Embedded Solutions

F603 – 3U CompactPCI®
Side Card USB/COM

Configuration example

User Manual

mea

mikro elektronik
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F603 – 3U CompactPCI® Side Card USB/COM

The F603 is a 4HP mixed USB/COM extension card for 3U Intel® based CompactPCI® single-board computers such as F14, F15, F17, F18 and further boards of the Intel® low power family.

Modern Intel® based boards increasingly support USB interfaces as an exclusive universal connection of devices such as keyboard, mouse, CD-ROM, floppy etc. Especially in industrial applications however many existing systems still use legacy I/O.

Thus, the F603 provides one COM interface as well as two more USB 2.0 interfaces that extend the Single-Board Computer functionality to 4 USB ports at the front panel.

In addition an on-board 2.5" SATA hard-disk slot and a CompactFlash® slot is available on the F603.

The F603 is directly plugged to the right side of the respective single-board computer. A robust connector makes for high mechanical stability. It is delivered with an 8HP front panel, replacing the 4HP front panel of a 3U single-board computer and thus resulting in a solid one-piece front panel.

Technical Data

I/O

- USB
  - Two USB 2.0 ports
  - Series A connector at front panel
  - UHCI implementation
  - Data rates up to 480Mbits/s
  - High current up to 1A
- UART
  - One RS232 at front panel
  - Data rates 300bit/s..230kbit/s (up to 1 Mbit/s with shielded cable)
  - FIFO receive and transmit buffers for high data throughput
  - Handshake lines: full support

Mass Storage

- Serial IDE (SATA)
  - One port for on-board 2.5" hard-disk drive
  - Transfer rates up to 150MB/s (depends on hard disk)
  - RAID level 0/1 support (depends on CPU board)
- CompactFlash® card interface
  - Via USB to PATA converter
  - Type I
  - True IDE mode
  - Multiword DMA 2 and UDMA 4 support
- Please note that operating systems which cannot boot from removable data carriers (e.g. Windows® XP) cannot boot from the CompactFlash® over USB

Miscellaneous

- CompactPCI® J1 is assembled for increased mechanical stability and/or for power supply

Electrical Specifications

- Supply voltage/power consumption:
  - +5V (-3%/+5%), 50mA typ. (w/o hard disk)
  - +3.3V (-3%/+5%), 95mA typ. (w/o hard disk)
- MTBF: tbd @ 40°C according to IEC/TR 62380 (RDF 2000)

Mechanical Specifications

- Dimensions: conforming to CompactPCI® specification for 3U boards
- Mountable on right (standard) or left (option) side of the CPU
- Weight: 130g (w/o hard disk and CompactFlash®)

Environmental Specifications

- Temperature range (operation):
  - 0..+60°C up to -40..+85°C (depending on hard disk; please refer to the hard disk specifications for possible limits)
  - Airflow: min. 10m³/h
- Temperature range (storage): -40..+85°C
- Relative humidity (operation): max. 95% non-condensing
- Relative humidity (storage): max. 95% non-condensing
- Altitude: -300m to + 3,000m
- Shock: 15g/11ms
- Bump: 10g/16ms
- Vibration (sinusoidal): 2g/10..150Hz
- Conformal coating on request

Safety

- PCB manufactured with a flammability rating of 94V-0 by UL recognized manufacturers
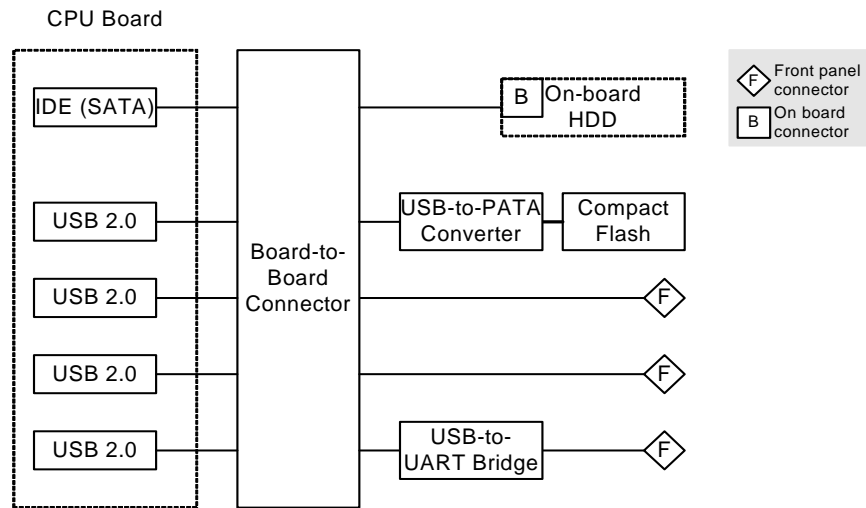
EMC

- Tested according to EN 55022 (radio disturbance), IEC1000-4-2 (ESD) and IEC1000-4-4 (burst) with regard to CE conformity

Software Support

- Driver software can be found in the data sheet of the CPU board that you use.

Block Diagram

CPU Board

```
IDE (SATA) ────┐              ┌──── B │ On-board HDD
               │              │
USB 2.0 ───────┤  Board-to-   ├──── USB-to-PATA Converter ── Compact Flash
               │  Board       │
USB 2.0 ───────┤  Connector   ├──── F
               │              │
USB 2.0 ───────┤              ├──── F
               │              │
USB 2.0 ───────┘              └──── USB-to-UART Bridge ── F
```

F Front panel connector
B On board connector

Configuration Options

Mass storage

- Second CompactFlash® interface instead of SATA hard disk
  - Via AD95 adapter

Mechanical

- Mounting of side card on left side of the CPU

Operation Temperature

- 0..+60°C
- -40..+85°C

Please note that some of these options may only be available for large volumes. Please ask our sales staff for more information.

For available standard configurations see online data sheet.

Product Safety

⚠ **Electrostatic Discharge (ESD)**

Computer boards and components contain electrostatic sensitive devices. Electrostatic discharge (ESD) can damage components. To protect the board and other components against damage from static electricity, you should follow some precautions whenever you work on your computer.

- Power down and unplug your computer system when working on the inside.
- Hold components by the edges and try not to touch the IC chips, leads, or circuitry.
- Use a grounded wrist strap before handling computer components.
- Place components on a grounded antistatic pad or on the bag that came with the component whenever the components are separated from the system.
- Store the board only in its original ESD-protected packaging. Retain the original packaging in case you need to return the board to MEN for repair.

About this Document

This user manual describes the hardware functions of the board, connection of peripheral devices and integration into a system. It also provides additional information for special applications and configurations of the board.

The manual does not include detailed information on individual components (data sheets etc.). A list of literature is given in the appendix.

History

Edition	Comments	Technical Content	Date of Issue
E1	First edition	M.Rottmann, R.Küffner	2007-02-05
E2	General update UART data rate corrected Removed 12V power supply description Corrected J1 pin table	M.Rottmann, R.Küffner	2008-07-24

Conventions

⚠ This sign marks important notes or warnings concerning proper functionality of the product described in this document. You should read them in any case.

italics Folder, file and function names are printed in *italics*.

bold **Bold** type is used for emphasis.

monospace A `monospaced` font type is used for hexadecimal numbers, listings, C function descriptions or wherever appropriate. Hexadecimal numbers are preceded by "0x".

hyperlink Hyperlinks are printed in blue color.

🌐 The globe will show you where hyperlinks lead directly to the Internet, so you can look for the latest information online.

IRQ# Signal names followed by "#" or preceded by a slash ("/") indicate that this signal is
/IRQ either active low or that it becomes active at a falling edge.

in/out Signal directions in signal mnemonics tables generally refer to the corresponding board or component, "in" meaning "to the board or component", "out" meaning "coming from it".

Vertical lines on the outer margin signal technical changes to the previous edition of the document.

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Contents

Figures

Tables

1   Getting Started

This chapter gives an overview of the board and some hints for first installation in a system.

1.1   Map of the Board

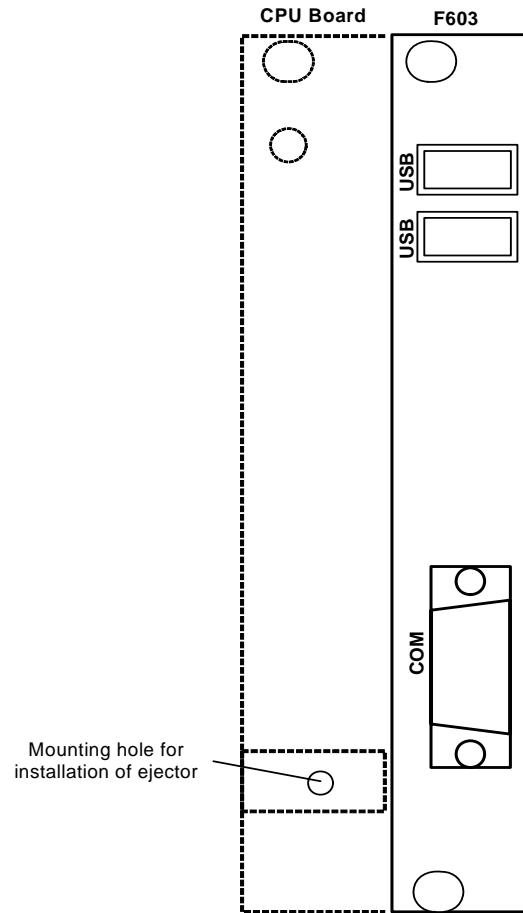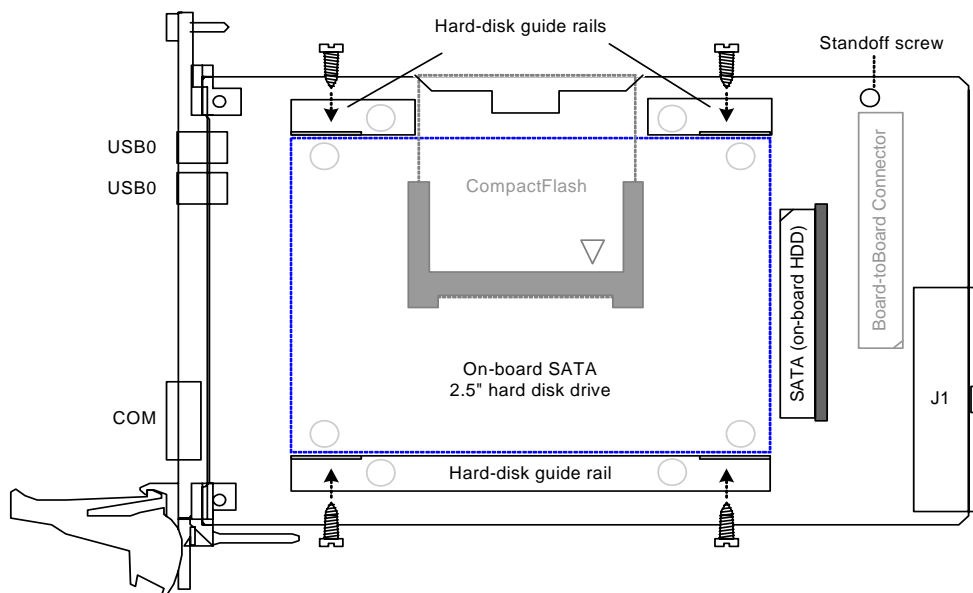***Figure 1.*** *Map of the board – front panel*

Figure 2. *Map of the board - top view*

1.2 Configuring the Hardware

You should check your hardware requirements before attaching the F603 to a CPU board, since most modifications are only possible when the boards are disconnected. You should also stick to the following order.

The following check list gives an overview on what you might want to configure.

☑ CompactFlash

The board is shipped without a CompactFlash card. You should check your needs and install a suitable CompactFlash card.

Refer to Chapter 2.5.1.1 Installing CompactFlash on page 23 for a detailed installation description and hints on supported CompactFlash cards.

☑ SATA hard disk on board

You can easily install a 2.5" SATA hard disk. MEN offers a suitable hard disk. Installation material is already supplied with F603.
See MEN's website for ordering information.

Refer to Chapter 2.5.3.1 Installing a Hard Disk on page 26 for a detailed installation description.

☑ Second CompactFlash instead of hard disk

The hard disk can be exchanged for a second CompactFlash on a special adapter card.
See MEN's website for ordering information.

Refer to Chapter 2.5.3.2 Installing CompactFlash Adapter on page 28 for a detailed installation description.

1.3 Integrating the Board into a System

The F603 is suited as a side card for different MEN CPU boards. If you are not sure if your CPU board is supported, please check the CPU's data sheet.

If the F603 can be used with your CPU, attach it to the CPU board as is described in the CPU board's user manual.

1.4 Installing Driver Software

For a detailed description on how to install driver software please refer to the respective documentation.

You can find any driver software available for download on MEN's website.

2   Functional Description

2.1   Power Supply

The board is supplied with +5V and +3.3V via the CPU board (board-to-board connector) and via the CompactPCI backplane. For this purpose, CompactPCI bus connector J1 is assembled. However, the board can also be operated with power supply from the board-to-board connector alone.

2.2   Board-to-Board Connector

The F603 side card is attached to a CPU board using a board-to-board connector. This connector supports special I/O functions from the CPU.

The board-to-board connector is located at the bottom side of the board, so that the F603 can be attached to the right side of a CPU board. As an option, the board-to-board connector can also be assembled on the top side of the board in order to attach the F603 on the left side of the CPU board.

The board-to-board connector on F603 supports the following interfaces:

- One SATA channel
- One USB-to-PATA converter
- Two USB interfaces
- One USB-to-UART interface

See MEN's website for available board versions.

2.2.1   Connection

Connector types:

- 114-pin matched impedance plug connector, MICTOR 0.64 mm grid
- Mating connector:
  114-pin matched impedance receptacle connector, MICTOR 0.64 mm grid

Table 1. *Pin assignment of the 114-pin board-to-board connector, pins 1..38*
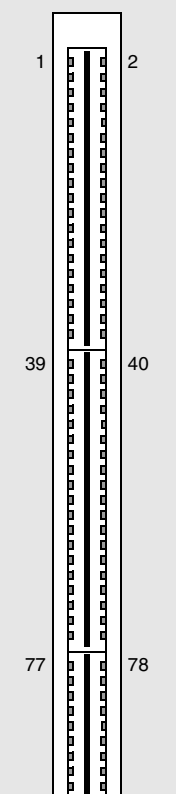
1	GND		2	GND
3	SATA_TX+		4	-
5	SATA_TX-		6	-
7	GND		8	GND
9	SATA_RX+		10	-
11	SATA_RX-		12	-
13	GND		14	GND
15	-		16	-
17	-		18	-
19	GND	GND	20	GND
21	-		22	-
23	-		24	-
25	GND		26	GND
27	-		28	-
29	-		30	-
31	GND		32	GND
33	-		34	-
35	-		36	-
37	GND		38	GND

Table 2. *Pin assignment of the 114-pin board-to-board connector, pins 39..76*
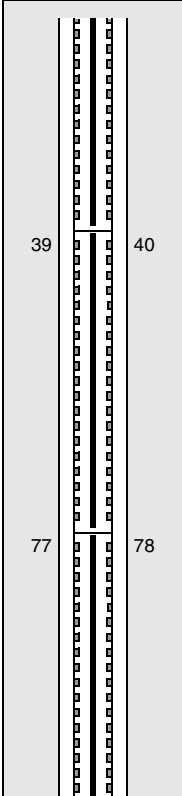
39	+3.3V	40	+3.3V
41	USB_OCR#	42	-
43	-	44	-
45	GND	46	-
47	USB_D3-	48	-
49	USB_D3+	50	-
51	GND	52	GND
53	USB_D2-	54	-
55	USB_D2+	56	USB_RST#
57	GND	58	-
59	USB_D5-	60	SMB_CLK
61	USB_D5+	62	SMB_DATA
63	GND	64	GND
65	USB_D4-	66	-
67	USB_D4+	68	-
69	GND	70	GND
71	-	72	-
73	-	74	-
75	GND	76	GND

(Center column label: +5V)

Table 3. *Pin assignment of 114-pin board-to-board connector, pins 77..114*
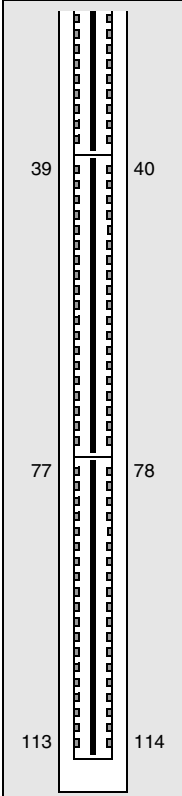
77	GND			78	GND
79	-			80	-
81	-			82	-
83	GND			84	GND
85	-			86	-
87	-			88	-
89	GND			90	GND
91	-			92	-
93	-			94	-
95	GND	GND	96	GND
97	-			98	-
99	-			100	-
101	GND			102	GND
103	-			104	-
105	-			106	-
107	GND			108	GND
109	-			110	-
111	-			112	-
113	GND			114	GND

Table 4. *Signal mnemonics of 114-pin board-to-board connector*

	Signal	**Direction**	**Function**
Power	+3.3V	out	+3.3V power supply
	+5V	out	+5V power supply
	GND	-	Digital ground
IDE SATA	SATA_RX+, SATA_RX-	in	Differential pair of SATA receive lines
	SATA_TX+, SATA_TX-	out	Differential pair of SATA transmit lines
USB	USB_D[2]+, USB_D[2]-	in/out	Differential pair of USB lines, port 2
	USB_D[3]+, USB_D[3]-	in/out	Differential pair of USB lines, port 3
	USB_D[4]+, USB_D[4]-	in/out	Differential pair of USB lines, port 4
	USB_D[5]+, USB_D[5]-	in/out	Differential pair of USB lines, port 5
	USB_RST#	in	Platform reset from CPU, resets all USB ports
	USB_OCR#	out	USB overcurrent warning
Other	SMB_CLK	out	System Management Bus clock
	SMB_DATA	in/out	System Management Bus data

2.3   USB Interfaces

The two USB interfaces are controlled by the CPU via the board-to-board connector and are accessible at two connectors at the front panel.

The USB interfaces support UHCI. The two interfaces support a maximum current of 1A before switching off.

Connector types:

- 4-pin USB Series A receptacle according to Universal Serial Bus Specification Revision 1.0

- Mating connector:
  4-pin USB Series A plug according to Universal Serial Bus Specification Revision 1.0

Table 5. *Pin assignment of USB front-panel connectors*
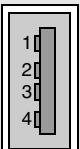
	1	+5V
1 2 3 4	2	USB_D-
	3	USB_D+
	4	GND

Table 6. *Signal mnemonics of USB front-panel connectors*

Signal	Direction	Function
+5V	out	+5 V power supply
GND	-	Digital ground
USB_D+, USB_D-	in/out	USB lines, differential pair

2.4   UART Interface

The F603 provides one RS232 UART interface at the front that is controlled using one USB port from the CPU board. Data rates from 300bit/s to 230kbit/s are possible (up to 1 Mbit/s with shielded cable).

In addition it provides FIFO receive and transmit buffers for high data throughput and full handshake support.

Connector types:

- 9-pin D-Sub plug according to DIN41652/MIL-C-24308, with thread bolt UNC 4-40

- Mating connector:
  9-pin D-Sub receptacle according to DIN41652/MIL-C-24308, available for ribbon cable (insulation piercing connection), hand-soldering connection or crimp connection

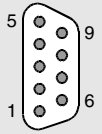***Table 7.*** *Pin assignment of the 9-pin D-Sub RS232 plug connector*

5	GND		9	RI
4	DTR		8	CTS
3	TXD		7	RTS
2	RXD		6	DSR
1	DCD			

Table 8. *Signal mnemonics of UART interfaces*

Signal	Direction	Function
+5V	out	+5V power supply
CTS#	in	Clear to send
DCD#	in	Data carrier detect
DSR#	in	Data set ready
DTR#	out	Data terminal ready
GND	-	Digital ground
RI#	in	Ring indicator
RTS#	out	Request to send
RXD	in	Receive data
TXD	out	Transmit data

2.5   Mass Storage

2.5.1   Parallel IDE (PATA)

The F603 is equipped with a CompactFlash slot which is controlled by one USB interface from the CPU board. Conversion from USB to PATA is realized by a USB to PATA interface chip.

It provides one parallel ATA channel with master and slave support. Devices can be operated in PIO mode 0 up to UDMA mode 5 (UDMA100).

2.5.1.1   Installing CompactFlash

The F603 is shipped without a CompactFlash card installed. To install CompactFlash, please stick to the following procedure.

☑ Power down your system.

☑ Insert the CompactFlash card carefully as indicated by the arrow on top of the card.
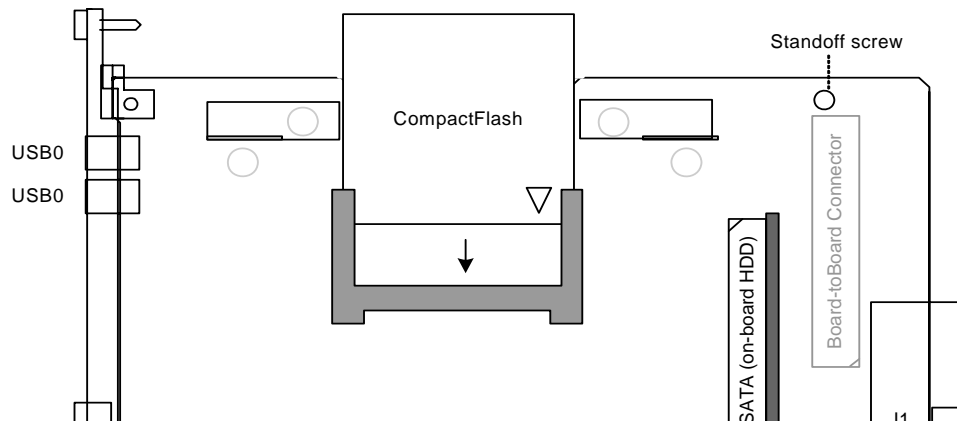
☑ Make sure that all the contacts are aligned properly and the card is firmly connected with the card connector.

☑ Observe manufacturer notes on usage of CompactFlash cards.

2.5.1.2   Supported CompactFlash Cards

The F603 supports standard CompactFlash cards. For CompactFlash cards available from MEN see MEN's website.

2.5.2 Serial IDE (SATA)

The F603 supports one serial IDE (SATA) interface controlled by the CPU board. You can connect a 2.5" hard-disk drive directly on the board.

Note: As an option a second CompactFlash can be connected to the SATA interface via a CompactFlash adapter instead of the hard disk (see Chapter 2.5.3.2 Installing CompactFlash Adapter on page 28).

The SATA interface supports transfer rates up to 150 MB/s.

Table 9. Signal mnemonics of SATA connectors
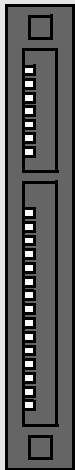
Signal	Direction	Function
+12V	out	+12V power supply
+3.3V	out	+3.3V power supply
+5V	out	+5V power supply
GND	-	Digital ground
SATA_RX+, SATA_RX-	in	Differential pair of SATA receive lines, port 1
SATA_TX+, SATA_TX-	out	Differential pair of SATA transmit lines, port 1

2.5.3   On-Board SATA Connector

Connector type:

- 7- & 15-pin SATA receptacle connector, 1.27mm pitch

Table 10. *Pin assignment of SATA connector for on-board hard disk*

|		
	S1	GND
	S2	SATA_TX+
	S3	SATA_TX-
	S4	GND
	S5	SATA_RX-
	S6	SATA_RX+
	S7	GND
S1	Key and spacing, separate signal and power segments	
	P1	+3.3V
	P2	+3.3V
P1	P3	+3.3V
	P4	GND
	P5	GND
	P6	GND
	P7	+5V
	P8	+5V
	P9	+5V
	P10	GND
	P11	GND
	P12	GND
	P13	-
	P14	-
	P15	-

2.5.3.1   Installing a Hard Disk

MEN offers a 2.5" hard-disk drive for on-board installation. With a hard disk installed, the board still needs only one slot in the system.
See also Figure 2, Map of the board - top view, on page 14.

Please see MEN's website for ordering options.

Perform the following steps to install a hard disk:

☑ If your F603 is already attached to a CPU board: Power down your system and remove the F603 from the system together with the attached CPU.
If the side card is attached to the right side of the CPU board it is not necessary to deinstall the F603 from the CPU board.

☑ Push the SATA connector to the right to make way for the hard disk.
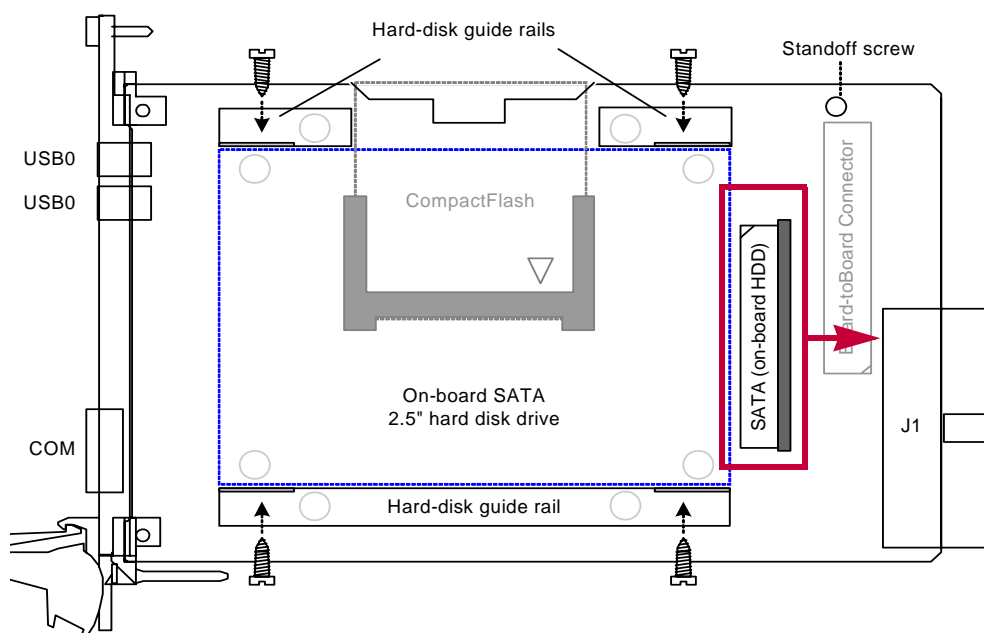
☑ Place the hard disk in the designated space between the guide rails. Align the four mounting holes on the hard disk's sides with the holes in the guide rails.
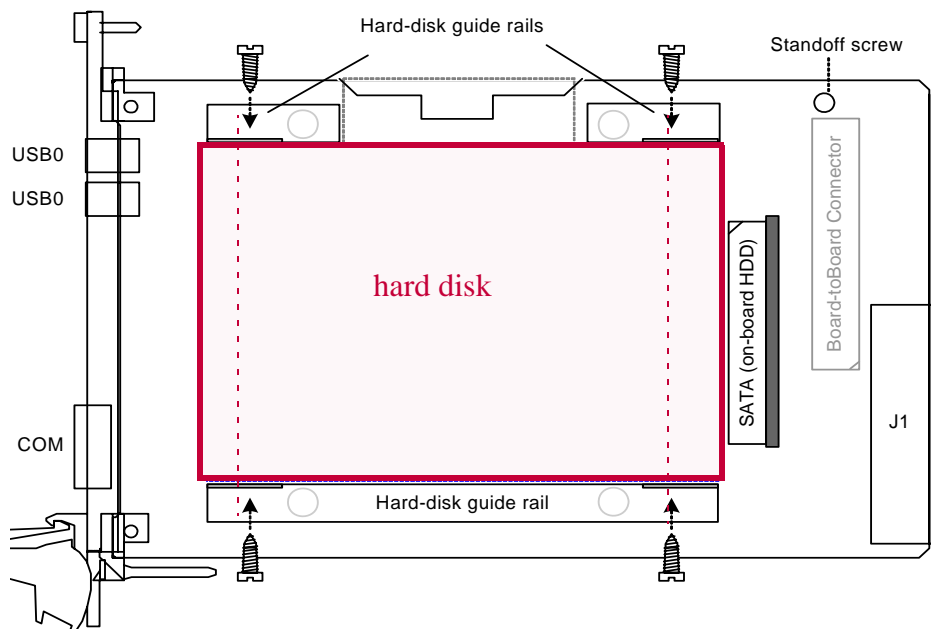
☑ Fasten the hard disk at the guide rails, using the four screws supplied with F603.

☑ Reinstall the SATA connector. Make sure to match the pins correctly.
Push the connector towards the hard disk until it sits firmly in its place.

2.5.3.2 Installing CompactFlash Adapter

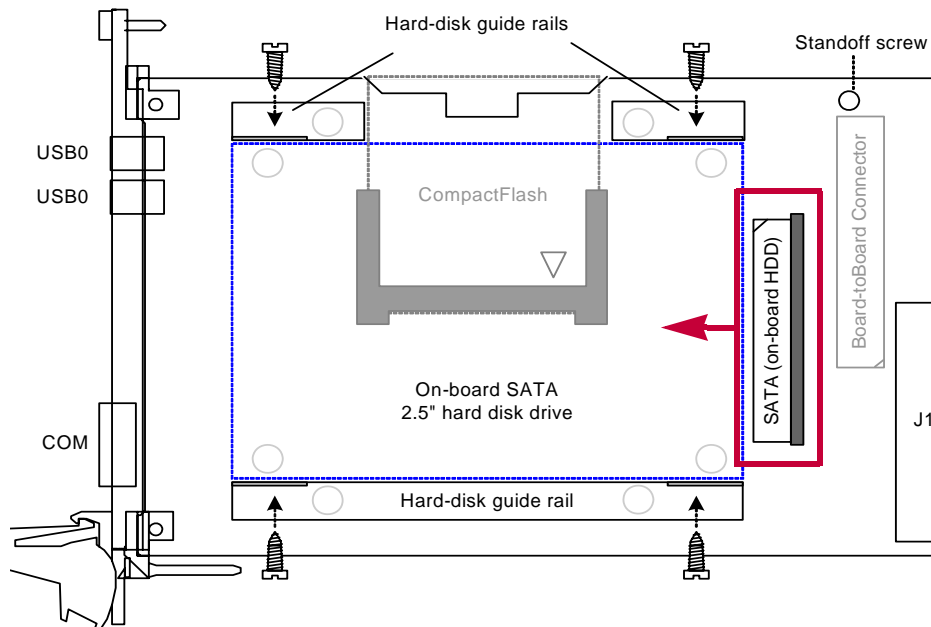Perform the following steps to install the adapter for the second CompactFlash:

☑ If your F603 is already attached to a CPU board: Power down your system and remove the F603 from the system together with the attached CPU.
Deinstall the F603 from the CPU board.

☑ Remove the hard disk and the hard disk guide rails if a hard disk is already installed on the F603. To remove the guide rails loosen the screws indicated in the drawing on the bottom side of the board

Board-toBoard Connector

J1

Mounting screws for hard disk guide rails
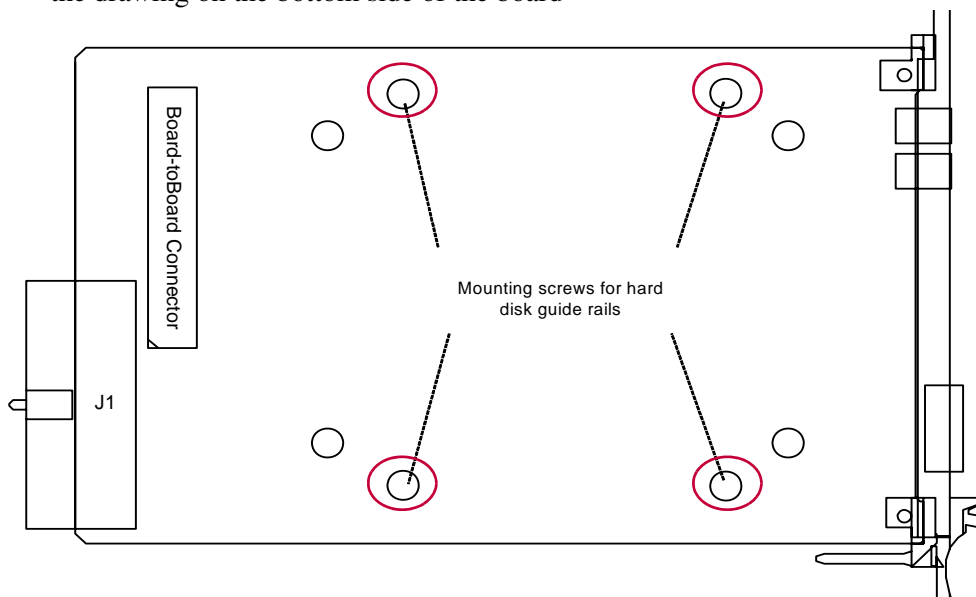
☑ Carefully align the SATA connectors and plug the adapter onto the F603. Make sure to match the pins correctly..

Standoff screw

USB0

USB0

COM

SATA (on-board HDD)

Board-toBoard Connector

J1
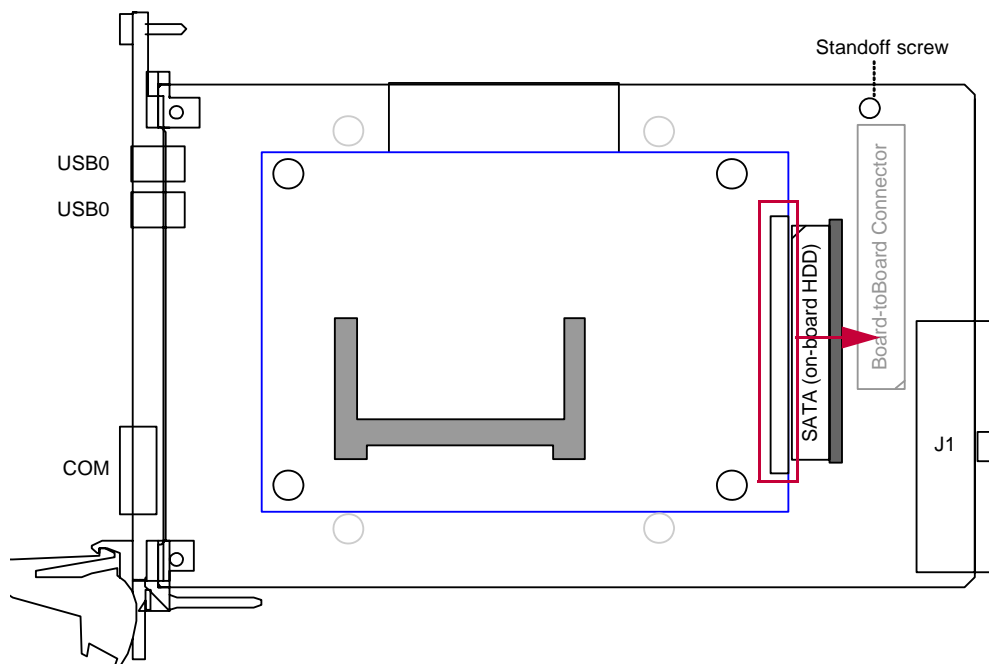
☑ Fasten the adapter card to the F603 at the bottom side of F603 using the four screws supplied with the adapter.
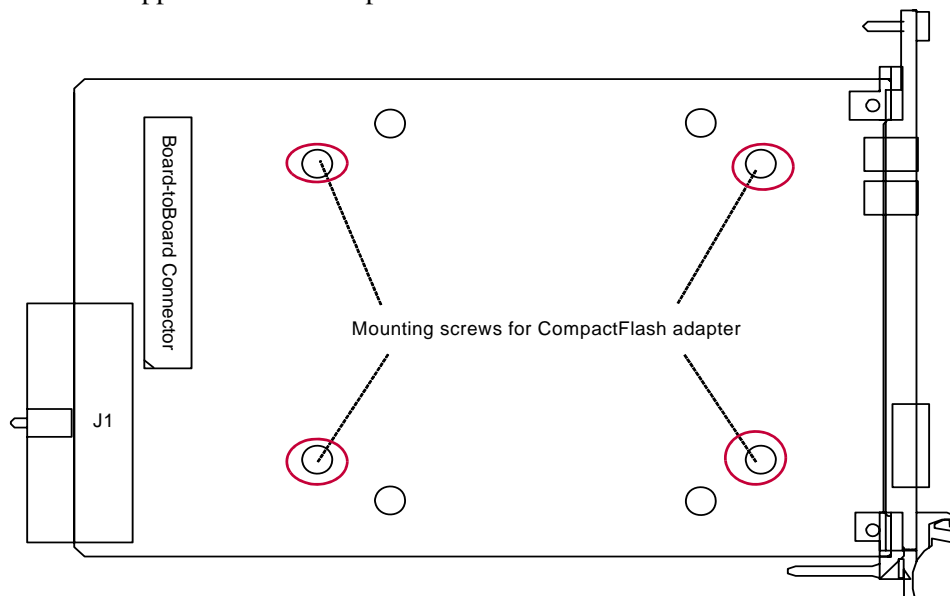
☑ Insert a CompactFlash card into the CompactFlash holder on the adapter as indicated by the arrow on top of the card.

2.6 CompactPCI J1

CompactPCI connector J1 is assembled for increased mechanical stability and/or for power supply via the CompactPCI bus.

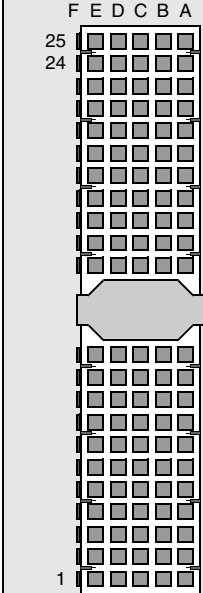*Table 11. Pin assignment of CompactPCI power supply connector J1 (125-pin type "A")*

	F	E	D	C	B	A
25	GND	+5V	+3.3V	-	-	+5V
24	GND	-	-	-	+5V	-
23	GND	-	+5V	-	-	+3.3V
22	GND	-	-	+3.3V	GND	-
21	GND	-	-	-	-	+3.3V
20	GND	-	-	-	GND	-
19	GND	-	GND	-	-	+3.3V
18	GND	-	-	+3.3V	GND	-
17	GND	-	GND	-	-	+3.3V
16	GND	-	-	-	GND	-
15	GND	-	-	-	-	+3.3V
11	GND	-	GND	-	-	-
10	GND	-	-	+3.3V	GND	-
9	GND	-	GND	-	-	-
8	GND	-	-	-	GND	-
7	GND	-	GND	-	-	-
6	GND	-	-	+3.3V	GND	-
5	GND	-	GND	-	-	-
4	GND	-	-	-	-	-
3	GND	-	+5V	-	-	-
2	GND	-	-	-	+5V	-
1	GND	+5V	-	-	-	+5V

Table 12. Signal mnemonics of CompactPCI power supply connector J1

Signal	Direction	Function
+3.3V	in	+3.3V power supply
+5V	in	+5V power supply
GND	-	Ground

3 Appendix

3.1 Literature and Web Resources

- F603 data sheet with up-to-date information and documentation:
www.men.de

3.1.1 SATA

- Serial ATA International Organization (SATA-IO)
www.serialata.org

3.1.2 CompactFlash

- CompactFlash Association:
www.compactflash.org

3.1.3 USB

- USB:
Universal Serial Bus Specification Revision 1.0; 1996; Compaq, Digital Equipment Corporation, IBM PC Company, Intel, Microsoft, NEC, Northern Telecom
www.usb.org

## 3.2 Finding out the Board's Article Number, Revision and Serial Number

MEN user documentation may describe several different models and/or hardware revisions of the F603. You can find information on the article number, the board revision and the serial number on two labels attached to the board.

- **Article number:** Gives the board's family and model. This is also MEN's ordering number. To be complete it must have 9 characters.
- **Revision number:** Gives the hardware revision of the board.
- **Serial number:** Unique identification assigned during production.

If you need support, you should communicate these numbers to MEN.

Figure 3. *Labels giving the board's article number, revision and serial number*

Complete article number

02F603-00
00.00.00

Revision number

641517
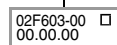
Serial number

You can request the circuit diagrams for the current revision of the product described in this manual by completely filling out and signing the following non-disclosure agreement.

Please send the agreement to MEN by mail. We will send you the circuit diagrams along with a copy of the completely signed agreement by return mail.

MEN reserves the right to refuse sending of confidential information for any reason that MEN may consider substantial.

Non-Disclosure Agreement

for Circuit Diagrams provided by MEN Mikro Elektronik GmbH

between

MEN Mikro Elektronik GmbH
Neuwieder Straße 5-7
D-90411 Nürnberg

("**MEN**")

and

_____
_____
_____
_____

("**Recipient**")

We confirm the following Agreement:

MEN		**Recipient**	
Date:	_____	Date:	_____
Name:	_____	Name:	_____
Function:	_____	Function:	_____

Signature: Signature:

_____   _____

The following Agreement is valid as of the date of the MEN signature.

MEN Mikro Elektronik GmbH

Neuwieder Straße 5-7
90411 Nürnberg
Deutschland

Tel. +49-911-99 33 5-0
Fax +49-911-99 33 5-901

E-Mail info@men.de
www.men.de

1 Subject

The subject of this Agreement is to protect all information contained in the circuit diagrams of the following product:

Article Number: _____ [filled out by recipient]

MEN provides the recipient with the circuit diagrams requested through this Agreement only for information.

2 Responsibilities of MEN

Information in the circuit diagrams has been carefully checked and is believed to be accurate as of the date of release; however, no responsibility is assumed for inaccuracies. MEN will not be liable for any consequential or incidental damages arising from reliance on the accuracy of the circuit diagrams. The information contained therein is subject to change without notice.

3 Responsibilities of Recipient

The recipient, obtaining confidential information from MEN because of this Agreement, is obliged to protect this information.

The recipient will not pass on the circuit diagrams or parts thereof to third parties, neither to individuals nor to companies or other organizations, without the written permission by MEN. The circuit diagrams may only be passed to employees who need to know their content. The recipient protects the confidential information obtained through the circuit diagrams in the same way as he protects his own confidential information of the same kind.

4 Violation of Agreement

The recipient is liable for any damage arising from violation of one or several sections of this Agreement. MEN has a right to claim damages amounting to the damage caused, at least to €100,000.

5 Other Agreements

MEN reserves the right to pass on its circuit diagrams to other business relations to the extent permitted by the Agreement.

Neither MEN nor the recipient acquire licenses for the right of lectual possession of the other party because of this Agreement.

This Agreement does not result in any obligation of the parties to purchase services or products from the other party.

6 Validity of Agreement

The period after which MEN agrees not to assert claims against the recipient with respect to the confidential information disclosed under this Agreement shall be _____ months [filled out by MEN]. (Not less than twenty-four (24) nor more than sixty (60) months.)

7 General

If any provision of this Agreement is held to be invalid, such decision shall not affect the validity of the remaining provisions and such provision shall be reformed to and only to the extent necessary to make it effective and legal.

This Agreement is only effective if signed by both parties.

Amendments to this Agreement can be adopted only in writing. There are no supplementary oral agreements.

This Agreement shall be governed by German Law.

The court of jurisdiction shall be Nuremberg.