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CIO-DDA06/16JR

Six 16-bit Analog Ouputs, 24 High-Drive Digital I/O

User's Guide

MEASUREMENT COMPUTING™

CIO-DDA06/JR

Analog Output Board

User's Guide



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About this User's Guide

What you will learn from this user's guide

This user's guide explains how to install, configure, and use the CIO-DDA06/JR board so that you get the most out of its analog output features. This user's guide also refers you to related documents available on our web site, and to technical support resources.

Conventions in this user's guide

The following conventions are used in this manual to convey special information:

For more information on …

Text presented in a box signifies additional information and helpful hints related to the subject matter you are reading.

Caution! Shaded caution statements present information to help you avoid injuring yourself and others, damaging your hardware, or losing your data.

<#:#> Angle brackets that enclose numbers separated by a colon signify a range of numbers, such as those assigned to registers, bit settings, etc.

bold text **Bold** text is used for the names of objects on the screen, such as buttons, text boxes, and check boxes. For example:
1. Insert the disk or CD and click the **OK** button.

italic text *Italic* text is used for the names of manuals and help topic titles, and to emphasize a word or phrase. For example:
The *Insta*Cal installation procedure is explained in the *Quick Start Guide*.
Never touch the exposed pins or circuit connections on the board.

Where to find more information

The following electronic documents provide information relevant to the operation of the CIO-DDA06/JR.

- MCC's *Specifications: CIO-DDA06/JR* (the PDF version of the *Specifications* chapter in this guide) is available on our web site at www.mccdaq.com/pdfs/CIO-DDA06_JR.pdf.
- MCC's *Quick Start Guide* is available on our web site at www.mccdaq.com/PDFmanuals/DAQ-Software-Quick-Start.pdf.
- MCC's *Guide to Signal Connections* is available on our web site at www.mccdaq.com/signals/signals.pdf.
- MCC's *Universal Library User's Guide* is available on our web site at www.mccdaq.com/PDFmanuals/sm-ul-user-guide.pdf.
- MCC's *Universal Library Function Reference* is available on our web site at www.mccdaq.com/PDFmanuals/sm-ul-functions.pdf.
- MCC's *Universal Library for LabVIEW™ User's Guide* is available on our web site at www.mccdaq.com/PDFmanuals/SM-UL-LabVIEW.pdf.

CIO-DDA06/JR User's Guide (this document) is also available on our web site at www.mccdaq.com/PDFmanuals/CIO-DDA06_JR.pdf.

Introducing the CIO-DDA06/JR

Overview: CIO-DDA06/JR features

The CIO-DDA06/JR can have a maximum of six analog ±5Volt output channels (two are installed) and 24 digital inputs and/or outputs. The analog outputs are dual-DAC AD7237s. The CIO-DDA06/JR is 100% register-compatible with the CIO-DDA06.

The analog outputs may be set for simultaneous update in groups of two, four or all six. Analog outputs are grouped as 0 and 1, 2 and 3, and 4 and 5. By selecting XFER on the jumper beside the DAC, each pair can be set for simultaneous transfer. In this way the CIO-DDA06/JR may be set to hold new values until all channels are loaded, then update any two, any four, or all six channels simultaneously. This is a very useful feature for multi-axis motor control.

The CIO-DDA06/JR digital I/O lines are an emulation of the 82C55 chip in mode 0. The digital I/O is equivalent to a CIO-DDIO24H high drive digital I/O board. This is sufficient to switch other TTL or similar inputs, as well as relays, LEDs or solid state relays.

Software features

For information on the features of *Insta*Cal and the other software included with your CIO-DDA06/JR, refer to the *Quick Start Guide* that shipped with your device. The *Quick Start Guide* is also available in PDF at www.mccdaq.com/PDFmanuals/DAQ-Software-Quick-Start.pdf.

Check www.mccdaq.com/download.htm for the latest software version.

CIO-DDA06/JR block diagram

CIO-DDA06/JR functions are illustrated in the block diagram shown here.

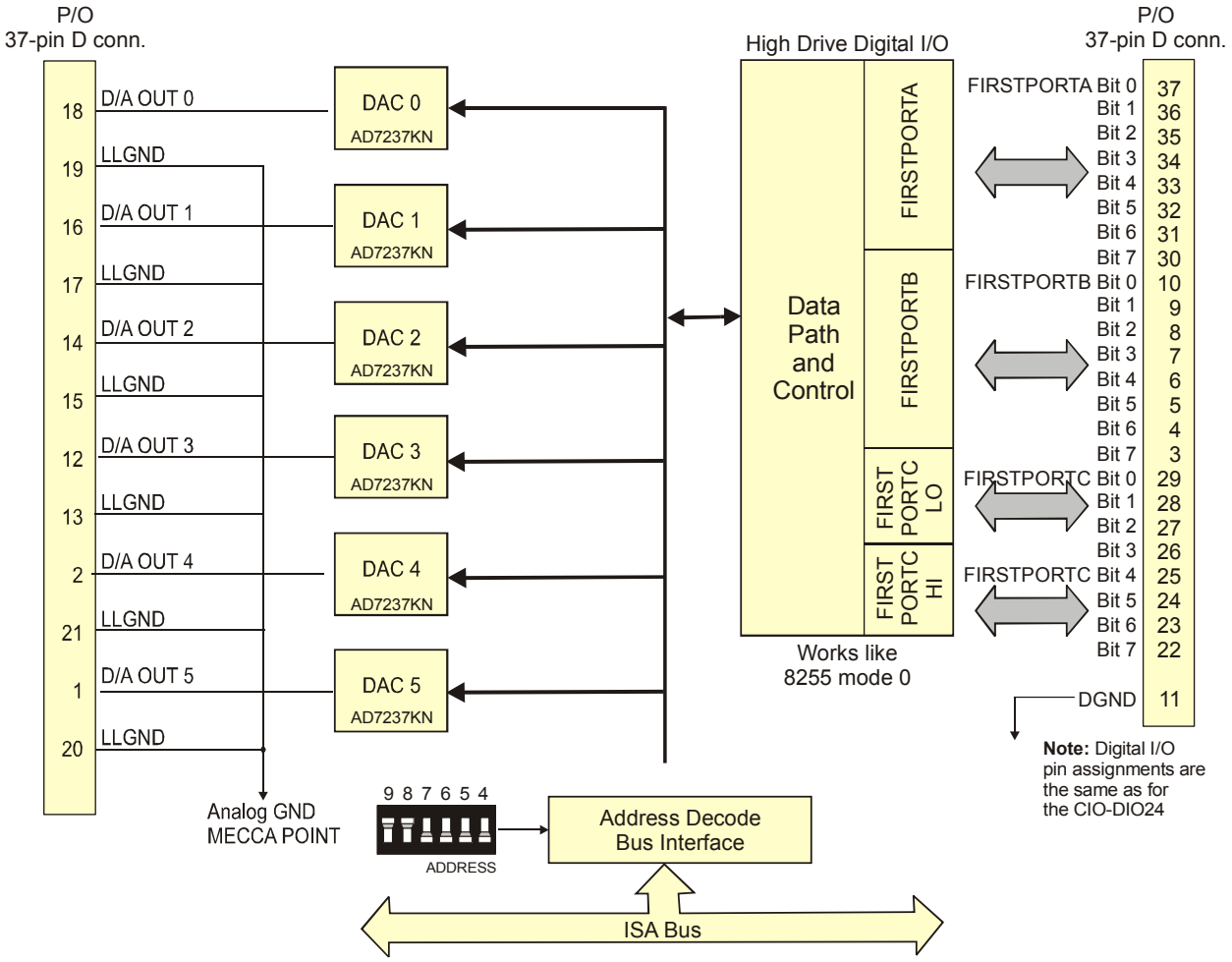


Figure 1. CIO-DDA06/JR Functional block diagram

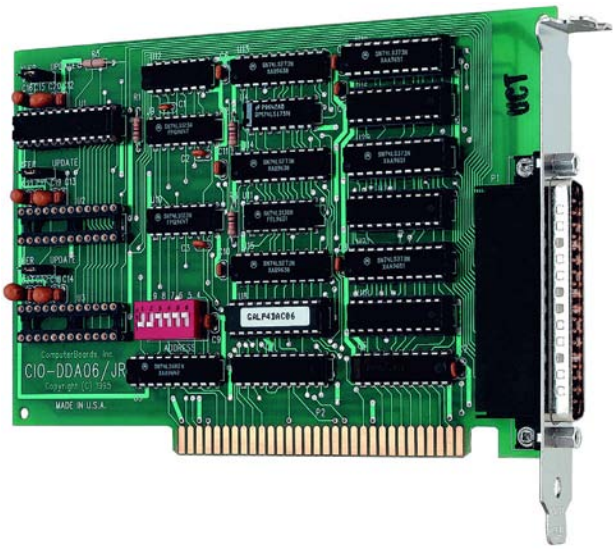
Installing the CIO-DDA06/JR

What comes with your CIO-DDA06/JR shipment?

The following items are shipped with the CIO-DDA06/JR.

Hardware

- CIO-DDA06/JR

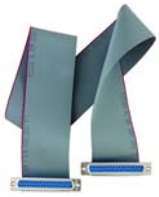


Additional documentation

In addition to this hardware user's guide, you should also receive the *Quick Start Guide* (available in PDF at www.mccdaq.com/PDFmanuals/DAQ-Software-Quick-Start.pdf). This booklet supplies a brief description of the software you received with your CIO-DDA06/JR and information regarding installation of that software. Please read this booklet completely before installing any software or hardware.

Optional components

- Cables



C37FF-x



C37FFS-x

- Signal termination and conditioning accessories

  MCC provides signal conditioning and termination products for use with the CIO-DDA06/JR. Refer to Field wiring, signal termination, and conditioning on page 13 for a complete list of compatible accessory products.

Unpacking the CIO-DDA06/JR

As with any electronic device, you should take care while handling to avoid damage from static electricity. Before removing the CIO-DDA06/JR from its packaging, ground yourself using a wrist strap or by simply touching the computer chassis or other grounded object to eliminate any stored static charge.

If any components are missing or damaged, notify Measurement Computing Corporation immediately by phone, fax, or e-mail:

- Phone: 508-946-5100 and follow the instructions for reaching Tech Support.
- Fax: 508-946-9500 to the attention of Tech Support
- Email: techsupport@mccdaq.com

Installing the software

Refer to the *Quick Start Guide* for instructions on installing the software on the *Measurement Computing Data Acquisition Software CD*. This booklet is available in PDF at www.mccdaq.com/PDFmanuals/DAQ-Software-Quick-Start.pdf.

Configuring the CIO-DDA06/JR

The CIO-DDA06/JR has one base address switch and a simultaneous update jumper for each DAC pair. The *Insta*Cal calibration and test program will show you how to set the switches. Run *Insta*Cal before you open your computer and install the board. The CIO-DDA06/JR is shipped with the factory-default settings listed in the table below.

Factory-configured default settings

Board label	Switch/jumper description	Default setting
ADDRESS	DIP switch for setting the base address	300h (768 decimal)
J1, J2, or J3	Jumpers to select simultaneous or single channel update for each DAC channel pair	UPDATE position (single channel update)

Before installing the CIO-DDA06/JR in the computer, verify that the board is configured with the settings that you want. Review the following information to change the default configuration of a jumper or switch on the CIO-DDA06/JR board.

Base address switch

Set the base address with the dip switch labeled **ADDRESS** located on the board. The easiest way to set the base address switch is to let *Insta*Cal show you the correct settings. However, if are already familiar with setting ISA base addresses, you may use the base address switch description below to guide your base address selection.

Unless there is already another board in your system using address 300 hex (768 decimal), leave the switches as they are set at the factory. Figure 2 shows the base address switch set to its default base address of 300 hex.

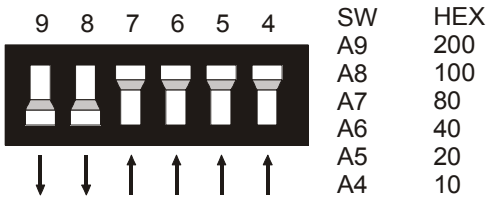


Figure 2. Base address switch

In the default configuration shown in Figure 2, addresses 9 and 8 are DOWN, and all others are UP. Address 9 = 200 hex (512 decimal), and address 8 = 100 hex (256 decimal). When added together they equal 300 hex (768 decimal).

Disregard the numbers printed on the switch

When setting the base address, refer to the numbers printed in white on the printed circuit board.

Individual / simultaneous transfer jumper

The analog outputs can be jumpered so that new output data is held until several DACs are loaded with new digital data. Then, as a group, the data for each DAC is simultaneously transferred and the DAC voltage outputs are updated when any of the addresses BASE + 0 to BASE + B are read.

The analog output chips are dual DACs (two analog outputs per chip). A single jumper sets both DACs on a single chip to be either simultaneously transferred on a read, or individually updated when the control register is written. The jumpers are labeled J1, J2 or J3 on the board.

- J1 sets the transfer mode for channels 0 and 1.
- J2 sets the transfer mode for channels 2 and 3.
- J3 sets the transfer mode for channels 4 and 5.

Figure 3 shows the jumper block configured for each update mode.

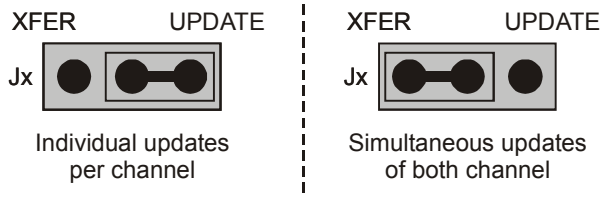


Figure 3. Individual / simultaneous update jumper

- When the jumpers are in the **XFER** position, new output data is held until one or more DACs have been loaded with new digital data. The new data transfers to the voltage outputs as a group. The simultaneous transfers occur when any of the CIO-DDA06/JR addresses are read (and the jumpers are in the **XFER** position).
- When the jumpers are in the **UPDATE ##** position, the DAC channel pair is individually updated when the control register is written.

Installing the CIO-DDA06/JR

After you configure the board's switches and jumpers, you can install the CIO-DDA06/JR into your computer. To install your board, follow the steps below.

Install the MCC DAQ software before you install your board

The driver needed to run your board is installed with the MCC DAQ software. Therefore, you need to install the MCC DAQ software before you install your board. Refer to the *Quick Start Guide* for instructions on installing the software.

1. Turn your computer off, open it up, and insert your board into an available ISA slot.
2. Close your computer and turn it on.
3. To test your installation and configure your board, run the *Insta*Cal utility you installed in the previous section. Refer to the *Quick Start Guide* that came with your board www.mccdaq.com/PDFmanuals/DAQ-Software-Quick-Start.pdf for information on how to initially set up and load *Insta*Cal.

Connecting the board for I/O operations

Connectors, cables – main I/O connector

The table below lists the board connector type, applicable cables, and compatible accessory products.

Board connector, cables, and accessory equipment

Connector type	37-pin male "D" connector
Compatible cables	C37FF-x C37FFS-x DFCON-37 (D-connector, D-shell, and termination pins to construct your own cable)
Compatible accessory products with the C37FF-x cable or C37FFS-x cable	CIO-MINI37 CIO-TERMINAL CIO-SPADE50 SCB-37 SSR-RACK24 ENC-MINI37

Information on signal connections

General information regarding signal connection and configuration is available in the *Guide to Signal Connections* (available at www.mccdaq.com/signals/signals.pdf).

Pinout – main I/O connector

The CIO-DDA06/JR I/O connector is a standard 37-pin male connector that is accessible through the PC/AT expansion bracket. Pin assignments of 8255 digital signals are identical to those on the CIO-DIO24.

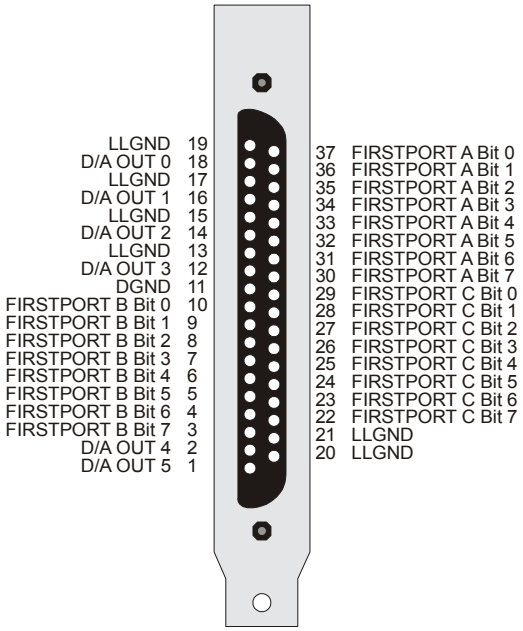


Figure 4. I/O connector pin-out

The analog outputs of the CIO-DDA06/JR are two-wire hook-ups. Always use low-level ground (LLGND) as the ground reference for all analog hook-ups. The output range of the CIO-DDA06/JR is ±5 volts and cannot be changed. There are no trimming pots on the board so no hardware calibration is necessary or possible.

All the digital outputs inputs on the CIO-DDA06/JR connector are TTL level. Before connecting external devices, review the specifications in this manual to avoid damage to the CIO-DDA06/JR.

Cabling

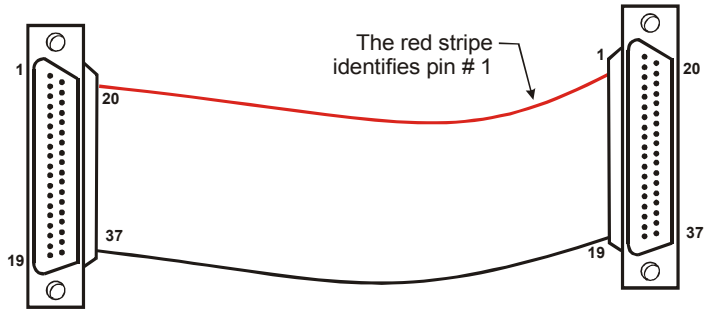


Figure 5. C37FF-x cable

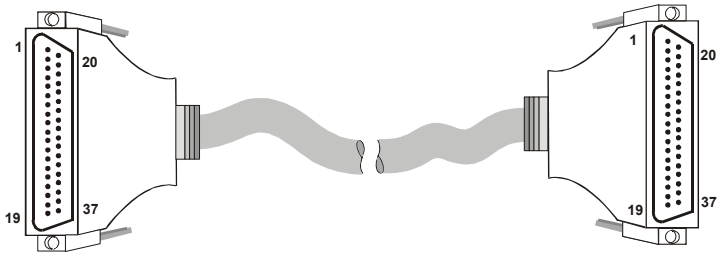


Figure 6. C37FFS-x cable

Field wiring, signal termination, and conditioning

You can use the following cabling, screw termination, and signal conditioning products with the CIO-DDA06/JR.

- DFCON37 – Connector kit that includes a 37-pin female D-connector, D-shell, 37 crimp pins, and cable termination kit to construct your own cable.
- CIO-MINI37 – 37-pin screw terminal board.
- CIO-TERMINAL – 37-pin screw terminal board with on-board prototyping area.
- CIO-SPADE50 — 16" X 4" termination panel which mates with both 37-pin and 50-pin connectors.
- SCB-37 – 37-conductor, shielded signal connection/screw terminal box.
- SSR-RACK24 – 24-channel, solid-state relay mounting rack for digital signal conditioning.
- ENC-MINI37– Enclosure for the MINI37.

Programming and Developing Applications

After following the installation instructions in Chapter 2, your board should now be installed and ready for use. In general there may be no correspondence among registers for different boards. Software written at the register level for other models will not function correctly with your board.

Programming languages

Measurement Computing's Universal Library provides access to board functions from a variety of Windows programming languages. If you are planning to write programs, or would like to run the example programs for Visual Basic® or any other language, please refer to the *Universal Library User's Guide* (available on our web site at www.mccdaq.com/PDFmanuals/sm-ul-user-guide.pdf).

Packaged applications programs

Many packaged application programs now have drivers for your board. If the package you own does not have drivers for your board, please fax or e-mail the package name and the revision number from the install disks. We will research the package for you and advise how to obtain drivers.

Some application drivers are included with the Universal Library package, but not with the application package. If you have purchased an application package directly from the software vendor, you may need to purchase our Universal Library and drivers. Please contact us by phone, fax or e-mail:

- Phone: 508-946-5100 and follow the instructions for reaching Tech Support.
- Fax: 508-946-9500 to the attention of Tech Support
- Email: techsupport@mccdaq.com

Register-level programming

You should use the Universal Library or one of the packaged application programs mentioned above to control your board. Only experienced programmers should try register-level programming.

If you need to program at the register level in your application, refer to the *Register Map for the CIO-DDA06/JR*. This document is available on our website at www.mccdaq.com/registermaps/RegMapCIO-DDA06-JR.pdf.

Specifications

Typical for 25 °C unless otherwise specified.

Specifications in *italic* text are guaranteed by design.

Analog output

Table 1. Analog output specifications

D/A type	AD7237KN
Resolution	12 bits
Number of channels	6 max, 2 installed
Voltage ranges	±5
Offset error	±3 LSB max
Gain error	±5 LSB max
Differential nonlinearity	±0.9 LSB max
Integral nonlinearity	±0.5 LSB
Monotonicity	*guaranteed*
Gain drift	±25 ppm/°C
Settling time (10V step to .01%)	10 µs max
Slew rate	3 V/µs
Current drive	±5 mA min
Output short-circuit current	80 mA typ
D/A pacing	Software paced
Data transfer	Programmed I/O
Throughput	*PC dependent*
Miscellaneous	▪ Double buffered output latches ▪ Update DACs individually or simultaneously (jumper selectable)

Digital input / output

Table 2. DIO specifications

Digital type	8255 emulation
Output	74S244
Input	74LS373
Number of channels	24 I/O
Configuration	*2 banks of 8, 2 banks of 4, programmable by bank as input or output*
Output high	2.4 volts min @ –15 mA
Output low	0.5 volts max @ 64 mA
Input high	2.0 volts min, 7 volts absolute max
Input low	0.8 volts max, –0.5 volts absolute min
Power-up / reset state	Input mode (high impedance)

Power consumption

Table 3. Power consumption specifications

+5 V	650 mA typ, 1196 mA max
+12 V	33 mA typ, 45 mA max (for each pair of D/A channels installed)
–12 V	9 mA typ, 15 mA max (for each pair of D/A channels installed)

Environmental

Table 4. Environmental specifications

Operating temperature range	*0 to 70 °C*
Storage temperature range	*–40 to 100 °C*
Humidity	*0 to 90% non-condensing*

Main connector and pin out

Table 5. Connector specifications

Connector type	37-pin male "D" connector
Compatible cables	C37FF-x C37FFS-x DFCON-37 (D-connector, D-shell, and termination pins to construct your own cable)
Compatible accessory products with the C37FF-x cable or C37FFS-x cable	CIO-MINI37 CIO-TERMINAL CIO-SPADE50 SCB-37 SSR-RACK24, CIO-ERB24, SSR-RACK08, CIO-ERB08 ENC-MINI37

Table 6. Connector pin out

Pin	Signal Name	Pin	Signal Name
1	D/A OUT 5	20	LLGND
2	D/A OUT 4	21	LLGND
3	FIRSTPORTB Bit 7	22	FIRSTPORTC Bit 7
4	FIRSTPORTB Bit 6	23	FIRSTPORTC Bit 6
5	FIRSTPORTB Bit 5	24	FIRSTPORTC Bit 5
6	FIRSTPORTB Bit 4	25	FIRSTPORTC Bit 4
7	FIRSTPORTB Bit 3	26	FIRSTPORTC Bit 3
8	FIRSTPORTB Bit 2	27	FIRSTPORTC Bit 2
9	FIRSTPORTB Bit 1	28	FIRSTPORTC Bit 1
10	FIRSTPORTB Bit 0	29	FIRSTPORTC Bit 0
11	DGND	30	FIRSTPORTA Bit 7
12	D/A OUT 3	31	FIRSTPORTA Bit 6
13	LLGND	32	FIRSTPORTA Bit 5
14	D/A OUT 2	33	FIRSTPORTA Bit 4
15	LLGND	34	FIRSTPORTA Bit 3
16	D/A OUT 1	35	FIRSTPORTA Bit 2
17	LLGND	36	FIRSTPORTA Bit 1
18	D/A OUT 0	37	FIRSTPORTA Bit 0
19	LLGND		

CE Declaration of Conformity

Manufacturer: Measurement Computing Corporation
Address: 10 Commerce Way
Suite 1008
Norton, MA 02766
USA

Category: Electrical equipment for measurement, control and laboratory use.

Measurement Computing Corporation declares under sole responsibility that the product

CIO-DDA06/JR

to which this declaration relates is in conformity with the relevant provisions of the following standards or other documents:

EU EMC Directive 89/336/EEC: Electromagnetic Compatibility, EN55022 (1987), EN50082-1

Emissions: Group 1, Class B

- EN55022 (1987): Radiated and Conducted emissions.

Immunity: EN50082-1

- IEC 801-2 (1987): Electrostatic Discharge immunity, Criteria B.
- IEC 801-3 (1984): Radiated Electromagnetic Field immunity Criteria A.
- IEC 801-4 (1988): Electric Fast Transient Burst immunity Criteria B.

Declaration of Conformity based on tests conducted by Chomerics Test Services, Woburn, MA 01801, USA in December, 1995. Test records are outlined in Chomerics Test Report #EMI0168B.95.

We hereby declare that the equipment specified conforms to the above Directives and Standards.



Carl Haapaoja, Director of Quality Assurance

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