EXT SYNC INPUT HI
9	EXT SYNC INPUT LO
2	DIGITAL GND
10	DIGITAL GND
3	EXT CLK INPUT HI
11	EXT CLK INPUT LO
4	DIGITAL GND
12	DIGITAL GND
5	EXT SYNC OUT HI
13	EXT SYNC OUT LO
6	DIGITAL GND
14	DIGITAL GND
7	EXT CLK OUT HI
15	EXT CLK OUT LO
8	DIGITAL GND

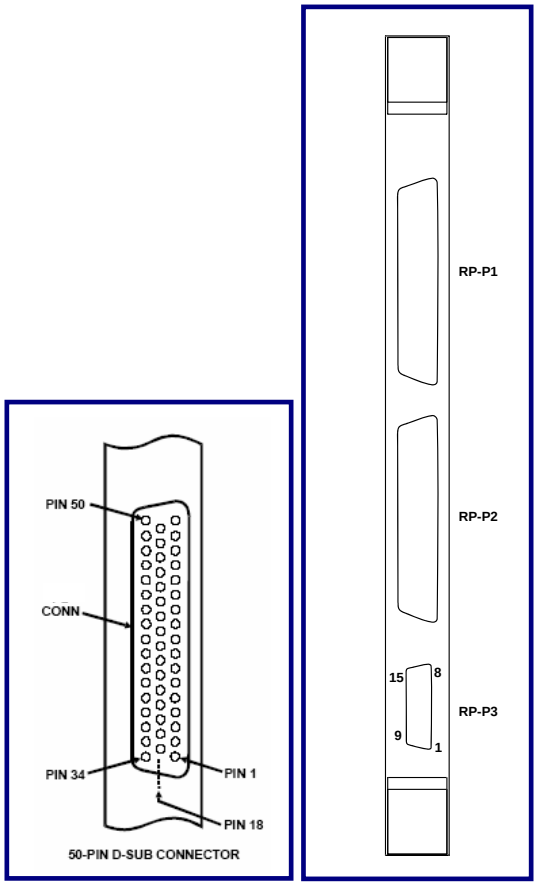

Figure 2. I/O Connectors

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