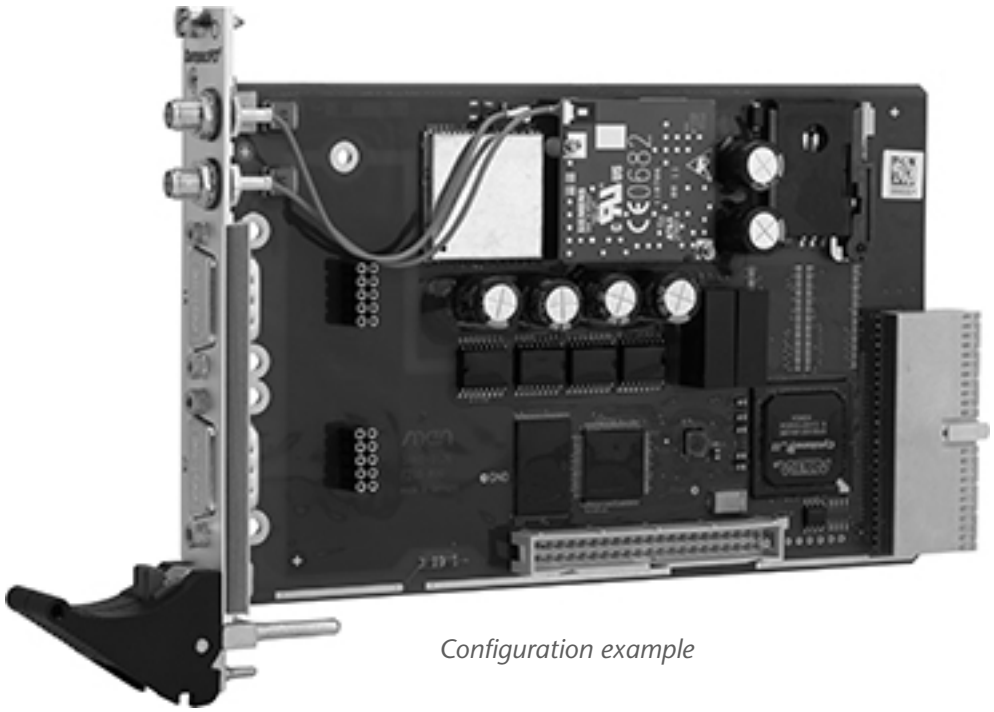
Embedded Solutions

F210 – 3U CompactPCI®
GSM/GPS/UART Interface



Configuration example

User Manual

mikro elektronik
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F210 – 3U CompactPCI® GSM/GPS/UART Interface

The F210 is a rugged single Eurocard CompactPCI® GSM/GPS/UART interface that needs only one slot on the CompactPCI® bus.

The board is equipped with a GSM-R device that is used in rolling stock and commercial vehicles like buses or trucks. GSM-R was specified to support train safety and is introduced at the UIC organization as EIRENE (European Integrated Railway radio Enhanced NEtwork) project. The F210 supports the EGSM 900 and GSM 1800 frequency bands.

A separate GPS device is implemented on the F210 to combine the receiving function of any kind of positioning data with the transmitting possibilities of a mobile phone. The highly sensitive GPS receiver supports 20-channel GPS technology, and is capable of acquisition and tracking in very low signal-strength environments. This allows effective and reliable operation in all scenarios.

The GPS and GSM units are optically isolated from all other parts of the board.

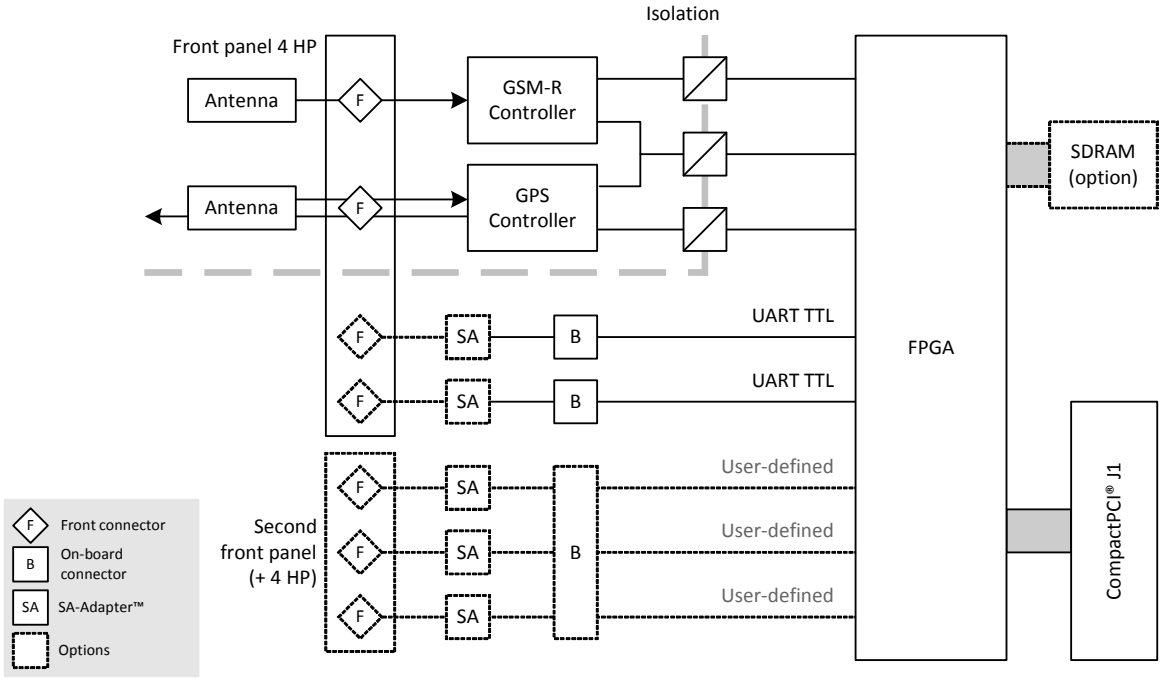
In addition to the GPS and GSM functionality the F210 offers two SA-Adapter™ slots for serial interfaces with RS232 or RS422 or RS485 line drivers, with or without isolation.

As an option, another three SA-Adapters™ can be connected to the F210 for user-defined functions like even more serial interfaces (synchronous/asynchronous) and/ or fieldbus interfaces like CAN bus or IBIS. These user-defined functions can be implemented as IP cores in an onboard FPGA.

Robust Reverse SMA connectors provide the physical interface to the external GSM and GPS antennas.

The F210 is screened for extended operation temperature and conformally coated for use in harsh and mobile environments.

Block Diagram



Technical Data

GSM-R Interface

- GSM-Rail: Global System for Mobile Communications – Railway
- Frequency bands
  - EGSM 900, GSM 1800
  - Compliant to GSM Phase 2/2+
- GSM class: Small MS
- Transmit power:
  - Class 4 (2 W) at EGSM 900
  - Class 1 (1 W) at GSM 1800
- GPRS connectivity
  - GPRS multi-slot class 10
  - GPRS mobile station class B
- Data Services
  - GPRS data downlink transfer: max. 85.6 kbit/s
  - GPRS data uplink transfer: max. 42.8 kbit/s
  - Support of PAP (Password Authentication Protocol) and CHAP (Challenge Handshake Authentication Protocol) for PPP connections
  - Support of PBCCH (Packet Switched Broadcast Control Channel) for enhanced GPRS performance
  - CSD transmission rates: 2.4, 4.8, 9.6, 14.4 kbit/s, non-transparent, V.110
  - WAP compliant
  - Internet services: TCP, UDP, HTTP, FTP, SMTP, POP3
- SMS
  - MT, MO, CB, Text and PDU mode
  - SMS storage: SIM card plus 25 SMS locations in the mobile equipment
  - Transmission of SMS alternatively over CSD or GPRS (user-defined)
  - MMS compliant
- Fax: Group 3, Class 2
- Onboard SIM card interface
  - Supported SIM card: 3 V
- Coding scheme CS 1, 2, 3, 4
- Optical isolation: 1 kV DC
- One antenna connector at front panel
  - For the use of an external antenna
  - Rugged screw connection
- Please note that MEN does not offer SIM cards or mobile telephony contracts!

GPS Interface

Board Revision < R01

- 12-parallel-channel GPS (Global Positioning System) receiver
- GPS Band/Code: L1 frequency, C/A code
- Integrated TCXO, RTC
- Accuracy: 5 m 2DRMS
- Time To First Fix (TTFF):
  - Cold start: 50 s (average)
  - Warm start: 35 s (average)
  - Hot start: 2.6 s (95%)
- Sensitivity:
  - Acquisition (unaided): -139 dBm
  - Acquisition (Hi-Sensitivity): -150 dBm
  - Tracking: -152 dBm
- GPS modes
  - Autonomous
  - MS-based (AGPS)
- AGPS standards supported: TS 04.31, ETSI TS 101 109
- Protocol: NMEA 0183

Board Revision >= R01

- 20-parallel-channel GPS (Global Positioning System) receiver
- GPS Band/Code: L1 frequency, C/A code
- Integrated TCXO, RTC
- Horizontal accuracy: better than 2.1 m (CEP) 5.2 m 2dRMS
- Time To First Fix (TTFF):
  - Cold start: 34 s typ.
  - Warm start: 32 s typ.
  - Hot start: 0.5 s typ.
- Sensitivity:
  - Acquisition: -155 dBm
  - Navigation: -157 dBm
  - Tracking: -159 dBm
- GPS modes
  - TricklePower™ mode for power saving
  - Push-To-Fix™ mode
- Protocol: NMEA 0183
  - SiRF® binary messages: altitude, longitude, elevation, velocity, heading, time, satellite tracking status, command/control messages
  - SiRF® binary interface: raw data

- Antenna voltage supervision
- 3GPP compliance
- Optical isolation: 1 kV DC
- One antenna connector at front panel
  - For the use of an external active antenna
  - Rugged screw connection

UARTs

- Two channels
- Accessible via onboard connectors
- Physical interface at front panel using SA-Adapters™
  - Two SA-Adapters™ can be directly plugged within 4HP
  - Different physical layers depending on SA-Adapter™: RS232, RS422, RS485 with or without optical isolation
  - SA-Adapters™ to be ordered separately
- Data rates up to 2 Mbit/s
- 60-byte transmit/receive buffer
- Handshake lines: full support; lines depend on SA-Adapters™

Front Connections

- Two Reverse SMA antenna connectors
- Two cut-outs for SA-Adapters™

FPGA

- Standard factory FPGA configuration:
  - Main bus interface
  - 16Z057_UART – UART controller (controls in-system GSM-R/GPS communication and UARTs)
  - 16Z045_FLASH – Flash interface
- The FPGA offers the possibility to add customized I/O functionality. See FPGA.

CompactPCI® Bus

- Compliance with CompactPCI® Core Specification PICMG 2.0 R3.0
- Peripheral slot
- 32-bit/33-MHz PCI-to-PCI bridge
- V(I/O): +3.3 V

Electrical Specifications

- Supply voltage/power consumption:
  - Depends on mounted SA-Adapters™ and used functions
  - +5 V (-3%/+5%), 1900 mA max.
  - +3.3 V (-3%/+5%), 850 mA max.

Mechanical Specifications

- Dimensions: conforming to CompactPCI® specification for 3U boards
- Front panel:
  - 4HP with ejector
  - 3U single-slot front panel for two antenna and up to two UART connectors
- Weight: 170 g

Environmental Specifications

- Temperature range (operation):
  - -40..+85°C for all functions except GSM-R (screened)
  - GSM-R component only operable in -20..+70°C range (auto on/off)
  - 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 + 3000 m
- Shock: 15 g/11 ms
- Bump: 10 g/16 ms
- Vibration (sinusoidal): 2 g/10..150 Hz
- Conformal coating (standard)

MTBF

- 189 239 h @ 40°C according to IEC/TR 62380 (RDF 2000)

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)

Software Support

- Driver software for Windows®, Linux, VxWorks®
- For more information on supported operating system versions and drivers see online data sheet.

Configuration Options

Interface configuration

- Also available with GSM only or GPS only
- Also available with standard GSM instead of GSM-R

GSM Interface

- GSM 850 / GSM 1900 support
  - For operation in USA and Canada
  - Through different GSM component
  - Without railway qualification

Additional user-defined functions

- I/O functionality customizable in FPGA
- Three additional serial interfaces
  - Three additional SA-Adapters™ can be added within 8HP using a second front panel
  - For user-defined interface functions, e.g. CAN bus, IBIS, ...
- Nios® soft core implementation possible
  - With up to 16 MB SDRAM
  - For onboard intelligence
- See also FPGA

Mechanical

- For user-defined functions customized front panels are available on request.

Cooling Concept

- Also available with conduction cooling in MEN CCA frame

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

FPGA

Flexible Configuration

- Customized I/O functions can be added to the FPGA.
- It depends on the board type, pin counts and number of logic elements which IP cores make sense and/or can be implemented. Please contact MEN for information on feasibility.
- You can find more information on our web page "User I/O in FPGA"

FPGA Capabilities

- FPGA Altera® Cyclone® II EP2C20
  - 18 752 logic elements
  - 239 616 total RAM bits
- Simple functional updates via software
- 2 MB Flash for FPGA configurations
- Connection
  - Functions available via two onboard 10-pin I/O connectors
  - SA-Adapters™ are used to realize the physical lines.

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 is intended only for system developers and integrators, it is not intended for end users.

It 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
E1	First edition	2007-05-16
E2	Hardware revision R01 with different GPS controller	2007-09-28
E3	Chapter 1.3.1 Logical Mapping of F210 UARTs to Operating-System Devices added	2007-11-20
E4	Added chapters 2.5.1 to 2.5.4	2010-12-13
E5	Updated Technical Data and board maps	2013-04-26

Conventions

This sign marks important notes or warnings concerning the use of voltages which can lead to serious damage to your health and also cause damage or destruction of the component.

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".

comment — Comments embedded into coding examples are shown in green color.

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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Since July 1, 2006 all MEN standard products comply with RoHS legislation.

Since January 2005 the SMD and manual soldering processes at MEN have already been completely lead-free. Between June 2004 and June 30, 2006 MEN's selected component suppliers have changed delivery to RoHS-compliant parts. During this period any change and status was traceable through the MEN ERP system and the boards gradually became RoHS-compliant.

WEEE Application

The WEEE directive does not apply to fixed industrial plants and tools. The compliance is the responsibility of the company which puts the product on the market, as defined in the directive; components and sub-assemblies are not subject to product compliance.

In other words: Since MEN does not deliver ready-made products to end users, the WEEE directive is not applicable for MEN. Users are nevertheless recommended to properly recycle all electronic boards which have passed their life cycle.

Nevertheless, MEN is registered as a manufacturer in Germany. The registration number can be provided on request.

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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*

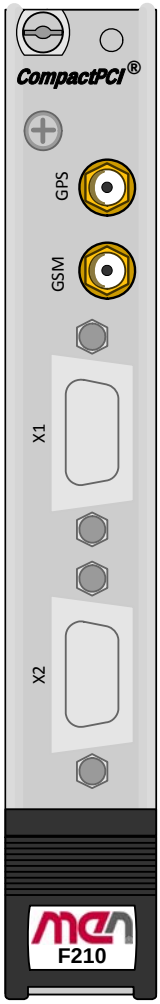
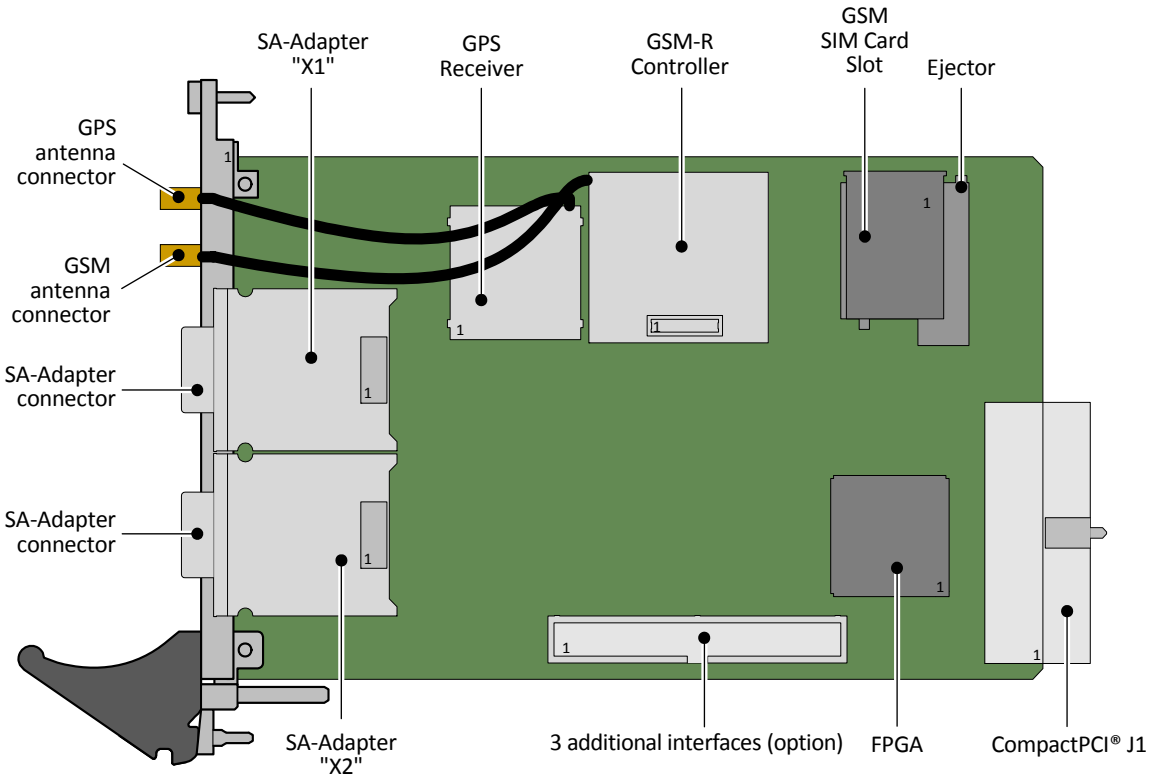


Figure 2. *Map of the board – top view*



1.2 Integrating the Board into a System

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

Note: The F210 **must not** be inserted into the system slot! The system slot of every CompactPCI system is marked by a △ triangle on the backplane and/or at the front panel.

- ☑ Power-down the system.
- ☑ If you want to use GSM:
  - Insert a GSM SIM card into the F210's SIM card slot. (See Figure 1, Map of the board – front panel, on page 17 and Chapter 2.2 GSM-R Interface on page 22.)
  - Connect a suitable antenna at the front panel. (Not included in delivery.)
- ☑ If you want to use GPS: Connect a suitable active antenna at the front panel. (Not included in delivery.)
- ☑ If you want to use additional UARTs: Install SA-Adapters on the F210 as described in Chapter 2.5 UART Interfaces on page 25.
- ☑ Insert the F210 into your CompactPCI system, making sure that the Compact-PCI connectors are properly aligned.
- ☑ Power-up the system.
- ☑ You can now install driver software for the F210 GSM/GPS controllers and UARTs.

1.3 Installing Driver Software

The F210 is supported under Windows, Linux and VxWorks. The GSM and GPS controllers are connected to the host system via UART interfaces and will appear accordingly in your operating system.

If you use additional UARTs on F210 using SA-Adapters, don't confuse them with the GSM/GPS UARTs. Since all of the standard UARTs (including GSM/GPS) are based on the same FPGA IP cores, driver support is also the same for all UARTs.

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.

1.3.1 Logical Mapping of F210 UARTs to Operating-System Devices

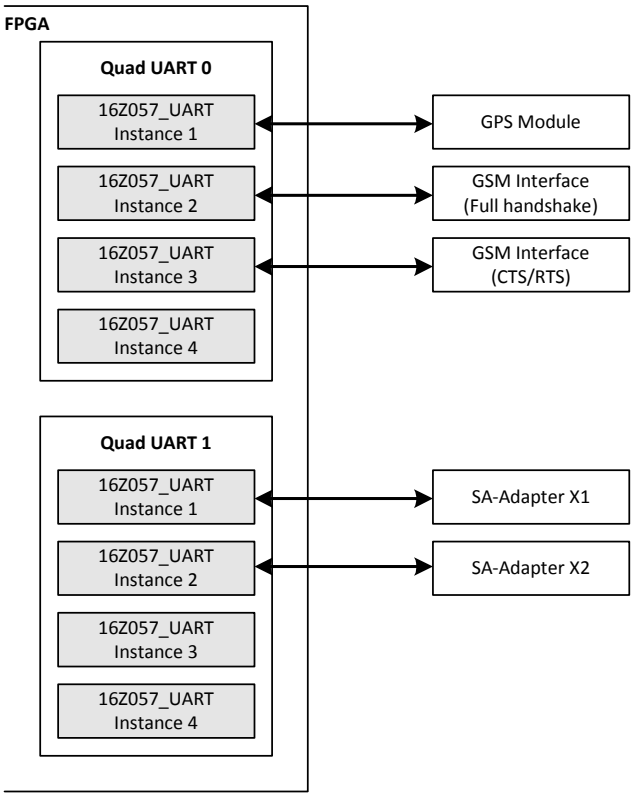
Under some operating systems such as Linux the mapping of the GPS and GSM UARTs may be unclear. For instance, when MEN's native Linux UART driver (article number 13Z025-90) is used to register the additional UARTs it is not clear if they are to be accessed as */dev/ttyS0* or using a different device name.

The problem is that it is unknown if there are already other serial ports in the system, like the two classic COM ports in most desktop PCs. Under Linux these are mapped to */dev/ttyS0* and */dev/ttyS1*, so when the additional serial ports on the F210 are registered they get higher device numbers.

On the other hand, MEN boards like the F14 come with no serial devices included, so the F210's UARTs would be consecutively numbered starting at */dev/ttyS0*.

In this case it is helpful to take a look at the internal implementation of the UARTs with respect to their position in the PCI configuration space. The figure below is a part of the IC design's logical assignment of UARTs to functional units.

Figure 3. *Quad UART instance assignment to function*



The F210 has two quad UART units, but both not fully equipped with serial ports.

To decide how each serial port can be accessed we need to know under which addresses the CPU sees the 16Z057_UART units. The PCI address map provides this information, its layout is defined by MEN, so the offsets are always the same. The following table shows the relevant part of the PCI map.

Table 1. *PCI address map*

BAR	Offset	Unit	Comment
0	0x0	Chameleon table V2	
0	0x200	Quad UART 0	Memory mapped
0	0x300	Quad UART 1	Memory mapped

The offset of serial register instances within one quad UART is always 0x10, so the offset addresses for the GPS and GSM UARTs are 0x200 and 0x210. These offsets will always be the same regardless which address PCI BAR0 of the F210 is mapped to.

To decide now which device name will be assigned by the kernel to each UART the kernel messages must be watched (e.g. using the *dmesg* command). When the serial port driver is loaded (module *men_lx_frodo.ko* loaded via *modprobe*) and the UARTs on the F210 are registered, messages similar to the ones below will appear:

```
Nov 10 10:54:48 tcu kernel: serial8250: ttyS0 at MMIO 0xd7fff200 (irq = 10) is a 16550A
Nov 10 10:54:48 tcu kernel: serial8250: ttyS1 at MMIO 0xd7fff210 (irq = 10) is a 16550A
...
```

If you compare the last three numbers of each given memory mapped address (MMIO) to the addresses given in the PCI address map above, you can clearly identify each UART.

In this example, the GPS module will be accessible as */dev/ttyS0* and the GSM module as */dev/ttyS1*.

2 Functional Description

2.1 Power Supply

Power supply is fed via the CompactPCI backplane. The board operates on +3.3 V and +5 V.

2.2 GSM-R Interface

The GSM-Rail interface of the F210 is based on the Triorail TRM:2 modem, which adds railway suitability to standard GSM technology (GSM = Global System for Mobile Communications).

The F210 itself has no antenna but provides a sturdy Reverse SMA connector at the front panel. You need to select and connect an antenna suitable for your application. **Please note that MEN does not supply antennas with the F210, since the choice of a suitable antenna depends on your application.**

The host computer can communicate with the GSM modem via a serial interface. The communication speed is between 300 bits/s and 230 400 bits/s.

Alternative board versions with different GSM 850 / GSM 1900 support for operation in USA and Canada are available on request. Please contact MEN's sales team for more information.

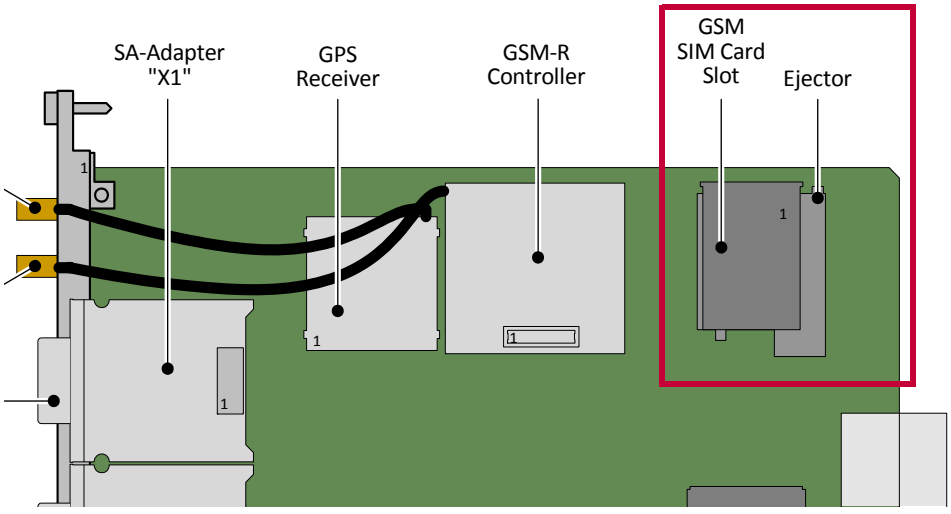
For technical data see Chapter Technical Data on page 4.

See also Chapter 4.1 Literature and Web Resources on page 34.

2.2.1 SIM Card

To get access to a mobile phone network you need a SIM card (subscriber identity module) and a contract with a mobile service provider. **Please note that MEN does not provide mobile services or SIM cards!**

Figure 4. *GSM-R: Inserting a SIM card*



Do the following to insert a SIM card:

- ☑ Push the ejector and pull out the plastic SIM card holder.
- ☑ Turn it around and insert the SIM card as indicated by the holder's shape and imprint.
- ☑ Slide the SIM card holder back into the slot until it clicks into place. If it is firmly locked, you cannot pull it out unless you push the ejector again.

2.2.2 Temperature Monitoring

The GSM-R submodule has its own temperature control mechanism. The GSM module automatically shuts down if the ambient temperature exceeds its operation range of -20 °C to +70 °C. This does not impede the other functions of the F210 but adds to the board's reliability.

2.3 GPS Interface

The GPS interface of the F210 is built around the Navman Jupiter 30 GPS receiver module (board revisions < R01: HS110 GPS module).

The F210 itself has no antenna but provides a sturdy Reverse SMA connector at the front panel. You need to select and connect an active antenna suitable for your application. **Please note that MEN does not supply antennas with the F210, since the choice of a suitable antenna depends on your application.**

The host computer can communicate with the GPS controller via a serial interface.

The GPS interface provides the power supply for the active antenna. The active antenna is driven by 5 V (50 mA). As a board option, this voltage can be changed to 3.3 V or can be disabled completely. Please contact MEN's sales team.

The GPS antenna power is limited by a polyfuse to 300 mA.

For technical data see Chapter Technical Data on page 4.

See also Chapter 4.3 Finding out the Board's Article Number, Revision and Serial Number on page 35.

2.4 Typical Application of GSM-R/GPS in a System

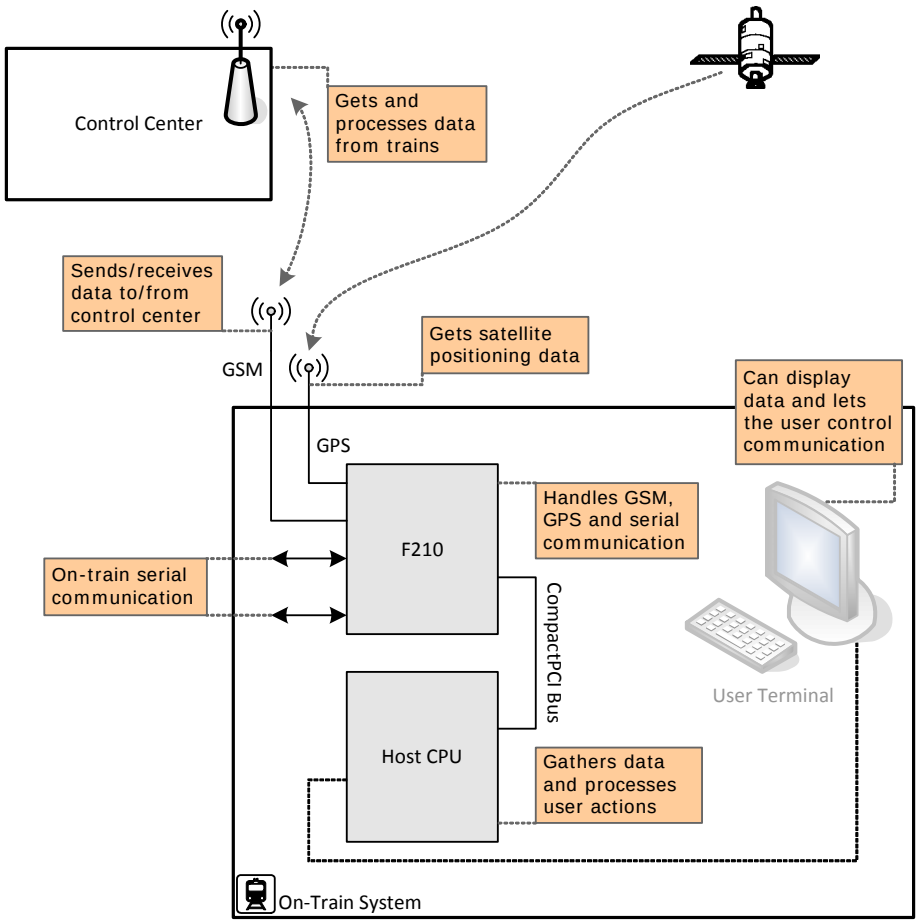
MEN provides UART driver software to support communication inside the system. You will need to select suitable further software or write your own software to implement the requirements of your specific application.

The following figure gives you a typical on-train application of the F210.

- The GSM and GPS functions provide wireless communication.
- A host CPU may process data and may also be connected to a user terminal, if needed.
- The F210 can handle on-train serial communication using its two standard UARTs. It can also be configured to the user's needs with additional interfaces or even with a Nios processor for more sophisticated data processing.

If you are interested in customizing your F210 solution e. g. through additional interfaces, please contact MEN's sales team.

Figure 5. *Typical set-up of a system with F210 based GSM-R/GPS communication*



2.5 UART Interfaces

The F210 offers two standard UARTs. The physical layer is realized individually for each channel by means of SA-Adapters. Two SA-Adapters can be plugged directly on the PCB.

You can use different types of SA-Adapters with the F210, e.g. isolated and non-isolated adapters for RS232, RS422 and RS485 interfaces. The interfaces are accessible at the front by means of 9-pin D-Sub connectors on the SA-Adapter. Please see the F210 data sheet for a list of available standard SA-Adapters.

The UART interfaces are controlled by an on-board FPGA (see also Chapter 3 FPGA on page 32). SA-Adapter X1 is connected to "Quad UART 1 - Instance 1" and SA-Adapter X2 is connected to "Quad UART 1 - Instance 2".

2.5.1 Configuration under Windows

MEN's driver installation package for Windows allows easy configuration through the Device Manager.

To do this, open the *Properties* page of each F210 UART device via the Windows Device Manager, select the *Port Interface* tab and choose the used physical interface.

You can find more details on the Windows driver installation package in the F210 under Windows User Manual.
You can download the Windows driver and user manual from MEN's website.

2.5.2 Configuration under Linux

MEN provides a Linux driver that allows to configure the interface mode and baud rate.

You can find more details on MEN's Linux driver software in *Application Note: Using 16Z025_UART and 16Z125_UART under Linux* (21APPN009).
You can download the application note from MEN's website.
You can download the Linux driver from MEN's website.

The *baud_base* parameter must be set to 115200.

MEN's Linux driver supports the following values for the *mode* parameter:

se	single ended (RS232)
df_fdx	differential, full duplex (RS422)
df_hdxe	differential, half duplex, with echo (RS485)
df_hdx	differential, half duplex, no echo (RS485)

The following examples show how to use the driver with F210.

Set SA-Adapter X1 and X2 to RS232 (e.g. SA01)

```
# modprobe men_lx_frodo_sw baud_base=115200
mode=se,se,se,se
```

Set SA-Adapter X1 and X2 to RS422 full-duplex (e.g. SA02-01)

In order to change the settings, the driver needs to be removed first.

```
# modprobe men_lx_frodo_sw baud_base=115200
mode=se,se,se,df_fdx,df_fdx
```

The first three UART instances always have to be set to *se* as they are connected to the GPS and the GSM interface. See Chapter 3.2 Standard Factory FPGA Configuration on page 33.

Note: Most Linux kernels only support 4 UARTs by default. If more than 4 UARTs are needed, the kernel parameter *CONFIG_NR_8250_UARTS* has to be adjusted and the kernel has to be recompiled.

2.5.3 Configuration under VxWorks

MEN provides a VxWorks driver that provides comprehensive I/O control support to configure the interfaces.

You can find more details on MEN's VxWorks driver software in the driver's included HTML documentation.

You can download the VxWorks driver from MEN's website.

The UART clock frequency must be set to 1843200. You can use driver function *Z25_CreateDevice* or *Z25_SetBaseBaud* to do this.

2.5.4 Configuration under QNX

MEN provides a QNX driver that allows configuration of the interfaces through QNX tool *stty*.

The *stty* tool together with MEN's QNX driver provides a large number of parameters to configure serial interfaces. MEN's driver includes options to set the physical interface itself. You can get details on the driver using QNX command *use devc-serz025*.

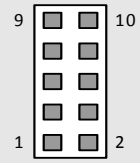
You can download the QNX driver from MEN's website.

To get details on the driver use QNX command *use devc-serz025*.

You can find more information on *stty* also on the QNX developer community website.

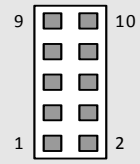
2.5.5 Pin Assignments

Table 2. *Pin assignment of the 10-pin UART "X1" receptacle connector*



9	DCD1#	10	RI1#
7	DSR1#	8	CTS1#
5	DTR1#	6	RTS1#
3	TXD1	4	RXD1
1	GND	2	+5V

Table 3. *Pin assignment of the 10-pin UART "X2" receptacle connector*



9	DCD2#	10	RI2#
7	DSR2#	8	CTS2#
5	DTR2#	6	RTS2#
3	TXD2	4	RXD2
1	GND	2	+5V

Connector types:

- 10-pin receptacle, 2.54mm pitch, for SA-Adapter connection

Mating connector:

- 10-pin SA-Adapter plug

Table 4. *Signal mnemonics of UART interfaces*

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

Note: Some SA-Adapters do not support all signals. Please refer to the user manual of the actually used SA-Adapter for its pin assignment and for further details. See Chapter 4.1 Literature and Web Resources on page 34.

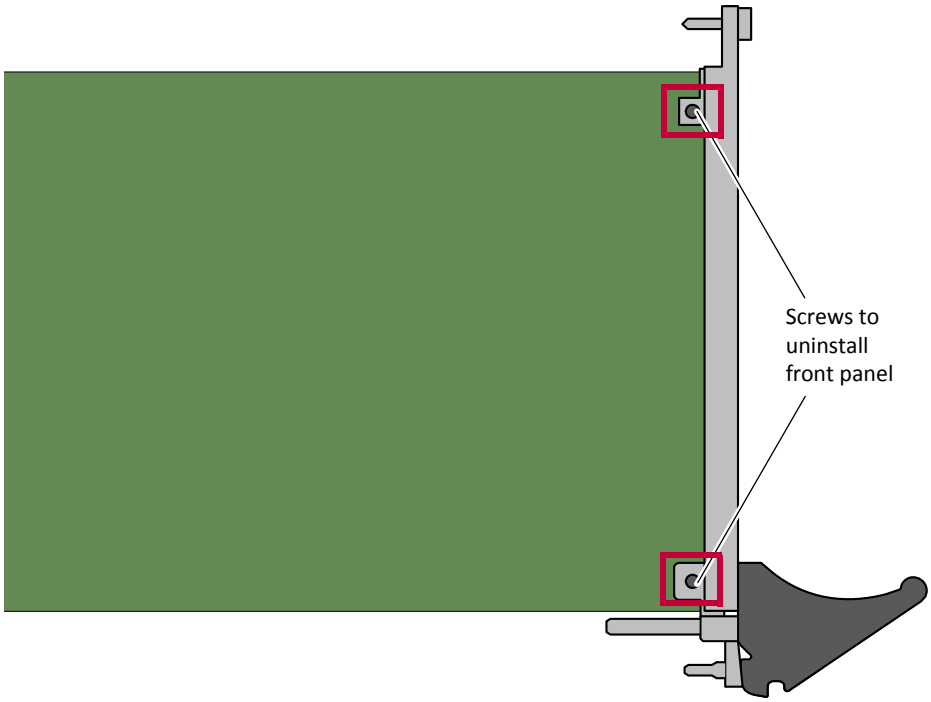
2.5.6 Installing SA-Adapters

Two SA-Adapters can be mounted directly on the F210 on the 10-pin receptacle connectors of X1 and X2.

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

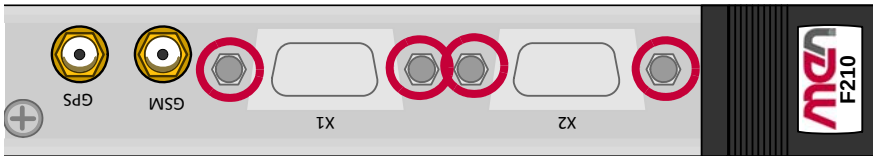
☑ Power down your system and remove the F210 from the system.

☑ Loosen the front panel: Loosen and remove the two screws highlighted in red. Take care not to pull out the antenna cables.



☑ Remove the two front panel screws and the two screws on top of the mounting bolts of the SA-Adapter.

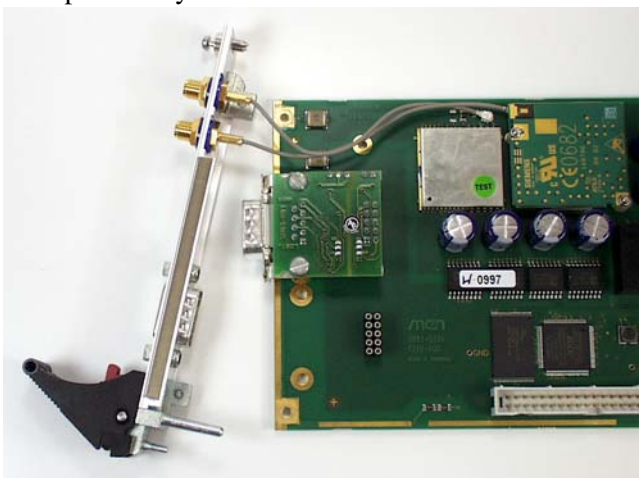
☑ Remove the blind connector from the front panel slot that you want to use: Loosen the two screws at the front of the panel.
Hint: Hold the screw in place with a suitable tool from the back of the panel, then loosen the screw at the front.



☑ The SA-Adapter is plugged on the F210 with the component sides of the PCBs facing each other.

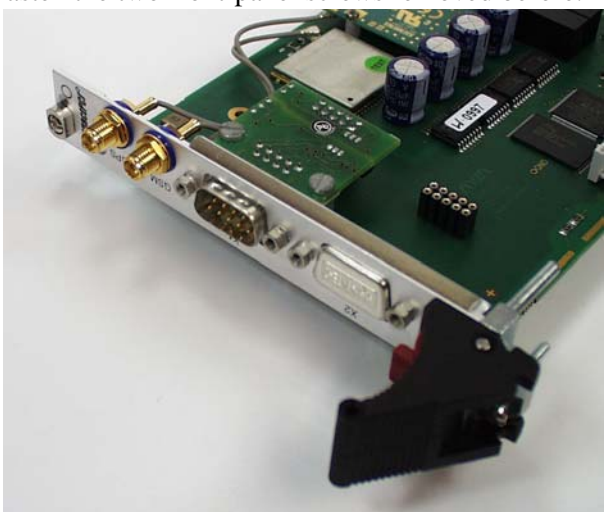
☑ Carefully put it down, making sure that the connectors are properly aligned.

☑ Press the SA-Adapter firmly onto the F210.

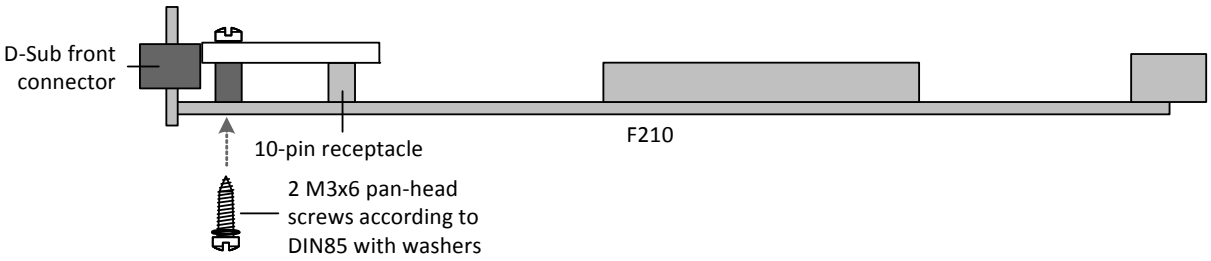


☑ Reinstall the front panel: Place the front panel back over the connectors, taking care not to damage the antenna cables.

☑ Put back and fasten the two front-panel screws removed before.



☑ Screw the SA-Adapter tightly to the F210 PCB using the two pan-head screws removed before.


D-Sub front
connector
10-pin receptacle
F210
2 M3x6 pan-head
screws according to
DIN85 with washers

2.6 Additional Interfaces

The F210 provides the option of adding another three additional interfaces. Such interfaces can be implemented inside the FPGA and can be tailored to user needs. This makes the board very flexible and allows to implement different serial interfaces as an option, e. g. IBIS or CAN bus.

The signals are then available on a 40-pin on-board connector, with the pin assignment depending on the FPGA configuration. SA-Adapters with ribbon cabling are used to lead the interfaces to a second 4 HP front panel with the desired physical layer.

If you are interested in expanding your F210 solution by customized interfaces, please contact MEN's sales team.

2.7 CompactPCI Interface

The F210 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 VI/O.

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 FPGA

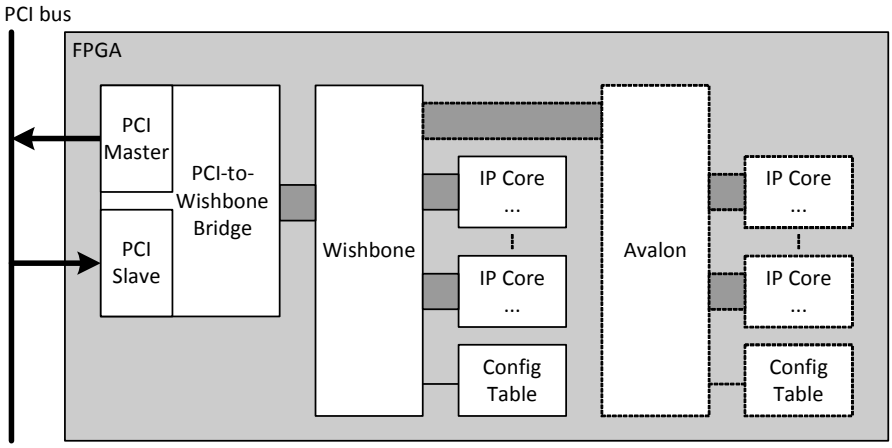
3.1 General

The FPGA – as a part of the F210 – represents an interface between a user-selectable configuration of I/O modules (IP cores) and the PCI bus. The PCI core included in the FPGA is a PCI target. It can be accessed via memory single/burst read/write cycles.

The Wishbone bus is the uniform interface to the PCI bus. However, the FPGA may have multiple internal buses, so that IP cores can be connected to one of several internal buses, e.g., Wishbone or Avalon. This guarantees the highest possible flexibility for different configurations of the FPGA.

Typically each implementation contains basic system functions such as reset and interrupt control etc. and the system library, which are also IP cores.

Figure 6. *FPGA – Block diagram (exemplary)*



A configuration table provides the information which modules are implemented in the current configuration. Furthermore the revision, the instance number (one module can be instantiated more than one time), the interrupt routing and the base address of the module are stored. At initialization time, the CPU has to read the configuration table to get the information of the base addresses of the included modules.

Note that with regard to the FPGA resources such as available logic elements or pins it is not possible to grant all possible combinations of the FPGA IP cores. The following chapter describes one possible configuration of the FPGA. Please ask our sales staff for other configurations.

You can find an overview and descriptions of all available FPGA IP cores on MEN's website.

3.2 Standard Factory FPGA Configuration

The factory FPGA configuration for standard boards comprises the following FPGA IP cores:

- 16Z024-01_Chameleon – Chameleon table
- 16Z014_PCI – PCI-to-Wishbone Bridge
- 16Z100_WBBUS – Wishbone Bus Interconnection Unit
- 16Z069_RST – Reset controller
- 16Z052_GIRQ – Interrupt controller
- 16Z045_FLASH – Flash controller
- 16Z057_UART – UART controller (2 IP cores, controls GSM-R, GPS and UART serial interfaces)
  - Quad UART 0 - Instance 1 is connected to the GPS interface
  - Quad UART 0 - Instances 2 and 3 are connected to the GSM interface
  - Quad UART 1 - Instance 1 is connected to SA-Adapter X1
  - Quad UART 1 - Instance 2 is connected to SA-Adapter X2

4 Appendix

4.1 Literature and Web Resources

- F210 data sheet with up-to-date information and documentation:
  www.men.de

4.1.1 CompactPCI

- CompactPCI Specification Revision 2.0 R3.0:
  1997; PCI Industrial Computers Manufacturers Group (PICMG)
  www.picmg.org
- PCI Local Bus Specification Revision 2.1:
  1995; PCI Special Interest Group
  P.O. Box 14070
  Portland, OR 97214, USA
  www.pcisig.com

4.1.2 GSM-R

- GSM-R modem:
  Triorail TRM:2; data sheet; 2006; Triorail GmbH & Co. KG
  www.triorail.com
- GSM-R in general:
  http://en.wikipedia.org/wiki/GSM-R
- SIM cards in general:
  http://en.wikipedia.org/wiki/Subscriber_Identity_Module

4.1.3 GPS

- GPS controller (board revision >= R01):
  Navman Jupiter 30 GPS receiver module; data sheet; 2006; Navman New Zealand
  www.navman.com
- GPS controller (board revision < R01):
  HiSense HS110 Embedded GPS module; data sheet; 2004; CellGuide Ltd.
  www.cell-guide.com
- GPS in general:
  http://en.wikipedia.org/wiki/Gps

4.1.4 SA-Adapters

- MEN SA-Adapters:
  www.men.de/products/search.asp?prodc=accessories.1&h=SA-Adapters

4.2 ID EEPROM

The F210 has an ID EEPROM containing factory information on the board. This EEPROM is connected to the FPGA via SMBus. Although you normally should not modify factory data, you may change the EEPROM information if needed.

The addresses are configured as follows:

- First 256 bytes: 0xAC
- Second 256 bytes: 0xAE

By standard the EEPROM contains the following data:

- Product name: 'F210'
- Model: e.g. '00'
- Revision: e.g. '00.00.00'
- Serial number: e.g. '000023'

MEN offers an MDIS-based driver to modify EEPROM data. Please see MEN's website for downloads.

4.3 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 F210. 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 7. *Labels giving the board's article number, revision and serial number*