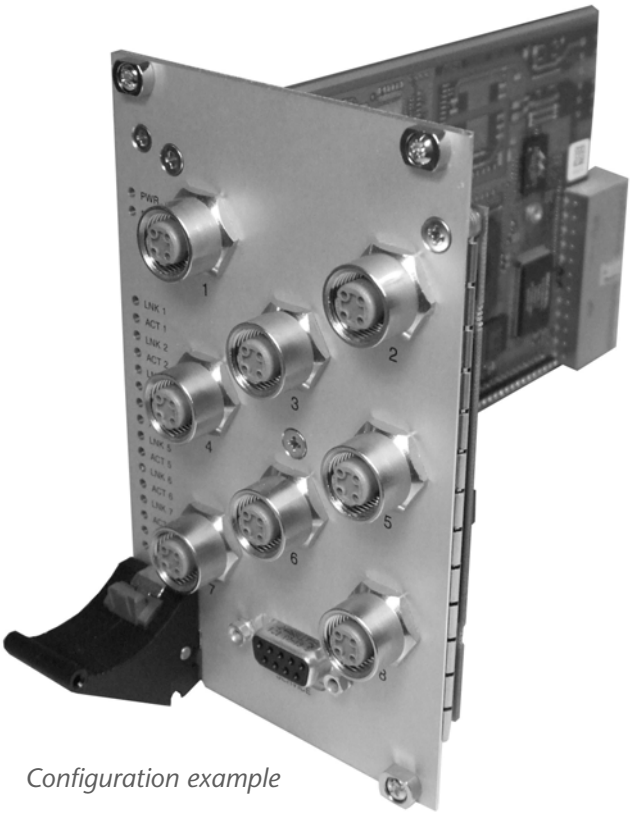
Embedded Solutions

F302 – 3U CompactPCI 8+1-Port Managed Ethernet Switch



Configuration example

User Manual

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F302 – 3U CompactPCI® 8+1-Port Managed Ethernet Switch

The F302 is a managed 3U Fast Ethernet switch module that provides eight channels at the front panel (8 RJ45 or M12 connectors) plus one additional Ethernet channel that is led to the CompactPCI® J1 connector at the rear.

The F302 is managed by its own PowerPC CPU that integrates the configuration firmware. A service interface is accessible at the front panel, providing an easy way to configure the switch. A command line interface is available via the RS232 at the service port and over Ethernet via Telnet or Secure Shell (SSH). The switch can also be configured via SNMP (version 3) and through its HTTP web server. Additionally, the service connector can be used to attach an external dongle to store or update the switch configuration. This makes it easy to exchange the unit for service purposes.

The F302 supports full-duplex and half-duplex operation with auto-negotiation, high-speed non-blocking store-and-forward-switching, Quality of Service (QoS) support with four traffic classes IEEE 802.1p and three-level 802.1x security as well as the logical segmentation of ports (802.1q VLANs). The switch is fault tolerant and restores itself on its own: If a link is temporarily unavailable, frames can be sent via backup/redundant links (spanning tree protocol / link aggregation) and no data loss occurs. Its built-in test mechanisms make the F302 an even more reliable component in the communication system.

The F302 was specifically designed for rugged mobile communication systems. It is thus for example fully compliant with the EN 50155 railway standard. All components on the board are specified for a -40 to +85°C operation temperature. There are no socketed components, hardening the card against shock and vibration. The board is ready for coating (standard with M12 connectors) and has a guaranteed minimum standard availability of 5 years.

Depending on the connector type, the F302 has a front-panel width of 12 HP (3 slots) with RJ45 or 16 HP (4 slots) with M12 connectors. In either case the card occupies only one CompactPCI® backplane slot.

Technical Data

Switch Fabric Key Features

- Eight 10/100Base-T ports at front panel
  - Electrical isolation: 1,500 Vrms
- Ninth 10/100Base-T port via CompactPCI® J1 (rear)
- Auto-negotiation
- High-speed non-blocking, store-and-forward switching
- 8K MAC address lookup table with automatic learning and aging
- Layer 2 switching
- Back pressure or IEEE802.3x flow control
- Automatic MDI/MDI-X crossover (all ports)

Management Firmware System Features

- Saving and restoring user configurations
- Software upgrades through TFTP
- System logs (syslog) and e-mail alerts for critical events
- Remote monitoring (RMON) and alarm generation
- Displaying the running configuration in the form of CLI commands
- DHCP client, server and relay
- Management interfaces through
  - CLI (RS232 console, Telnet, SSH)
  - SNMP v3
  - WebUI (HTTP and HTTPS/SSL)
- Switch configuration can be loaded from external dongle

Management Firmware Layer 2 Features

- TCP/IP (IPv4, IPv6)
- Transparent bridging
- QoS (DiffServ) and 802.1p traffic prioritization queuing, polishing, shaping
- VLAN-aware bridging with GARP
- Static and dynamic VLANs (through GVRP)
- Dynamic learning of multicast groups through GMRP
- Rapid Spanning Tree Protocol and Multiple Spanning Tree Protocol to ensure loop free topology formation
- Reducing multicast traffic in the network through multicast snooping – IGS (IPv4) and MLDS (IPv6)
- IGMP proxy
- Aggregating physical ports for increasing bandwidth and redundancy through link aggregation (LACP)
- Link Layer Discovery Protocol (LLDP)
- SNMP (v1, v2c, v3) agent and MIB support, configuration save/restore

Management Firmware Security Features

- User authentication using 802.1x
- Controlling management access through SNMP, CLI and web only from authorized managers
- MAC based access list (ACL) for traffic filtering
- Rate-limiting and storm control to prevent packet flooding from malicious peers

Supported Ethernet Standards

- Transparent bridging: IEEE 802.1D, 2004
- VLAN: IEEE 802.1Q Rev D5.0, 2005
- Port based VLANs: IEEE 802.1Q Rev D5.0, 2005
- GVRP/GMRP support: IEEE 802.1D
- Rapid Spanning Tree Protocol: IEEE 802.1D
- Multiple Spanning Tree: IEEE 802.1s, IEEE 802.1Q Rev D5.0, 2005
- IGMP snooping: draft-ietf-magma-snoop-12.txt
- MLD snooping: draft-ietf-magma-snoop-12.txt
- Link aggregation: IEEE 802.3ad, 2005
- Port based authentification with EAP: IEEE 802.1X – REV2004
- Link Layer Discovery Protocol: IEEE 802.1AB, 2005
- Priority based switching: IEEE 802.1p

Service Interface

- 9-pin D-Sub connector at front
- RS232 / V24
- I^2C interface for external dongle

Front I/O

- 8 Ethernet ports via RJ45 or M12 D connectors
- 1 service interface via 9-pin D-Sub plug connector
- 16 link and activity Ethernet status LEDs (2 per channel)
- Status LEDs for power, reset and error codes

CompactPCI® Bus

- Compliance with CompactPCI® Specification 2.0 R3.0
- Only one slot required on the 3U CompactPCI® bus
- Peripheral slot
- Compliance with PCI Specification 2.1
- V(I/O): +3.3 V or +5 V
- Ninth Fast Ethernet port via CompactPCI® J1

Electrical Specifications

- Supply voltage:
  - +3.3 V (-3%/+5%)
  - +5 V (-3%/+5%)
- Power consumption: 5 W (max.)
- MTBF: Approx. 200,000 h @ 40°C according to IEC/TR 62380 (RDF 2000)

Mechanical Specifications

- Dimensions: conforming to CompactPCI® specification for 3U boards
- Weight: 316 g (16HP model with M12 connectors)

Environmental Specifications

- Temperature range (operation):
  - -40..+85°C (qualified components)
  - Airflow: min. 10 m³/h
- Temperature range (storage): -40..+85°C
- Relative humidity (operation): max. 95% non-condensing
- Relative humidity (storage): max. 95% non-condensing
- Altitude: -300 m to + 3,000 m
- Shock: according to EN 60068-2-27
- Bump: according to EN 60068-2-29
- Vibration (sinusoidal): according to EN 60068-2-6
- Conformal coating on request (standard with M12 connectors)

Safety

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

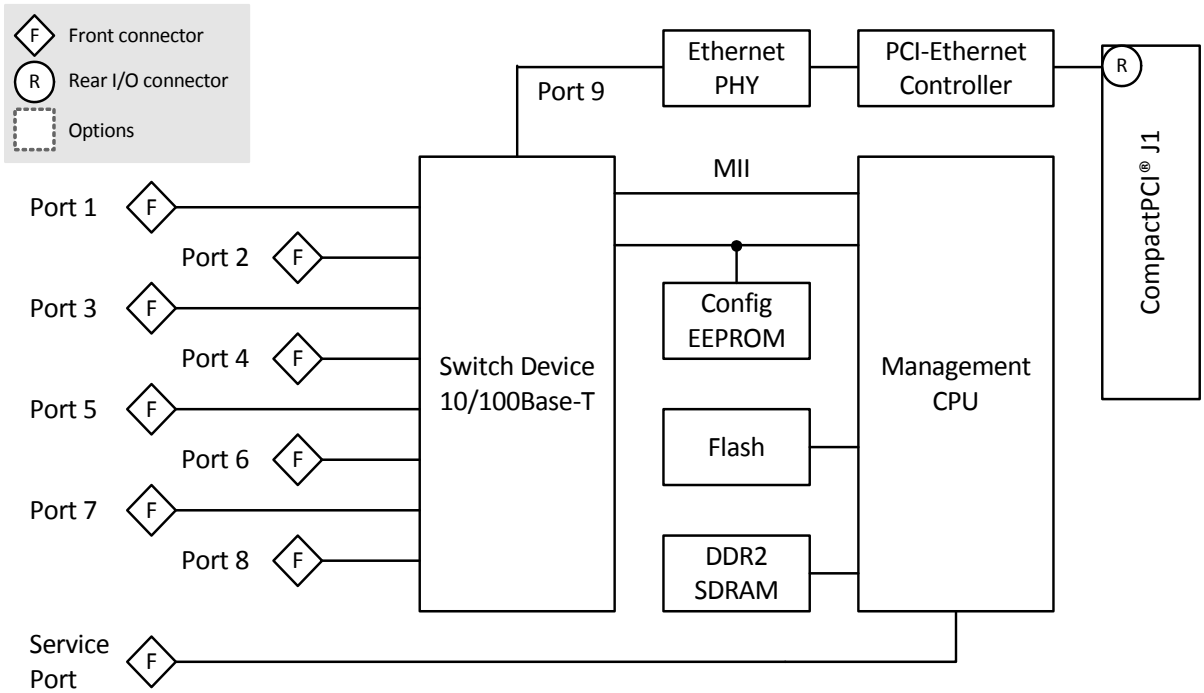
EMC

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

Firmware

- Firmware for configuration and management included
- For more information on supported operating system versions and drivers see online data sheet.

Block Diagram



Configuration Options

Front Connectors / Mechanical

- RJ45 connectors
  - 12 HP (3-slot) front panel
- M12 D connectors
  - 16 HP (4-slot) front panel

Environmental Specifications

- Conformal coating for RJ45 models (standard with M12 connectors)

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

Issue	Comments	Date of Issue
E1	First issue	2009-02-16
E2	Major general update based on new hardware and firmware specification	2010-02-15
E3	Unit also supports +5 V supply voltage, added power consumption Reworked block diagram (connection between CPU and switch device, config EEPROM connection) Removed IP-based ACL from technical data Moved TCP/IP (IPv4, IPv6) to Layer 2 features	2010-12-15
E4	Slight changes to clarify support of +5 V supply voltage	2010-12-16

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 issue of the document.

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Contents

Tables

Figures

1 Getting Started

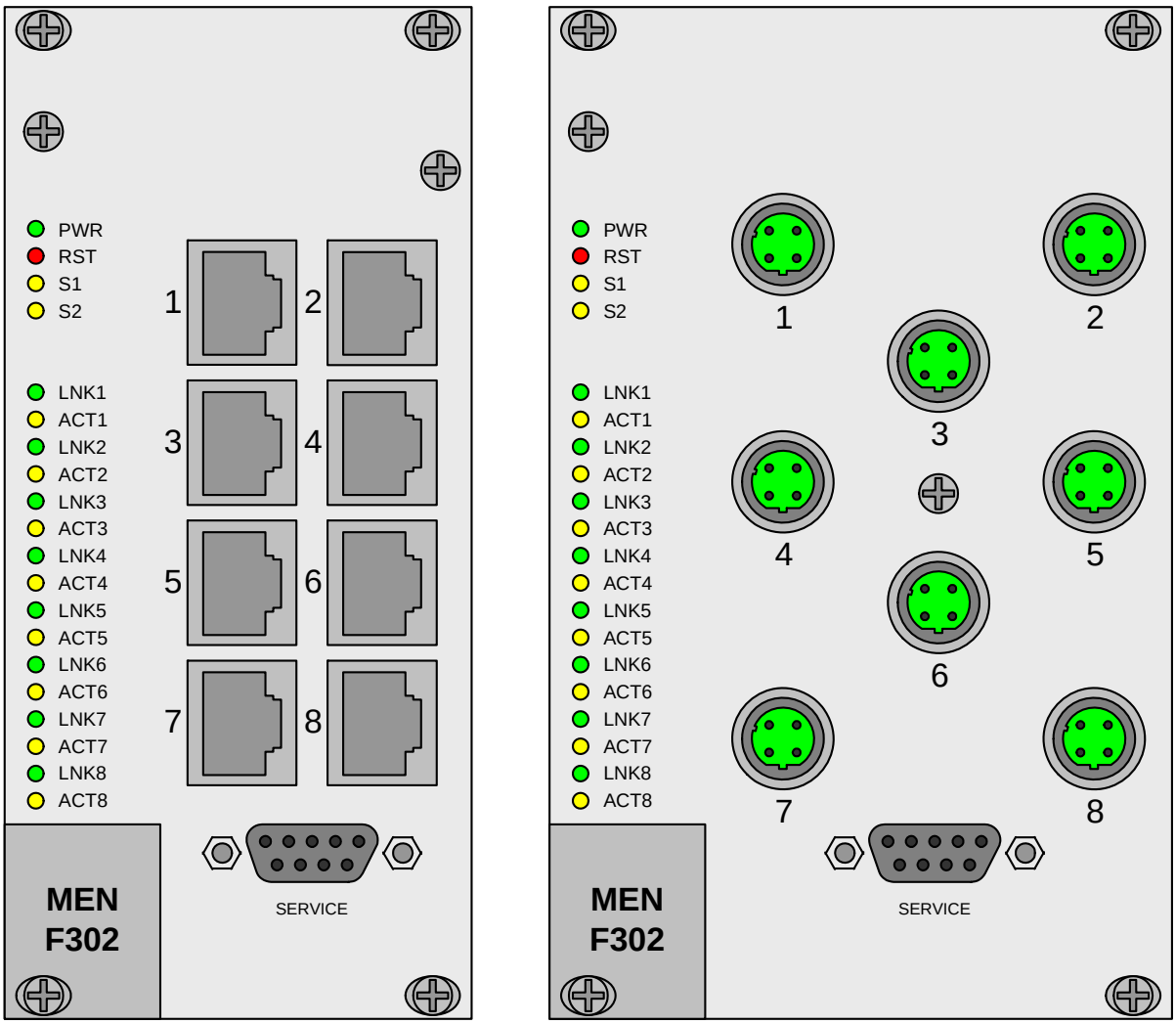
This chapter gives an overview of the board and some hints for first installation in a system.

1.1 Front Panels

Two different types of front panels are available for the F302:

- 8 RJ45 connectors on a 12HP front panel (standard)
- 8 M12 connectors on a 16HP front panel (optional)

Figure 1. *Front panels*



1.2 Integrating the Board into a System

You can use the following "check list" when installing the F302 in a CompactPCI system for the first time.

- ☑ Power-down the system.
- ☑ Insert the F302 into a peripheral slot of your CompactPCI system, making sure that the CompactPCI connectors are properly aligned.

  Note: The peripheral slots of every CompactPCI system are marked by a circle ○ on the backplane and/or at the front panel.
- ☑ Power-up the system.
- ☑ You can now install driver software for the F302 Ethernet controllers, if needed.

1.3 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 the MEN website.

2 Functional Description

2.1 Power Supply

The F302 is supplied with +3.3V or +5V via the CompactPCI bus.

2.2 Ethernet Interface

The F302 offers eight Ethernet ports at the front. An additional Ethernet port accessible via the CompactPCI interface can be made available on request.

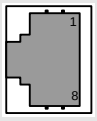
Table 1. *Signal mnemonics of Ethernet 10/100Base-T connectors*

Signal	Direction	Function
RX+/-	in	Differential pair of receive data lines for 10/100Base-T
TX+/-	out	Differential pair of transmit data lines for 10/100Base-T

Connector types for the RJ45 version:

- Modular 8/8-pin mounting jack according to FCC68
- Mating connector:
  Modular 8/8-pin plug according to FCC68

Table 2. *Pin assignment of 8-pin RJ45 Ethernet 10/100Base-T connectors*

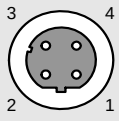


1	RX+
2	RX-
3	TX+
4	-
5	-
6	TX-
7	-
8	-

Connector types for the M12 version:

- 4-pin circular M12 receptacle
- Mating connector: 4-pin circular M12 plug

Table 3. *Pin assignment of 4-pin M12 Ethernet 10/100Base-T connectors*



1	TX+
2	RX+
3	TX-
4	RX-

The management interface and the Ethernet ports have their own MAC address etc.

The unique MAC addresses are set at the factory and should not be changed. Any attempt to change these addresses may create node or bus contention and thereby render the switch inoperable. The MAC addresses on the F302 are:

- Management interface: 0x 00 C0 3A 9F xx x0
- Port 1: 0x 00 C0 3A 9F xx x1
- Port 2: 0x 00 C0 3A 9F xx x2
- ...
- Port 8: 0x 00 C0 3A 9F xx x8
- Port 9 (Gigabit Uplink): 0x 00 C0 3A 9F xx x9

where "00 C0 3A" is the MEN vendor code, "9F" is the MEN product codes, and "xx x" is the hexadecimal serial number of the product, which depends on your switch, e.g., "... 02 A3" for serial number "000042" (0x2A) and port 3. (See Chapter 3.2 Finding out the Board's Article Number, Revision and Serial Number on page 22.)

2.2.1 Ethernet Switch

The F302 uses a manageable 8-port 10/100Base-T switch component, the Marvell 88E6095. The switch provides 10/100 Mbits/s configuration possibility on each port.

It is also possible to configure each port in half-duplex or full-duplex.

The device characteristics are:

- 8 external ports configurable as 10/100 Mbits/s
- MII interface
- Each external port is configurable in half-duplex or full-duplex mode
- Non-blocking wire speed switching
- Store-and-forward mode
- Auto negotiation
- Port mirroring
- Port monitoring
- Flow control
- VLAN support
- Automatic MDI/MDI-X crossover (all ports)
- Port based frame priorization

2.2.2 Configuration of the Switch

The F302 loads the following standard configuration for the 8 ports available at the front of the unit at startup:

Table 4. *Default switch configuration at startup*

Setting	Default
Duplex mode	Full Duplex
Port speed	Auto-Negotiate
VLAN (port-based)	Off
QoS (Quality of Service)	Off
Port mirroring and port monitoring	Off
Port trunking	Off

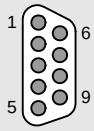
All of the ports are individually configurable using an external dongle, a Telnet or Secure Shell (SSH) command line interface via the D-Sub service connector or over Ethernet via SNMP (Version 3) or the unit's web server interface. For further information about configuration options please refer to the documentation of the F302 firmware.

2.3 Service Interface (RS232 / I²C)

The service connector features an RS232 UART interface for maintenance purposes. Further information about maintenance and configuration options is provided in the documentation of the F302 firmware.

An I²C connection is also available to connect an external dongle (available from MEN) for easy dumping or uploading of configuration data.

Table 5. *Pin assignment of the 9-pin D-Sub service interface connector*

	Pin	Name	Description
	1	GPIO[0]	General purpose I/O 0 Apply active signal for more than 2 seconds: Reset Apply active signal for more than 10 seconds: Reset with restored factory settings
	2	RS232_RX	RS232 receive data
	3	RS232_TX	RS232 transmit data
	4	SCL	I²C data clock for external dongle
	5	GND	Ground
	6	GPIO[1]	General purpose I/O 1 Used for detection of external dongle
	7	+3.3V	Power supply for external dongle
	8	SDA	I²C serial data input/output for external dongle
	9	GND	Ground

2.4 Front Panel Status LEDs

The F302 has a number of status LEDs at its front panel.

Table 6. *Front-panel status LEDs*

LED	Description
PWR	General Power Good
RST	Reset
S1	Service LED 1
S2	Service LED 2
LNK 1	Port 1 link/data receive
ACT 1	Port 1 link/data receive
LNK 2	Port 2 link/data receive
ACT 2	Port 2 link/data receive
...	...
LNK 8	Port 8 link/data receive
ACT 8	Port 8 link/data receive

2.4.1 General Status LEDs

Table 7. *General status LEDs*

LED	Description
PWR	On: Switch is powered on
RST	On: Reset signal is active

2.4.2 Service LEDs

Table 8. *Service LEDs*

LED	Description
S1	Micro controller LED (function depends on software)
S2	Micro controller LED (function depends on software)

The micro controller uses the LEDs connected to it to indicate the reason for an error during startup. The status LED will blink or light up as listed in Table 9, Error codes signaled via service LEDs until the system is restarted or completely powered off. The supported error codes are as follows:

Table 9. *Error codes signaled via service LEDs*

Failure source	S1	S2
RS232 UART	fast	fast
Memory	fast	slow
Marvell switch access	slow	fast
Marvell switch internal PHYs	slow	on
External PHYs	slow	slow
Temperature sensor	on	fast
IDPROM	on	on
PoE	on	slow
Firmware image	off	on
Unspecified	off	fast

"Slow" means blinking with a frequency of 1 Hz, "fast" means blinking with a frequency of 10 Hz.

2.4.3 Ethernet Port Status LEDs

Each Ethernet user port (1 to 8) provides two LEDs to display its status (*LNK x* and *ACT x*). The display LEDs act as described in the following table.

Table 10. *Ethernet port status LEDs*

LED	Description
LNK x	On: Link up
ACT x	On: Transmit or receive activity

An alternative LED configuration with one LED indicating link status and receive activity and the other indicating transmit activity can be realized on demand.

2.5 CompactPCI Interface

The F302 supports a 32-bit 33-MHz CompactPCI interface fully compatible with CompactPCI specification PICMG 2.0 Rev. 3.0. The board works with 3.3V for V(I/O) only. For full CompactPCI functionality only the J1 connector is needed, therefore the board only has a J1 connector to the bus.

Connector type of J1:

- 110-pin shielded, 2mm-pitch, 5-row receptacle according to IEC 917 and IEC 1076-4-101

The pin assignment of connector J1 as defined in the CompactPCI specification will not be repeated here.

3 Appendix

3.1 Literature and Web Resources

- F302 data sheet with up-to-date information and documentation: http://www.men.de/products/02F302-.html

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 F302. 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 2. *Labels giving the board's article number, revision and serial number*