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PCI-DIO16 Interface Adapter Board
User's Manual



Manual PN: 931-0005-00-A
June 2000

kontron
... always a Jump ahead!

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Kontron reserves the right to make changes without notice in product or component design as warranted by evolution in user needs or progress in engineering or manufacturing technology. Changes which affect the operation of the unit will be documented in the next revision of this user's guide.

Safety Instructions

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Before You Begin

Before handling the product, read the instructions and safety guidelines on the following pages to prevent damage to the product and to ensure your own personal safety. Refer to the "Advisories" section in the Preface for advisory conventions used in this user's guide, including the distinction between Warnings, Cautions, Important Notes, and Notes.

- Always use caution when handling/operating the computer. Only qualified, experienced, authorized electronics service personnel should access the interior of the computer. The power supplies produce high voltages and energy hazards, which can cause bodily harm.
- Use extreme caution when installing or removing components. Refer to the installation instructions in this user's guide for precautions and procedures. If you have any questions, please contact Kontron Post-Sales Technical Support.

WARNING



High voltages are present inside the chassis when the unit's power cord is plugged into an electrical outlet. Turn off system power, turn off the power supply, and then disconnect the power cord from its source before removing the chassis cover. Turning off the system power switch does not remove power to components.



B

When Working Inside a Computer

Before taking covers off a computer, perform the following steps:

1) Turn off the computer and any peripherals.

2) Disconnect the computer and peripherals from their power sources or subsystems to prevent electric shock or system board damage. This does not apply when hot swapping parts.

3) Follow the guidelines provided in "Preventing Electrostatic Discharge" on the following page.

4) Disconnect any telephone or telecommunications lines from the computer.

In addition, take note of these safety guidelines when appropriate:

- To help avoid possible damage to system boards, wait five seconds after turning off the computer before removing a component, removing a system board, or disconnecting a peripheral device from the computer.

- When you disconnect a cable, pull on its connector or on its strain-relief loop, not on the cable itself. Some cables have a connector with locking tabs. If you are disconnecting this type of cable, press in on the locking tabs before disconnecting the cable. As you pull connectors apart, keep them evenly aligned to avoid bending any connector pins. Also, before connecting a cable, make sure both connectors are correctly oriented and aligned.



CAUTION

Do not attempt to service the system yourself except as explained in this user's guide. Follow installation and troubleshooting instructions closely.



Preventing Electrostatic Discharge

Static electricity can harm system boards. Perform service at an ESD workstation and follow proper ESD procedure to reduce the risk of damage to components. Kontron strongly encourages you to follow proper ESD procedure, which can include wrist straps and smocks, when servicing equipment.

You can also take the following steps to prevent damage from electrostatic discharge (ESD):

- When unpacking a static-sensitive component from its shipping carton, do not remove the component's antistatic packing material until you are ready to install the component in a computer. Just before unwrapping the antistatic packaging, be sure you are at an ESD workstation or grounded. This willl discharge any static electricity that may have built up in your body.
- When transporting a sensitive component, first place it in an antistatic container or packaging.
- Handle all sensitive components at an ESD workstation. If possible, use antistatic floor pads and workbench pads.
- Handle components and boards with care. Don't touch the components or contacts on a board. Hold a board by its edges or by its metal mounting bracket.
- Do not handle or store system boards near strong electrostatic, electromagnetic, magnetic, or radioactive fields.

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Preface

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Customer Comments

If you have any difficulties using this user's guide, discover an error, or just want to provide some feedback, please send us a message using the online form under "Contact Us" on our web site (*www.kontron.com*) under "Technical Support." Detail any errors you find. We will correct the errors or problems as soon as possible and post the revised user's guide in our online Support Library. Thank you.



Note: You may also use the online form on our web site to submit comments or concerns about our products, or request technical support.

Advisory Conventions

Four types of advisories are used throughout the user guides to provide helpful information or to alert you to the potential for hardware damage or personal injury. They are Notes, Cautions, and Warnings. The following is an example of each type of advisory. Use caution when servicing electrical components.



Note: A note is used to make helpful information stand out.



Important: An important note indicates information that is important for you to know.

CAUTION



A CAUTION indicates potential damage to hardware and tells you how to avoid the problem.



WARNING



A WARNING indicates the potential for bodily harm and tells you how to avoid the problem.



Disclaimer: We have tried to identify all situations that may pose a warning or caution condition in this user's guide. However, Kontron does not claim to have covered all situations that might require the use of a Caution or Warning.

Unpacking

When unpacking, follow these steps:

1) After opening the box, save it and the packing material for possible future shipment.

2) Remove all items from the box. If any items listed on the purchase order are missing, notify Kontron customer service immediately.

3) Inspect the product for damage. If there is damage, notify Kontron customer service immediately. Refer to “Guarantee and Warranty Policy” for the return procedure.

Regulatory Compliance Statements

This section provides the FCC compliance statement for Class A devices and describes how to keep the system CE compliant.

FCC Compliance Statement for Class A Devices

The product(s) described in this user's guide has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the user's guide, may cause harmful interference to radio communications. Operation of this equipment in a residential area (domestic environment) is likely to cause harmful interference, in which case the user will be required to correct the interference (take adequate measures) at their own expense.

Changes or modifications not expressly approved by Kontron could void the user's authority to operate the equipment.



Note: The assembler of a personal computer system may be required to test the system and/or make necessary modifications if a system is found to cause harmful interference or to be noncompliant with the appropriate standards for its intended use.

CE Certification

CE The product(s) described in this user's guide complies with all applicable European Union (CE) directives if it has a CE marking. The CE declaration of conformity is provided on the last page of this user's guide. For computer systems to remain CE compliant, only CE-compliant parts may be used. Maintaining CE compliance also requires proper cable and cabling techniques. Although Kontron offers accessories, the customer must ensure that these products are installed with proper shielding to maintain CE compliance. Kontron does not offer engineering services for designing cabling systems. In addition, Kontron will not retest or recertify systems or components that have been reconfigured by customers.

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Guarantee and Warranty Policy

Guarantee

A thirty day money-back guarantee is provided on all standard products sold. Special order products are covered by our Limited Warranty, *however they may not be returned for refund or credit. EPROMs, RAM, Flash EPROMs or other forms of solid electronic media are not returnable for credit - but for replacement* only. An extended warranty is available. Consult the factory.

Refunds

In order to receive a refund on a product for the purchase price, the product must not have been damaged by the customer or by the common carrier chosen by the customer to return the goods and the product must be returned complete (meaning all user's guides, software, cables, etc.) within 30 days of receipt and in an as-new and resalable condition. The "Return Procedure" must be followed to assure a prompt refund.

Restocking Charges

Product returned *after* 30 days, and *before* 60 days, of the purchase will be subject to a minimum 20% restocking charge and charges for any damaged or missing parts. Products not returned within 60 days of purchase, or products which are not in an as-new and resalable condition, are not eligible for a credit return and will be returned to the customer.

Limited Warranty

Effective April 1, 1998, all products carry a 2-year limited warranty. Within 2 years of purchase, Kontron will repair or replace, at our option, any defective product. Kontron will service the warranty for all standard catalog products for the first two years from the date of shipment. Please note: The 2-year warranty may not apply to special promotion items. Please consult the factory for warranty verification.

The limited warranty is void if the product has been subjected to alteration, neglect, misuse, or abuse; if any repairs have been attempted by anyone other than Kontron or its authorized agent; or if the failure is caused by accident, acts of God, or other causes beyond the control of Kontron or the manufacturer. Neglect, misuse, and abuse shall include any installation, operation, or maintenance of the product other than in accordance with the user's guide.

No agent, dealer, distributor, service company, or other party is authorized to change, modify, or extend the terms of this Limited Warranty in any manner whatsoever. Kontron reserves the right to make changes or improvements in any product without incurring any obligation to similarly alter products previously purchased.

Return Procedure

For any Guarantee or Limited Warranty return, please contact Kontron Customer Service at 800-480-0044 or 858-677-0877 and obtain a Return Material Authorization (RMA) Number. All product(s) returned to Kontron for service or credit **must** be accompanied by a Return Material Authorization (RMA) Number. Freight on all returned items **must** be prepaid by the customer who is responsible for any loss or damage caused by common carrier in transit. Returns for Warranty **must** include a Failure Report for each unit, by serial number(s), as well as a copy of the original invoice showing the date of purchase.

To reduce risk of damage, returns of product must be in an Kontron shipping container. If the original container has been lost or damaged, new shipping containers may be obtained from Kontron Customer Service at a nominal cost.

Kontron owns all parts removed from repaired products. Kontron uses new and reconditioned parts made by various manufacturers in performing warranty repairs and building replacement products. If Kontron repairs or replaces a product, its warranty term is not extended.

Kontron will normally return your replacement or repaired items via ground. Overnight delivery or delivery via other carriers is available at an additional charge.

Shipments not in compliance with this Guarantee and Limited Warranty Return Policy will not be accepted by Kontron.

Limitation of Liability

In no event shall Kontron be liable for any defect in hardware, software, loss, or inadequacy of data of any kind, or for any direct, indirect, incidental, or consequential damages in connection with or arising out of the performance or use of any product furnished hereunder. Kontron's liability shall in no event exceed the purchase price of the product purchased hereunder. The foregoing limitation of liability shall be equally applicable to any service provided by Kontron or its authorized agent.

Some sales items and customized systems are **not** subject to the guarantee and limited warranty. However in these instances, any deviations will be disclosed prior to sales and noted in the original invoice. **Kontron reserves the right to refuse returns or credits on software or special order items.**

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Chapter 1
Introduction

Overview

ThePCI-DIO16 interface adapter board provides:

- Eight *reed relays*, which can latch power, data, or other electronic signals for control applications
- Eight *optically isolated inputs*, to allow monitoring of off-board switch closures or relays, or for general purpose monitoring needs

The PCI-DIO16 is PC compatible and PCI slot.

What's Included

The PCI-DIO16 board is shipped with the following items. If any of these items are missing or damaged, contact ICS Advent.

- PCI-DIO16 interface adapter board
- Software drivers
- User's Guide

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Chapter 2
Installation

Board Setup

The PCI-DIO16 board is a fully compliant PCI "Plug-n-Play" adapter. All board resources (I/O address and IRQ) are autoassigned by either your system BIOS or your "Plug-n-Play" operating system.

Software Installation

For Windows 98/2000/NT Users

Run setup from floppy disk 1. Then, install **SeaI/O** and select the **Digital I/O** software drivers. For users of DOS, Windows 3.1, etc., run disk 3 and the Read Me file.

System Installation

The PCI-DIO16 board can be installed in any PCI expansion slot.

1) Turn off system power. Disconnect the power cord from the electrical outlet.

2) Remove the chassis cover.

3) Locate an available PCI slot and remove the associated slot filler bracket from the rear panel of the chassis.

4) Gently insert the PCI-DIO16 into the PCI slot. Make sure that the board is seated properly.

5) Secure the board's slot bracket to the rear panel with a screw.

6) Replace the chassis cover.

7) Plug the power cord into an electrical outlet.

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Chapter 3
Technical Description

The PCI-DIO16 interface adapter board provides two parallel input/output (I/O) ports. The ports are organized as ports A, B, C, and D. Ports A and C are the only ports used. This is done to maintain compatibility with software written for the PCI-DIO32 board, which has twice as much I/O, and hence, uses more ports. Port A is an input port interfaced to optically isolated inputs. Port C is the reed relay output port.

Features

- Eight SPST relays
- One 8-bit optically isolated input port
- DB-37 male connector for relay outputs
- Highly reliable 10VA DIP reed relays
- Multiple adapters residing in one computer
- PCI 2.1 bus compatibility

Port A: Input port

Port A is an eight-bit input port connected to optically isolated input sensors. Each sensor can be used to interface a voltage input and then sense whether the voltage is on or off. Each sensor is isolated from every other sensor with respect to a common ground, and each is isolated with respect to the host PC ground. This means that signals such as low level AC line voltage, motor servo voltage, and control relay signals can be *sensed*, or read, by the PC without the risk of damage due to ground loops or ground faults.

Each sensor input pair has a current limiting resistor that is used to limit the input current to the opto-isolator. The opto-isolator has two “back-to-back” internal diodes. This allows AC or DC signals to be sensed, regardless of polarity. When the applied voltage is high enough to cause the LED in the opto-isolator to turn on, the output of the opto-isolator goes low (0 volts) and the signal is read as a low logic level (binary 0) by the PC. When the input signal is too low to turn on the opto-isolator, the output goes high and the port bit is read by the PC as a high logic level (binary 1).

The input impedance of each isolated input is approximately 560 ohms (factory default). The opto-isolator requires approximately 3 mA to turn on. The maximum input current is 60 mA. There are two things to consider when selecting the input resistor: (1) the turn-on voltage, sensed by the circuit; and (2) the maximum input voltage. The maximum input voltage must not provide too much power to the input resistor, and it also must not overdrive the opto-isolator input current specification. The following formulas apply:

- Turn-on current = 3 mA
- Isolator diode drop = 1.1V
- Maximum resistor power = 0.25W

Turn-on voltage = diode drop + (turn on current) x (resistance)

Or: 1.1 + (0.003) x R

Maximum voltage = square root of (0.25 x (resistor value))

The following table shows four common input resistors and the ranges associated with each:

Input Resistor (ohms)	**Value Turn-On (volts)**	**Max Input Voltage (volts)**	**Max Current (mA)**
220	1.76	7	27
560*	2.80	12	20
1K	4.10	16	15
2.2K	7.70	24	10

*Factory default

Increasing the input resistor accordingly can increase the maximum input voltage. Because socketed DIP resistor networks are used, they can easily be replaced with a different value. This can be done at the factory. **The input circuits are not intended for monitoring 120-volt AC circuits.** This voltage is too high for the circuits and dangerous to have on the board.

Table 3-1. Sensor Input Port Pin Assignments (P3 DB-37 Male)

Port A Bit	P3 Pin#
0	2,20
1	3,21
2	4,22
3	5,23
4	6,24
5	7,25
6	8,26
7	9,27

Port C: Output Port (Reed Relay)

Reed relays provide very high quality, long life, low current (ten watts maximum), dry-contact switch closures. Reed relays are not suited for high current applications. They can be destroyed by inductive load switching, where a spark occurs across the contacts internally. The relays are normally open, and close when energized. Each relay can be energized individually by writing a “1” to the proper port bit.

Relay Specifications

- Contact Power Ratings = 10 watts maximum
- Contact Voltage Maximum = 100VDC or 100VAC maximum
- Contact Current Maximum = 0.5 amps DC or AC RMS
- Contact Resistance, Initial = 0.15 ohms
- Rated Life:
  - Low Load = 200 million closures
  - Maximum Load = 100 million closures
- Contact Speed:
  - Operate = 0.5 ms
  - Release = 0.5 ms
  - Bounce = 0.5 ms
- Maximum Operating Speed = 600Hz

Table 3-2. Output Port (Reed Relay) Pin Assignments (P3 DB-37 Male)

Port C Bit	Relay	P3 Pin#
0	K1	10,28
1	K2	11,29
2	K3	12,30
3	K4	13,31
4	K5	14,32
5	K6	15,33
6	K7	16,34
7	K8	17,35

Table 3-3. Power and Ground Pin Assignments (P3 DB-37 Male)

Power	P3 Pin#
Ground	18,36,37
+ 5 Volts	19
+ 12 Volts	1

Software

The PCI-DIO16 board ships with ICS Advent's SeaI/O suite of Windows 95/98/2000/NT drivers on floppy disks 1 and 2. SeaI/O provides the user with a consistent and straightforward API, allowing the developer to concentrate on the details of the application instead of low level driver development. Popular development environments, including Visual C++, Visual Basic, and Delphi, are supported for application development. SeaI/O includes a utility for configuring the driver parameters under Windows 95/98/2000 and Windows NT, to further simplify installation.

For DOS, Windows 3.1, QNX, Linux, and other operating systems, please refer to the software included on floppy disk 3.

Programming Examples

All examples assume a base address of 300 hex.

To read inputs at Port A:

```
MOV DX, 300H            ;Set DX to Port A
IN AL, DX               ;Get Input Port Data
NOT AL                  ;Data read is negative logic
```

Programming example to set Relay #3 on, write a '1' in bit position D3, to port address Base+3, or 303 hex.

```
MOV DX, 303H            ;Set DX to Port D
MOV AL, 00001000B       ;Set bit 3 to a '1'
OUT DX, AL
```

Another method that takes into account the read-back capability of the output ports C and D:

```
MOV DX, 303H            ;Set DX to Port D
IN AL, DX               ;Get old port setting
NOT AL                  ;Invert bits – see note below
OR AL, 00001000B        ;OR in bit 3
OUT DX, AL              ;Set bit 3
```



Note: Reading back the ports (C and D) results in the binary complement of the output.

Table 3-4. Register Description

Address	Mode	D7	D6	D5	D4	D3	D2	D1	D0
Base+0	RD/ WR	PAD7	PAD6	PAD5	PAD4	PAD3	PAD2	PAD1	PAD0
Base+1	RD Only	{0}	{0}	{0}	{0}	{0}	{0}	{0}	{0}
Base+2	RD/ WR	PCD7	PCD6	PCD5	PAD4	PCD3	PCD2	PCD1	PCD0
Base+3	RD Only	{0}	{0}	{0}	{0}	{0}	{0}	{0}	{0}
Base+4	RD Only	{0}	{0}	{0}	{0}	{0}	{0}	{0}	{0}
Base+5	RD/ WR	IRQEN	IRQST	{0}	{0}	{0}	{0}	IRC1	IRC0
Base+6	RD Only	{0}	{0}	{0}	{0}	{0}	{0}	{0}	{0}

Address	Mode	D7	D6	D5	D4	D3	D2	D1	D0
Base+7	RD Only	{0}	{0}	{0}	{0}	{0}	{0}	{0}	{0}

Note: When selecting the Interrupt Mode, always disable interrupts before changing or setting states, to prevent inadvertent or unexpected interrupts. When using the high and low level interrupts, a change in state of the input must occur before the interrupt can be cleared. **The device providing the input to Base+0 bit D0 must do this.**

PAD0–7 = Port A (Base+0) Input port.
PCD0–7 = Port C (Base+2) Output port.

IRC0–1= Interrupt Mode select (Base+5):

IRC1	IRC0	Interrupt type
0	0	low level
0	1	high level
1	0	falling edge
1	1	rising edge

IRQEN = enable interrupts (Base+5)
0 = disabled 1 = enabled (disabled after reset or power up).

IRQEN = enable interrupts (Base+5)
0 = disabled 1 = enabled (disabled after reset or power up).

IRQST = interrupt status (Base+5)
1 = interrupt pending (reading the bit clears interrupt)

Chapter 4
Specifications

Power Requirements
+5VDC

Size
Length: 5.00 in (127mm)
Height: 3.90 in (99mm) with goldfingers,
3.58 in (91 mm) excluding goldfingers

Weight
3.2 ounces (90.71 g)

Temperature Range
Operating: 0 °C to 50 °C (32 °F to 122 °F)
Storage: -20 °C to 70 °C (-4 °F to 158 °F)

Humidity
10 to 90% RHNC

MTBF
Greater than 150,000 hours (calculated)

Agency Approvals
FCC Class A (47 CFR Part 15, Subpart B)
UL 1950, 2nd edition 1993
CE Conformity with:
EU EMC Directive 89/336/EEC
EU Low Voltage Directive 72/23/EEC

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Appendix A
Troubleshooting

The following steps can eliminate most common problems without the need to call technical support.

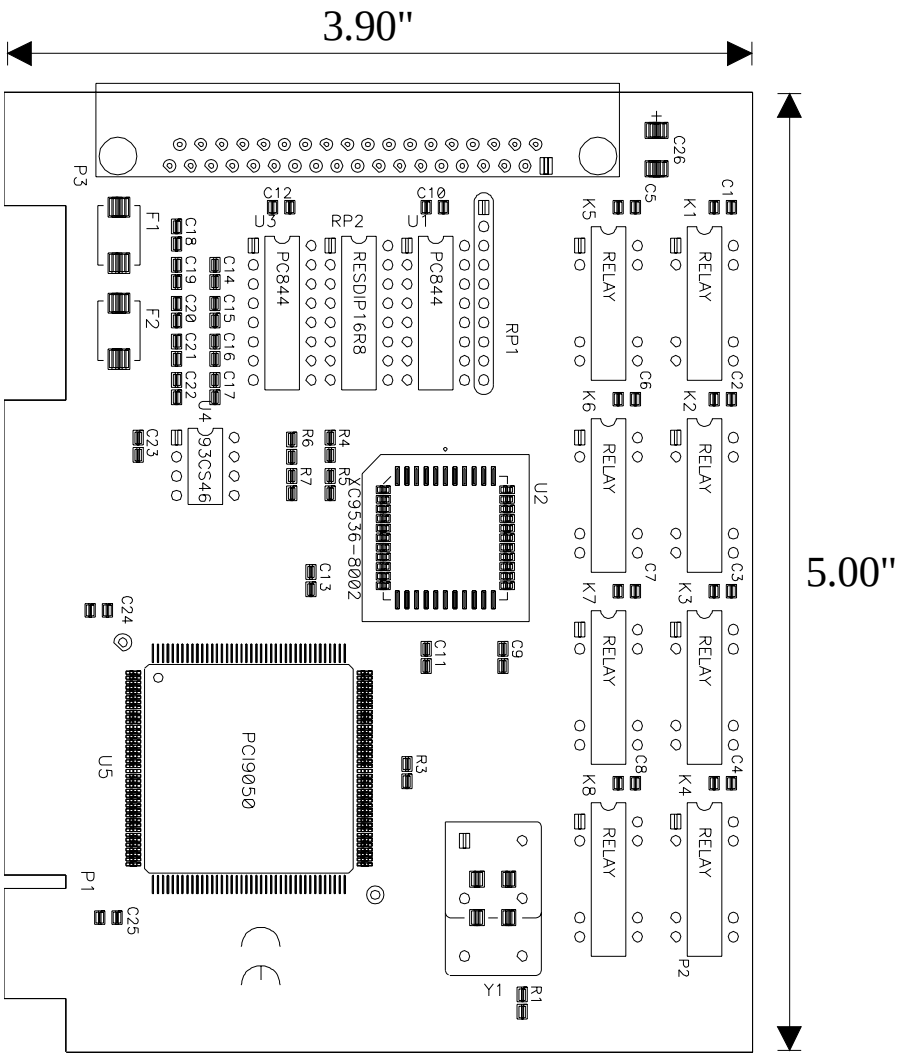
1) Install the software *first*, then add the hardware. This places the required installation files in the correct locations.

2) Identify all I/O adapters currently installed in your system, including onboard serial ports, controller cards, and sound cards. The I/O addresses and any IRQs used by these adapters should be identified.

3) Ensure that there is no conflict with currently installed adapters. No two adapters can occupy the same I/O address and may not be allowed to share IRQs.

4) Make sure the PCI-DIO16 adapter is securely installed in a motherboard slot.

Appendix B
Board Layout Drawing



Declaration of Conformity

Information Technology Equipment

The product(s) covered by this declaration has a CE marking:

PCI-DIO16 Interface Adapter Board

The European Union directives covered by this declaration:

EMC Directive 89/336/EEC and Low Voltage Directive 73/23/EEC

The basis on which conformity is declared:

EN 50081-1:1992 Emissions, Generic Requirements

-EN 55022:1998 Limits and Methods of Measurement of Radio Disturbance Characteristics of Information Technology Equipment

EN 50082-1:1992 Immunity, Generic Requirements

- EN61000-4-2: 1995 Electrostatic Discharge (ESD) Immunity
- EN61000-4-3: 1995 Radiated RF Field Immunity
- EN61000-4-4: 1995 EFT Immunity for AC and I/O Lines

The technical documentation required to demonstrate this product meets the requirements of the EMC Directive and the Low Voltage Directive has been compiled by Kontron and is available for inspection by the relevant enforcement authorities.

Attention

The attention of the specifier, purchaser, installer, or user is drawn to special measures and limitations for use which must be observed when the product is taken into service to maintain compliance with the above directives. Details of these special measures and limitations are in the product manual.



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