# CPCI-DDA02/16, 04/16, 08/16
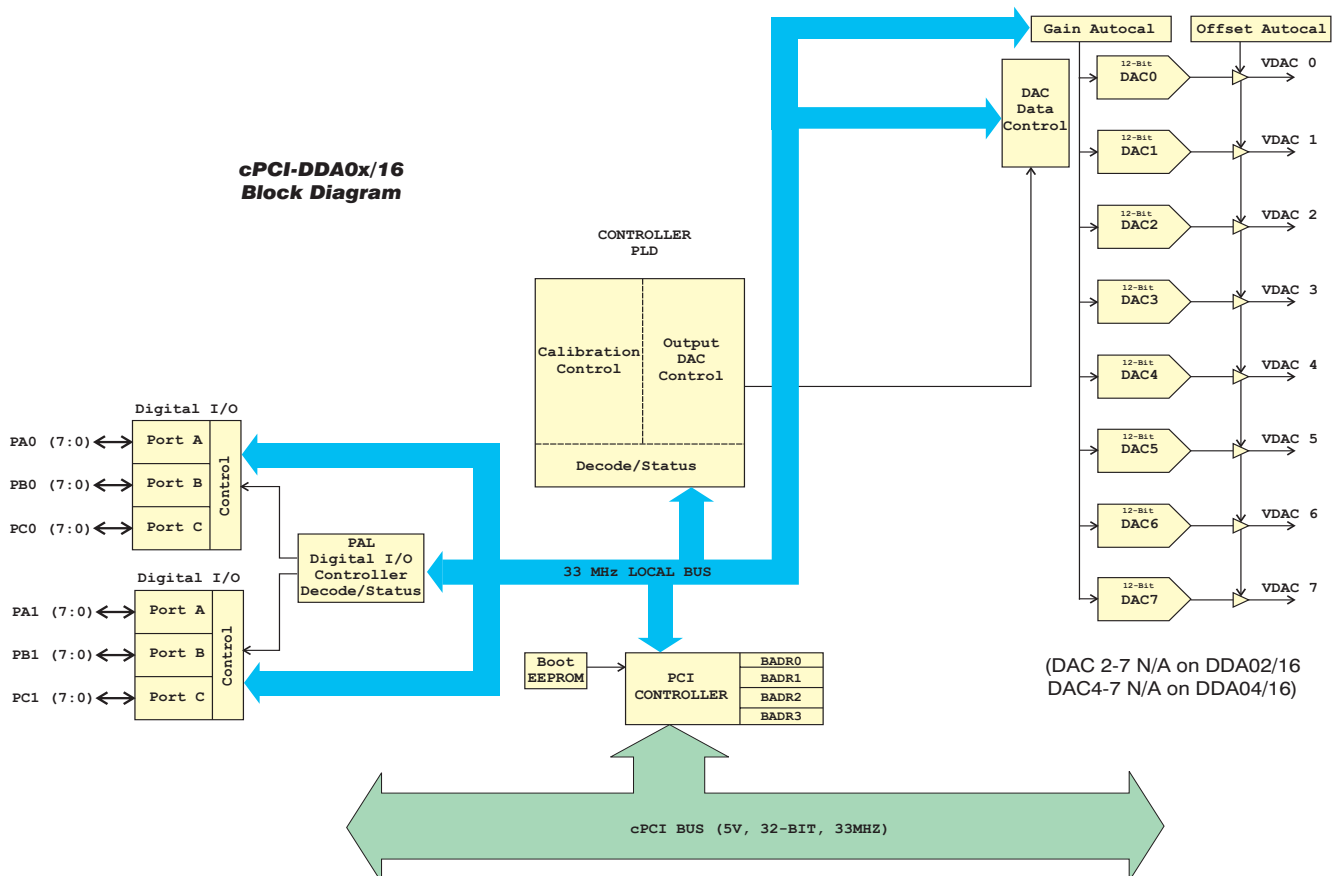
*CompactPCI-bus Compatible, 2, 4, & 8-Channel, 16-Bit Analog Output Board with 48 Digital I/O bits*

## Features

- 2, 4, & 8 channel analog output models
- One D/A per channel
- 16-bit D/A resolution (1 in 65,536)
- 48 bits of high output digital I/O
- High current digital outputs
- Digital I/O section is connector compatible with all ComputerBoards 50-pin based signal conditioning
- Unique *in-system* calibration function allows the removal of wiring IR errors
- Fully Plug-and-Play
- Fully Autocalibrating

## Block Diagram

**cPCI-DDA0x/16 Block Diagram**

Gain Autocal | Offset Autocal

VDAC 0 — 12-Bit DAC0
VDAC 1 — 12-Bit DAC1
VDAC 2 — 12-Bit DAC2
VDAC 3 — 12-Bit DAC3
VDAC 4 — 12-Bit DAC4
VDAC 5 — 12-Bit DAC5
VDAC 6 — 12-Bit DAC6
VDAC 7 — 12-Bit DAC7

DAC Data Control

CONTROLLER PLD
- Calibration Control
- Output DAC Control
- Decode/Status

Digital I/O
PA0 (7:0) — Port A
PB0 (7:0) — Port B
PC0 (7:0) — Port C
Control

Digital I/O
PA1 (7:0) — Port A
PB1 (7:0) — Port B
PC1 (7:0) — Port C
Control

PAL Digital I/O Controller Decode/Status

33 MHz LOCAL BUS

Boot EEPROM

PCI CONTROLLER
- BADR0
- BADR1
- BADR2
- BADR3

cPCI BUS (5V, 32-BIT, 33MHZ)

(DAC 2-7 N/A on DDA02/16
DAC4-7 N/A on DDA04/16)

# Functional Description

The CPCI-DDA0x/16 multifunction analog output and digital I/O boards set a new standard for high performance, analog output on the CompactPCI-bus. The CPCI-DDA0x/16 family consists of three models with either 2, 4, or 8 output channels and 48 bits of digital I/O. The CPCI-DDA0x/16 analog output channels may be updated independently or simultaneously.

The CPCI-DDA0x/16 is completely plug-and-play. There are no switches, jumpers or potentiometers on the board. All board addresses, interrupt channels, etc. are set by your computer's plug-and-play software. Even calibration is performed via software by using on-board trim D/A converters. A powerful *in-system* calibration capability allows the board to be calibrated after installation, and eliminates connection wire and connector IR errors. (For more details on our digital calibration techniques, please see our calibration tutorial on page 270).

## Analog Outputs

The CPCI-DDA0x/16 provides two, four, or eight channels of 16-bit analog output (one part in 65536). Each channel is implemented with an independent D/A converter, and the analog outputs are updated under software control. Software selectable output ranges of 0-10V, 0-5V, 0-2.5V, ±10V, ±5V, and ±2.5V are provided and channels may be set at different ranges. The D/A outputs provide rated accuracy to ±5 mA, are short circuit protected (25 mA limit) and are cleared to 0 volts on power up or reset.

The table below details the input ranges and resolutions for the available input configurations and gains.

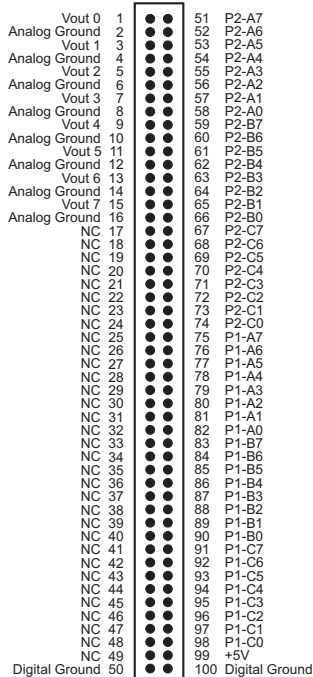| Bipolar | | Unipolar | |
|---|---|---|---|
| **Range** | **Resolution** | **Range** | **Resolution** |
| ±10V | 305 µV | 0-10V | 152.6 µV |
| ±5V | 152.6 µV | 0-5V | 76.29 µV |
| ±2.5V | 76.29 µV | 0-2.5V | 38.15 µV |

## Parallel Digital I/O

The CPCI-DDA0x/16 provide 48 bits of parallel, digital I/O in the form of four 8-bit ports and four 4-bit ports. This digital capability is based on an on-board, high output current emulation of the 82C55 mode 0 and allows each of the ports to be set independently as input or output. On power up or reset, the ports default to the input state (high impedance). The digital I/O section of the board is fully connector compatible with all of ComputerBoards 50-pin digital signal conditioning boards.

# I/O Connector & Cables

All I/O signals are brought through a 100-pin high-density connector. The standard C100HD50-X series cable splits the 100 pins into two separate 50-pin cables. The first 50-pin cable contains pins 1-50, while the second carries pins 51-100 keeping the analog signals in one cable and the digital in another. This configuration minimizes noise in the analog signal lines and greatly simplifies field wiring as well as connections to external signal conditioning products. The C100HD50-X series cable then connects to either the SCB-50 screw connection box (one required) or the CIO-MINI50 (two required).

The C100HDS-X series shielded cable provides greater noise immunity and is compatible with the SCB-100 screw connection box.

| | | | | |
|---|---|---|---|---|
| Vout 0 | 1 | ● ● | 51 | P2-A7 |
| Analog Ground | 2 | ● ● | 52 | P2-A6 |
| Vout 1 | 3 | ● ● | 53 | P2-A5 |
| Analog Ground | 4 | ● ● | 54 | P2-A4 |
| Vout 2 | 5 | ● ● | 55 | P2-A3 |
| Analog Ground | 6 | ● ● | 56 | P2-A2 |
| Vout 3 | 7 | ● ● | 57 | P2-A1 |
| Analog Ground | 8 | ● ● | 58 | P2-A0 |
| Vout 4 | 9 | ● ● | 59 | P2-B7 |
| Analog Ground | 10 | ● ● | 60 | P2-B6 |
| Vout 5 | 11 | ● ● | 61 | P2-B5 |
| Analog Ground | 12 | ● ● | 62 | P2-B4 |
| Vout 6 | 13 | ● ● | 63 | P2-B3 |
| Analog Ground | 14 | ● ● | 64 | P2-B2 |
| Vout 7 | 15 | ● ● | 65 | P2-B1 |
| Analog Ground | 16 | ● ● | 66 | P2-B0 |
| NC | 17 | ● ● | 67 | P2-C7 |
| NC | 18 | ● ● | 68 | P2-C6 |
| NC | 19 | ● ● | 69 | P2-C5 |
| NC | 20 | ● ● | 70 | P2-C4 |
| NC | 21 | ● ● | 71 | P2-C3 |
| NC | 22 | ● ● | 72 | P2-C2 |
| NC | 23 | ● ● | 73 | P2-C1 |
| NC | 24 | ● ● | 74 | P2-C0 |
| NC | 25 | ● ● | 75 | P1-A7 |
| NC | 26 | ● ● | 76 | P1-A6 |
| NC | 27 | ● ● | 77 | P1-A5 |
| NC | 28 | ● ● | 78 | P1-A4 |
| NC | 29 | ● ● | 79 | P1-A3 |
| NC | 30 | ● ● | 80 | P1-A2 |
| NC | 31 | ● ● | 81 | P1-A1 |
| NC | 32 | ● ● | 82 | P1-A0 |
| NC | 33 | ● ● | 83 | P1-B7 |
| NC | 34 | ● ● | 84 | P1-B6 |
| NC | 35 | ● ● | 85 | P1-B5 |
| NC | 36 | ● ● | 86 | P1-B4 |
| NC | 37 | ● ● | 87 | P1-B3 |
| NC | 38 | ● ● | 88 | P1-B2 |
| NC | 39 | ● ● | 89 | P1-B1 |
| NC | 40 | ● ● | 90 | P1-B0 |
| NC | 41 | ● ● | 91 | P1-C7 |
| NC | 42 | ● ● | 92 | P1-C6 |
| NC | 43 | ● ● | 93 | P1-C5 |
| NC | 44 | ● ● | 94 | P1-C4 |
| NC | 45 | ● ● | 95 | P1-C3 |
| NC | 46 | ● ● | 96 | P1-C2 |
| NC | 47 | ● ● | 97 | P1-C1 |
| NC | 48 | ● ● | 98 | P1-C0 |
| NC | 49 | ● ● | 99 | +5V |
| Digital Ground | 50 | ● ● | 100 | Digital Ground |

Connector Diagram

# Software

All CPCI-DDA0x/16 boards come complete with ComputerBoards' powerful *Insta*Cal™ software package. *Insta*Cal is a complete installation, calibration and test program for Computer-Boards data acquisition and control boards. Complete with extensive error checking, *Insta*Cal guides you through installation and setup of your data acquisition board and creates the board configuration file for use by your program or application software package. *Insta*Cal is described in detail within the software section of this website.



*Insta*CAL provides installation, calibration and test functions for all of our boards!

The CPCI-DDA0x/16 boards are fully supported by ComputerBoards' powerful Universal Library. Universal Library is a complete set of I/O libraries and drivers for all of our boards, in all Windows based languages. When using the Universal Library you can switch boards or even programming languages and the syntax remains constant. For details on Universal Library, please refer to this website's software section.

The CPCI-DDA0x/16 boards are fully supported by a wide variety of applications software packages including SoftWIRE™, DAS-Wizard™, (and DAS-Wizard Pro™), HP VEE®, HP VEE Lab and LabVIEW™. For further details on these, as well as a variety of other software packages, please refer to the software section of this website.

# CPCI-DDA0x/16 Specifications

## Analog Output:

| | |
|---|---|
| D/A convertor type | Voltage Output |
| Resolution | 16-bits |
| Number of channels | 8, 4 or 2 depending on model |
| Output Ranges | ±10V, ±5V, ±2.5V, 0 - 10V, 0 - 5V, 0 - 2.5V. Each channel independently programmable. |
| Data transfer modes | Programmed I/O. |
| Offset error | ±1.5 LSB (calibrated) |
| Gain error | ±1.5 LSB (calibrated) |
| Differential nonlinearity | ±0.5 LSB typ., ±1 LSB max (over temp) |
| Integral nonlinearity | ±0.5 LSB typ., ±4 LSB max (over temp) |
| Monotonicity | 16-bits |
| D/A Gain drift | ±0.1 ppm/°C |
| D/A Offset drift | ±0.5 ppm/°C |
| Throughput | PC dependent |
| Settling time | 20µs max (20V step to ±1.5 LSB) 12µs typ (20V step to ±1.5 LSB) |
| Slew Rate | 2.5 V/µs |
| Current Drive | ±5 mA |
| Output short-circuit duration | 25 mA indefinite |
| Output coupling | DC |
| Output impedance | 0.011 ohms max |
| In-system calibration range | In-system calibration can compensate for connector/cable resistance up to 7 ohms |
| Miscellaneous | Double buffered output latches Update DACs individually or simultaneously (software selectable) |
| Power up and reset state | all DAC's cleared to 0 volts |

## Digital Input / Output

| | |
|---|---|
| Number of channels | 48 I/O |
| Configuration | 4 banks of 8, 4 banks of 4, programmable by bank as input or output |
| Port configurations | Dual 8255 mode 0 emulation |
| Digital Interface chips | Output: 74S244   Input: 74LS373 |
| Output High | 2.4 volts @ -15mA min |
| Output Low | 0.5 volts @ 64 mA min |
| Input High | 2.0 volts min, 7 volts absolute max |
| Input Low | 0.8 volts max, -0.5 volts absolute min |
| Power On / Reset State | All ports to input mode |

## Power consumption

**CPCI-DDA08/16**

| | |
|---|---|
| +5V Operating | 1.8A typical, 2.2A max |
| +12V | not used |
| -12V | not used |

**CPCI-DDA04/16**

| | |
|---|---|
| +5V Operating | 1.6A typical, 2.1A max |
| +12V | not used |
| -12V | not used |

**CPCI-DDA02/16**

| | |
|---|---|
| +5V Operating | 1.4A typical, 2.0A max |
| +12V | not used |
| -12V | not used |

## Environmental

| | |
|---|---|
| Operating temp range | 0 to 70 °C |
| Storage temp range | -40 to 100 °C |
| Humidity | 0 to 90% non-condensing |

# Auto-Calibration / Self-Calibration

In keeping with general plug-and-play standards, the CPCI-DDA0x/16 boards have no switches, jumpers or potentiometers. *Auto-calibration* is performed with trim D/A converters.

The calibration factors that control the digital trim components are stored in EEPROM on the board. You can remove the board from one computer, install it in another, and it will still provide calibrated data.

# Signal Conditioning & Accessories
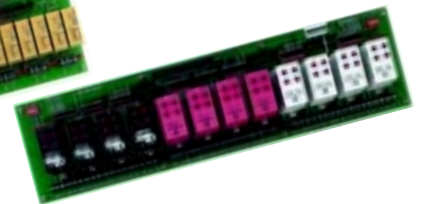
## Analog Signal Conditioning
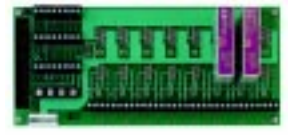


**ISO-DA02/P***    2-channel ISO-5B module rack connects a ISO-5B module to each analog output channel.
**ISO-DA04/P***    4-channel ISO-5B module rack connects a ISO-5B module to each analog output channel.
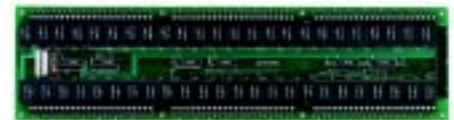**ISO-DA08/P***    8-channel ISO-5B module rack connects a ISO-5B module to each analog output channel.

## Solid State I/O Modules & Racks



**SSR-RACK48***    48 channel solid state I/O module rack.
**SSR-RACK24***    24 channel solid state I/O module rack.

## Electromechanical Relays



**CIO-SERB48***    48 channel relay rack with 10 Amp, socketed and field replacable Form C relays.
**CIO-ERB48***    48 channel relay rack with 6 Amp, Form C relays.
**CIO-ERB24***    24 channel relay rack with 6 Amp, Form C relays
**CIO-SERB24***    24 channel fault detecting relay rack with 10 Amp, socketed and field replacable Form C relays.
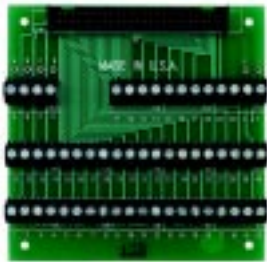
### Screw Terminal Accessory Boards and Boxes

**SCB-Series Screw Connection Box**
The 100-pin connector is compatible with the C100HD50-X series cable and the SCB-50 (1 required). The C100HDS-X series shielded cable provides maximum noise immunity and is compatible with the SCB-100 screw terminal interface box.

**CIO-MINI-50 Screw Terminal Board**
The 100-pin connector is compatible with the C100HD50-X series cable and the CIO-MINI50 (2 required).

**CPCI-DDA02/16**  2-channel, 16-bit D/A & high-current digital I/O board for PCI-bus computers.

**CPCI-DDA04/16**  4-channel, 16-bit D/A & high-current digital I/O board for PCI-bus computers.
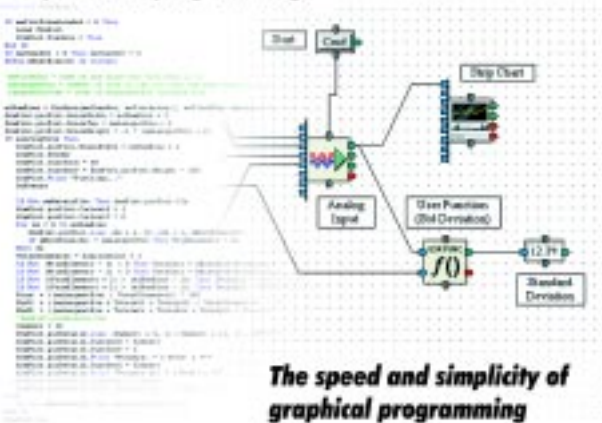
**CPCI-DDA08/16**  8-channel, 16-bit D/A & high-current digital I/O board for PCI-bus computers.

The CIO-MINI50 is available with detachable screw terminals. These terminals simplify field wiring and board replacements. To specify detachable screw terminals order the CIO-MINI50/DST

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