Embedded Solutions

F600 – 3U CompactPCI®
Side Card for SATA/Legacy I/O

Configuration example

User Manual

mikro elektronik
gmbh · nürnberg

F600 - 3U CompactPCI Side Card for SATA/Legacy I/O

The F600 is a 4HP legacy I/O 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 COM interfaces.

The F600 provides SA-Adapter™ slots for up to four additional COMs, two at the front panel and two on board. Since SA-Adapters™ provide the physical layers, the F600 can be configured flexibly with a combination of RS232, RS422 or RS485 interfaces, alternatively isolated or not isolated. In addition an on-board 2.5" SATA hard-disk slot can be used on the standard version of the F600, which comes with two COM interfaces.

The F600 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

- Up to four UARTs
  - From four CPU-controlled USB channels
  - Two at front panel
  - Two on board, instead of on-board SATA device, on request
  - Physical interface using SA-Adapters™ via 10-pin connectors
  - RS232..RS485, isolated or not: for free use in system (e. g. cable to front)
  - Data rates up to 1 Mbit/s
  - FIFO receive and transmit buffers for high data throughput
  - Handshake lines: full support; lines depend on SA-Adapters™

Mass Storage

- Serial IDE (SATA)
  - One port for on-board 2.5" hard-disk drive
  - One port for external device (e.g. SATA DVD Drive)
  - Transfer rates up to 150MB/s (depends on hard disk, 28MB/s for 2.5" hard disk)
  - RAID level 0/1 support (depends on CPU board)

Miscellaneous

- CompactPCI® J1 and J2 are assembled for increased mechanical stability and/or for power supply via J1

Electrical Specifications

- Supply voltage/power consumption:
  - +5V (-3%/+5%), 21mA typ. (with two SA1 SA-Adapters™, w/o hard disk)
  - +3.3V (-3%/+5%), 50mA typ. (with two SA1 SA-Adapters™, w/o hard disk)
- MTBF: 1,663,000h @ 40°C (derived from MIL-HDBK-217F)

Mechanical Specifications

- Dimensions: conforming to CompactPCI® specification for 3U boards
- Weight: 145g (w/o hard disk)

Environmental Specifications

- Temperature range (operation):
  - -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

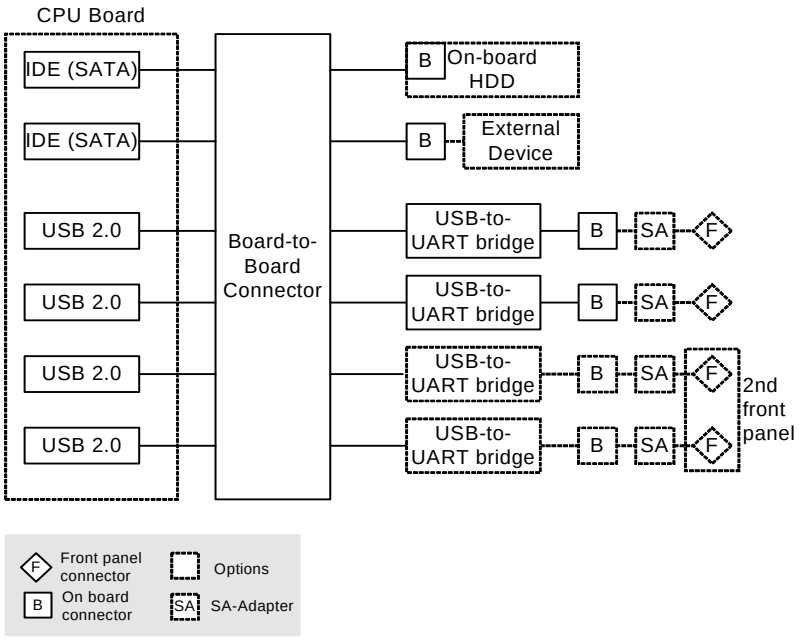
EMC

- 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 for the UART interface for Windows®, Linux (to be verified), VxWorks® (to be verified), QNX® (on request)
- For more information on supported operating system versions and drivers see online data sheet.
- Further information can be found in the data sheet of the CPU board that you use.

Block Diagram



Configuration Options

Mass storage

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

UARTs

- Two additional UARTs instead of on-board SATA hard disk
- 1 to 4 COMs possible

Mechanical

- Side card can be added at left or right side of CPU

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

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. Himmler	2006-02-21
E2	Update, J1 pin assignment corrected	M. Himmler, K.Schöne	2008-02-29

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#
/IRQ Signal names followed by "#" or preceded by a slash ("/") indicate that this signal is 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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Tables

1 Getting Started

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

1.1 Maps of the Board

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

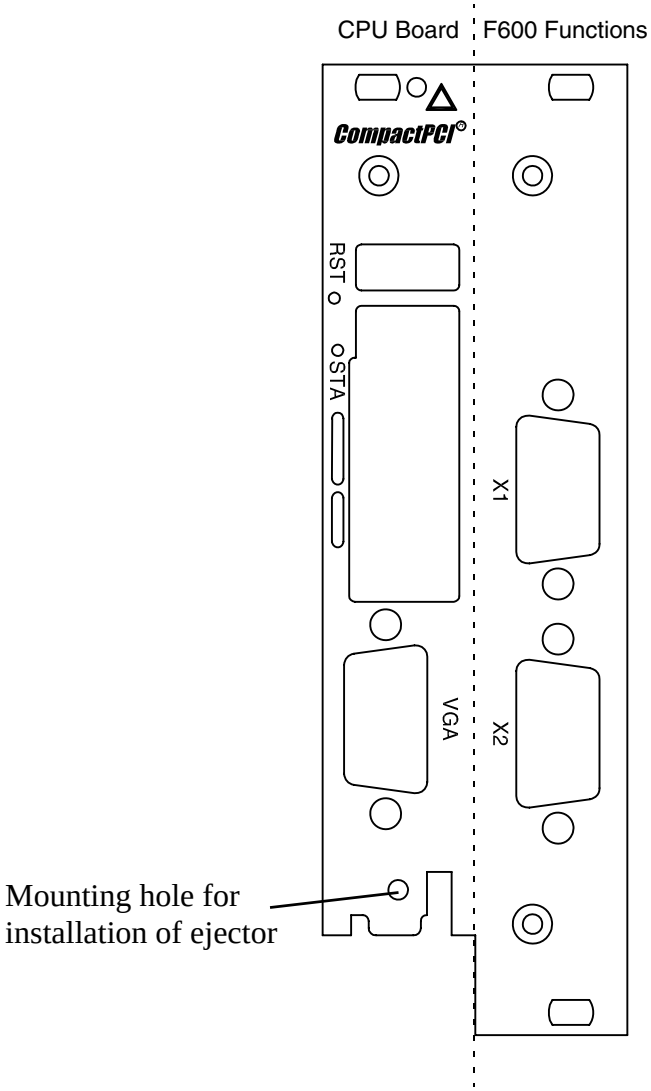
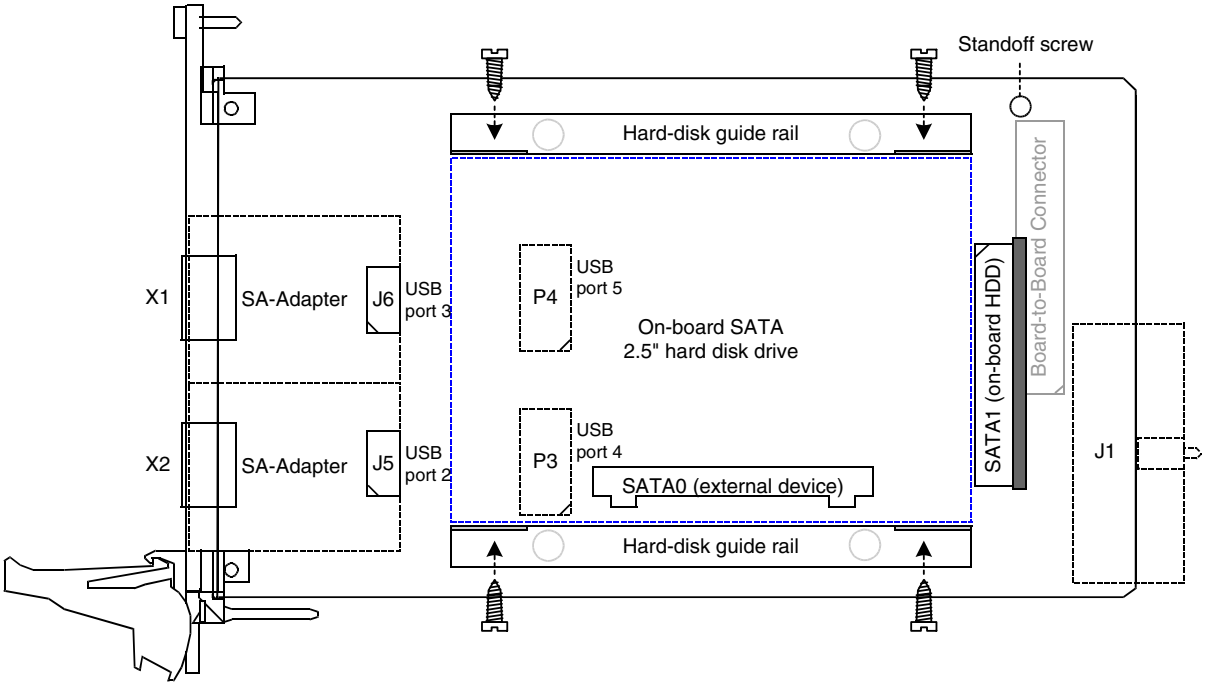


Figure 2. *Map of the board—top view*



1.2 Configuring the Hardware

You should check your hardware requirements before attaching the F600 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.

☑ SATA external device

You can install an external SATA device, e.g. a CD-ROM drive. Suitable standard cables are available.

Refer to Chapter 2.4.2.1 Installing an External SATA Device on page 31 for more details.

☑ 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 F600.
See MEN's website for ordering information.

Refer to Chapter 2.4.1.1 Installing a Hard Disk on page 28 for a detailed installation description.

☑ SA-Adapters on board

The board is shipped without SA-Adapters installed. To use the UARTs, you can install two SA-Adapters directly on the board.

Refer to Chapter 2.3.1.1 Installing SA-Adapters Directly on F600 on page 22 for a detailed installation description.

1.3 Integrating the Board into a System

The F600 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 F600 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, +3.3V and +12V via the CPU board (board-to-board connector) and via the CompactPCI backplane. For this purpose, CompactPCI bus connector J1 is assembled.

2.2 Board-to-Board Connector

The F600 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 F600 can be attached to the right side of a CPU board.

The board-to-board connector on F600 supports the following interfaces:

- Two SATA channels
- Two USB-to-UART interfaces
- Two additional USB-to-UART interfaces optional

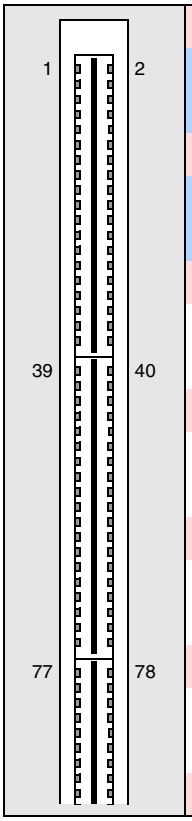
See MEN's website for available board versions.

2.2.1 Connection

Connector types:

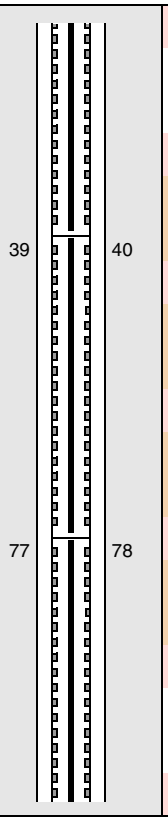
- 114-pin matched impedance plug connector, MICTOR 0.64 mm grid
- Mating connector:
  114-pin matched impedance receptacle connector, MICTOR 0.64 mm grid

Table 1. *Pin assignment of the 114-pin board-to-board connector, pins 1..38*



1	GND		2	GND
3	SATA0_TX+		4	SATA1_TX+
5	SATA0_TX-		6	SATA1_TX-
7	GND		8	GND
9	SATA0_RX+		10	SATA1_RX+
11	SATA0_RX-		12	SATA1_RX-
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

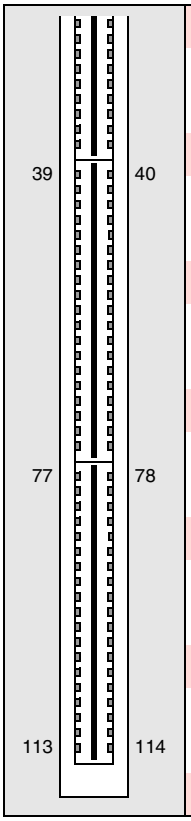
Table 2. *Pin assignment of the 114-pin board-to-board connector, pins 39..76*



39	+3.3V		40	+3.3V
41	-		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	+5V	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

Note: USB ports 4 and 5 can be implemented as an option.

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	SATA0_RX+, SATA0_RX-	in	Differential pair of SATA receive lines, port 0
	SATA0_TX+, SATA0_TX-	out	Differential pair of SATA transmit lines, port 0
	SATA1_RX+, SATA1_RX-	in	Differential pair of SATA receive lines, port 1
	SATA1_TX+, SATA1_TX-	out	Differential pair of SATA transmit lines, port 1
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, optional
	USB_D[5]+, USB_D[5]-	in/out	Differential pair of USB lines, port 5, optional
	USB_RST#	in	Platform reset from CPU, resets all USB ports
Other	SMB_CLK	out	System Management Bus clock
	SMB_DATA	in/out	System Management Bus data

2.3 UART Interfaces

The F600 provides up to four UART interfaces that are controlled using USB ports from the CPU board. Physical interfaces from RS232 to RS485—isolated or not—are implemented using SA-Adapters via 10-pin on-board connectors. Data rates up to 1 Mbit/s are possible.

By standard, F600 comes with two on-board 10-pin connectors for direct connection of SA-Adapters at the front panel.

Another two UARTs can be implemented as an option, also through two on-board 10-pin connectors. These two can be led to SA-Adapters using ribbon cable, e.g. at an additional front panel. **If the additional two UART connectors are implemented, you cannot install an on-board SATA hard disk.**

Please ask our sales team for more information and for customized versions of F600!

You can find more information on MEN SA-Adapters on MEN's website.

Table 5. *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

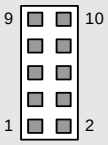
2.3.1 Connection via 10-pin SA-Adapter Connectors

The F600 provides two 10-pin connectors that allow direct connection to MEN SA-Adapters. See Figure 2, Map of the board—top view, on page 14.

Connector types:

- 10-pin IDC receptacle, 2.54mm pitch
- Mating connector:
  10-pin low-profile plug

Table 6. *Pin assignment of 10-pin SA-Adapter UART connectors*



9	DCD#	10	RI#
7	DSR#	8	CTS#
5	DTR#	6	RTS#
3	TXD	4	RXD
1	GND	2	+5V

2.3.1.1 Installing SA-Adapters Directly on F600

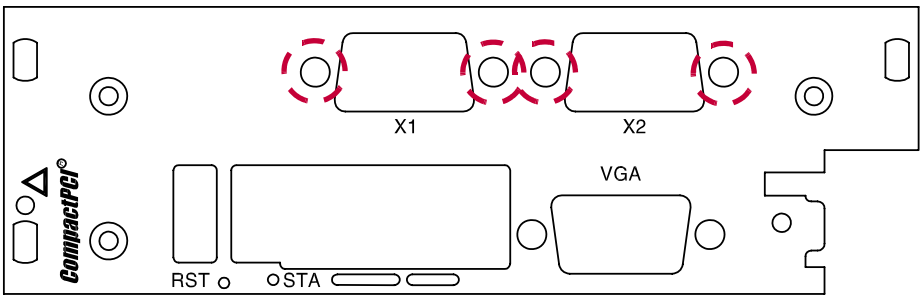
You can install two SA-Adapters directly on the F600 like mezzanine modules, with the I/O connector at the front.

Perform the following steps to install an SA-Adapter:

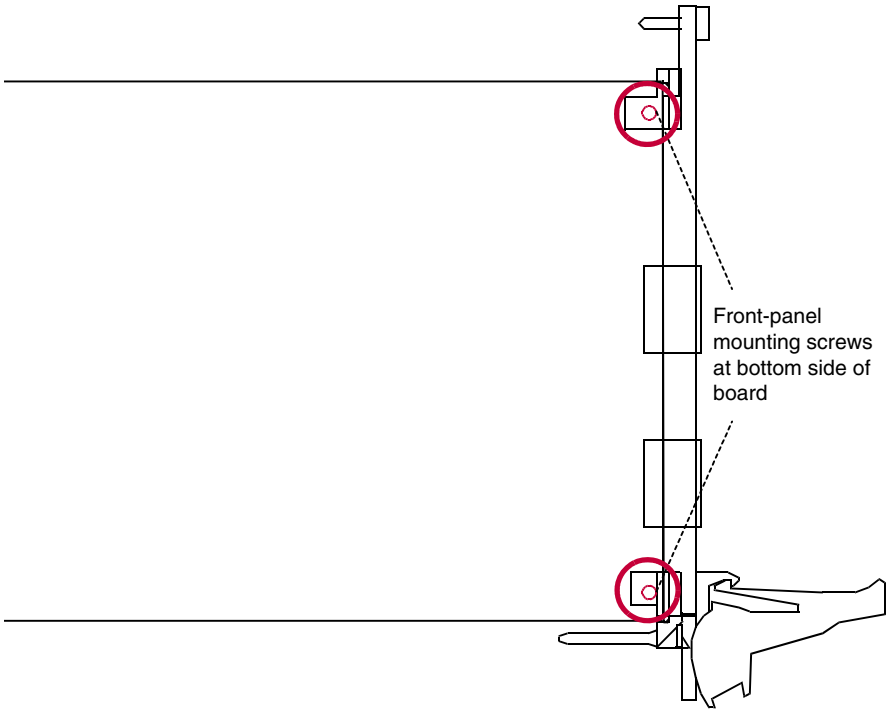
☑ Make sure that the adapter matches the standard dimensions for SA-Adapters. (See also installation hints in the adapter's user manual.)

☑ If your F600 is already attached to a CPU board: Power down your system and remove the F600 from the system together with the attached CPU, and disconnect the two boards as described in the CPU board's user manual.
It is not necessary to remove an on-board SATA hard disk, if installed.

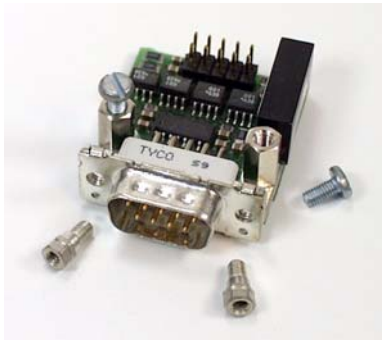
☑ Remove the respective blind connector from the front panel: Loosen and remove the screws highlighted in red.



☑ Remove the front panel: Loosen and remove the front-panel mounting screws at the bottom side of the board, highlighted in red.

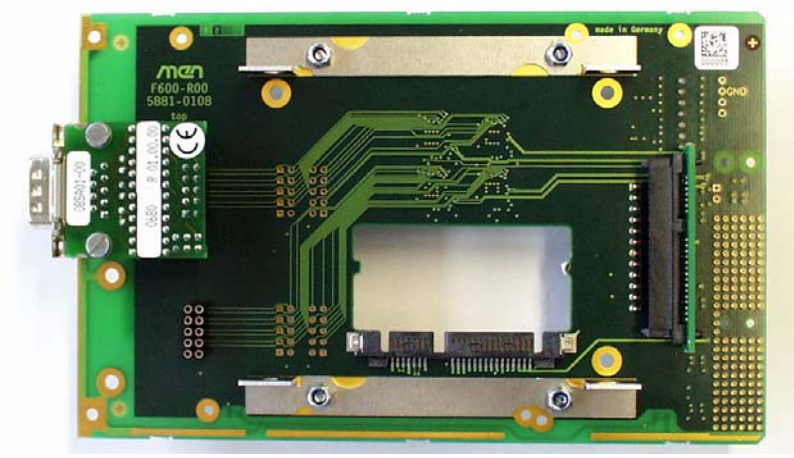


☑ Remove the front panel screws of the SA-Adapter.

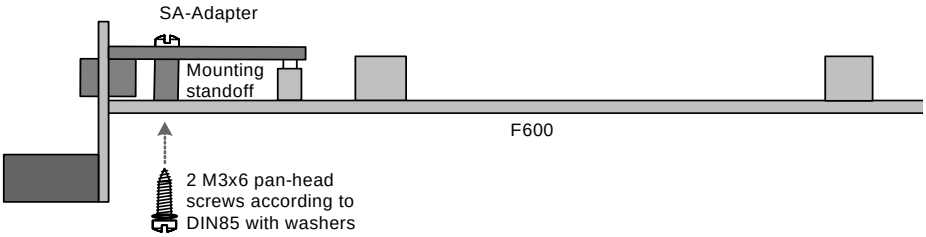


☑ The SA-Adapter is plugged on the F600 with the component sides of the PCBs facing each other. Plug the SA-Adapter into the respective slot, and push it down carefully.

☑ Reinstall the front panel: Place the front panel back over the SA-Adapter connector. Put back and fasten the front-panel mounting screws removed before.



☑ Screw the SA-Adapter tightly to the F600 using the front-panel screws removed before and two pan-head screws of type M3x6 according to DIN85 with washers.



2.3.2 Connection via 10-pin Ribbon-Cable Connectors

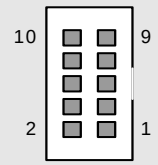
Two additional 10-pin connectors can be assembled that allow ribbon-cable connection to MEN SA-Adapters. See Figure 2, Map of the board—top view, on page 14.

A mounting kit to install two SA-Adapters using an additional front panel was in preparation at print time of this document. Please see MEN's website for the latest ordering information.

Connector types:

- 10-pin low-profile plug, 2.54mm pitch, for ribbon-cable connection
- Mating connector:
  10-pin IDC receptacle, e.g. Elco Series 8290 IDC socket

Table 7. *Pin assignment of 10-pin ribbon-cable UART connectors*



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

2.4 Serial IDE (SATA)

The F600 supports two serial IDE (SATA) interfaces controlled by the CPU board. You can connect a 2.5" hard-disk drive directly on the board, and connect another external device through ribbon cabling.

The SATA interfaces support transfer rates up to 150 MB/s.

Table 8. *Signal mnemonics of SATA connectors*

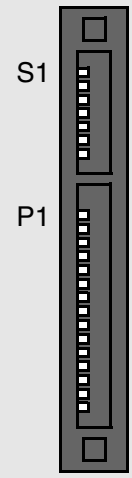
Signal	Direction	Function
+12V	out	+12V power supply
+3.3V	out	+3.3V power supply
+5V	out	+5V power supply
GND	-	Digital ground
SATA0_RX+, SATA0_RX-	in	Differential pair of SATA receive lines, port 0
SATA0_TX+, SATA0_TX-	out	Differential pair of SATA transmit lines, port 0
SATA1_RX+, SATA1_RX-	in	Differential pair of SATA receive lines, port 1
SATA1_TX+, SATA1_TX-	out	Differential pair of SATA transmit lines, port 1

2.4.1 On-Board Hard-Disk Connector (SATA1)

Connector type:

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

Table 9. *Pin assignment of SATA connector for on-board hard disk*



S1	GND
S2	SATA1_TX+
S3	SATA1_TX-
S4	GND
S5	SATA1_RX-
S6	SATA1_RX+
S7	GND
Key and spacing, separate signal and power segments	
P1	+3.3V
P2	+3.3V
P3	+3.3V
P4	GND
P5	GND
P6	GND
P7	+5V
P8	+5V
P9	+5V
P10	GND
P11	GND
P12	GND
P13	-
P14	-
P15	-

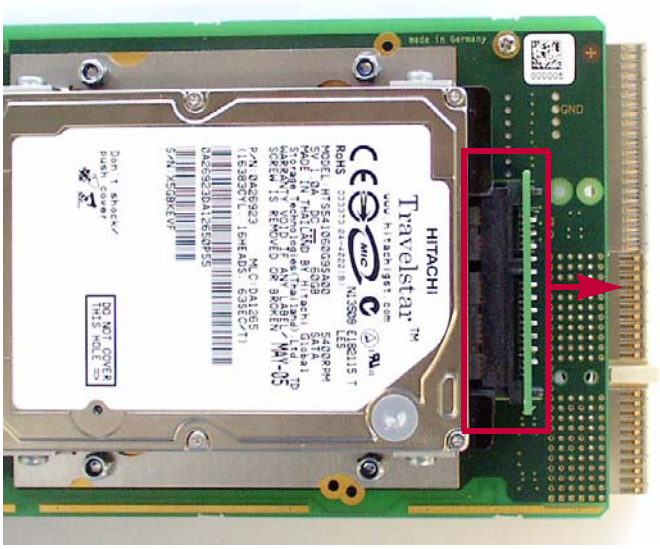
2.4.1.1 Installing a Hard Disk

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.

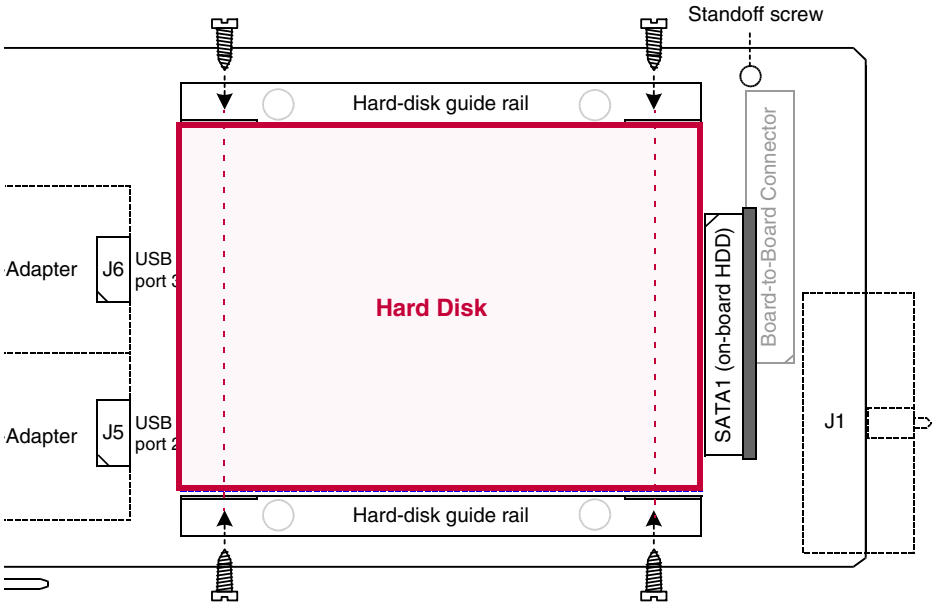
Please see MEN's website for ordering options.

Perform the following steps to install a hard disk:

- ☑ If your F600 is already attached to a CPU board: Power down your system and remove the F600 from the system together with the attached CPU.
  It is not necessary to deinstall the F600 from the CPU board.
- ☑ If you also want to connect an external device to SATA port 0: Connect a suitable SATA cable to SATA0.
- ☑ Push the SATA connector to the right to make way for the hard disk.

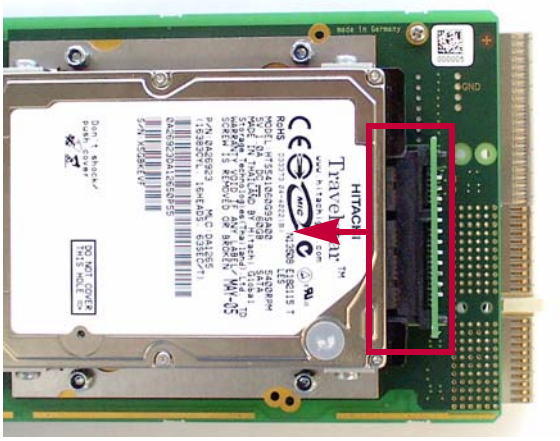


☑ Place the hard disk in the designated space between the guide rails. Align the four mounting holes on the hard disk's sides with the holes in the guide rails.



☑ Fasten the hard disk at the guide rails, using the four screws supplied with F600.

☑ 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.

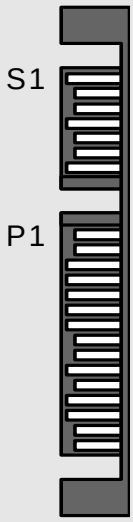


2.4.2 On-Board Connector for External Device (SATA0)

Connector type:

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

Table 10. *Pin assignment of SATA connector for external device*



S1	GND
S2	SATA0_TX+
S3	SATA0_TX-
S4	GND
S5	SATA0_RX-
S6	SATA0_RX+
S7	GND
Key and spacing, separate signal and power segments	
P1	+3.3V
P2	+3.3V
P3	+3.3V
P4	GND
P5	GND
P6	GND
P7	+5V
P8	+5V
P9	+5V
P10	GND
P11	GND
P12	GND
P13	+12V
P14	+12V
P15	+12V

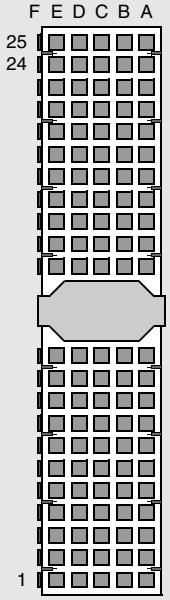
2.4.2.1 Installing an External SATA Device

Standard cables are available to connect SATA devices via ribbon cable. If you want to install an external SATA device in addition to an on-board hard disk, you must connect the cable under the on-board hard disk. Therefore, you should first install the cable for the external device, and then install the on-board hard disk.

2.5 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	+12V	-	-	+5V

Table 12. *Signal mnemonics of CompactPCI power supply connector J1*

Signal	Direction	Function
+12V	in	+12V power supply
+3.3V	in	+3.3V power supply
+5V	in	+5V power supply
GND	-	Ground

3 Appendix

3.1 Literature and Web Resources

- F600 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

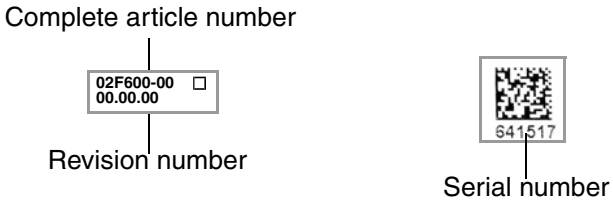
3.2 Finding out the Board's Article Number, Revision and Serial Number

MEN user documentation may describe several different models and/or hardware revisions of the F600. 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*



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 intellectual 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.

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