ADDI-DATA®
PARTNER FÜR PRÄZISION

Technical Description

APCIe-7300, APCIe-7420, APCIe-7500 and APCIe-7800

1-port, 2-port, 4-port and 8-port serial interface

DIN EN ISO 9001:2015 certified

Edition: 02.06-09/2019

Product information

This manual contains the technical installation and important instructions for correct commissioning and usage, as well as production information according to the current state before printing.
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Warning!

The following risks result from the improper implementation of the board and from use contrary to the regulations:

Personal injury

Damage to the board, the PC and peripherals

Pollution of the environment.

- Protect yourself, others and the environment!
- Read the safety precautions (yellow leaflet) carefully!

  If this leaflet is not enclosed with the documentation, please contact us and ask for it.
- Observe the instructions of this manual!

  Make sure that you do not forget or skip any step!
  We are not liable for damages resulting from the wrong use of the board.
- Pay attention to the following symbols:

NOTICE!
Designates hints and other useful information.

NOTICE!
Designates a possibly dangerous situation.
If the instructions are ignored, the board, the PC and/or peripherals may be **destroyed**.

WARNING!
Designates a possibly dangerous situation.
If the instructions are ignored, the board, the PC and/or peripherals may be **destroyed** and persons may be **endangered**.

Contents

Figures

Tables

Chapter overview

In this manual, you will find the following information:

Chapter	Content
1	Important information on the application, the user and on handling the board
2	Brief description of the board (features, cables, transmission standards)
3	Detailed information on the insertion of the board, connection of the accessories (including pin assignment) and driver installation **Tip:** Print out this chapter to have help at hand for inserting and installing the board.
4	Block diagrams of the boards
5	Procedure for returning (repairing, etc.) or disposing of the board
6	List of technical data and limit values of the board
7	Appendix with glossary and index
8	Contact and support address

1 Definition of application, user, handling

1.1 Definition of application

1.1.1 Intended use

The **APCIe-7xx0**[1] board must be inserted in a personal computer (PC) with PCI Express slots which is used as electrical equipment for measurement, control and laboratory pursuant to the standard EN 61010-1 (IEC 61010-1).

The used personal computer (PC) must fulfil the requirements of IEC 60950-1 or EN 60950-1 and EN 55022 or IEC/CISPR 22 and EN 55024 or IEC/CISPR 24.

The use of the board **APCIe-7xx0** in combination with external screw terminal panels requires correct installation according to the series IEC 61439 or EN 61439 (Low-voltage switchgear and controlgear assemblies).

1.1.2 Usage restrictions

The **APCIe-7xx0** board must not be used as a safety-related part (SRP).

The board must not be used for safety-related functions, for example for emergency stop functions.

The **APCIe-7xx0** board must not be used in potentially explosive atmospheres.

The **APCIe-7xx0** board must not be used as electrical equipment according to the Low Voltage Directive 2014/35/EU.

1.1.3 Limits of use

All safety information and the instructions in the manual must be followed to ensure proper intended use.

Uses of the board beyond these specifications are considered as improper use. The manufacturer is not liable for damages resulting from improper use.

The board must remain in its anti-static packaging until it is installed.

Please do not delete the identification numbers of the board or the warranty claim will be invalid.

1.2 User

1.2.1 Qualification

Only persons trained in electronics are entitled to perform the following works:

- Installation
- Commissioning
- Use
- Maintenance.

[1] **APCIe-7xx0** = **APCIe-7300, APCIe-7420, APCIe-7500** and **APCIe-7800**

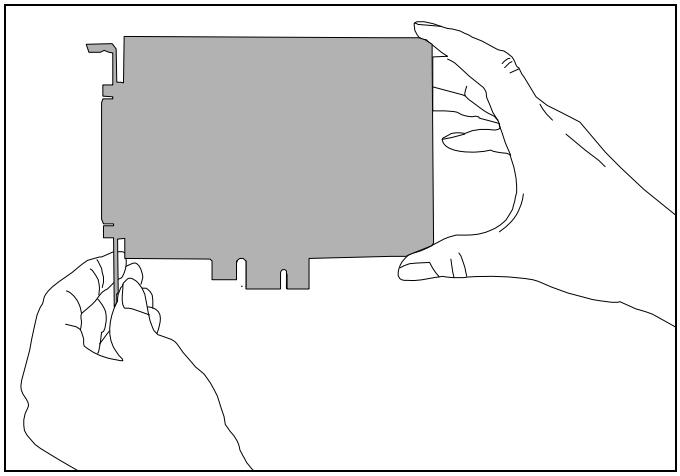
1.2.2 Country-specific regulations

Do observe the country-specific regulations regarding

- the prevention of accidents
- electrical and mechanical installations
- Electromagnetic compatibility (EMC).

1.3 Handling of the board

Fig. 1-1: Correct handling



Hold the board cautiously at the outer end and at the slot bracket.
Do not touch the surface of the board!

1.4 Questions and updates

If you have any questions, do not hesitate to call us or to send us an e-mail:

Phone: +49 7229 1847-0
E-mail: info@addi-data.com

Manual and software download from the Internet

The latest versions of the technical manual and the standard software for the **APCIe-7xx0** board can be downloaded for free at: www.addi-data.com.

NOTICE!
Before using the board and in case of malfunction during operation, check if there is an update (manual, driver) available. Current data can be found on our website or contact us directly.

2 Brief description

The boards **APCIe-7300, APCIe-7420, APCIe-7500** and **APCIe-7800** provide industrial PCs with one, two, four or eight asynchronous serial interfaces for the communication with external devices.
The configuration of these communication boards is determined by SI modules, which are automatically detected by the boards.
Via the SI modules, the serial interfaces can be fitted with the following transmission standards: RS232, RS422, RS485 and TTY (with or without optical isolation). The SI modules with optical isolation offer protection of up to 1000 V for harsh environments and prevent ground loops. The input/output lines are protected against short-circuits, rapid transients, electrostatic discharges and high-frequency EMI.

The serial interfaces are supported by a 128-byte FIFO for data transmission and reception and guarantee reliable operations with high data rates.

Features:

- Transmission standards: RS232, RS422, RS485, TTY (20 mA current loop); free configuration for each interface through SI modules
- With/without optical isolation (1000 V)
- FIFO buffer (128-byte) for each interface
- UART-compatible with: 16C450, 16C550, 16C654, 16C750 and 16C950

Table 2-1: Number of serial interfaces

Board	Serial interfaces
APCIe-7300	1
APCIe-7420	2
APCIe-7500 **APCIe-7500/4C**	4
APCIe-7800	8

Cables

In terms of electromagnetic compatibility (EMC), the connection cables have the following properties:

- Metallised connector housing
- Shielded cable
- Cable shield folded back over insulation and firmly screwed on both sides to the connector housing.

Transmission standards

The transmission standard of the respective serial interface depends on the fitted SI module.

Table 2-2: Plug-in modules and their transmission standards

Plug-in module[1]	Transmission standard	Maximum Baud rate	Optical isolation	Interface setting	Distance between transmitter and receiver[2]
SI232	RS232	1 MBaud	-	-	30 m
SI232-G			1 kV		
SI422	RS422	1 MBaud	-	-	1.2 km
SI422-G SI422-PEP (RTS/CTS as RS422)			1 kV		
SI485	RS485	1 MBaud	-	Automatic transmitter control	1.2 km
SI485-G			1 kV	Automatic transmitter control	
SITTY	TTY (20 mA current loop)	19.2 kBaud	1 kV	Standby current on transmit and receive channel	1 km

If the **APCIe-7xx0** board is operated at the same time with modules that are optically isolated and modules that are not optically isolated, the creeping distance of 3.2 mm applies only for the modules that are optically isolated.

[1] Plug-in module **SIxxx-G:** The -G suffix stands for optical isolation. The **SITTY** module is always optically isolated.

[2] The indicated maximum lengths apply to normal interface cables (shielded control lead, 0.14 mm²). The length is also limited by the number of users, line capacity, impedance and transfer rate.

3 Insertion and installation of the board

3.1 Insertion of the APCIe board

Risk of injury!
Please follow the safety precautions! An improper handling of the board may cause property damage and injury.

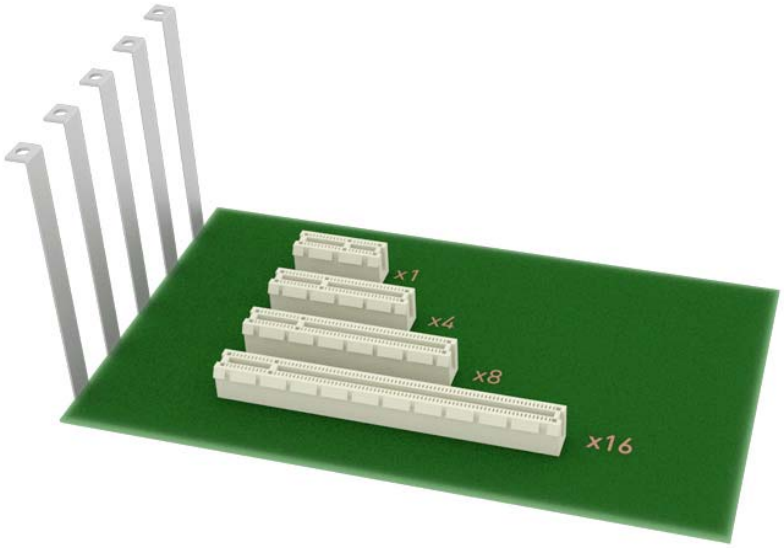
3.1.1 Opening the PC

- Switch off the PC and all the units connected to it.
- Pull the PC mains plug from the socket.
- Open the PC as described in the manual of the PC manufacturer.

3.1.2 Selecting a slot

- Select a free 1-lane (x1), 4-lane (x4), 8-lane (x8) or 16-lane (x16) PCI Express slot for the board.

Fig. 3-1: PCI Express slot types



- Unscrew the back cover from the selected slot. For this, follow the operating instructions provided by the PC manufacturer!
  Keep the back cover in a safe place. You will need it if you remove the board.
- Provide for potential equalisation.
- Take the board out of its protective packaging.

3.1.3 Replacing the SI modules

NOTICE!

If an SI module has to be replaced, we recommend you to send the board back to us.

If you would like to replace the SI module yourself:

- Respect the combination options according to the intended use!
- Follow the safety precautions!
- Remove/fit the SI module carefully according to the following figures!

Fig. 3-2: Removing an SI module

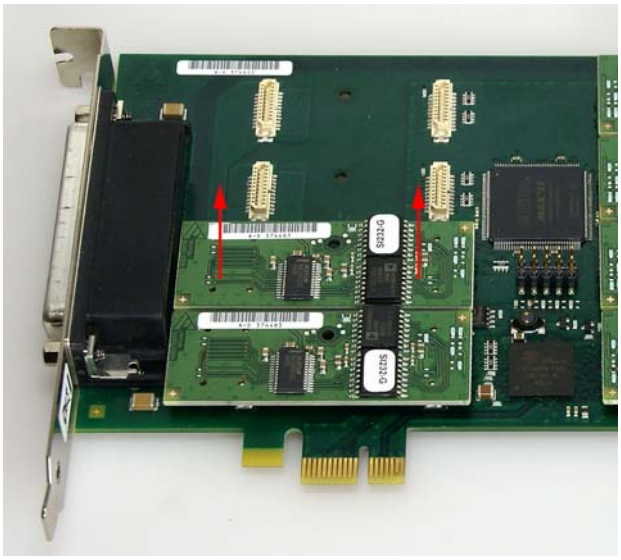
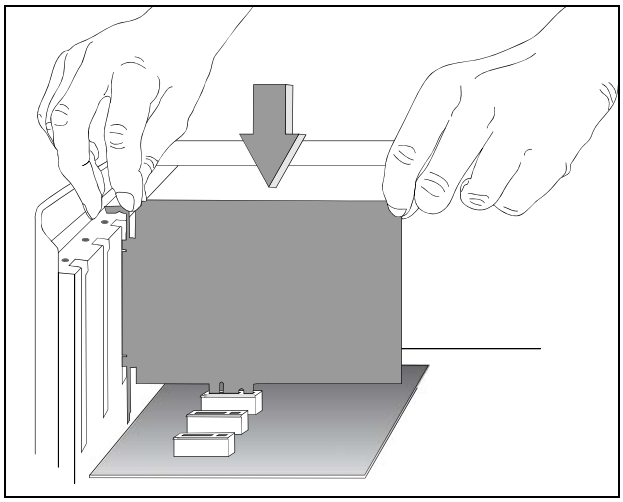


Fig. 3-3: Fitting an SI module

3.1.4 Inserting the board

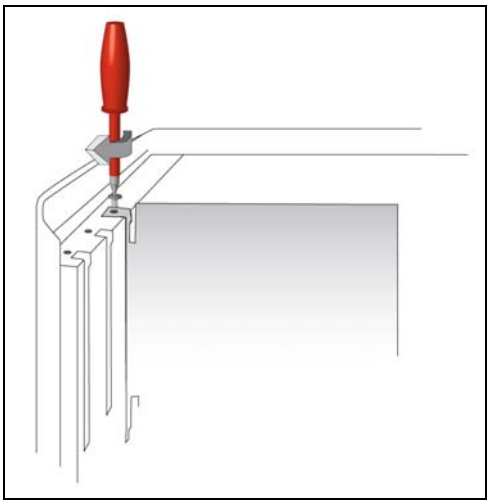
- Insert the board vertically from above into the selected slot.

Fig. 3-4: Slot: Insert the board



- Fasten the board to the rear of the PC housing using the screw which held the back cover in place.

Fig. 3-5: PC housing: Fasten the board



- Tighten all loose screws.

3.1.5 Closing the PC

- Close the PC as described in the manual of the PC manufacturer.

3.2 Connecting the accessories

NOTICE!
Interference is propagated and spread via the connection cable. An incorrect cable could therefore jeopardise the operating and functional safety of your system.

- Use our standard connection cable.
- When installing the connection cable, ensure that it is placed a sufficient distance away from sensitive analog signals and that the distance from potential sources of interference such as frequency inverters, mains supplies, etc. is as large as possible.

3.2.1 Pin assignment

1) APCIe-7500

Fig. 3-6: APCIe-7500: 37-pin D-Sub male connector

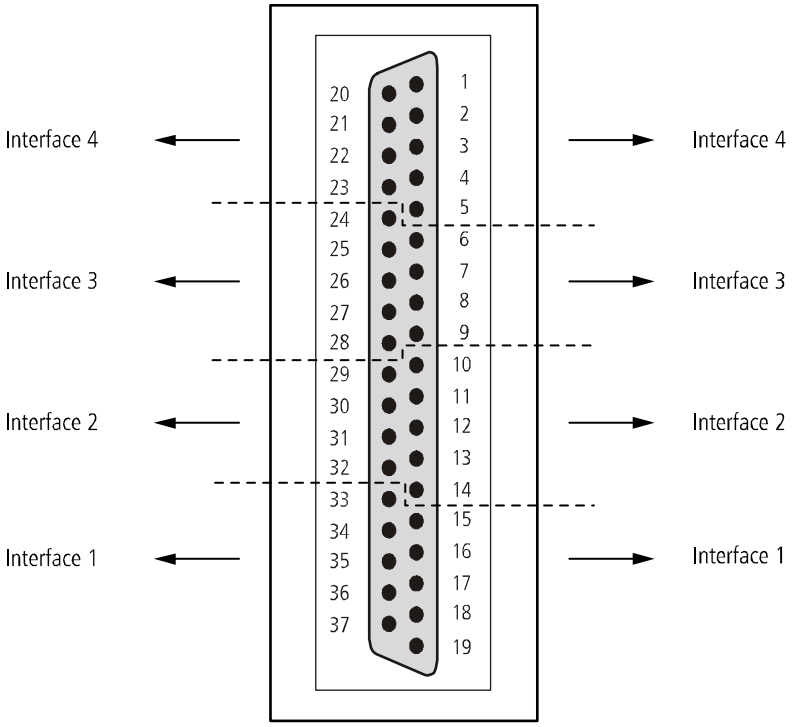


Table 3-1: APCIe-7500: Pin assignment

Pin	Interface	RS232	RS422	RS422-PEP	RS485	TTY
33	UART 0	DCD	T_A (Tx+)	T_A (Tx+)		$T_{Collector}$ (Tx+)
34		Rx	T_B (Tx-)	T_B (Tx-)		$T_{Emitter}$ (Tx-)
35		Tx	R_A (Rx+)	R_A (Rx+)	Tx/Rx+	D_{Anode} (Rx+)
36		DTR	$R_{Termination}$	I_B (CTS-)	$R_{Termination}$	
37		GND	GND	GND	GND	GND
15		DSR	100 Ω	I_A (CTS+)	120 Ω	
16		RTS		C_B (RTS-)		T_{Source}
17		CTS		C_A (RTS+)		R_{Source}
18		RI	R_B (Rx-)	R_B (Rx-)	Tx/Rx-	$D_{Cathode}$ (Rx-)
10	UART 1	DCD	T_A (Tx+)	T_A (Tx+)		$T_{Collector}$ (Tx+)
11		Rx	T_B (Tx-)	T_B (Tx-)		$T_{Emitter}$ (Tx-)
12		Tx	R_A (Rx+)	R_A (Rx+)	Tx/Rx+	D_{Anode} (Rx+)
13		DTR	$R_{Termination}$	I_B (CTS-)	$R_{Termination}$	
14		GND	GND	GND	GND	GND
29		DSR	100 Ω	I_A (CTS+)	120 Ω	
30		RTS		C_B (RTS-)		T_{Source}
31		CTS		C_A (RTS+)		R_{Source}
32		RI	R_B (Rx-)	R_B (Rx-)	Tx/Rx-	$D_{Cathode}$ (Rx-)
24	UART 2	DCD	T_A (Tx+)	T_A (Tx+)		$T_{Collector}$ (Tx+)
25		Rx	T_B (Tx-)	T_B (Tx-)		$T_{Emitter}$ (Tx-)
26		Tx	R_A (Rx+)	R_A (Rx+)	Tx/Rx+	D_{Anode} (Rx+)
27		DTR	$R_{Termination}$	I_B (CTS-)	$R_{Termination}$	
28		GND	GND	GND	GND	GND
6		DSR	100 Ω	I_A (CTS+)	120 Ω	
7		RTS		C_B (RTS-)		T_{Source}
8		CTS		C_A (RTS+)		R_{Source}
9		RI	R_B (Rx-)	R_B (Rx-)	Tx/Rx-	$D_{Cathode}$ (Rx-)
1	UART 3	DCD	T_A (Tx+)	T_A (Tx+)		$T_{Collector}$ (Tx+)
2		Rx	T_B (Tx-)	T_B (Tx-)		$T_{Emitter}$ (Tx-)
3		Tx	R_A (Rx+)	R_A (Rx+)	Tx/Rx+	D_{Anode} (Rx+)

Pin	Interface	RS232	RS422	RS422-PEP	RS485	TTY
4	UART 3	DTR	$R_{Termination}$	I_B (CTS-)	$R_{Termination}$	
5		GND	GND	GND	GND	GND
20		DSR	100 Ω	I_A (CTS+)	120 Ω	
21		RTS		C_B (RTS-)		T_{Source}
22		CTS		C_A (RTS+)		R_{Source}
23		RI	R_B (Rx-)	R_B (Rx-)	Tx/Rx-	$D_{Cathode}$ (Rx-)

A cable connection between the resistor (RS422/RS485) and $R_{Termination}$ activates the termination resistor.

2) APCIe-7300, APCIe-7420, APCIe-7500/4C and breakout cables

Fig. 3-7: APCIe-7300, APCIe-7420, APCIe-7500/4C and breakout cables: 9-pin D-Sub connector

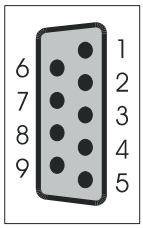


Table 3-2: APCIe-7300, APCIe-7420, APCIe-7500/4C and breakout cables: Pin assignment

Pin	RS232	RS422	RS422-PEP	RS485	TTY
1	DCD	T_A (Tx+)	T_A (Tx+)		$T_{Collector}$ (Tx+)
2	Rx	T_B (Tx-)	T_B (Tx-)		$T_{Emitter}$ (Tx-)
3	Tx	R_A (Rx+)	R_A (Rx+)	Tx/Rx+	D_{Anode} (Rx+)
4	DTR	$R_{Termination}$	I_B (CTS-)	$R_{Termination}$	
5	GND	GND	GND	GND	GND
6	DSR	100 Ω	I_A (CTS+)	120 Ω	
7	RTS		C_B (RTS-)		T_{Source}
8	CTS		C_A (RTS+)		R_{Source}
9	RI	R_B (Rx-)	R_B (Rx-)	Tx/Rx-	$D_{Cathode}$ (Rx-)

A cable connection between the resistor (RS422/RS485) and $R_{Termination}$ activates the termination resistor.

3) APCIe-7800

Fig. 3-8: APCIe-7800: 78-pin D-Sub female connector

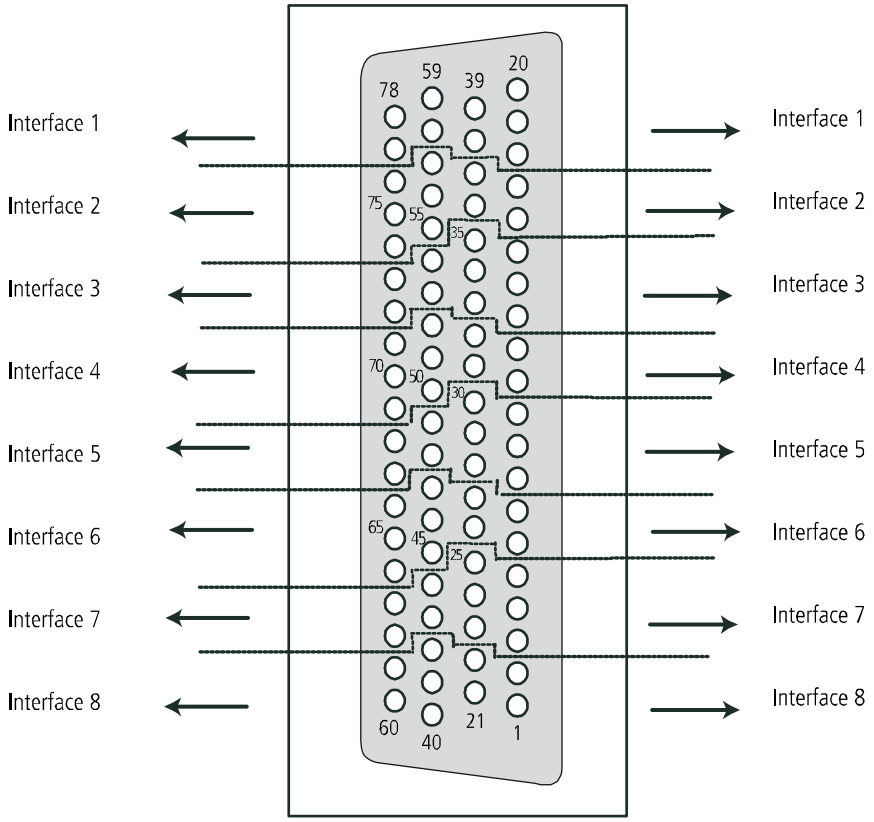


Table 3-3: APCIe-7800: Pin assignment

Pin	Interface	RS232	RS422	RS422-PEP	RS485	TTY
59	UART 0	DCD	T_A (Tx+)	T_A (Tx+)		$T_{Collector}$ (Tx+)
19		Rx	T_B (Tx-)	T_B (Tx-)		$T_{Emitter}$ (Tx-)
20		Tx	R_A (Rx+)	R_A (Rx+)	Tx/Rx+	D_{Anode} (Rx+)
78		DTR	$R_{Termination}$	I_B (CTS-)	$R_{Termination}$	
18		GND	GND	GND	GND	GND
58		DSR	100 Ω	I_A (CTS+)	120 Ω	
39		RTS		C_B (RTS-)		T_{Source}
38		CTS		C_A (RTS+)		R_{Source}
77		RI	R_B (Rx-)	R_B (Rx-)	Tx/Rx-	$D_{Cathode}$ (Rx-)
37	UART 1	DCD	T_A (Tx+)	T_A (Tx+)		$T_{Collector}$ (Tx+)
75		Tx	R_A (Rx+)	R_A (Rx+)	Tx/Rx+	D_{Anode} (Rx+)
76		Rx	T_B (Tx-)	T_B (Tx-)		$T_{Emitter}$ (Tx-)

Pin	Interface	RS232	RS422	RS422-PEP	RS485	TTY
17	UART 1	DTR	$R_{Termination}$	I_B (CTS-)	$R_{Termination}$	
74		GND	GND	GND	GND	GND
36		DSR	100 Ω	I_A (CTS+)	120 Ω	
56		RTS		C_B (RTS-)		T_{Source}
55		CTS		C_A (RTS+)		R_{Source}
16		RI	R_B (Rx-)	R_B (Rx-)	Tx/Rx-	$D_{Cathode}$ (Rx-)
54	UART 2	DCD	T_A (Tx+)	T_A (Tx+)		$T_{Collector}$ (Tx+)
15		Rx	T_B (Tx-)	T_B (Tx-)		$T_{Emitter}$ (Tx-)
14		Tx	R_A (Rx+)	R_A (Rx+)	Tx/Rx+	D_{Anode} (Rx+)
73		DTR	$R_{Termination}$	I_B (CTS-)	$R_{Termination}$	
13		GND	GND	GND	GND	GND
53		DSR	100 Ω	I_A (CTS+)	120 Ω	
34		RTS		C_B (RTS-)		T_{Source}
33		CTS		C_A (RTS+)		R_{Source}
72		RI	R_B (Rx-)	R_B (Rx-)	Tx/Rx-	$D_{Cathode}$ (Rx-)
32	UART 3	DCD	T_A (Tx+)	T_A (Tx+)		$T_{Collector}$ (Tx+)
71		Rx	T_B (Tx-)	T_B (Tx-)		$T_{Emitter}$ (Tx-)
70		Tx	R_A (Rx+)	R_A (Rx+)	Tx/Rx+	D_{Anode} (Rx+)
12		DTR	$R_{Termination}$	I_B (CTS-)	$R_{Termination}$	
69		GND	GND	GND	GND	GND
31		DSR	100 Ω	I_A (CTS+)	120 Ω	
51		RTS		C_B (RTS-)		T_{Source}
50		CTS		C_A (RTS+)		R_{Source}
11		RI	R_B (Rx-)	R_B (Rx-)	Tx/Rx-	$D_{Cathode}$ (Rx-)
49	UART 4	DCD	T_A (Tx+)	T_A (Tx+)		$T_{Collector}$ (Tx+)
10		Rx	T_B (Tx-)	T_B (Tx-)		$T_{Emitter}$ (Tx-)
9		Tx	R_A (Rx+)	R_A (Rx+)	Tx/Rx+	D_{Anode} (Rx+)
68		DTR	$R_{Termination}$	I_B (CTS-)	$R_{Termination}$	
8		GND	GND	GND	GND	GND
48		DSR	100 Ω	I_A (CTS+)	120 Ω	
29		RTS		C_B (RTS-)		T_{Source}

Pin	Interface	RS232	RS422	RS422-PEP	RS485	TTY
28	UART 4	CTS		C_A (RTS+)		R_{Source}
67		RI	R_B (Rx-)	R_B (Rx-)	Tx/Rx-	$D_{Cathode}$ (Rx-)
27	UART 5	DCD	T_A (Tx+)	T_A (Tx+)		$T_{Collector}$ (Tx+)
66		Rx	T_B (Tx-)	T_B (Tx-)		$T_{Emitter}$ (Tx-)
65		Tx	R_A (Rx+)	R_A (Rx+)	Tx/Rx+	D_{Anode} (Rx+)
7		DTR	$R_{Termination}$	I_B (CTS-)	$R_{Termination}$	
64		GND	GND	GND	GND	GND
26		DSR	100 Ω	I_A (CTS+)	120 Ω	
46		RTS		C_B (RTS-)		T_{Source}
45		CTS		C_A (RTS+)		R_{Source}
6		RI	R_B (Rx-)	R_B (Rx-)	Tx/Rx-	$D_{Cathode}$ (Rx-)
44	UART 6	DCD	T_A (Tx+)	T_A (Tx+)		$T_{Collector}$ (Tx+)
5		Rx	T_B (Tx-)	T_B (Tx-)		$T_{Emitter}$ (Tx-)
4		Tx	R_A (Rx+)	R_A (Rx+)	Tx/Rx+	D_{Anode} (Rx+)
63		DTR	$R_{Termination}$	I_B (CTS-)	$R_{Termination}$	
3		GND	GND	GND	GND	GND
43		DSR	100 Ω	I_A (CTS+)	120 Ω	
24		RTS		C_B (RTS-)		T_{Source}
23		CTS		C_A (RTS+)		R_{Source}
62		RI	R_B (Rx-)	R_B (Rx-)	Tx/Rx-	$D_{Cathode}$ (Rx-)
22	UART 7	DCD	T_A (Tx+)	T_A (Tx+)		$T_{Collector}$ (Tx+)
61		Rx	T_B (Tx-)	T_B (Tx-)		$T_{Emitter}$ (Tx-)
60		Tx	R_A (Rx+)	R_A (Rx+)	Tx/Rx+	D_{Anode} (Rx+)
2		DTR	$R_{Termination}$	I_B (CTS-)	$R_{Termination}$	
40		GND	GND	GND	GND	GND
21		DSR	100 Ω	I_A (CTS+)	120 Ω	
42		RTS		C_B (RTS-)		T_{Source}
41		CTS		C_A (RTS+)		R_{Source}
1		RI	R_B (Rx-)	R_B (Rx-)	Tx/Rx-	$D_{Cathode}$ (Rx-)

A cable connection between the resistor (RS422/RS485) and $R_{Termination}$ activates the termination resistor.

3.2.2 Connection cable ST075 (APCIe-7500)

This cable converts the 37-pin D-Sub male connector of the **APCIe-7500** board to four 9-pin D-Sub female connectors. The pin assignment is to be found in Chapter 3.2.1.

3.2.3 Connection cables ST074 (APCIe-7500) and ST7825 (APCIe-7800)

The **ST074** cable converts the 37-pin D-Sub male connector of the **APCIe-7500** board to four 25-pin D-Sub female connectors.

The **ST7825** cable converts the 78-pin D-Sub male connector of the **APCIe-7800** board to eight 25-pin D-Sub female connectors.

Fig. 3-9: APCIe-7500/4C, APCIe-7800 and breakout cables: 25-pin D-Sub male connector

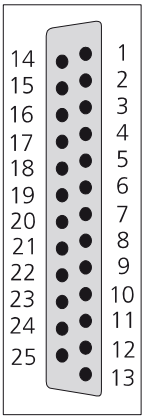


Table 3-4: APCIe-7500, APCIe-7800 and breakout cables: Pin assignment

Pin	RS232	RS422	RS422-PEP	RS485	TTY
8	DCD	T_A (Tx+)	T_A (Tx+)		$T_{Collector}$ (Tx+)
3	Rx	T_B (Tx-)	T_B (Tx-)		$T_{Emitter}$ (Tx-)
2	Tx	R_A (Rx+)	R_A (Rx+)	Tx/Rx+	D_{Anode} (Rx+)
20	DTR	$R_{Termination}$	I_B (CTS-)	$R_{Termination}$	
7	GND	GND	GND	GND	GND
6	DSR	100 Ω	I_A (CTS+)	120 Ω	
4	RTS		C_B (RTS-)		T_{Source}
5	CTS		C_A (RTS+)		R_{Source}
22	RI	R_B (Rx-)	R_B (Rx-)	Tx/Rx-	$D_{Cathode}$ (Rx-)

A cable connection between the resistor (RS422/RS485) and $R_{Termination}$ activates the termination resistor.

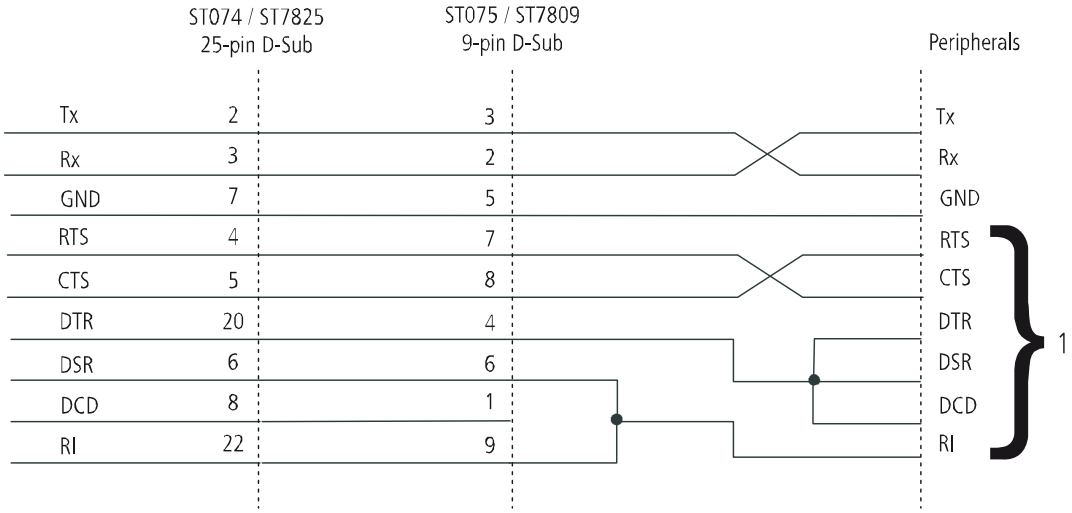
3.2.4 Connection cable ST7809 (APCIe-7800)

This cable converts the 78-pin D-Sub female connector of the **APCIe-7800** board to eight 9-pin D-Sub female connectors. The pin assignment is to be found in Chapter 3.2.1.

3.3 Connection examples

3.3.1 RS232

Fig. 3-10: RS232 wiring



1: Where the modem control signals are not used, they must be connected externally across a wire bridge.

3.3.2 RS422

Fig. 3-11: RS422 wiring

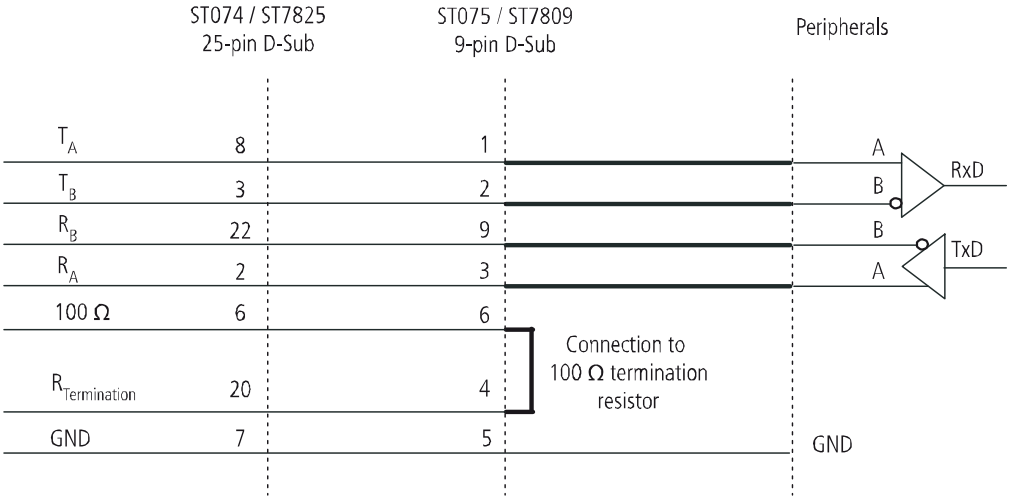
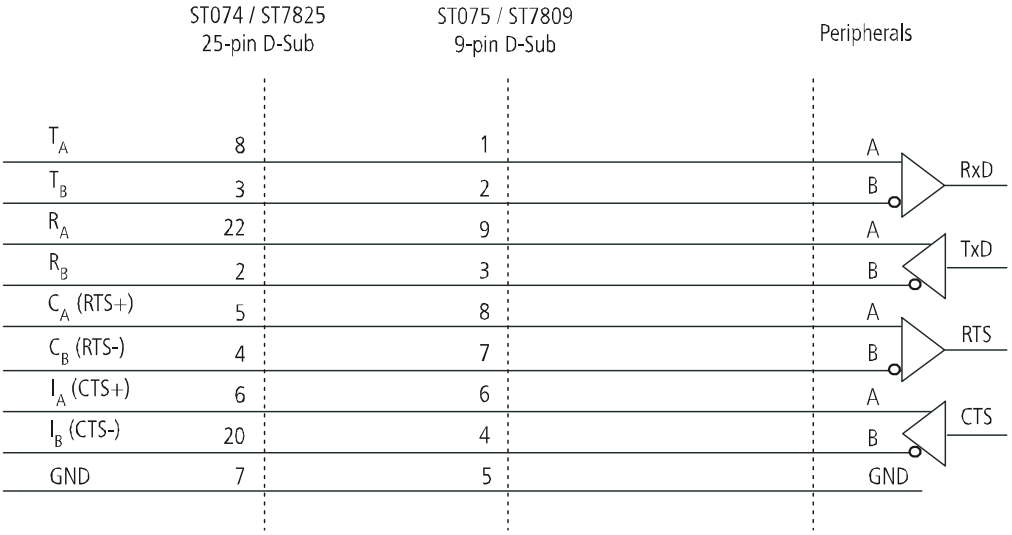
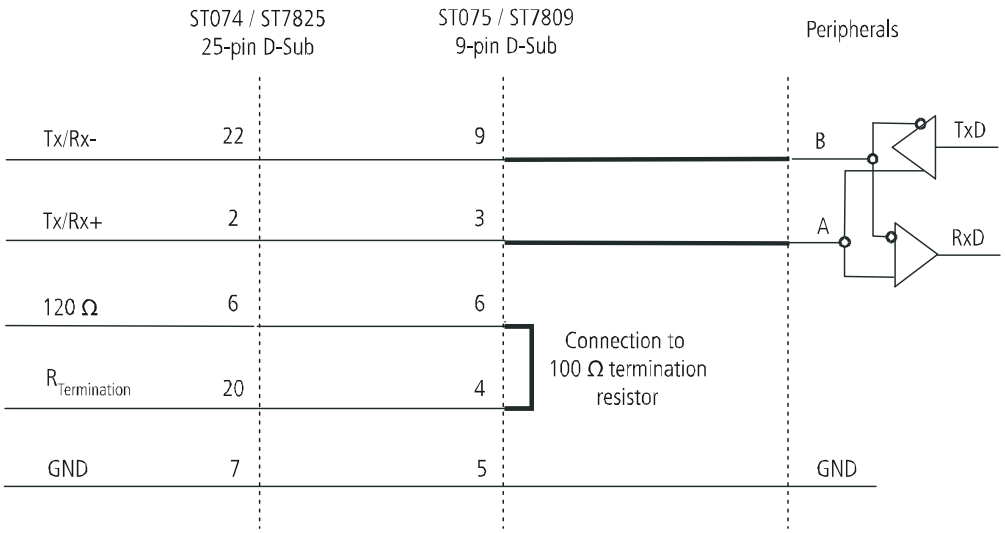


Fig. 3-12: RS422 with RTS/CTS signals as RS422 signals



3.3.3 RS485

Fig. 3-13: RS485 wiring



3.3.4 TTY (20 mA current loop)

When a transmitter and receiver communicate with each other, one of them has to provide the current. If the transmitter provides the current, it is active. In this case, the receiver is passive. If the receiver supplies the current, it is active and the transmitter is passive.

Fig. 3-14: Active transmission / active reception

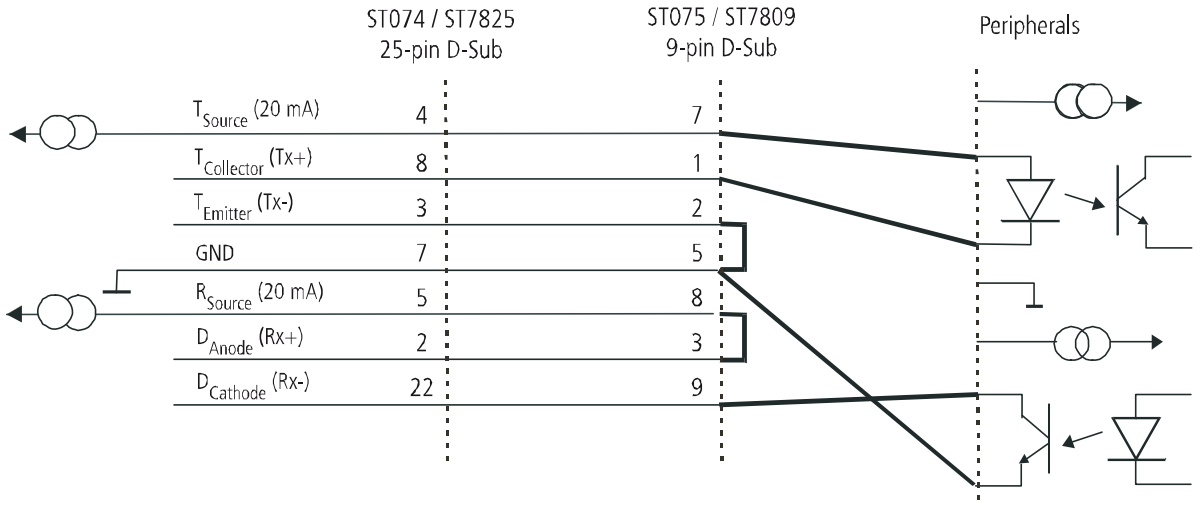


Fig. 3-15: Active transmission / passive reception

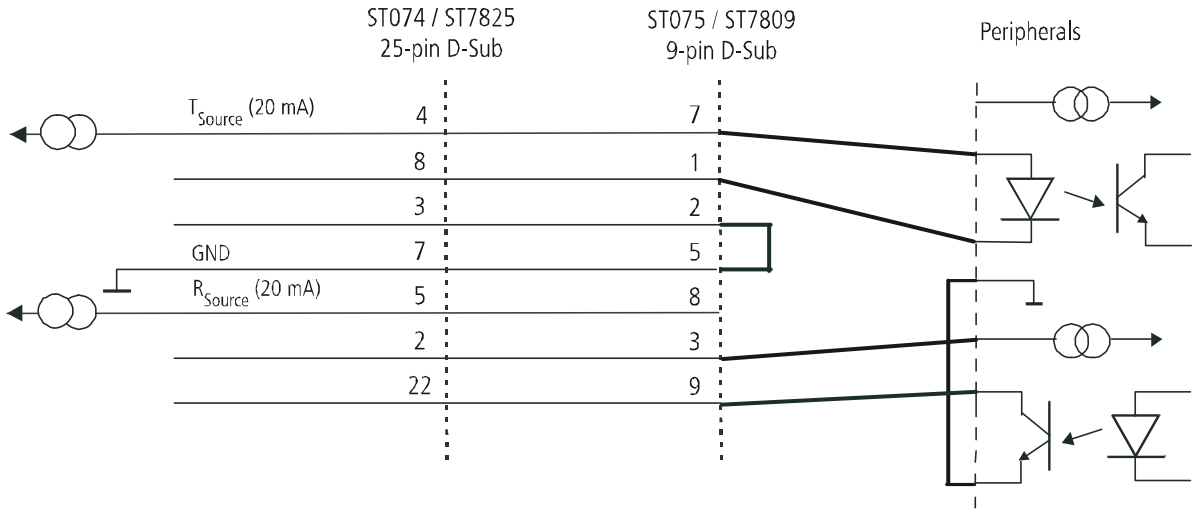


Fig. 3-16: Passive transmission / active reception

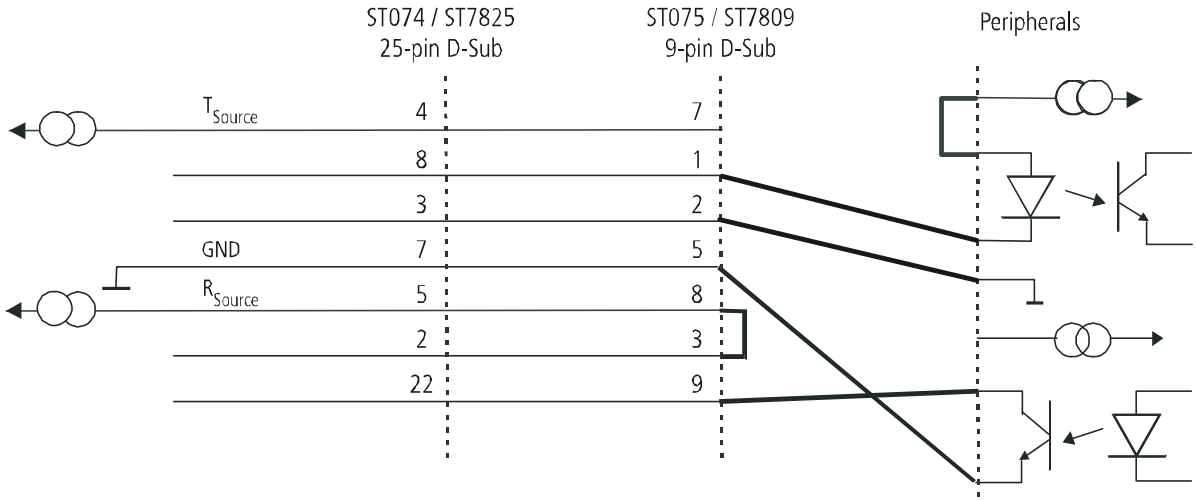
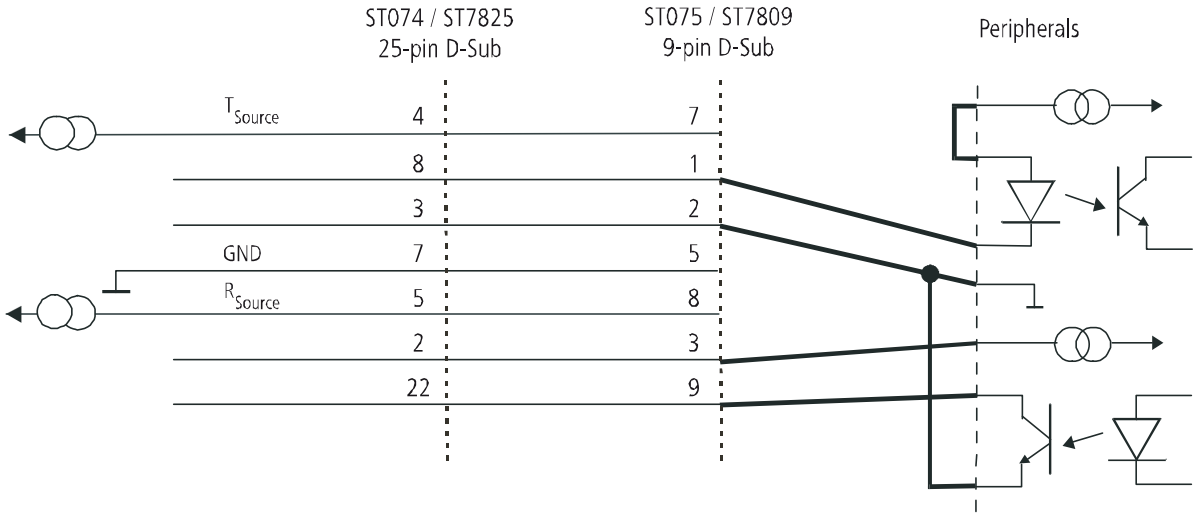


Fig. 3-17: Passive transmission / passive reception



3.4 Driver installation

Information on how to select and download the appropriate driver can be found in the document "Quick installation PC boards" (see PDF link).

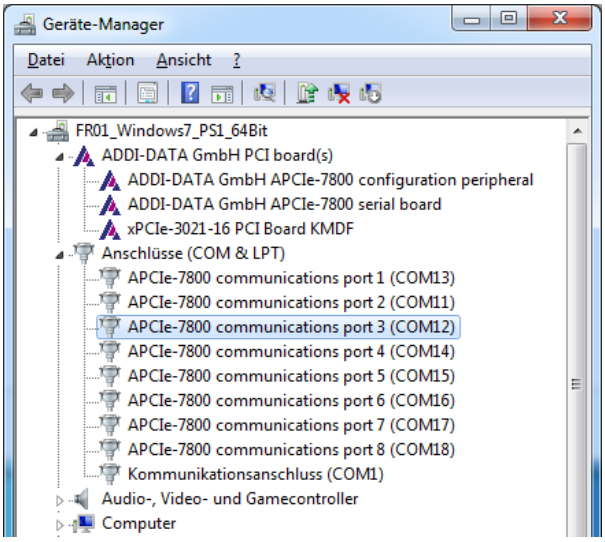
The installation of drivers of the type "ADDI-DATA Multiarchitecture Device Drivers 32-/64-Bit for x86/AMD64" as well as the installation of the corresponding samples is described in the installation instructions (see PDF link).

3.5 Board configuration

After installing the driver and updating the board interfaces (see PDF link “Installation instructions”), you can configure each interface in the “Device Manager” according to your requirements.

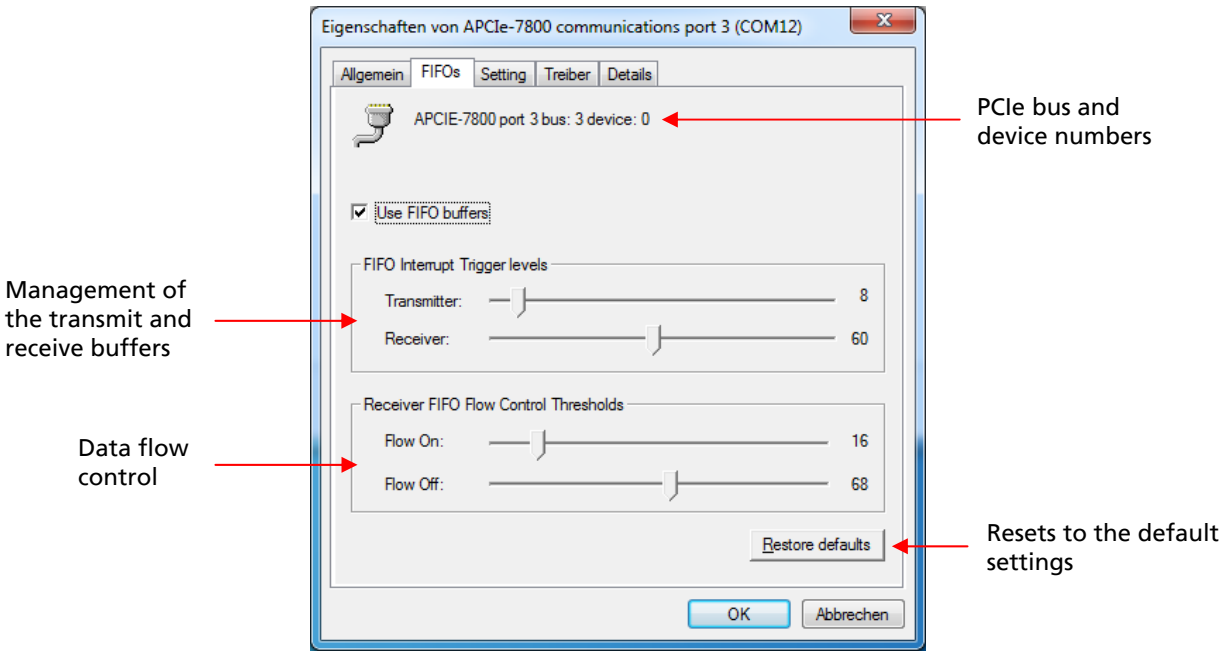
- Open the “Device Manager” and double-click on the interface to be configured (e.g. “APCIe-7800 communications port 3 (COM12)”).

Fig. 3-18: Device Manager



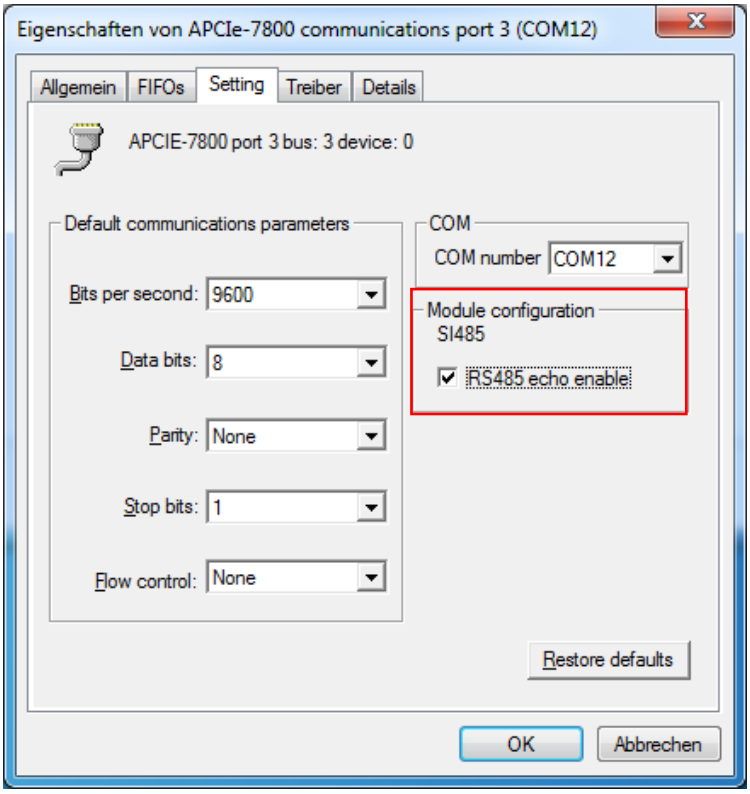
On the “FIFOs” tab, the following settings can be made (example under Windows 7):

Fig. 3-19: FIFOs



On the “Setting” tab, in the “Module configuration” section, you can adapt the transmission standard depending on the used interface.

Fig. 3-20: Settings example: RS485

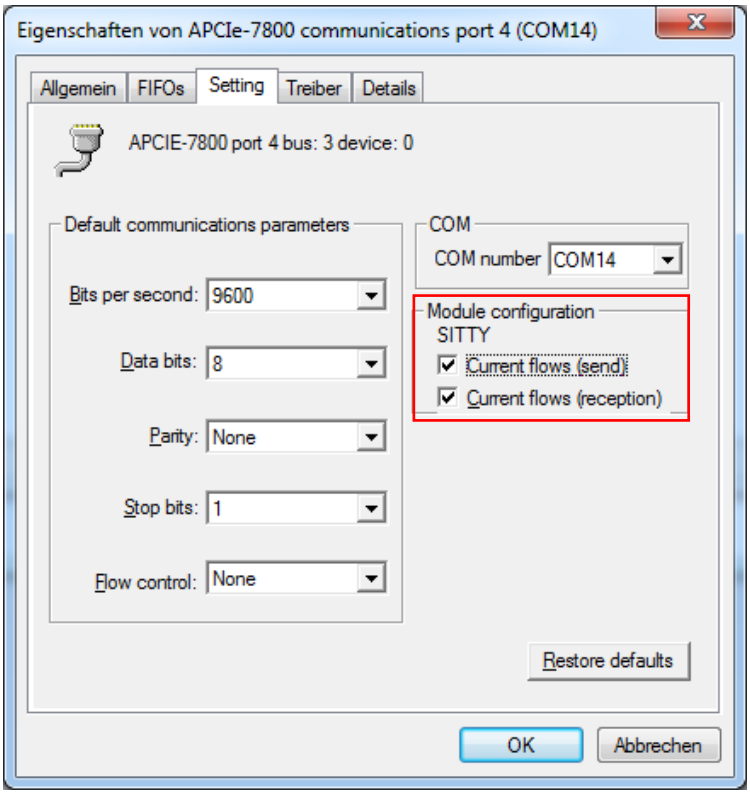


RS 485 echo enable: Receiver control for the RS485 half-duplex communication

☑ Ticked:
When data is sent from the board to the peripherals, the receiver is enabled on the board.

☐ Not ticked:
When data is sent from the board to the peripherals, the receiver is disabled on the board.

Fig. 3-21: Settings example: TTY (20 mA current loop)



Current flows (send):
Definition of the current flow in the transmit current loop, i.e. the connection between the **APCIe-7xx0** board (transmitter) and the peripheral device (receiver) in standby state (no serial data stream)

☑ Ticked: Current flowing

☐ Not ticked: No current flowing

Current flows (reception):
Definition of the current flow in the receive current loop, i.e. the connection between the **APCIe-7xx0** board (receiver) and the peripheral device (transmitter) in standby state (no serial data stream)

☑ Ticked: Current flowing

☐ Not ticked: No current flowing

3.6 Board test

To test if the PC board is correctly installed, a self-test of the board can be run using a short-circuit plug (for RS232, RS422 and TTY) and the **MTTTY** test program.

NOTICE!
For the self-test of the RS485 standard, no short-circuit plug is needed.

3.6.1 Connecting the short-circuit plug

The short-circuit plug is used to set up a connection between the output signals (data transmission) and the input signals (data reception) in order to test the serial communication.

Fig. 3-22: Connection of the short-circuit plug (RS232)

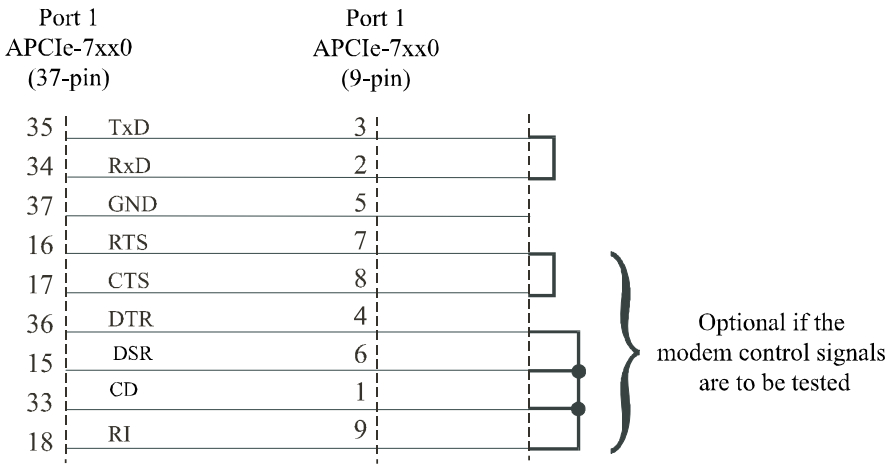


Fig. 3-23: Connection of the short-circuit plug (RS422)

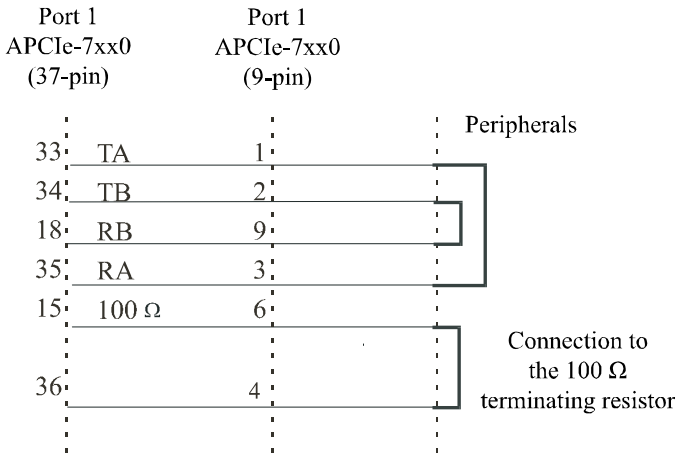


Fig. 3-24: Connection of the short-circuit plug (TTY) – active transmission / passive reception

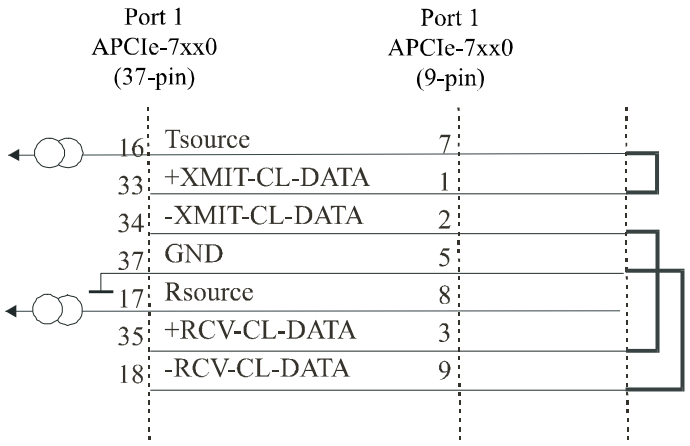
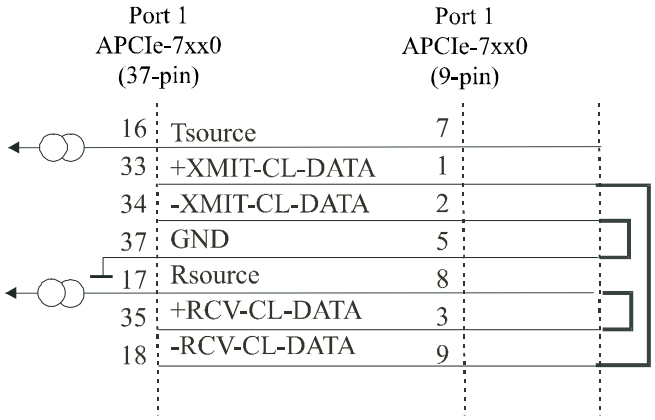


Fig. 3-25: Connection of the short-circuit plug (TTY) – passive transmission / active reception

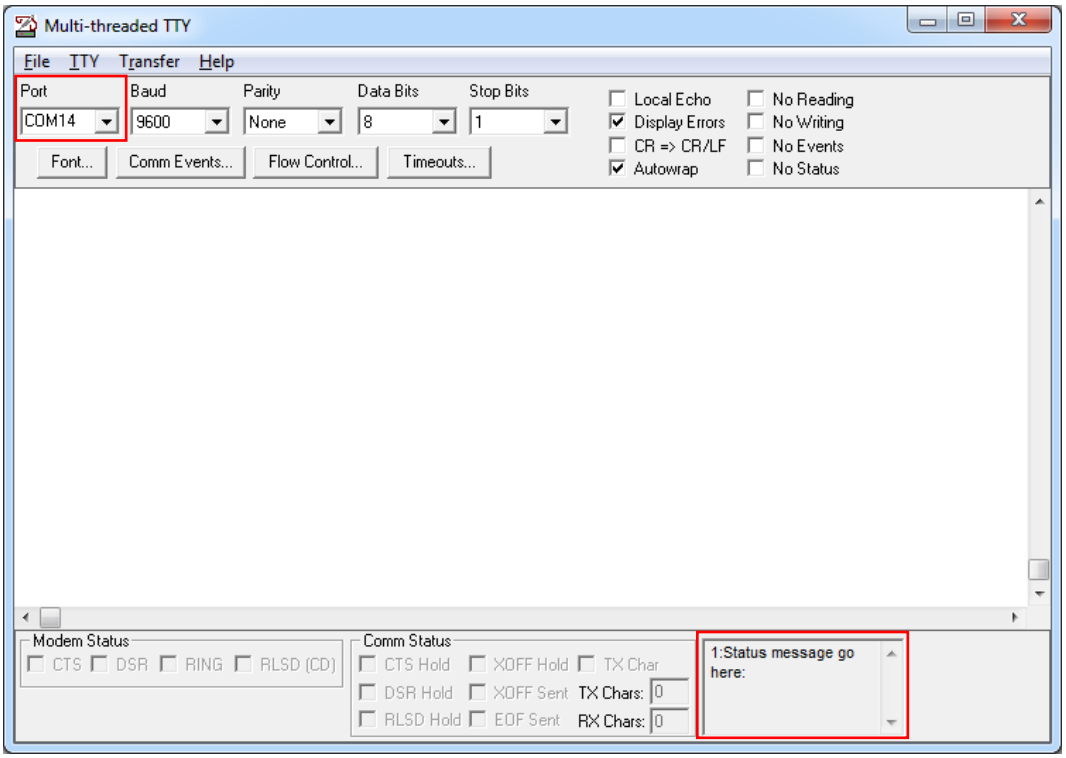


3.6.2 Test program "MTTTY"

The test program **MTTTY** is to be found on the supplied CD 1 "ADDI-DATA Standard Drivers".

- Start the **MTTTY** test program by double-clicking on the file "Mttty_255.exe" in the CD 1 folder "Mttty".

Fig. 3-26: MTTTY main window



Status or error messages are displayed on the bottom right of the **MTTTY** main window.

1) RS232, RS422 and TTY (20 mA current loop)

- In the **MTTTY** main window, under “Port”, select the right COM interface.
- Connect the interface via the menu item "File/Connect".

If the short-circuit plug is connected and if after pressing any key (= send data or character), a character is displayed on the screen (= receive data or character), the board works correctly.

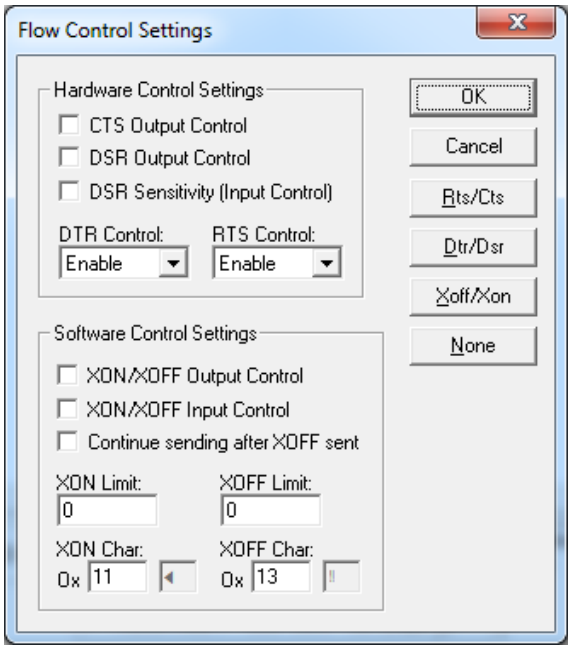
Once the port is initialised, the state of the modem control signals can be read in the “Modem Status” area of the **MTTTY** main window. If the RTS signal is set, the CTS state is indicated. For DTR, the other three fields are activated.
Your settings are displayed in the “Comm Status” area of the main window.

The handshake of the modem control signals according to your application can be configured as follows:

- In the **MTTTY** main window, click on the “Flow Control…” button.

In the “Flow Control Settings” window, you can make the desired settings:

Fig. 3-27: "Flow Control Settings" window



2) RS485

This transmission standard must first be set via the "Device Manager" of the operating system (see also Chapter 8):

1. Open the "Device Manager" and double-click on the interface to be configured (e.g. "APCI-7800-3 communications port 7 (COM9)").
2. On the "Setting" tab, in the "Module configuration" section, activate the check box "RS485 ECHO enable" and click on "OK".
3. Then start the **MTTTY** test program.
4. In the **MTTTY** main window, under "Port", select the right COM interface.
5. Connect the interface via the menu item "File/Connect".

If after pressing any key (= send data or character), a character is displayed on the screen (= receive data or character), the board works correctly.

4 Function description

4.1 Block diagrams

Fig. 4-1: APCIe-7300: Block diagram

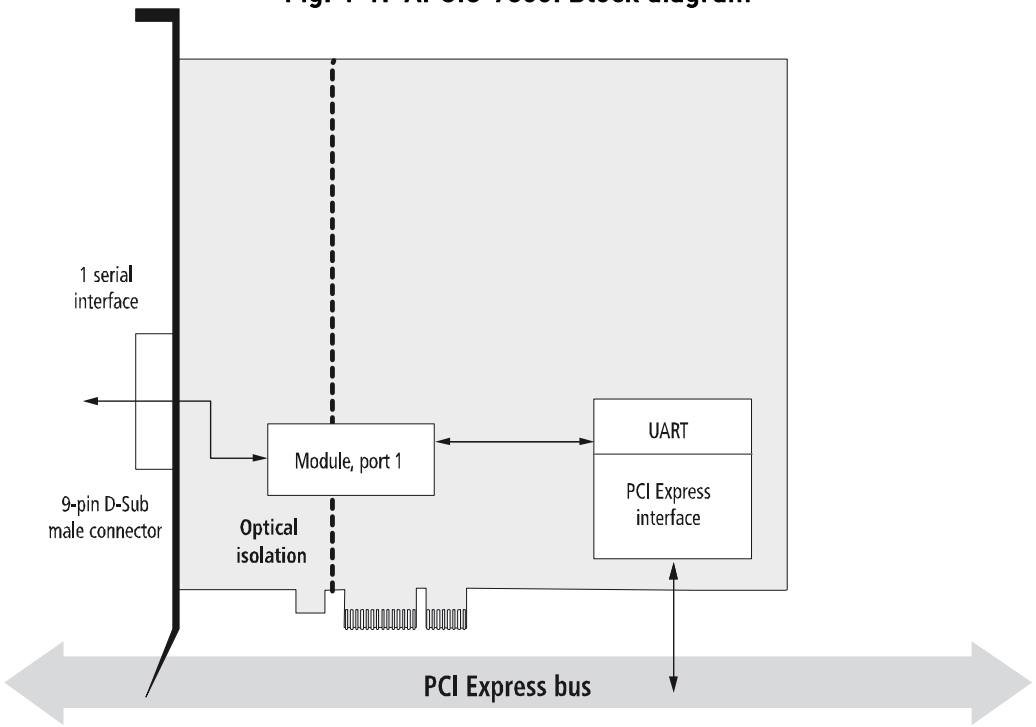


Fig. 4-2: APCIe-7420: Block diagram

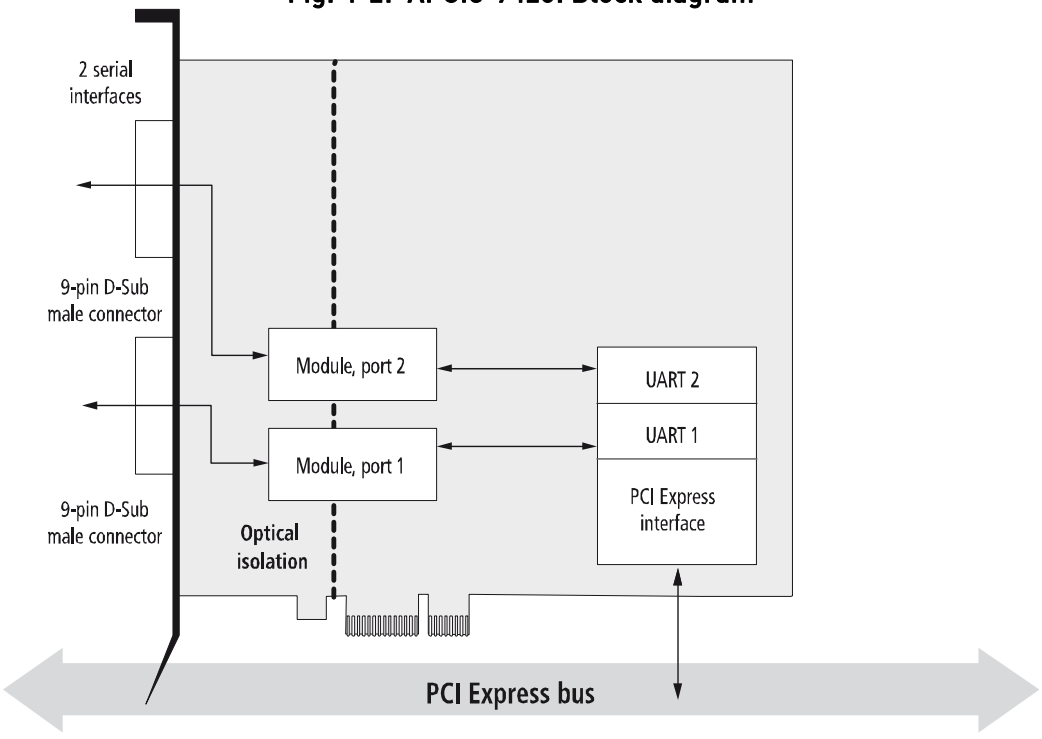


Fig. 4-3: APCIe-7500: Block diagram

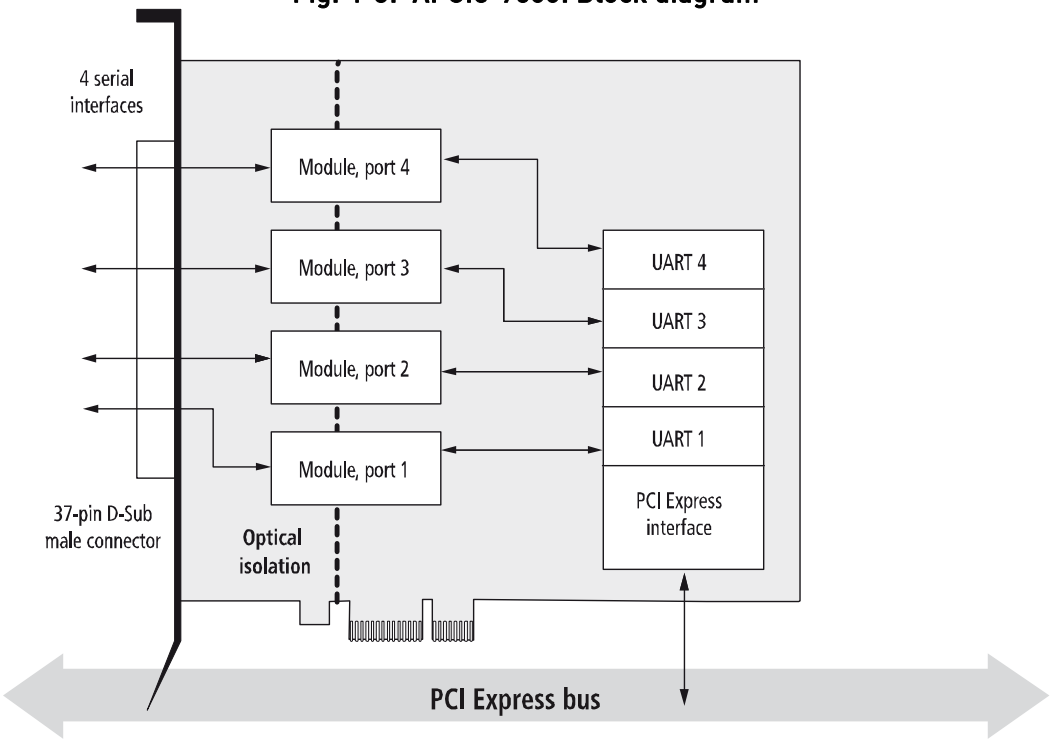


Fig. 4-4: APCIe-7500/4C : Block diagram

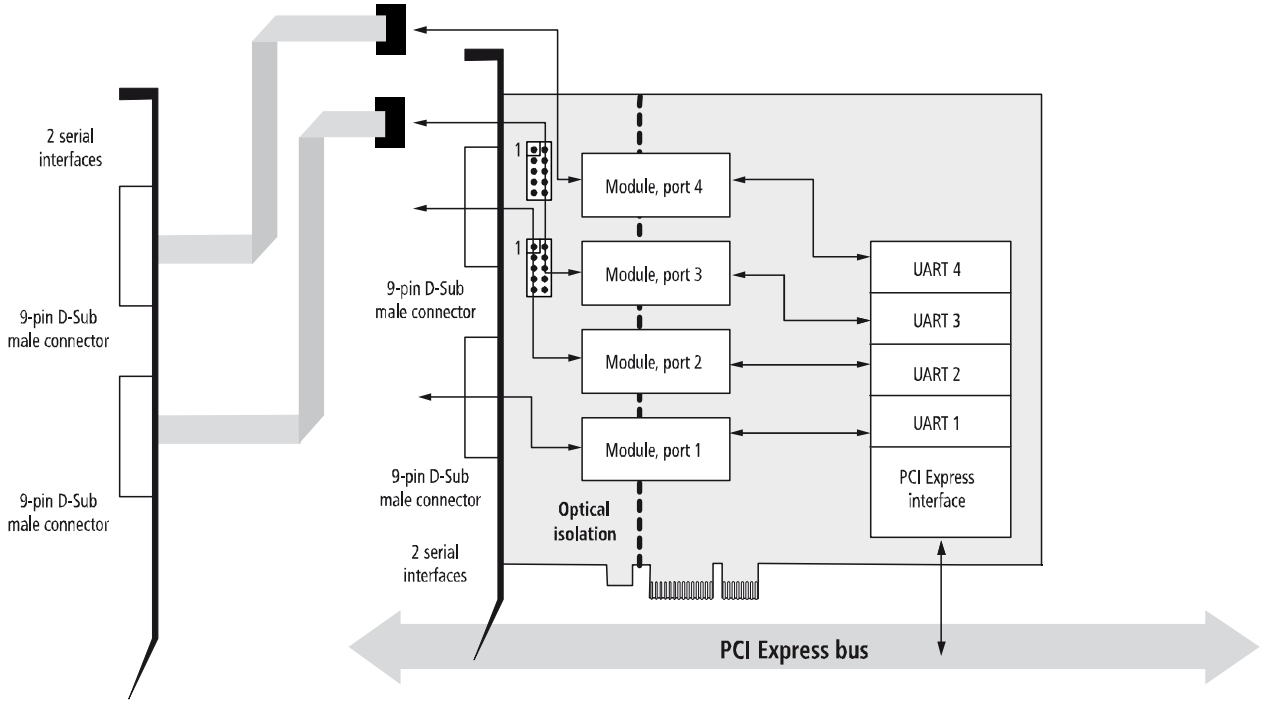
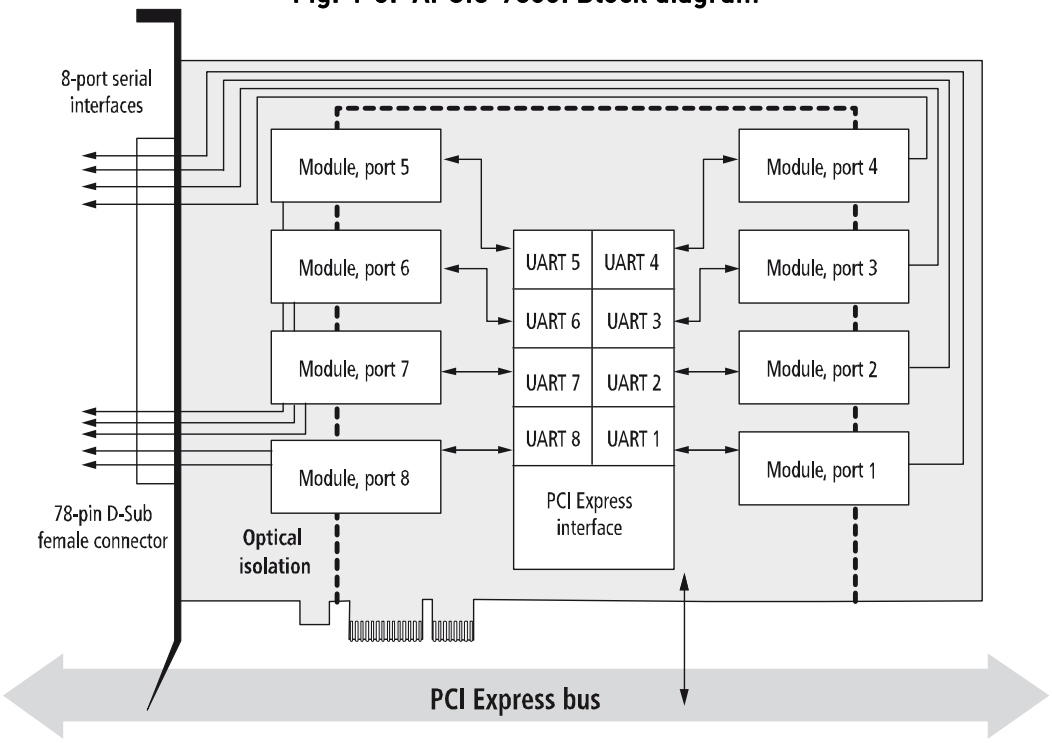


Fig. 4-5: APCIe-7800: Block diagram



5 Return or disposal

5.1 Return

If you need to return your board, you should read the following checklist before.

Checklist for returning the board:

- Specify the reason for returning your board (e.g. exchange, modification, repair), the serial number of the board, the contact person in your company including his/her telephone extension and e-mail address, as well as the mailing address for a potential new delivery. You do not have to indicate the RMA number.

Fig. 5-1: Serial number

- Note down the serial number of the board.
- Place the board in an ESD protective cover. Then pack it in a cardboard box so that it is well-protected for shipping. Send the packed board together with your details to:

  ADDI-DATA GmbH
  Airpark Business Center
  Airport Boulevard B210
  77836 Rheinmünster
  Germany

- If you have any questions, do not hesitate to contact us:

  Phone: +49 7229 1847-0
  E-mail: info@addi-data.com

5.2 Disposal of ADDI-DATA waste equipment

ADDI-DATA organises the disposal of ADDI-DATA products that were put on the German market after 13 August 2005.
If you want to return waste equipment, please e-mail your request to: info@addi-data.com.

Boards that were delivered after 13 August 2005 can be recognised by the following label:

Fig. 5-2: Disposal: Labelling

This symbol indicates the disposal of waste electrical and electronic equipment. It is valid in the European Union and in other European countries that have a separate collection system. Products carrying this symbol must not be treated as household waste.
For more detailed information on the recycling of these products, please contact your local citizens' office, your household waste collection service, the shop where you bought this product or the distributor you purchased this product from.

If you dispose of this product correctly, you will help to prevent damage that could be caused to the environment and to human health by inappropriate disposal. The recycling of materials will help to conserve our natural resources.

Disposal in other countries than Germany
Please dispose of the product according to the country-specific regulations.

6 Technical data and limit values

6.1 Electromagnetic compatibility (EMC)

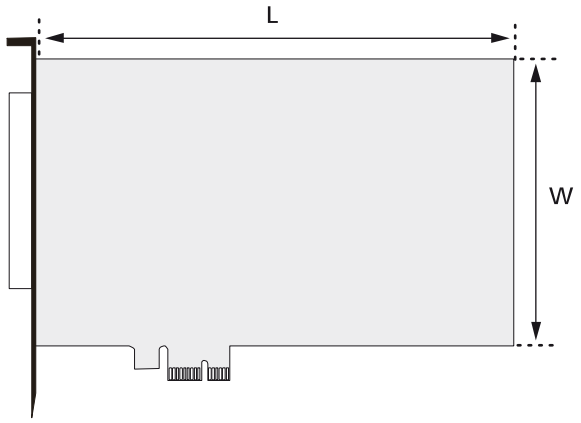
The **APCIe-7xx0** board is suited for installation in personal computers (PCs) which comply with the European EMC directive.

The board **APCIe-7xx0** complies with the European EMC directive. The tests were carried out by a certified EMC laboratory in accordance with the standard from the EN 61326 series (IEC 61326).
The limit values as set out by the European EMC directive for an industrial environment are complied with.

The respective EMC test report is available on request.

6.2 Mechanical structure

Fig. 6-1: APCIe-7xx0: Dimensions



Dimensions (L x W):	**APCIe-7300, APCIe-7420, APCIe-7500:** 110 x 98 mm **APCIe-7800:** 168 x 98 mm	
Weight:	**APCIe-7300, APCIe-7420, APCIe-7500:** ca. 120 g **APCIe-7800:** approx. 150 g	
Insertion into:	PCI Express slot	
Connection to peripherals:		
Front connector:	**APCIe-7300:**	9-pin D-Sub male connector
	APCIe-7420:	2 x 9-pin D-Sub male connector
	APCIe-7500:	37-pin D-Sub male connector
	APCIe-7500/4C:	4 x 9-pin D-Sub male connector with 2nd slot bracket
	APCIe-7800:	78-pin D-Sub female connector
Accessories:[4]		
Cables:	**APCIe-7500:**	**ST074, ST075**
	APCIe-7800:	**ST7809, ST7825**

[4] Not included in standard delivery

NOTICE!
The connection lines must be installed in such a way that they are protected against mechanical loads.

6.3 Versions

The board **APCIe-7xx0** is available in the following versions:

Table 6-1: Versions

Version	Features
APCIe-7300	1-port serial interface (1 x 9-pin D-Sub)
APCIe-7420	2-port serial interface (2 x 9-pin D-Sub)
APCIe-7500	4-port serial interface (1 x 37-pin D-Sub)
APCIe-7500/4C	4-port serial interface (4 x 9-pin. D-Sub)
APCIe-7800	8-port serial interface (1 x 78-pin D-Sub)

The specific version name can be found on the type label at the slot bracket of your board.

6.4 Limit values

Height:	2000 m over NN
Operating temperature:	0-60 °C (with forced ventilation)
Storage temperature:	-25 °C to +70 °C
Relative air humidity at indoor installation:	50 % at +40 °C 80 % at +31 °C
Minimum PC requirements:	
System bus:	1-/4-/8-/16-lane PCI Express according to PCI Express Base Specification, Revision 1.0a (PCI Express 1.0a)
Link speed:	2.5 Gbit/s
Required space:	1 PCI Express slot **APCIe-7500/4C:** 2 PCI Express slots
Operating system:	Windows 10/7/XP, Linux
Energy demand:	
Operating voltage from the PC:	3.3 V ± 5 %
Current consumption (typ., without load):	see the following table

Table 6-2: Current consumption (boards)

	APCIe-7300	APCIe-7420	APCIe-7500	APCIe-7800
+ 3.3 V from PC	114 mA ± 10 %	104 mA ± 10 %	100 mA ± 10 %	85 mA ± 10 %

The current consumption of the used SI modules according to the following table adds to the values indicated in Table 6-2:

Table 6-3: Current consumption (SI modules)

	SIxxx	SIxxx-G
RS232	1 mA	16 mA
RS422	46 mA	15 mA
RS485	46 mA	15 mA
TTY (20 mA)	82 mA	-
RS422 with CTS/RTS (SI422PEP)	-	18 mA

6.4.1 RS232

CCITT recommendation:	V.24
US standard EIA:	RS232
Without optical isolation (SI232):	
Maximum Baud rate:	1 MBaud
Baud rate on request:	up to 2.5 MBaud
ESD protection:	15 kV
With optical isolation (SI232-G):	
Maximum Baud rate:	1 MBaud
Baud rate on request:	up to 2.5 MBaud
ESD protection:	15 kV
Creeping distance:	3.2 mm
Test voltage:	1000 V DC

6.4.2 RS422, RS485

CCITT recommendation:	V.11
US standard EIA:	RS422, RS485
Without optical isolation (SI422, SI485):	
Maximum Baud rate:	1 MBaud
Baud rate on request:	up to 2.5 MBaud
ESD protection:	15 kV
Short-circuit protection:	available
With optical isolation (SI422-G, SI485-G):	
Maximum Baud rate:	1 MBaud
Baud rate on request:	up to 2.5 MBaud
ESD protection:	15 kV
Creeping distance:	3.2 mm
Test voltage:	1000 V DC
Short-circuit protection:	available

6.4.3 TTY 20 mA constant current loop (current Loop, SITTY)

Maximum Baud rate:	19.2 kBaud
TVS-Dioden:	400 W
Creeping distance:	3.2 mm
Test voltage:	1000 V DC
Load:	500 Ω
Reverse voltage protection:	

7 Appendix

7.1 Glossary

Baud rate
The baud rate is the number of signal states that can be transmitted in a given unit of time. In a binary transmission system, one bit can represent one signal state ('high' or 'low'). The baud rate is expressed in baud, after the French engineer Baudot. As a rule, the baud rate is not equivalent to the transmission speed (in bps).

Creeping distance
In order to prevent any risk to electro-mechanical components from the effects of electrical voltages and currents, minimum insulation distances must be maintained. The creeping distance is the shortest distance between 2 reference points (contact elements) across the surface of an insulating material.

Driver
A driver is a series of software instructions written specifically to manage particular devices.

Duplex
The ability to both send and receive data simultaneously over the same communications line is called duplex.

EMC
The definition of the VDE regulation 0870 states: Electromagnetic compatibility is the ability of an electrical installation to function satisfactorily within its electromagnetic environment without unduly affecting its environment and the equipment it contains.

ESD
= Electrostatic discharge

ESD is the sudden and momentary electric current that flows between two objects at different electrical potentials caused by direct contact or induced by an electrostatic field. The term is usually used in the electronics and other industries to describe momentary unwanted currents that may cause damage to electronic equipment.

FIFO
= First in, First out

Data that is written into the FIFO memory buffer first, gets out of it first.

Half duplex
With this transmission method, pieces of information are sent in sequence in both directions.

Handshaking
By means of handshake lines, the transmission of message bytes between the devices is handled asynchronously. The so-called three-level handshaking is a nested procedure, which guarantees the transmission and receipt of message bytes on the data lines without any transfer errors.

Limit value
Exceeding the limit values, even for a short time, can easily result in the destruction of the component or the (temporary) loss of functionality.

Operating voltage
The operating voltage is the voltage to the device in sustained operation. It must not exceed the maximum sustained voltage, and all unfavourable operating conditions, such as possible mains power surges for over a minute when the device is switched on, must be taken into account.

Optical isolation
Optical isolation means that two networks are only connected through an optoelectric transmitter and receiver with no electrical continuity between the two networks.

PCI Express
This is a parallelisable serial process for switched point-to-point connections. Unlike PCI bus, PCIe is not a parallel bus but a serial point-to-point connection. Data transfer is via so-called lanes comprising a line pair for transmission and a second pair for receiving. Individual components are connected via switches.
PCIe is also hot-plug compatible, which allows (defective) expansion boards to be replaced in operation – a feature much in demand in the server area.

RS232
In by far the commonest interface standard (V.24), all signals are related to 'ground'. This means that it is a ground asymmetric interface.

RS422
This is an interface standard with ground symmetrical operation, giving greater resistance to interference.
RS422 has the following features: Four-wire connection (inverting/non-inverting); permitted cable length up to 1200 m; transfer rates up to 10 Mbit/s; one transmitter can communicate with multiple receivers.

RS485
Compared to RS422, RS485 is an extended interface standard. One RS485 bus can have up to 32 users (transmitters/receivers) connected to it. RS485 has the following features:
Two-wire connection (half duplex operation) or four-wire connection (full duplex operation); permitted cable length up to 1200 m; transfer rates up to 10 Mbit/s.

Short-circuit
A short-circuit is an electrical circuit in a device of lower resistance than that of a normal circuit, typically resulting from the unintended contact of components, and consequent accidental diversion of the current.

Short-circuit current
A short-circuit current is the current between two short-circuited terminals.

Synchronous
Two time-dependent events, time slots, or signals are synchronous if their respective significant dates correspond with each other and are divided by requested time intervals that are nominally the same.

TTY
The TTY interface is the oldest interface.
In contrast to RS232, the data transfer over an asymmetric signal connection is not signal-driven, but driven by a specific line current (typically 20 mA for High, 0 mA for Low).
Only one connected device can provide the necessary loop current of 20 mA within a current loop. This device is described as 'active', while the other is passive.

TVS
= Transient Voltage Suppression

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8 Contact and support

Do you have any questions? Write or call us:

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