# *chip*DISK-IDE

## User's Guide

**Document Revision 1.2**

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# 1. USER INFORMATION

## 1.1 About This Manual

This document provides information about products from Kontron Embedded Computers AG and/or its subsidiaries. No warranty of suitability, purpose, or fitness is implied. While every attempt has been made to ensure that the information in this document is accurate, the information contained within is supplied "as-is" and is subject to change without notice.

For the circuits, descriptions and tables indicated, Kontron assumes no responsibility as far as patents or other rights of third parties are concerned.

## 1.2 Copyright Notice



JUMP*tec* Industrielle Computertechnik AG and Kontron Embedded Computers AG merged in July 2002. JUMP*tec* is now known as Kontron Embedded Modules GmbH. Products labeled and sold under the Kontron Embedded Modules name (formerly JUMP*tec*) are now considered Kontron products for all practical purposes, including warranty and support.

## 1.3 Trademarks

The following lists the trademarks of components used in this board.

- IBM, XT, AT, PS/2 and Personal System/2 are trademarks of International Business Machines Corp.
- Microsoft is a registered trademark of Microsoft Corp.
- Intel is a registered trademark of Intel Corp.
- All other products and trademarks mentioned in this manual are trademarks of their respective owners.

## 1.4 Standards

Kontron Embedded Modules is certified to ISO 9000 standards.

## 1.5 Warranty

This Kontron Embedded Modules product is warranted against defects in material and workmanship for the warranty period from the date of shipment. During the warranty period, Kontron Embedded Modules will at its discretion decide to repair or replace defective products.

Within the warranty period, the repair of products is free of charge as long as warranty conditions are observed.

The warranty does not apply to defects resulting from improper or inadequate maintenance or handling by the buyer, unauthorized modification or misuse, operation outside of the product's environmental specifications or improper installation or maintenance.

Kontron Embedded Modules will not be responsible for any defects or damages to other products not supplied by Kontron Embedded Modules that are caused by a faulty Kontron Embedded Modules product.

## 1.6 *Technical Support*

Technicians and engineers from Kontron Embedded Modules and/or its subsidiaries and official distributors are available for technical support. We are committed to making our product easy to use and will help you use our products in your systems.

Before contacting Kontron Embedded Modules technical support, please contact your local representative or consult our Web site for the latest product documentation, utilities, and drivers. If the information does not help to solve the problem, contact us by telephone.

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|---|---|---|
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# 2. INTRODUCTION

The *chip*DISK-IDE provides high-capacity, solid-state Flash memory and is electricallly compatible with IDE disk drives. *chip*DISK-IDE modules are available with up to 256MB of formatted storage capacity and will later carry even higher capacities. Please contact your local sales support for information about currently available capacities of this module.

It comes with a 44-pin, 2mm IDE connector onboard and therefore perfectly fits onto most PC/104 family products as well as the PISA® Slot-PC line of Kontron Embedded Modules GmbH. However it also can be used on all other modules of any manufacturer on the market that provide an IDE compatible hard disk interface.

A special mounting hole on its PCB can provide a way of secure assembly to the system it is used on.

As the *chip*DISK-IDE operates in true-IDE mode there is no need for special operating system drivers, which is a big advantage against other Flash based solid-state disks on the market.

This document is only valid for the *chip*DISK-IDE products designed in NAND technology. For older products designed in NOR technology refer to their corresponding technical manual.

# 3. SPECIFICATIONS

## 3.1 *Functional Specifications*

The *chip*DISK-IDE hard disk incorporates the following features:

- **True IDE hardware-compatible disk**
- **Based on NAND Flash technology**
- **Very low-power CMOS operation and ultra-low-power (ULP) standby modes**
- **5V only supply voltage**
- **No formatting by special software and no special operating system drivers needed**
- **8KB data buffers**
- **Automatic error correction and retry**
- **Supports power-down commands and sleep modes**
- **One of the industry's smallest IDE hard disks**
- **Space saving design optimized for MOPS family products and SLOT-PC line**
- **Low weight**
- **Noiseless operation**

## 3.2 *Mechanical Specifications*

### 3.2.1. PCB Dimensions

- 31 x 52.5 mm (1.22" x 2.07")

### 3.2.2. Height

- 7 mm (0.28")

### 3.2.3. Weight

- < 10g

## 3.3 *Electrical Specifications*

### 3.3.1. Supply Voltage

- 5V DC +/- 5%

### 3.3.2. Supply Voltage Ripple

- 400 mV peak to peak 50MHz

### 3.3.3. Supply Current (Typical)

- Sleep mode(*): <1mA at 5V
- Reading: <40mA at 5V
- Writing: <40mA at 5V

**Note**: (*) The sleep-mode current is specified under the condition that all *chip*DISK-IDE inputs are at static CMOS levels and in a "Not Busy" operating state at 33MHz.

### 3.3.4. Supply Current (Maximum)

- 160mA

(calculated theoretical value from all components maximum supply currents)

### 3.3.5. Output Drive Capacity

- 50pF

### 3.3.6. Startup Time

- Sleep to write: 2.5ms maximum
- Sleep to read: 50ms maximum
- Reset to ready: 50ms typical, 400ms maximum

### 3.3.7. Active to Sleep Delay

- Programmable

### 3.3.8. MTBF at 25°C

- >1,000,000 hours

### 3.3.9. Data Reliability

- <1 non-recoverable error in $10^{14}$ bits read

### 3.3.10. Endurance

- 300,000 erase/program cycles per logical sector guaranteed

## 3.4 *Capacity Specifications*

| Model Number | Capacity (bytes) | Sectors | Heads | Sectors/Track | Cylinders |
|---|---|---|---|---|---|
| chipDISK-IDE-16 | 16,056320 | 31,360 | 2 | 32 | 490 |
| chipDISK-IDE-32 | 32,112,640 | 62,720 | 4 | 32 | 490 |
| chipDISK-IDE-64 | 64,225,280 | 125,440 | 8 | 32 | 490 |
| chipDISK-IDE-96 | 96,251,904 | 187,992 | 4 | 63 | 746 |
| chipDISK-IDE-256 | 256,638,976 | 501,248 | 16 | 32 | 979 |

## 3.5 *Environmental Specifications*

### 3.5.1. Temperature

- **Operating:** 0 to +60 C(*) (with appropriate airflow)
- **Nonoperating:** -4 to +85 °C (noncondensing)

---

**Note**: The maximum operating temperature is the maximum measurable temperature on any spot on the module's surface. You must maintain the temperature according to the above specification.

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### 3.5.2. Thermal Gradient

- **Operating:** -25°C per hour
- **Nonoperating:** 40°C per hour

### 3.5.3. Humidity

- **Operating:** 10% to 90% (RH noncondensing)
- **Nonoperating:** 5% to 95% (RH noncondensing)

### 3.5.4. Mechanical

- **Shock:** 50G/20ms square-wave maximum
- **Vibration:** 1G/0-600Hz, dwell not to exceed

### 3.5.5. Altitude

- **Operating:** 0 – 3000m
- **Nonoperating:** 0 – 5000m

# 4. CHIPSET

The Flash chipset (FCS) on *chip*DISK-IDE .consists of two parts:

- One highly integrated Flash controller
- One to four Flash memory modules (depending on the capacity)

## 4.1 *Flash Controller*

The Flash controller SDC-1 from SanDisk provides a true Integrated Drive Electronics (IDE) compatible interface to the host computer. The controller manages:

- Interfacing to the host system
- Storing data
- Retrieving data
- Error checking and correcting (ECC) memory
- Handling defects
- Diagnosing
- Managing power

The controller manages all defects and errors and makes the Flash memory appear as perfect memory to the host. After the *chip*DISK-IDE has been configured by the host, it appears to the host as a standard IDE disk drive with transfer mode up to PIO 1.

## 4.2 *Flash Memory*

The *chip*DISK-IDE can come in different versions, however not all possible configurations mentioned here are available as standard products.

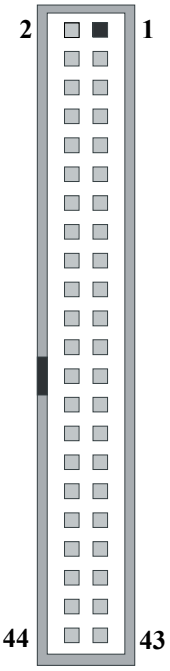
- 16MB
- 32MB
- 64MB
- 96MB
- 256MB

# 5. IDE INTERFACE

The *chip*DISK-IDE comes with a 44pin, 2mm female IDE interface connector. That way it is possible to directly assemble it with a product of the PC/104 MOPS family or a PISA Slot-PC from Kontron Embedded Modules GmbH. However it can also be used with other products offering an IDE interface, either directly or with an adapter available by Kontron (*chip*DISK-ADA1, Part Number 96004-0000-00-0).

## 5.1 *Connector*

The following table provides information about the IDE interface connector pinout.

| Header | Pin | Signal Name | Function | Pin | Signal Name | Function |
|---|---|---|---|---|---|---|
|  | 1 | /RESET | Reset | 2 | GND | Ground |
| | 3 | DD7 | Data 7 | 4 | DD8 | Data 8 |
| | 5 | DD6 | Data 6 | 6 | DD9 | Data 9 |
| | 7 | DD5 | Data 5 | 8 | DD10 | Data 10 |
| | 9 | DD4 | Data 4 | 10 | DD11 | Data 11 |
| | 11 | DD3 | Data 3 | 12 | DD12 | Data 12 |
| | 13 | DD2 | Data 2 | 14 | DD13 | Data 13 |
| | 15 | DD1 | Data 1 | 16 | DD14 | Data 14 |
| | 17 | DD0 | Data 0 | 18 | DD15 | Data 15 |
| | 19 | GND | Ground | 20 | Key (NC) | Key pin |
| | 21 | NC | Not connected | 22 | GND | Ground |
| | 23 | /DIOW | I/O write | 24 | GND | Ground |
| | 25 | /DIOR | I/O read | 26 | GND | Ground |
| | 27 | IOCHRDY | channel ready | 28 | NC | Not connected |
| | 29 | NC | Not connected | 30 | GND | Ground |
| | 31 | INTRQ | Interrupt | 32 | /IOCS16 | 16bit I/O |
| | 33 | DA1 | Addr 1 | 34 | /PDIAG | Passed Diag. |
| | 35 | DA0 | Addr 0 | 36 | DA2 | Addr 2 |
| | 37 | /CS0 | Chip select 0 | 38 | /CS1 | Chip select 1 |
| | 39 | /DASP | Device active | 40 | GND | Ground |
| | 41 | VCC | +5V | 42 | VCC | +5V |
| | 43 | GND | Ground | 44 | NC | Not connected |

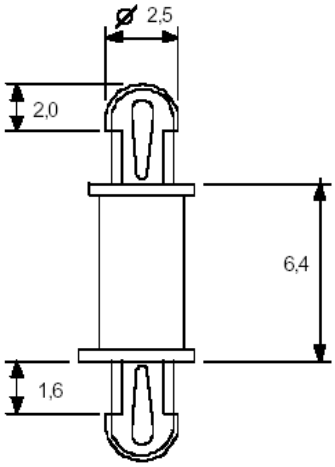
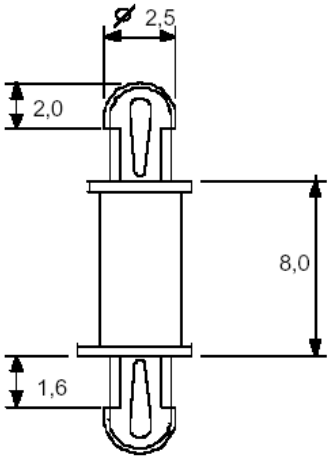
## 5.2 *Configuration*

The *chip*DISK-IDE is by hardware configured as a master. It cannot be configured as a slave by the customer. Therefore an additional devices connected to the same IDE channel has to be configured as slave.

# 6. MOUNTING HOLE

The printed circuit board (PCB) of the *chip*DISK-IDE is equipped with a mounting hole. This hole can be used to fix the *chip*DISK to the carrier board. Products of the PC/104 MOPS family, SLOT-PCs of the PISA line and the *chip*DISK-ADA1 also offer a hole as counterpart. That way the *chip*DISK can be secured against fall off caused by vibration. You can use either a mini-spacer or other suitable mounting parts.

The diameter of the *chip*DISK hole is 2.6mm (0.103”). If you are using metal screws and bolts, make sure that they don’t exceed the tin-plated area around the hole. We recommend to use a plastic mini-spacer (e.g. ELPAC LPR 8234-6,4 or LPR 8313-Mini). The height of the mini-spacer or bolts is depending on the IDE-connector used on the carrier board, which is normally either 6mm (0.236”) or 7.64mm (0.3”). About 0.4mm have to be added when the chipDISK is plugged.

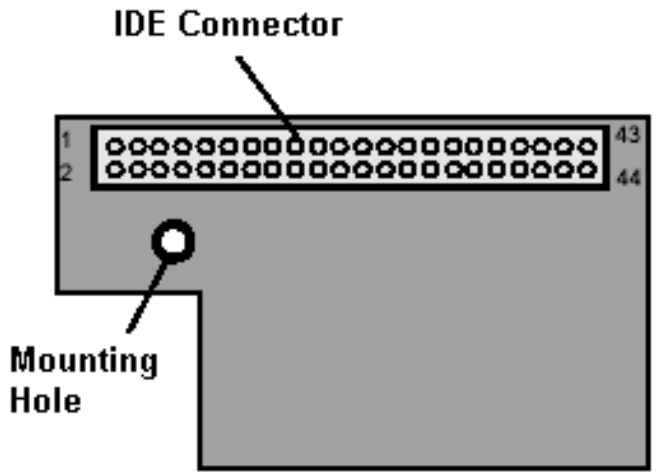
| ELPAC LPR 8234-6,4 | ELPAC LPR 8313-Mini |
|---|---|
|  |  |



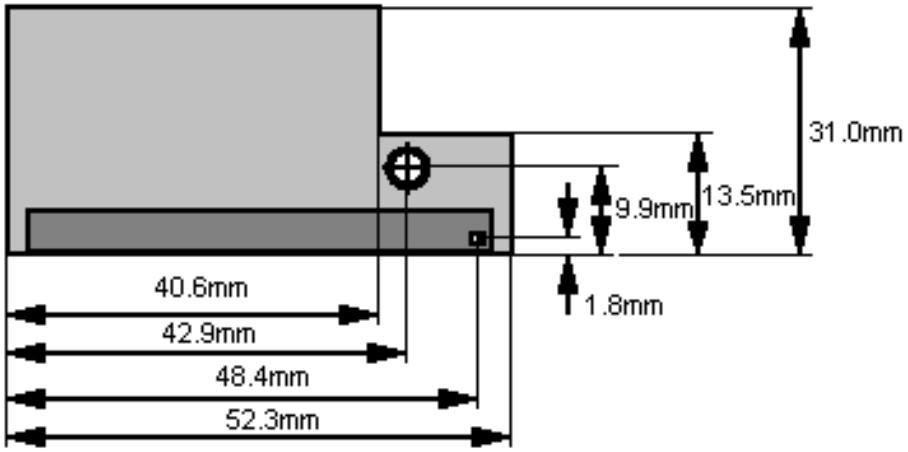


All dimensions in the above drawings in mm.

# 7. APPENDIX A: MECHANICAL DIMENSIONS




View from connector side




# 8. APPENDIX B: PC ARCHITECTURE INFORMATION

The following sources of information can help you better understand PC architecture.

## 8.1 *Buses*

### 8.1.1. ISA, Standard PS/2 - Connectors

- AT Bus Design: Eight and Sixteen-Bit ISA, E-ISA and EISA Design, Edward Solari, Annabooks, 1990, ISBN 0-929392-08-6
- AT IBM Technical Reference Vol 1&2, 1985
- ISA & EISA Theory and Operation, Edward Solari, Annabooks, 1992, ISBN 0929392159
- ISA Bus Specifications and Application Notes, Jan. 30, 1990, Intel
- ISA System Architecture, Third Edition, Tom Shanley and Don Anderson, Addison-Wesley Publishing Company, 1995, ISBN 0-201-40996-8
- Personal Computer Bus Standard P996, Draft D2.00, Jan. 18, 1990, IEEE Inc
- Technical Reference Guide, Extended Industry Standard Architecture Expansion Bus, Compaq 1989

### 8.1.2. PC/104, PCI - Information

- Embedded PC 104 Consortium
  The consortium provides information about PC/104 and PC/104-Plus technology. You can search for information about the consortium on the Web.
- PCI SIG
  The PCI-SIG provides a forum for its ~900 member companies, who develop PCI products based on the specifications that are created by the PCI-SIG. You can search for information about the SIG on the Web.
- *PCI & PCI-X Hardware and Software Architecture & Design*, Fifth Edition, Edward Solari and George Willse, Annabooks, 2001, ISBN 0-929392-63-9.
- *PCI System Architecture,* Tom Shanley and Don Anderson, Addison-Wesley, 2000, ISBN 0-201-30974-2.

## 8.2 General PC Architecture

- *Embedded PCs*, Markt&Technik GmbH, ISBN 3-8272-5314-4 (German)
- *Hardware Bible*, Winn L. Rosch, SAMS, 1997, 0-672-30954-8
- *Interfacing to the IBM Personal Computer*, Second Edition, Lewis C. Eggebrecht, SAMS, 1990, ISBN 0-672-22722-3
- *The Indispensable PC Hardware Book*, Hans-Peter Messmer, Addison-Wesley, 1994, ISBN 0-201-62424-9
- *The PC Handbook: For Engineers, Programmers, and Other Serious PC Users, Sixth Edition*, John P. Choisser and John O. Foster, Annabooks, 1997, ISBN 0-929392-36-1

## 8.3 Ports

### 8.3.1. RS-232 Serial

- EIA-232-E standard
  The EIA-232-E standard specifies the interface between (for example) a modem and a computer so that they can exchange data. The computer can then send data to the modem, which then sends the data over a telephone line. The data that the modem receives from the telephone line can then be sent to the computer. You can search for information about the standard on the Web.
- *RS-232 Made Easy: Connecting Computers, Printers, Terminals, and Modems*, Martin D. Seyer, Prentice Hall, 1991, ISBN 0-13-749854-3
- National Semiconductor
  The Interface Data Book includes application notes. Type “232” as a search criteria to obtain a list of application notes. You can search for information about the data book on National Semiconductor’s Web site.

### 8.3.2. Serial ATA

Serial AT Attachment (ATA) Working Group
This X3T10 standard defines an integrated bus interface between disk drives and host processors. It provides a common point of attachment for systems manufacturers and the system. You can search for information about the working group on the Web.
We recommend you also search the Web for information on *4.2 I/O cable*, if you use hard disks in a DMA3 or PIO4 mode.

### 8.3.3. USB

USB Specification
USB Implementers Forum, Inc. is a non-profit corporation founded by the group of companies that developed the Universal Serial Bus specification. The USB-IF was formed to provide a support organization and forum for the advancement and adoption of Universal Serial Bus technology. You can search for information about the standard on the Web.

## 8.4 *Programming*

- *C Programmer's Guide to Serial Communications*, Second Edition, Joe Campbell, SAMS, 1987, ISBN 0-672-22584-0
- *Programmer's Guide to the EGA, VGA, and Super VGA Cards*, Third Edition, Richard Ferraro, Addison-Wesley, 1990, ISBN 0-201-57025-4
- *The Programmer's PC Sourcebook,* Second Edition, Thom Hogan, Microsoft Press, 1991, ISBN 1-55615-321-X
- *Undocumented PC, A Programmer's Guide to I/O, CPUs, and Fixed Memory Areas*, Frank van Gilluwe, Second Edition, Addison-Wesley, 1997, ISBN 0-201-47950-8

# 9. APPENDIX C: DOCUMENT-REVISION HISTORY

| Revision | Date | Edited by | Changes |
|---|---|---|---|
| SFLGM110 | 27.02.2002 | JT | Manual created |
| SFLGM111 | 16.09.2002 | JT | Updated chapter 3 information |
| SFLGM112 | 19.11.2003 | BHO | Kontron style, added lots of information |
| | | | |
| | | | |