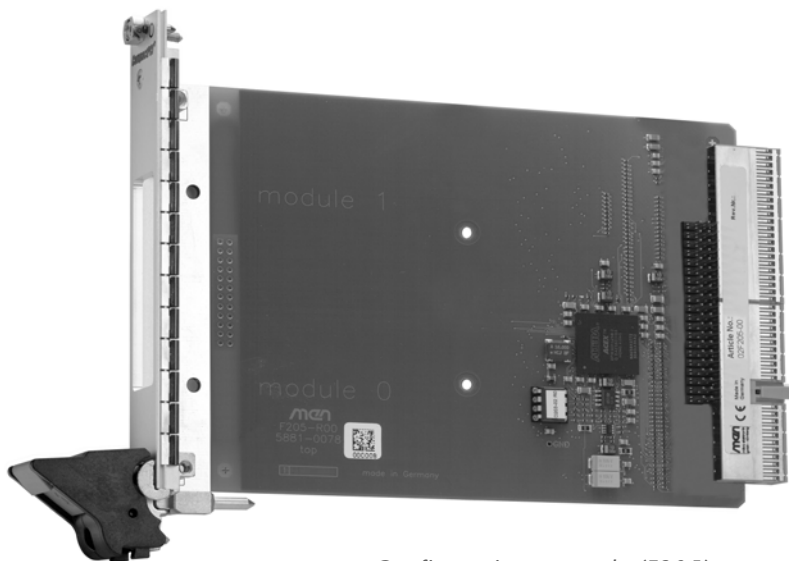


F204/F205 – 3U CompactPCI® M-Module™ Carrier Board



Configuration example (F205)

User Manual

F204/F205 - 3U CompactPCI® M-Module™ Carrier Board

The F204/F205 is a 3U M-Module™ carrier board for universal I/O on the CompactPCI bus. It allows high flexibility in applications such as data acquisition or process control.

The F205 is slightly higher than standard 3U format, providing enough space for two M-Modules™ while staying compatible with CompactPCI® housings through special guide rails already included in the delivery. F204 can carry one M-Module™. M-Modules™ are screwed tightly on the board and require no separately mounted transition panel.

The F204/F205 offers developers instant access to more than 70 different M-Modules™ for I/O in fields such as process I/O, measurement, instrumentation, motion control, communication, and development.

Technical Data

M-Module™ Slots

- F204: One M-Module™ slot
- F205: Two M-Module™ slots
- Compliant with M-Module™ standard
- Characteristics: A08, A24, D08, D16, D32, INTA, TRIGI, TRIGO

Peripheral Connections

- Via front panel

CompactPCI® Bus

- Compliance with CompactPCI® Specification 2.0 R2.1
- Only one slot required on the 3U CompactPCI® bus
- 32-bit/33-MHz PCI-to-M-Module™ bridge
 - FPGA-based
 - Compliant with PCI Specification 2.2
 - Target on PCI bus
- V(I/O): +3.3 V (+5 V tolerant)

Electrical Specifications

- Supply voltage/power consumption:
 - +5 V (-3%/+5%), 20 mA typ.
 - +3.3 V (-3%/+5%), 20 mA typ.
- MTBF: 1 046 000 h @ 50°C (derived from MIL-HDBK-217F)

Mechanical Specifications

- F204:
 - Dimensions: conforming to CompactPCI® specification for 3U boards
 - Front panel: aluminum with 1 handle, cut-out for front connector of M-Module™
 - Weight: 130 g (without M-Modules™)
- F205:
 - Dimensions: 111.7 mm x 160 mm standard
 - Front panel: aluminum without handles, cut-outs for front connectors of 2 M-Modules™
 - Weight: 125 g (without M-Modules™)

Environmental Specifications

- Temperature range (operation):
 - 0..+60°C or -40..+85°C
 - 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: -300 m to + 3 000 m
- Shock: 15 g, 11 ms
- Bump: 10 g, 16 ms
- Vibration (sinusoidal): 2 g, 10..150 Hz
- Conformal coating on request

Safety

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

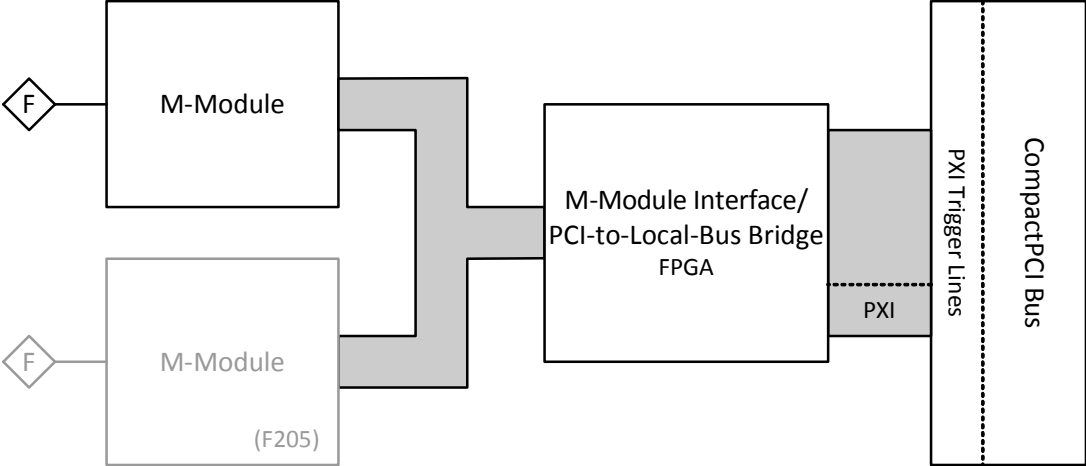
EMC

- Tested according to EN 55022 (radio disturbance), IEC61000-4-2 (ESD) and IEC61000-4-4 (burst)

Software Support

- M-Module™ drivers for Windows®, VxWorks®, Linux, QNX®, OS-9® as supported

Block Diagram



Configuration Options

M-Module™ Slots

- 1 or 2

M-Module™ Characteristics

- A08/D16 or A24/D32 support

Operation Temperature

- 0..+60°C
- -40..+85°C

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.**



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 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	2003-12-19
E2	General update, minor errors corrected	2006-01-13
E3	New board versions with A24/D32 support	2006-10-27
E4	Corrected CompactPCI I/O voltage, cosmetics	2012-04-20
E5	Corrected CompactPCI I/O voltage in Chapter 3.3	2012-04-23

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".

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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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.

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

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1 Getting Started

This chapter will give an overview of the carrier board and some hints for first installation in a system as a "check list".

1.1 Map of the Board

Figure 1. Map of the board – F204 – top view

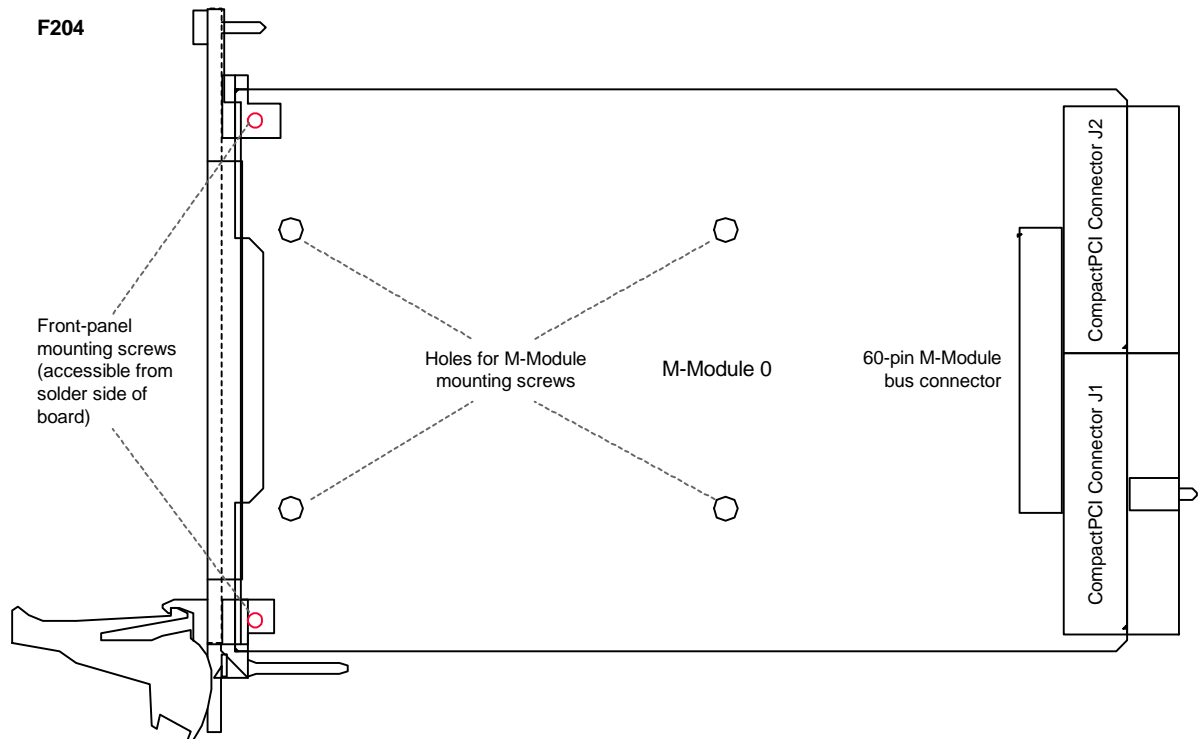
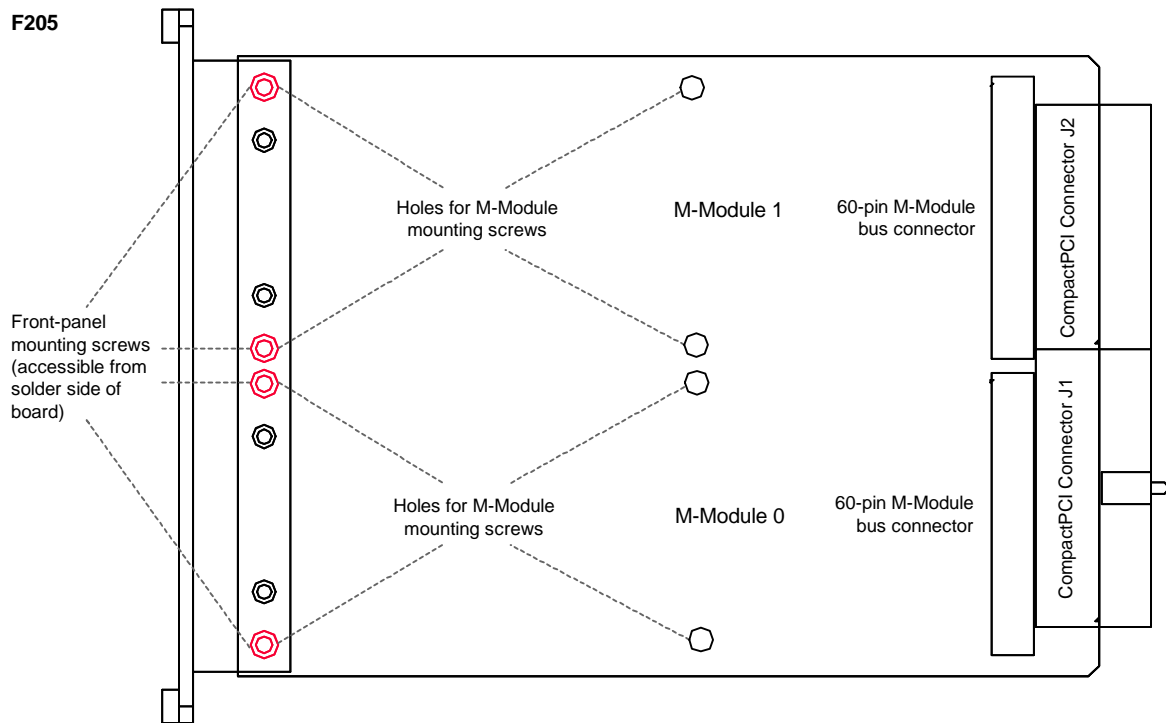


Figure 2. Map of the board – F205 – top view



1.2 Integrating the Board into a System

You can use the following "check list" when installing the F204 in a CompactPCI system for the first time.



Note: The F204 **must not** be inserted into the system slot! The system slot of every CompactPCI system is marked by a \triangle triangle on the backplane and/or at the front panel.

- Power-down the system.
- Install an M-Module on the F204 as described in [Chapter 1.3 Installing M-Modules on page 15](#).
- Insert the F204 into your CompactPCI system, making sure that the CompactPCI connectors are properly aligned.
- Power-up the system.
- You can now install driver software for the F204 and M-Modules.

1.3 Installing M-Modules

Perform the following steps to install an M-Module:

- ☑ Loosen the front-panel mounting screws at the solder side of the board and remove the whole front panel (two screws with F204, four screws with F205) (see [Figure 1, Map of the board – F204 – top view, on page 13](#) and [Figure 2, Map of the board – F205 – top view, on page 14](#)).
- ☑ Hold the M-Module over the target slot of the carrier board with the component sides facing each other.
- ☑ Align the 60-pin connectors of the M-Module and carrier board.
- ☑ Press the M-Module carefully but firmly on the F204, making sure that the connectors are properly linked.
- ☑ Turn the F204 upside down and use four M-Module mounting screws to fasten the M-Module on the solder side of the F204.
- ☑ Re-install the front panel of the F204.

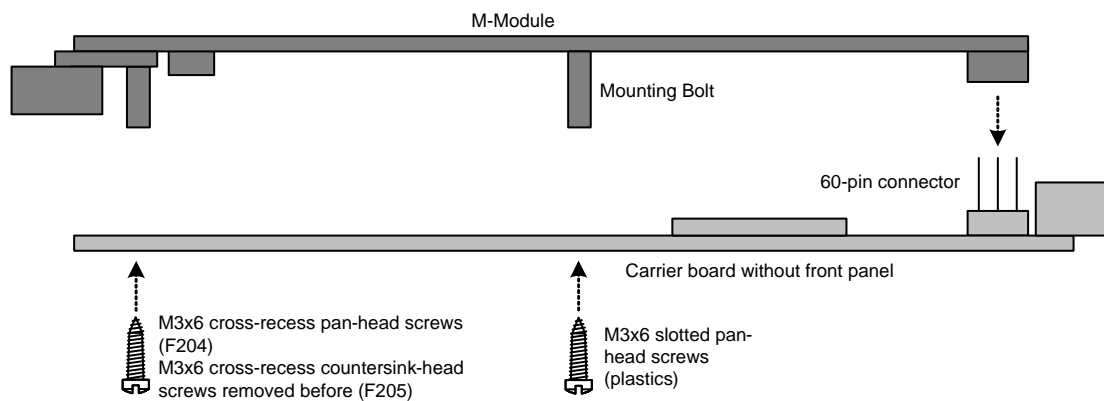


Note: You can order suitable mounting screws from MEN, see MEN's [website](#). In any case, use only the screw types specified in the following figure!



Note: Older M-Modules with a solder side cover may collide with the front panel. If you have any problems, please contact MEN's technical support: support@men.de.

Figure 3. Installing an M-Module



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 Connecting the Board

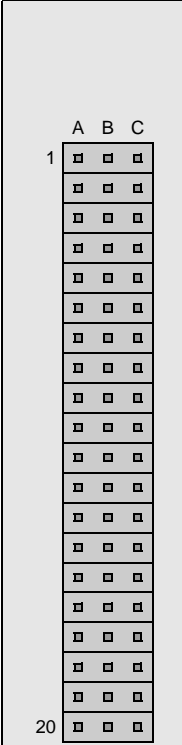
2.1 M-Module Connectors

Connector types:

- Three 20-pin plugs, 2.54mm pitch, square pins \varnothing 0.635mm gold
- Mating connector:
Three 20-pin receptacles, high-precision, 2.54mm pitch, for square pins \varnothing 0.635mm gold, 6.9mm height

Note: Signals which are not bussed (i.e. which are applied to each M-Module slot independently) are indexed with "x". For each slot, replace "x" with the slot number (0..3).

Table 1. Pin assignment of the 60-pin plug connectors

		A	B	C
	1	/CSx	GND	/AS
	2	A01	+5V	D16
	3	A02	+12V	D17
	4	A03	-12V	D18
	5	A04	GND	D19
	6	A05	/DREQx	D20
	7	A06	/DACKx	D21
	8	A07	GND	D22
	9	D08/A16	D00/A08	TRIGA
	10	D09/A17	D01/A09	TRIGB
	11	D10/A18	D02/A10	D23
	12	D11/A19	D03/A11	D24
	13	D12/A20	D04/A12	D25
	14	D13/A21	D05/A13	D26
	15	D14/A22	D06/A14	D27
	16	D15/A23	D07/A15	D28
	17	/DS1	/DS0	D29
	18	/DTACKx	/WRITE	D30
	19	/IACKx	/IRQx	D31
	20	/RESET	SYSCLKx	/DS2

Due to the characteristics, the following pins are not supported on the carrier board:

- /DREQx
- /DACKx

Note: There are different board versions with A08/D16 or A24/D32 M-Module support. If you are not sure which type of addressing your carrier board supports, you can check the different models on MEN's [website](#).

Table 2. Signal mnemonics of the M-Module connector

Name	Direction	Function
D00/A08..D15/A23	in/out	Multiplexed data/address bus
D16..D31	in/out	Most significant portion of data bus
A01..A07	out	Address bus
/WRITE	out	Read/write enable
/CS	out	M-Module chip select
/DTACK	in	Data acknowledge
/DS0..1	out	Data bus select signals
/RESET	out	M-Module reset
/IRQ	in	Interrupt request
/IACK	out	Interrupt acknowledge
/DREQ	in	DMA request (not supported)
/DACK	out	DMA acknowledge (not supported)
SYSCLK	out	16-MHz clock
GND	-	Logical reference signal
+5V, +12V, -12V	out	Power supplies
/AS	out	Address strobe for multiplexed address/data bus
TRIGA, TRIGB	in/out	Trigger inputs/outputs



Note: The 24-pin receptacle connector of M-Module slot 0 is provided only for mechanical stability. The I/O signals from the M-Module at this connector are not used.

2.2 PXI Trigger Lines

The carrier board supports PXI trigger lines PXI_TRIG[7:0]. These are located on CompactPCI J2 as shown below:

Table 3. PXI trigger lines on CompactPCI J2 (110-pin type "B" modified)

		F	E	D	C	B	A
	18	GND	PXI_TRIG6	GND	PXI_TRIG5	PXI_TRIG4	PXI_TRIG3
	17	GND	-	-	-	GND	PXI_TRIG2
	16	GND	PXI_TRIG7	-	-	PXI_TRIG0	PXI_TRIG1

3 Functional Description

3.1 Power Supply

Power supply is fed via the CompactPCI backplane. The board operates on +5V and +3.3V. +12V/-12V may be required by one of the M-Modules installed. Power consumption is 20 mA typ. plus the current drawn by M-Modules stacked on the carrier board.

3.2 Identifying the Board

You can identify the carrier board as follows:

Note: MEN drivers will also identify the board in this way.

- Scan all PCI buses in the system for
 - the vendor ID: 0x1172, and
 - the FPGA's device ID:
 - 0xD203 with A08 M-Module access boards, or
 - 0x203D with A24 M-Module access boards.

Note: There are different board versions for A08 or A24 M-Module addressing.

If you are not sure which type of addressing your carrier board supports, you can check the different models on MEN's [website](#).

- Check if the Subsystem Vendor ID is set to 0xFF00 and the Subsystem ID is set to 0xFF00 in the PCI config state (see [Table 4, PCI configuration registers](#), on [page 24](#)).

3.3 CompactPCI Interface

The F204 carrier board has a 32-bit CompactPCI interface on connectors J1/J2. It uses a 3.3 V signaling voltage on CompactPCI. For a pinout of the 32-bit CompactPCI interface on J1/J2 and a general description of CompactPCI, please refer to the CompactPCI specification.

Connector types of J1/J2:

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

The interface is implemented using an FPGA and is compliant to the PCI Specification Rev. 2.2.

3.3.1 Delayed Transactions

The F204 supports delayed transactions across the CompactPCI bus, i.e. if the F204 cannot deliver (on a read cycle) or accept (for a write cycle) data within 16 PCI clock cycles, it responds to the current bus master with a retry. In response to the retry, the bus master relinquishes the CompactPCI bus, which can now be used by another bus master. In the meantime, the F204 processes the retried transaction on the M-Module interface. When the bus master retries the bus cycle on PCI, the F204 will terminate the cycle with zero wait states. This will improve overall system throughput. Even slow M-Modules do not tie up the whole CompactPCI bus.

3.4 M-Module Interfaces

The M-Module interfaces of the F204 comply with the M-Module specification. They support the following M-Module characteristics: D08, D16, D32, A08, A24, INTA, TRIGI, TRIGO. It depends on the board version whether the F204 supports A08/D16 or A24/D32 accesses.



If you are not sure which type of addressing your carrier board supports, you can check the different models on MEN's [website](#).

The F204 does not support burst mode, since this leads to conflicts with the PCI architecture.

3.4.1 Configuring the M-Module Interfaces

M-Module Control/Status Register (read/write)

31..18	17	16		
-	GIEN	GIRQ		
15..4	3	2	1	0
-	TOUT	PCI RET	IEN	IRQ

<i>GIEN</i>	Global interrupt enable bit (common to all M-Modules) 0 = Disable interrupt 1 = Enable interrupt
<i>GIRQ</i>	Global interrupt pending (common to all M-Modules) (read-only) 1 = Interrupt pending
<i>TOUT</i>	Timeout 1 = Timeout occurred. Write 1 to clear.
<i>PCIRET</i>	PCI retries 0 = PCI retries during access (slower) 1 = No PCI retries during access (faster) (default) You should change this setting to 0 ("slower") if you can expect the M-Module access to be slower than 450 ns. Otherwise, leave the default setting as is.
<i>IEN</i>	Interrupt enable bit 0 = Disable interrupt 1 = Enable interrupt
<i>IRQ</i>	Interrupt pending (read-only) 1 = Interrupt pending

3.5 Using Triggers

There are 8 internal trigger lines, the "internal trigger bus". Every PXI trigger line can drive one and can be driven by one dedicated internal trigger line. This is set in the PXI Trigger Source and Destination Registers for each M-Module.

Every M-Module trigger line (*TRIGA/TRIGB*) can be driven by and can drive every internal trigger line. If there is more than one source for an internal trigger, all connected sources are ORed.

There is one [Trigger Source Register](#) and one [Trigger Destination Register](#) per M-Module. Bits 31..16 of the [Trigger Source](#) and [Trigger Destination Registers](#) are global, i.e. the PXI trigger lines can only be accessed for all M-Modules together.

The maximum propagation delay between a trigger source and trigger destination amounts to 25 ns.

Figure 4. Trigger routing

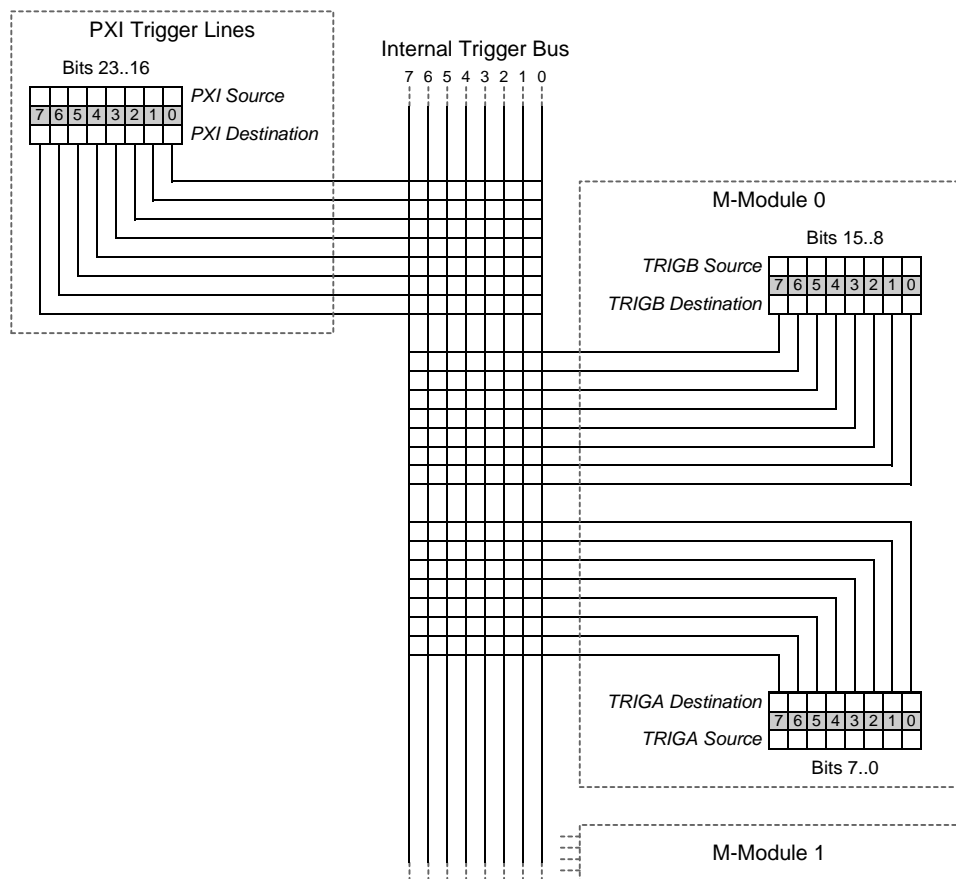
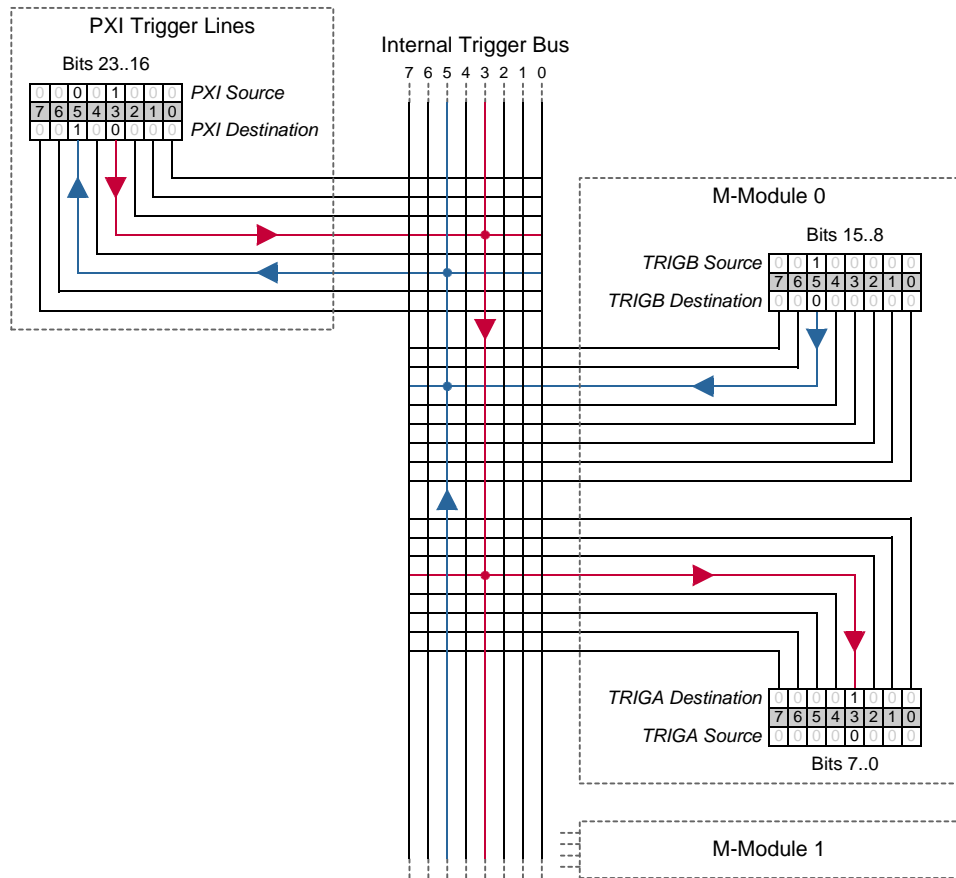


Figure 5. Trigger routing – examples



Trigger Source Register (read/write)

31..24	23..16
-	PXI Source 7.0
15..8	7..0
M-Module Source TRIGB 7.0	M-Module Source TRIGA 7.0

PXI Source 1 = The corresponding PXI input is connected to internal trigger line 7..0. (Common to all M-Modules)

M-Module Source TRIGB 1 = Trigger input *TRIGB* of the addressed M-Module is connected to the corresponding internal trigger line 7..0.

M-Module Source TRIGA 1 = Trigger input *TRIGA* of the addressed M-Module is connected to the corresponding internal trigger line 7..0.

Trigger Destination Register (read/write)

31..24	23..16
-	PXI Destination 7.0
15..8	7..0
M-Module Destination TRIGB 7.0	M-Module Destination TRIGA 7.0

PXI Destination 1 = The corresponding internal trigger line is connected to PXI trigger line 7..0. This line becomes an output and no longer an input line. (Common to all M-Modules)

M-Module Destination TRIGB 1 = The corresponding internal trigger line is connected to *TRIGB* of the addressed M-Module. This *TRIGB* line becomes an output and no longer an input line.

M-Module Destination TRIGA 1 = The corresponding internal trigger line is connected to *TRIGA* of the addressed M-Module. This *TRIGA* line becomes an output and no longer an input line.

Note: It is not forbidden but may make no sense to activate a trigger line as an output and use this line as an input as well. Care shall be taken to prevent loops! Using PXI 0 as an input connected to internal line 0, and activating PXI as an output as well might cause heavy oscillation or any other non-deterministic behavior.

4 Organization of the Board

The F204 complies with PCI specification 2.2. All resources requested by the F204 are mapped through the PCI configuration space. For a detailed description of the PCI configuration space, please refer to the PCI specification.

4.1 PCI Configuration Registers

4.1.1 Address Map

The following register map is shown for reference only.

Table 4. PCI configuration registers

Address	D31..D24	D23..D16	D15..D8	D7..D0	R/W
0x00	Device ID (A08: 0xD203 / A24: 0x203D) ¹		Vendor ID (0x1172)		R
0x04	Status (0x0400)		Command (0x0007)		R/W
0x08	Class Code (0x068000)			Revision ID	R
0x0C	BIST (0x00)	Header Type (0x00)	Latency Timer (0x40)	Cache Line Size	R/W
0x10	PCI Base Address 0 for Memory Mapped FPGA Registers				R/W
0x14	PCI Base Address 1 — Not used				R/W
0x18	PCI Base Address 2 — Not used				R/W
0x1C	PCI Base Address 3 — Not used				R/W
0x20	PCI Base Address 4 — Not used				R/W
0x24	PCI Base Address 5 — Not used				R/W
0x28	CardBus CIS Pointer (0x00000000)				R
0x2C	Subsystem ID (0xFF00)		Subsystem Vendor ID (0xFF00)		R
0x30	Expansion ROM Register (0x00000000)				R/W
0x34	Reserved (0x00000000)				R
0x38	Reserved (0x00000000)				R
0x3C	Max_Lat (0x00)	Min_Gnt (0x00)	Interrupt Pin (0x01)	Interrupt Line	R/W

¹ There are different board versions for A08 or A24 M-Module addressing. If you are not sure which type of addressing your carrier board supports, you can check the different models on MEN's [website](#).



4.2 M-Module Slot Address Spaces

Each M-Module slot is provided with a 1-KB address space with A08 access or a 32-MB address space with A24 access. (See also [Chapter 3.4 M-Module Interfaces on page 20](#).) The base address within the PCI address space is set by the corresponding base address registers in the PCI configuration space. Each of the M-Module address spaces is divided into three distinct areas:

- An area for A24 access cycles (depending on the board version).
- An area for A08 access cycles.
- An area for accesses to additional control registers.

Table 5. M-Module address map for board versions with A08/D16 support

M-Module	Offset Address Range	Function
M-Module 0	0x0000 .. 0x00FF	Reserved
	0x0100 .. 0x01FF	Reserved
	0x0200 .. 0x02FF	A08/D16 access
	0x0300 .. 0x0303	A08/D16 IACK
	0x0304 .. 0x0307	Control/Status Register
	0x0308 .. 0x030B	Trigger Source Register
	0x030C .. 0x030F	Trigger Destination Register
M-Module 1 (only F205)	0x0400 .. 0x04FF	Reserved
	0x0500 .. 0x05FF	Reserved
	0x0600 .. 0x06FF	A08/D16 access
	0x0700 .. 0x0703	A08/D16 IACK
	0x0704 .. 0x0707	Control/Status Register
	0x0708 .. 0x070B	Trigger Source Register
	0x070C .. 0x070F	Trigger Destination Register

Table 6. *M-Module address map for board versions with A24/D32 support*

M-Module	Offset Address Range	Function
M-Module 0	0x000 0000..0x0FF FFFF	A24/D32 access
	0x100 0000..0x1FF FCFF	A24/D16 access
	0x1FF FD00..0x1FF FDFE	A08/D32 access
	0x1FF FE00..0x1FF FEFF	A08/D16 access
	0x1FF FF00..0x1FF FF03	A08/D16 IACK
	0x1FF FF04..0x1FF FF07	Control/Status Register
	0x1FF FF08..0x1FF FF0B	Trigger Source Register
	0x1FF FF0C..0x1FF FF0F	Trigger Destination Register
M-Module 1 (only F205)	0x200 0000..0x2FF FFFF	A24/D32 access
	0x300 0000..0x3FF FCFF	A24/D16 access
	0x3FF FD00..0x3FF FDFE	A08/D32 access
	0x3FF FE00..0x3FF FEFF	A08/D16 access
	0x3FF FF00..0x3FF FF03	A08/D16 IACK
	0x3FF FF04..0x3FF FF07	Control/Status Register
	0x3FF FF08..0x3FF FF0B	Trigger Source Register
	0x3FF FF0C..0x3FF FF0F	Trigger Destination Register

5 Appendix

5.1 Literature and Web Resources

- F204 data sheet with up-to-date information and documentation:
www.men.de
- F205 data sheet with up-to-date information and documentation:
www.men.de
- M-Module Standard:
ANSI/VITA 12-1996, M-Module Specification;
VMEbus International Trade Association
www.vita.com
- CompactPCI Specification Revision 2.0 R2.1:
1997; PCI Industrial Computers Manufacturers Group (PICMG)
www.picmg.org

5.2 Finding out the Product's Article Number, Revision and Serial Number

MEN user documentation may describe several different models and/or design revisions of the F204. You can find information on the article number, the design revision and the serial number on a label attached to the board.

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

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

Figure 6. Labels giving the product's article number, revision and serial number

