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CE

Technical manual

ADDICOM PA 732

1-port serial interface

9th edition 10/2000

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Basically are effective our "general terms of delivery and payment". The manager receives them at the latest with the invoice. Claims for guarantee and responsibility in case of injuries and material damages are excluded, if they are due to one or some of the following causes:

- if the board has not been used for the intended purpose
- improper installation, operation and maintenance of the board
- if the board has been operated with defective safety devices or with not appropriate or non-functioning safety equipment
- nonobservance of the instructions concerning: transport, storage, inserting the board, use, limit values, maintenance, device drivers
- altering the board at the user's own initiative
- altering the source files at the user's own initiative
- not checking properly the parts which are subject to wear
- disasters caused by the intrusion of foreign bodies and by influence beyond the user's control.

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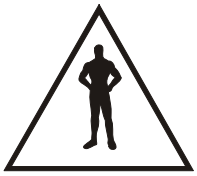
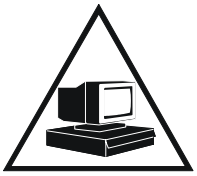
WARNING

In case of improper handling and if the board is not used for the intended purpose:



people may be injured,



the board, PC and peripheral may be damaged,

the environment may be polluted.

★★★ Protect yourself, other people and the environment★★★

- **Read the yellow safety leaflet carefully !**
  If this leaflet is not with the documentation, please contact us.

- **Do observe the instructions in the manual !**
  Make sure that you have not skipped any step. We are not liable for damage resulting from the improper use of the board.

- **Symbols used**

WARNING!
designates a possibly dangerous situation.
If the instructions are ignored **the board, PC and/or peripheral devices may be damaged**.

IMPORTANT!
designates hints and other useful information.

- **Do you have any questions?**
  Our technical support is always glad to help you.

CE

Declaration of Conformity

This declaration is valid for the following product:

ADDICOM PA 732
Asynchronous Communication Adapter
with Full Galvanic Isolation

It is made by

ADDI-DATA GmbH
Meß- und Steuerungstechnik
Dieselstraße 3
D-77833 Ottersweier

in sole responsibility and is valid on the understanding that the product is competently installed, used and maintained, according to the respective security regulations as well as to the manufacturer's instructions regarding its intended use.

This declaration states that the product complies with following EC Directives:

- **EWGRL 336/89 of 3.05.1989**
- **EWGRL 31/92 of 28.04.1992**
- **EWGRL 68/93 of 22.07.1993**

This declaration is valid for all units manufactured according to the manufacturing references listed in the form TD7500.020. Following norms have been applied to test the product regarding electromagnetic compatibility:

- **EN55011/03.91**
- **EN55022/08.94**
- **EN50082-2/03.95**

We point out that

- the conformity and herewith the permission of use expire if the user alters the product without consulting with the manufacturer.
- non-skilled users are to have the operational area of the product and the requirements resulting from it checked prior to putting into operation.
- by using this product in appliances coming under the EC EMC Directive, the user is to make sure they are conform to its regulations prior to putting into operation.
- by using this product in machines / installations coming under the EU Machine Directive, the user is to make sure they are conform to its regulations prior to putting into operation.

A copy of the EMC tests is at your disposal on request.

15 October 1995

Legally valid signature of the manufacturer

Figures

Tables

1 INTENDED PURPOSE OF THE BOARD

The **PA 732** board is an interface between an industrial process and a personal computer (PC). It is to be used in a free PC ISA slot. The PC is to comply with the EU directive 89/336/EEC and the specifications for EMC protection.

Products complying with these specifications bear the CE mark.

Serial data is exchanged with external communication devices through the 25-pin SUB-D connector of the **PA 732** board in the chosen transmission mode (RS232, RS422, RS485 or 20 mA current loop).

The connection with the external cables is to comply with the specifications:
- metallized plastic hoods
- shielded cable
- cable shield folded back and firmly screwed to the connector housing.

The use of the board in a PC could change the PC features regarding to noise emission and immunity. Increased noise emission or decreased noise immunity could result in the system not being conform anymore. Check the PC's and cable's shielding capacity prior to putting the device into operation.

The use of the board according to its intended purpose includes observing all advises given in this manual and the safety leaflet. Uses beyond these specifications are not allowed.

The manufacturer is not liable for any damages which would result from the non-observance of this clause.

CAUTION!

The board is intended to work in one operating mode only. Please read chapter 9 "Functions of the board".

2 USER

2.1 Qualification

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

- installation,
- use,
- maintenance.

2.2 Personal protection

Consider the country-specific regulations about

- the prevention of accidents
- electrical and mechanical installations
- radio interference suppression.

3 HANDLING THE BOARD

Fig. 3-1: Wrong handling

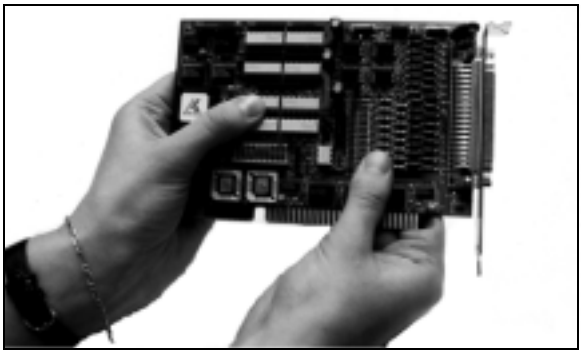
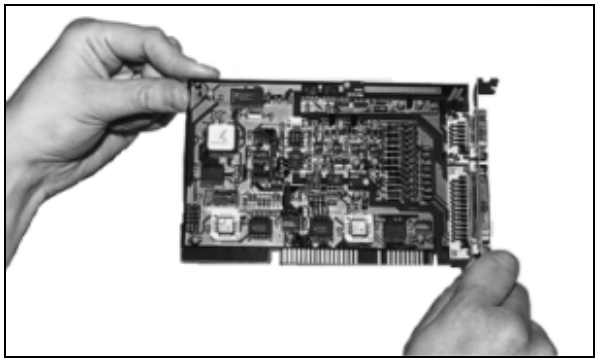


Fig. 3-2: Correct handling



4 TECHNICAL DATA

4.1 Electromagnetic compatibility (EMC)

The board has been subjected to EMC tests in an accredited laboratory in accordance with the norms EN50082-2, EN55011, EN55022. The board complies as follows with the limit values set by the norm EN50082-2:

	True value	Set value
ESD	4 kV	4 kV
Fields	10 V/m	10 V/m
Burst	4 kV	2 kV
Conducted radio interferences	10 V	10 V

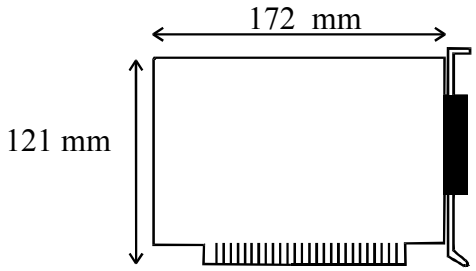
WARNING!
The EMC tests have been carried out in a specific appliance configuration. We guarantee these limit values **only** in this configuration[1)] .

Consider the following aspects:

- your test program must be able to detect operation errors.
- your system must be set up so that you can find out what caused errors.

4.2 Physical set-up of the board

The board is assembled on a 4-layer printed circuit card.



Weight	120 g
Installation in:	XT/AT slot
Front connector:	25-pin SUB-D male connector compliant with the PA 731

[1)] We transmit our appliance configuration on request.

4.3 Options

Option U: UART with 16-byte FIFO buffers

Option S: Addressing through DIP switches

Option RC: Modem control signals CTS, RTS as RS422 signals

4.4 Limit values

Operating temperature: ..... 0 to 60°C
Storage temperature: ..... -25 to 70°C
Relative humidity: ..... 30% to 95% non condensing

Minimum PC requirements:
- operating system: ..... MS DOS 3.3,
Windows 3.1,
Windows NT/95/98

Data transfer rate:
RS232: ..... max. 19.2kBaud
RS422/485: ..... max. 56kBaud
20mA current loop: ..... max. 19.2kBaud
Apparent ohmic resistance:
20mA current loop: ..... ≤ 400Ω
Current consumption: ..... +5V / 100mA typ.
+12V / 80mA typ.
Overvoltage protection:
RS232: ..... Breakdown voltage = ± 25V
VCL[1] = ± 38V ;
by Ipp[2] = 40A in 8-20 µs test
Ppp[3]: SURGE = 300W/1ms
RS422/RS485: ..... Breakdown voltage = ± 6.5V
VCL = ± 11.3V;
by Ipp = 35,4A in 1 ms test
Ppp = 400W/1ms

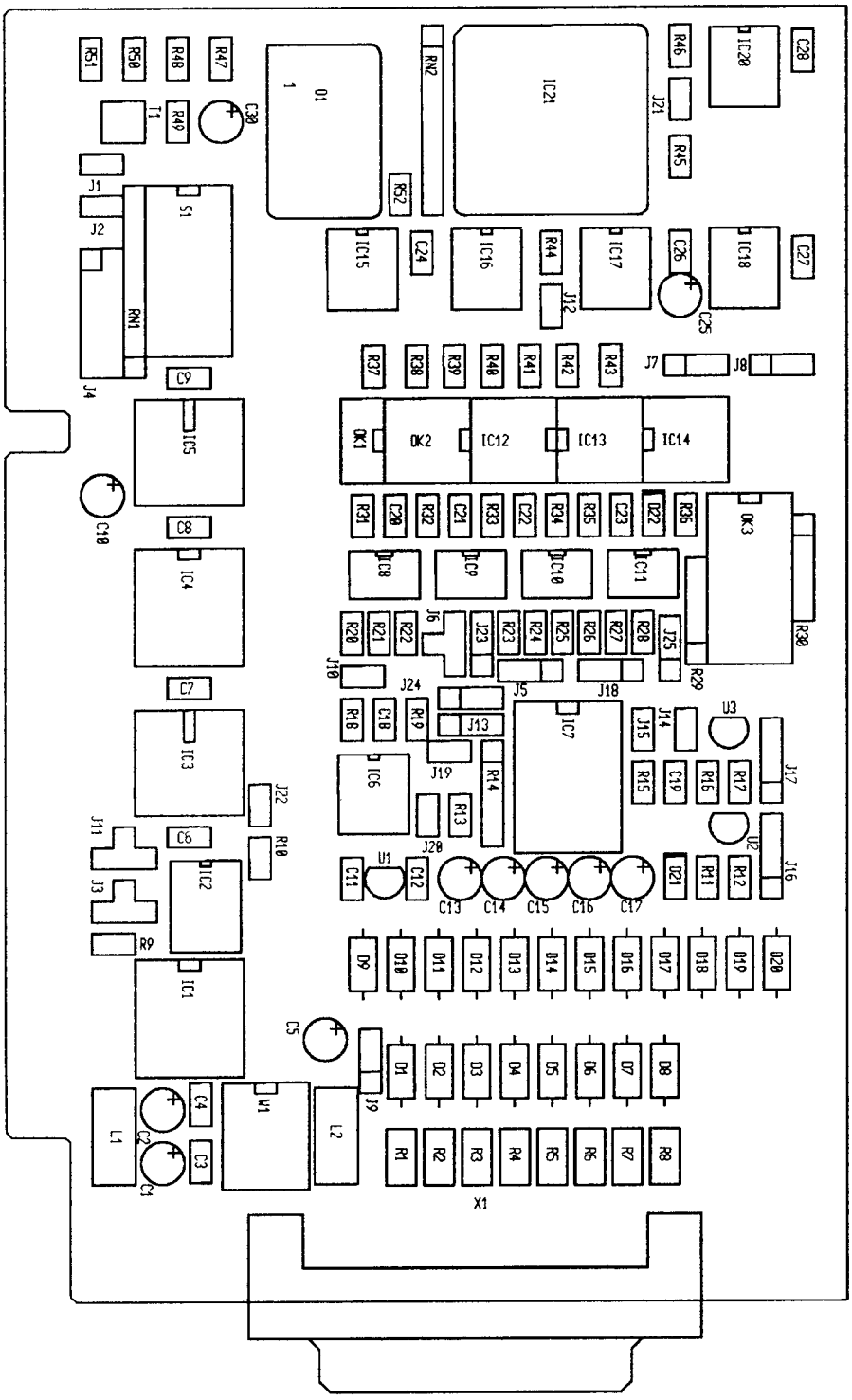
All channels are protected against short-circuits by PTC resistors.
20mA current loop: ..... Breakdown voltage: ±26V
VCL = ± 41,5V;
by Ipp = 9,6A in 1 ms test
Ppp = 400W/1ms
Isolation voltage: ..... 1000 VAC

[1] VCL = Clamping Voltage
[2] Ipp = Surge non repetitive reverse current.
[3] Ppp = Peak Pulse Power

5 SETTINGS

5.1 Component scheme

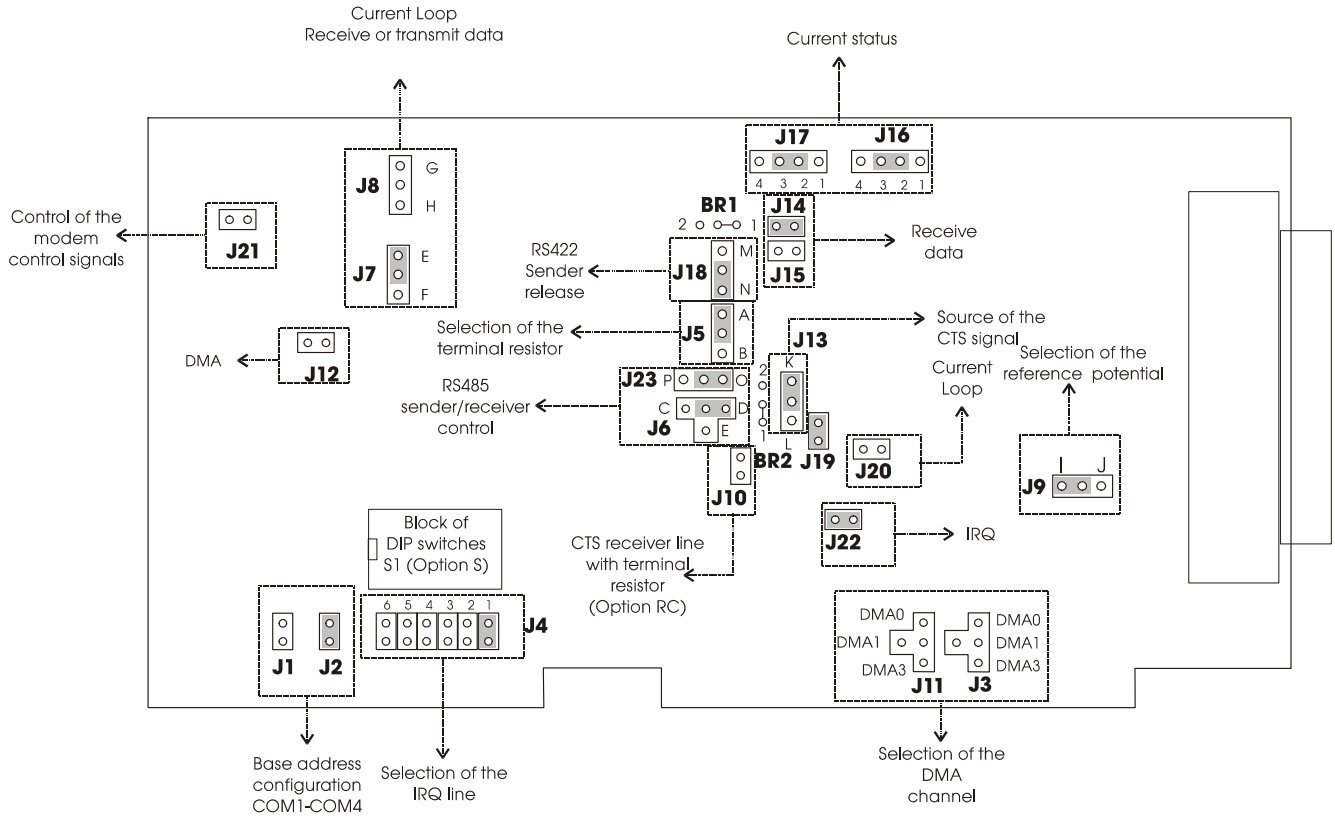
Fig. 5-1: Component scheme



5.2 Jumper settings

5.2.1 Location of the jumpers on the board and settings at delivery

Fig. 5-2: Location of the jumpers on the board and settings at delivery



5.2.2 Jumper settings

WARNING!
Do not operate the board simultaneously in several modes.
Otherwise you may destroy the board, PC and/or the peripheral.

Make sure to set only the jumpers required for the respective functions.

Base address

You can also set the base address through DIP switches (Option S). See Chapter 5.3: Base address.

Table 5-1: Setting the base address

Description	Address	Jumper settings	Settings at delivery
COM1	3F8H		-
COM2	2F8H		✔
COM3	3E8H		-
COM4	2E8H		-

Interrupt lines

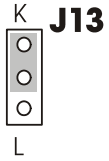
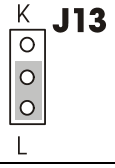
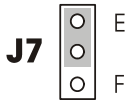
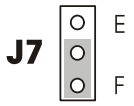
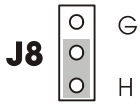
Table 5-2: Selection of the interrupt lines

Base address	Corresponding interrupt line	Jumper	Settings at delivery
COM1	IRQ4	J4-2 + J22	-
COM2	IRQ3	J4-1 + J22	✔
COM3	IRQ10	J4-4 + J22	-
COM4	IRQ11	J4-5 + J22	-
	IRQ5	J4-3 + J22	-
	IRQ15	J4-6 + J22	-
	no IRQ	J4 and J22 are not set	

Mode selection

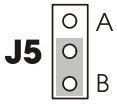
The board cannot simultaneously operate in several modes.
J9 is always set.

Table 5-3: Mode selection

Jumper	Settings	Function	Settings at delivery
J14	set	RS232	✔
J15	set	RS422, RS485	-
J13		Source of the CTS signal: CTS in RS232 mode	✔
		Source of the CTS signal: CTS in RS422 mode (Option RC)	-
J20	set	**Current Loop**	
J7		**Current loop - Transmitter** Current flows in rest state	✔
		Current does not flow in rest state	-
J8		**Current loop - Receiver** Current flows in rest state	-
		Current does not flow in rest state	-

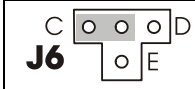
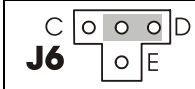
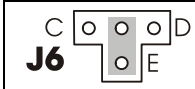
Terminal resistors

Table 5-4: Terminal resistors

Jumper	Settings	Function	Settings at delivery
J5		RS422, RS485 = 100 Ω terminal resistor	✔
		RS422, RS485 = 120 Ω terminal resistor	-
J10	set	**Option RC:** terminal resistor for the CTS signal, when board operated in RS422	-

Controlling the transmitter

Table 5-5: Transmitter control

Settings	Function	Settings at delivery
	RS485: Control occurs over the DTR signal	-
	RS485: Control occurs over the DATA-DIR signal	✔
	RS485: Control occurs over the RTS signal	-
	RS422: sender permanently released.	✔
	RS422: The release of the sender is programmed via the **DTR** bit	-

IMPORTANT!
To switch to RS422 the jumper **J6 is not** to be set.

Controlling the receiver

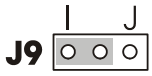
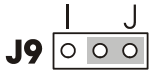
Table 5-6: Receiver control with J23

Settings	Function	Settings at delivery
	Alternate control (without echo)	-
	Control through the RD-EN bit (with echo)	✔

IMPORTANT!
To switch to RS422, **J23** is to be set in position **P**.

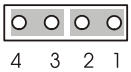
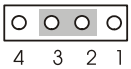
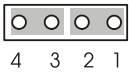
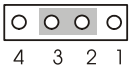
Selection of the reference potential

Table 5-7: Selection of the reference potential with J9

Settings	Function	Settings at delivery
	Derivation of the interference voltage via secondary ground DC/DC converter	✔
	Derivation of the interference voltage via pin 1 of the 25-pin SUB-D connector	-

Selection of the current source for Current Loop

Table 5-8: Selection of the current source with J16 and J17

Settings	Function	Settings at delivery
	**Sender current source:** active transmission (the board provides constant current)	-
	**Sender current source:** passive transmission (the peripheral provides constant current)	✔
	**Receiver current source:** active reception (the board provides constant current)	-
	**Receiver current source:** passive reception (the peripheral provides constant current)	✔

Control of the modem control signals

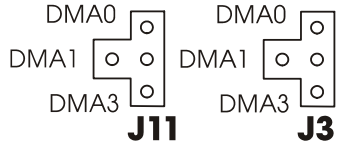
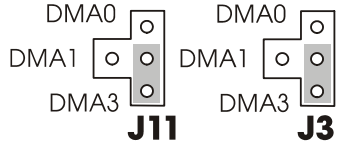
Table 5-9: Control of the modem control signals

Settings	Function	Settings at delivery
	The modem control signals are controlled via the 25-pin SUB-D male connector	-
	The modem control signals are internally wired (DTR → DCD, DSR RTS → CTS)	✔

Selection of the DMA channel

In DMA mode, J12 is always **to be set.**

Table 5-10: Selection of the DMA channel

Settings	Function	Settings at delivery
	-	✔
	**Example:** The DMA channel 1 is selected	-

5.3 Setting the base address

WARNING!
If the base address set is wrong, the board and/or the PC may be destroyed.

Before installing the board
Check, that
- the base address is free
- the address range required by the board is not already used by the PC or by boards already installed in the PC.

Possible settings of the base address (see also "Jumper settings")
You can find out which serial and parallel ports are already used by your PC.

• **Load** the DEBUG program
Are recognised: COM1, COM2, LPT1, LPT2 for DOS 3.3 and
COM1-COM4, LPT1-LPT2 for >DOS 4.0

Enter	On the screen	Meaning
	C:>	
debug <return>	-	
d40:0 <return>	F8 03 F8 02 00 00 00 00 -78 03	'address 03F8 = COM1 ´address 02F8 = COM2 ´address 0378 = LPT1
q <return>		

COM1 = 03F8, COM2 = 02F8, LPT1=0378 are used in this example by the PC. You can set the base address of the serial ports through the block of DIP switches (Option S). In this case the jumpers J1 and J2 are to be open.

Address ranges

- **Make sure** that the address ranges of the serial ports do not overlap.

Decoding of the base addresses

The address decoding requires 8 bytes in the I/O address space. (0 to 3FF Hex).

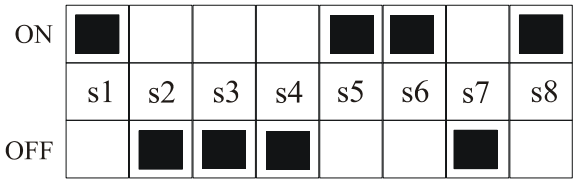
Table 5-11: Decoding the base address (0390H)

	MSB															LSB
Decoded address bus	A15	A14	A13	A12	A11	A10	A9	A8	A7	A6	A5	A4	A3	A2	A1	A0
Required Base address Hex	0				3				9				0			
Required Base address binary	0	0	0	0	0	0	1	1	1	0	0	1	0	0	0	0
DIP switsches Logic "0"= ON Logic "1" = OFF	*	*	*	*	*	s1 ON	s2 OFF	s3 OFF	s4 OFF	s5 ON	s6 ON	s7 OFF	s8 ON	X	X	X

X: Decoded address range of the board
* : Permanently decoded at logic "0"

Fig. 5-3: DIP switches

IMPORTANT!
You will find the switch **s1 on the left** of the DIP switches!



If you want to set the board PA 732 with DIP switches to COM1-COM4, the switches S1 to S8 are to be set to OFF.

6 INSERTING THE BOARD

IMPORTANT!
Do observe the *safety instructions*.

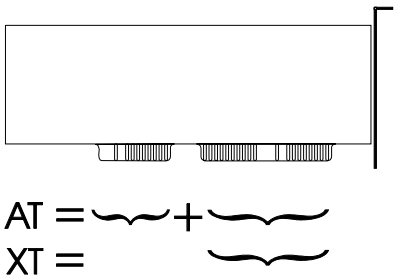
6.1 Opening the PC

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

6.2 Selecting a free slot

Two types of ISA slots are available: XT and AT.

Fig. 6-1: Types of slots



If necessary, the board can also be used in EISA slots.

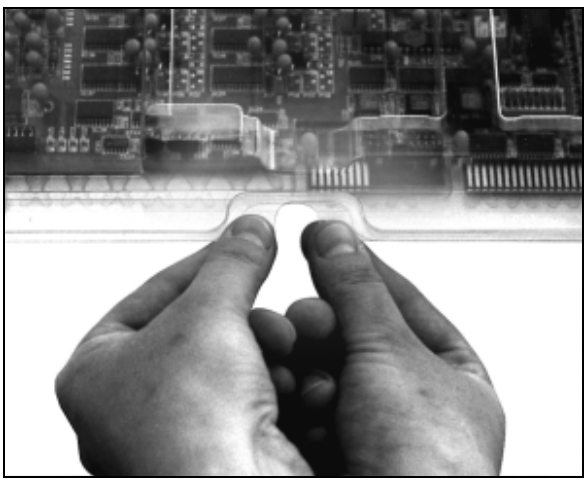
See in the PC manual which types of slots are free.

Remove the back cover of the selected slot according to the instructions of the PC manufacturer. Keep the back cover. You will need it if you remove the board.

Discharge yourself from electrostatic charges.

Take the board out of its protective blister pack.

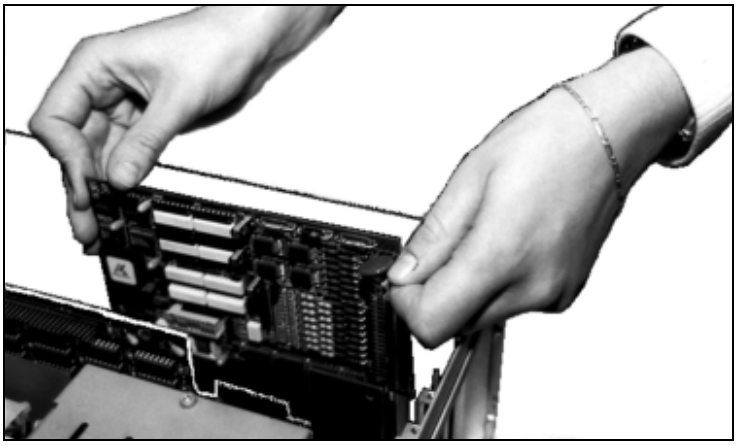
Fig. 6-2: Opening the blister pack



6.3 Plugging the board into the slot

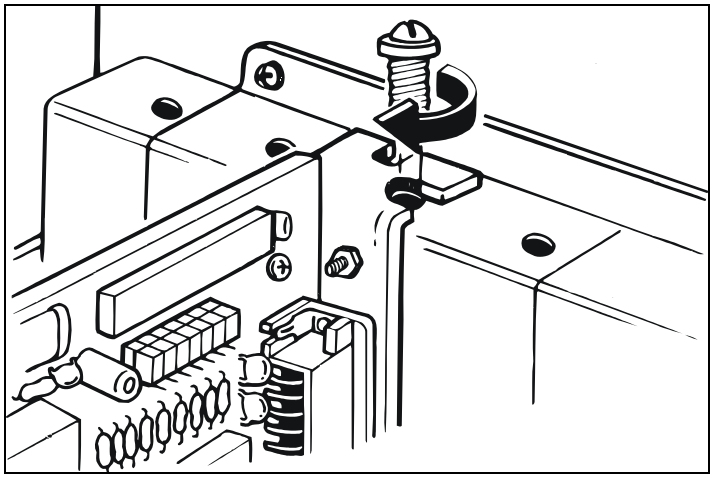
- **Discharge yourself from electrostatic charges.**
- Insert the board **vertically into the chosen slot.**

Fig. 6-3: Inserting the board



- **Fasten the board** to the rear of the PC housing with the screw which was fixed on the back cover.

Fig. 6-4: Fastening the board at the back cover



- **Tighten all the loosed screws.**

6.4 Closing the PC

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

7 SOFTWARE

7.1 Delivered Software

The board is supplied with a CD-ROM.

The CD contains ADDIREG for Windows NT 4.0 and Windows 95/98,
You can also download the ADDIREG program from Internet.

IMPORTANT!
Do install the ADDIREG program first, before you install and start any other applications.

The CD-ROM contains also software examples for the ADDI-DATA communication boards:
- 16-bit for MS-DOS and Windows 3.11
- 32-bit for Windows NT/95/98.

7.2 Software installation

- **Install and configure** the boards one after the other.
  You will thus avoid configuration errors.

1. Switch off the PC
2. Install the **first** board
3. Start the PC
4. Install ADDIREG (once is enough)
5. Configure the board

6. Install the driver and the software examples

7. Switch off the PC
8. Install the **second** board
9. Start the PC
10. Configure the second board
11. Install the driver and the software examples

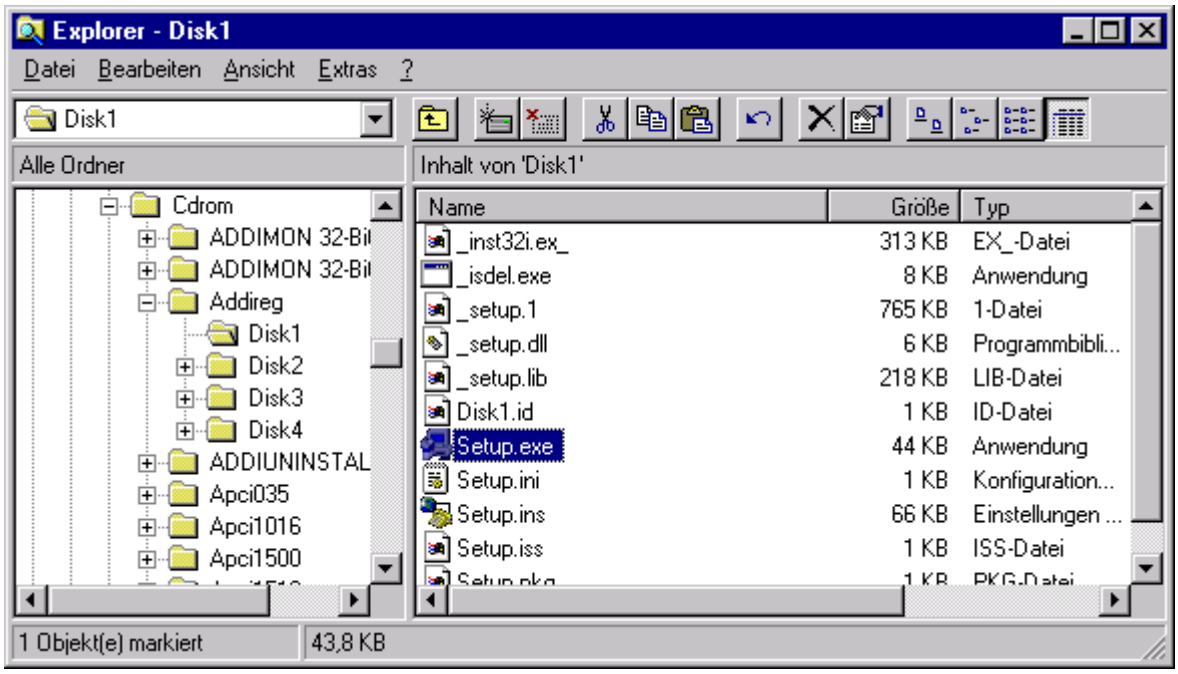
IMPORTANT!
To install the latest version of ADDIREG, first deinstall the former version through the ADDI_UNINSTALL program.
(See paragraph 7.3.5).

7.3 Board configuration with ADDIREG

7.3.1 Installing ADDIREG

- Change to the CD drive.

Fig. 7-1: Installation of the ADDIREG program



- Start the Set-up file.

- Select one of the 3 parameters
  1- typical
  2- compact
  3- custom

Proceed as indicated on the screen and read attentively the "Software License" and "Readme". In "custom", you can select your operating system.

The installation program gives you further instructions.

If the message "Der Keyboard Kernel wurde noch nicht gestartet, ..., soll der Kernel jetzt gestartet werden?" (the keyboard kernel has not been started, ... do you want to start the kernel now?) appears when starting the program, first deinstall the ADDIREG program with ADDI-UNINSTALL and install ADDIREG anew.

7.3.2 Program description

IMPORTANT!
If you use one or several resources of the board, you cannot start the ADDIREG program.

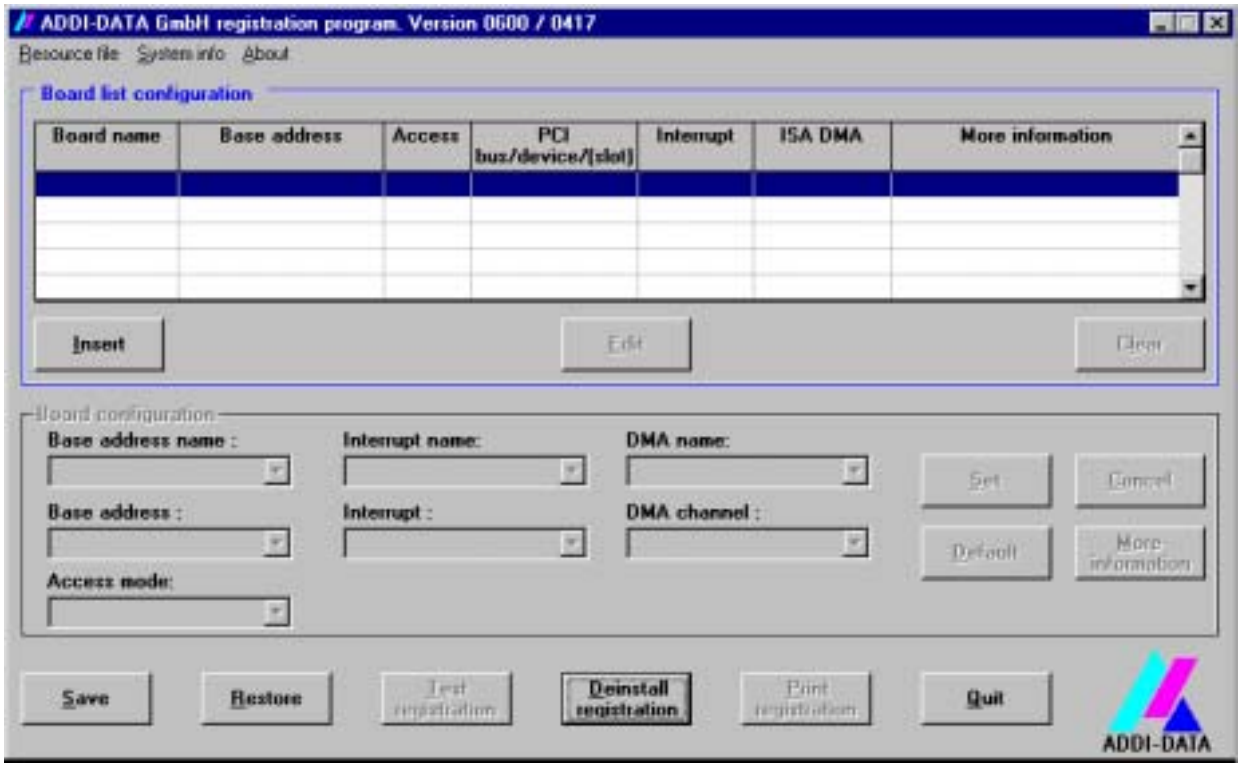
The ADDIREG registration program is a 32-bit program for Windows NT 4.0 and Windows 95/98.
The user can register all hardware information necessary to operate the ADDI-DATA PC boards.

IMPORTANT!
Insert the ADDI-DATA boards to be registered before starting the ADDIREG program.

If the board is not inserted, the user cannot test the registration.

Once the program is called up, the following dialog box appears.

Fig. 7-2: ADDIREG registration program



The table in the middle lists the registered boards and their respective parameters.

Board name:
Names of the different registered boards (e.g.: APCI-3120).
When you start the program for the first time, no board is registered in this table.

Base address:
Selected base address of the board.

IMPORTANT!
The base address selected with the ADDIREG program must correspond to the one set through DIP-switches.

Access:
Selection of the access mode for the ADDI-DATA digital boards.
Access in 8-bit or 16-bit.

PCI bus/device(slot):
Used PCI slot. If the board is no PCI board, the message "NO" is displayed.

Interrupt:
Used interrupt of the board. If the board uses no interrupt, the message "Not available" is displayed.

IMPORTANT!
The interrupt selected with the ADDIREG program must correspond to the one set through jumpers.

ISA DMA:
Indicates the selected DMA channel or "Not available" if the board uses no DMA.

More information:
Additional information like the identifier string (e.g.: PCI1500-50) or the installed COM interfaces.

Text boxes:

Under the table you will find 6 text boxes in which you can change the parameters of the board.

Base address name:
When the board operates with several base addresses (One for port 1, one for port 2, etc.) you can select which base address is to be changed.

Base address:
In this box you can select the base addresses of your PC board. The free base addresses are listed. The used base addresses do not appear in this box.

Interrupt name:
When the board must support different interrupt lines (common or single interrupts), you can select them in this box.

Interrupt:
Selection of the interrupt number which the board has to use.

DMA name:
When the board supports 2 DMA channels, you can select which DMA channel is to be changed.

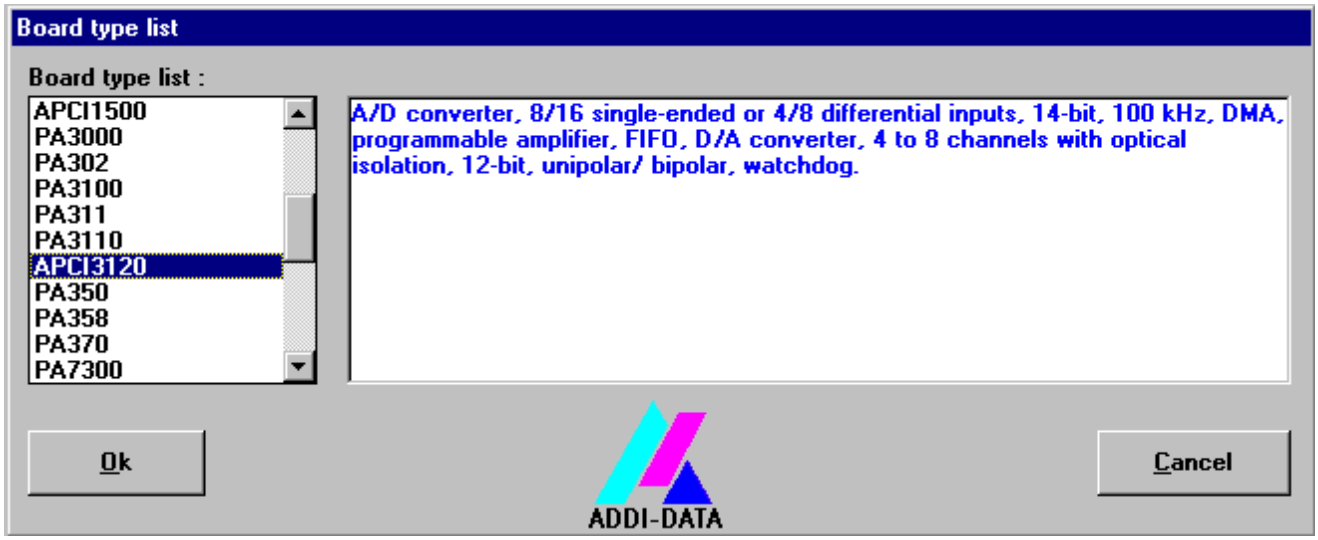
DMA channel:
Selection of the used DMA channel.

Buttons:

Edit [1]**:**
Selection of the highlighted board with the different parameters set in the text boxes.
Click on "Edit" to activate the data or click twice on the selected board.

Insert:
When you want to insert a new board, click on "Insert". The following dialog window appears:

Fig. 7-3: Configuring a new board



All boards you can registered are listed on the left. Select the wished board. (The corresponding line is highlighted).
On the right you can read technical information about the board(s).
Activate with "OK"; You come back to the former screen.

Clear:
You can delete the registration of a board. Select the board to be deleted and click on "Clear".

Set:
Sets the parameterised board configuration. The configuration should be set before you save it.

Cancel:
Reactivates the former parameters of the saved configuration.

Default:
Sets the standard parameters of the board.

1 "x": Keyboard shortcuts; e.g. "Alt + e" for Edit

More information:
You can change the board specific parameters like the identifier string, the COM number, the operating mode of a communication board, etc...
If your board does not support these information, you cannot activate this button.
If you use the standard driver for Windows, you can select the COM number.
If you use the ADDI-DATA driver, you can select the identifier string for each module.

Several options like "Module selection" and the different parameters can only be activated if the functions are available.

Save:
Saves the parameters and registers the board.

Restore:
Reactivates the last saved parameters and registration.

Test registration:
Controls if there is a conflict between the board and other devices.
A message indicates the parameter which has generated the conflict. If there is no conflict, "OK" is displayed.

Deinstall registration:
Deinstalls the registrations of all board listed in the table.

Print registration:
Prints the registration parameter on your standard printer.

Quit:
Quits the ADDIREG program.

7.3.3 Registering a new board

IMPORTANT!
To register a new board, you must have administrator rights.
Only an administrator is allowed to register a new board or change a registration.

- Call up the ADDIREG program. The figure 7-2 is displayed on the screen. Click on "Insert". Select the wished board.

- Click on "OK". The default address, interrupt, and the other parameters are automatically set in the lower fields. The parameters are listed in the lower fields.
  If the parameters are not automatically set by the BIOS, you can change them.
  Click on the wished scroll function(s) and choose a new value.
  Activate your selection with a click.

- Once the wished configuration is set, click on "Set".

- Save the configuration with "Save".

- You can test if the registration is "OK".
  This test controls if the registration is right and if the board is present.
  If the test has been successfully completed you can quit the ADDIREG program.
  The board is initialised with the set parameters and can now be operated.

  In case the registration data is to be modified, it is necessary to boot your PC again. A message asks you to do so. When it is not necessary you can quit the ADDIREG program and directly begin with your application.

7.3.4 Changing the registration of a board

IMPORTANT!
To change the registration of a board, you must have administrator rights. Only an administrator is allowed to register a new board or change a registration.

- Call up the ADDIREG program. Select the board to be changed.
  The board parameters (Base address, DMA channel, ..) are listed in the lower fields.

- Click on the parameter(s) you want to set and open the scroll function(s).

- Select a new value. Activate it with a click.
  Repeat the operation for each parameter to be modified.

- Once the wished configuration is set, click on "Set".

- Save the configuration with "Save".

- You can test if the registration is "OK".
  This test controls if the registration is right and if the board is present.
  If the test has been successfully completed you can quit the ADDIREG program.
  The board is initialised with the set parameters and can now be operated.

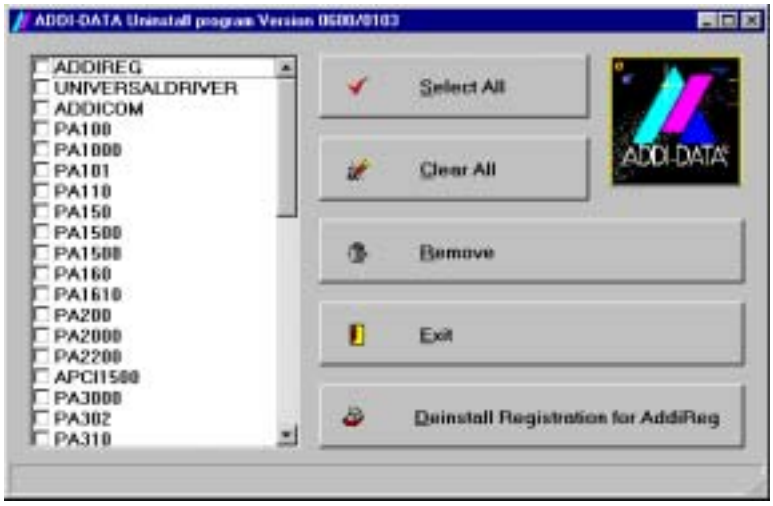
  In case the registration data is to be modified, it is necessary to boot your PC again. A message asks you to do so. When it is not necessary you can quit the ADDIREG program and directly begin with your application.

7.3.5 Removing the ADDIREG program

The ADDI_UNINSTALL program is delivered on the CD-ROM.

- Start the ADDI_UNINSTALL program.

Fig. 7-4: The ADDI_UNINSTALL program



- Click on "Deinstall registration for AddiReg".
- Proceed as indicated until the complete removing of ADDIREG.
- You can also download the program from Internet.

7.4 Installing the drivers

The ADDI-DATA communication boards are operated as standard COM. They can thus be used with the Windows Standard driver **"SERIAL COMMUNICATION in WIN32".** Software examples are available on the CD-ROM.

IMPORTANT!
Do install the ADDIREG program first, before you install and start any other applications.

7.4.1 Installation under DOS and Windows 3.11

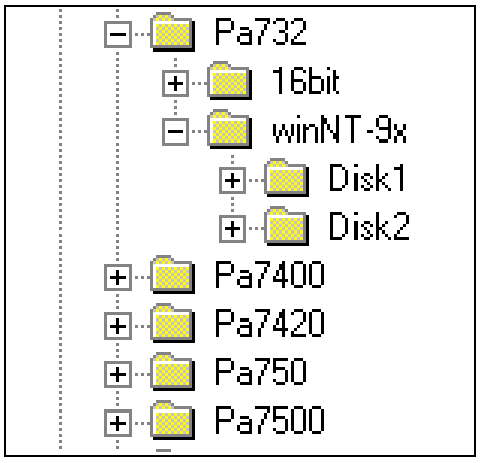
- Copy the contents of PA732\16bit on a disk.
  If several disks are to be used, the directory content is stored in several sub-directories (Disk1, Disk2, Disk3...).
- Insert the (first) disk into a drive and change to this drive.
- Enter <INSTALL>.

The installation program gives you further instructions.

7.4.2 Installation under Windows NT/95/98

- Change to the CD drive; You find the software examples as follows:

Fig. 7-5: Installation of the examples under Windows NT/95/98



- Under PA732/winNT-9x/Disk1 start the set-up program "setup.exe" (double click).

Proceed as indicated on the screen and read attentively the "Software License" and "Readme".

The installation program gives you further instructions.

7.5 Questions and software downloads

Do not hesitate to visit us or e-mail your questions.
Our Internet page is accessed:

- per e-mail: info@addi-data.de or hotline@addi-data.de

- per Internet : http://www.addi-data.de. or http://www.addi-data.com

Free download of standard software

You can download the latest versions of the standard software for the board **PA 732,** of ADDIREG and ADDI-UNINSTALL.

8 CONNECTION TO THE PERIPHERAL

Fig. 8-1: 25-pin SUD-D male connector

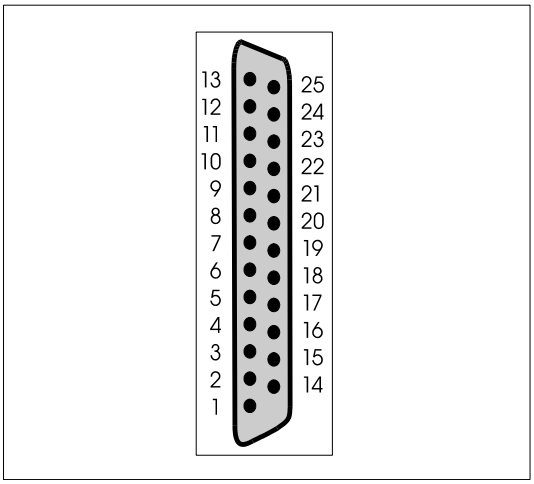


Table 8-1: Pin assignment

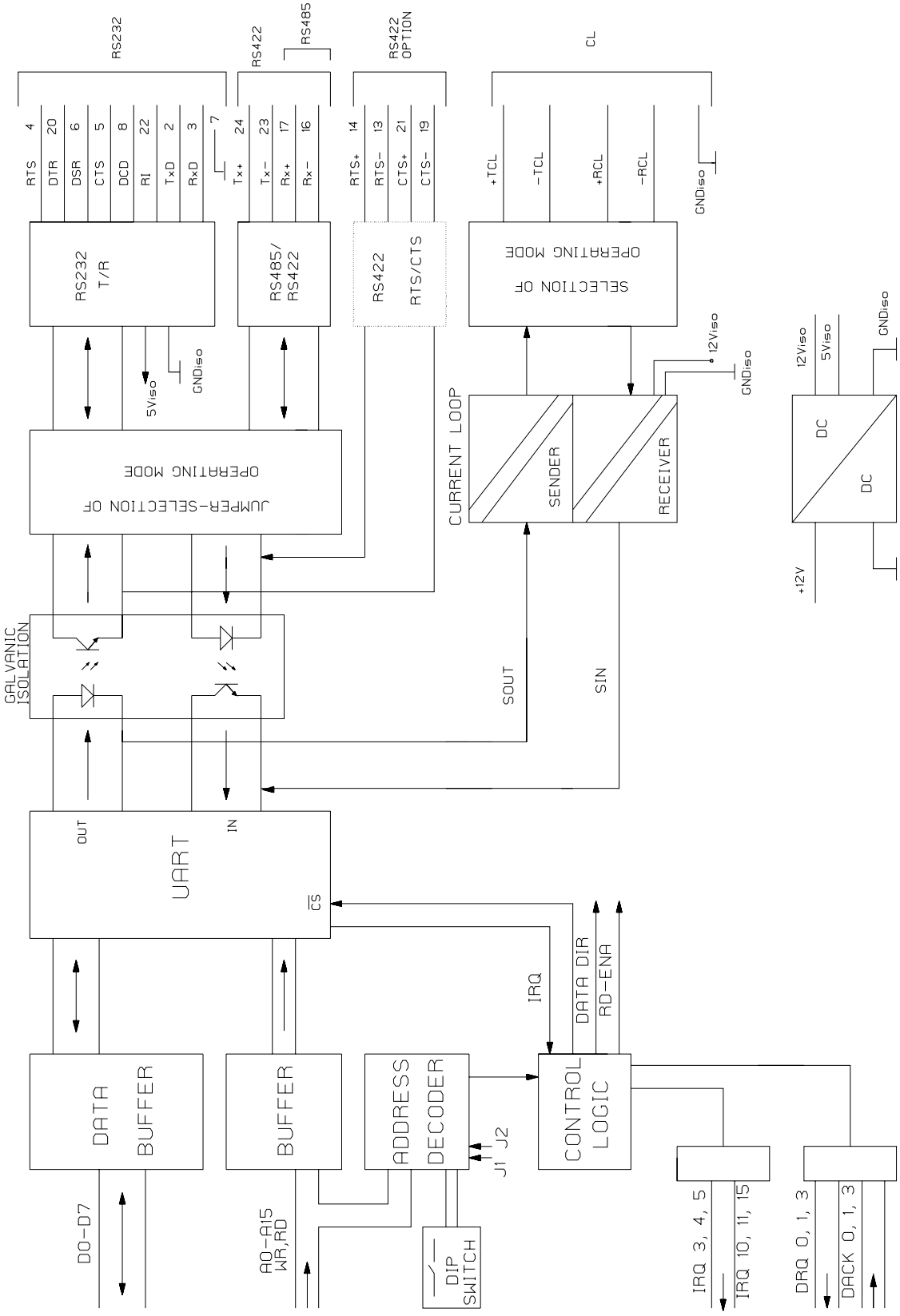
Pin	Signal	Mode / Meaning
1	PG	Protection ground
2	TxD	RS 232 transmitted data
3	RxD	RS 232 received data
4	RTS	RS 232 request to send
5	CTS	RS 232 clear to send
6	DSR	RS 232 data set ready
7	SGND	RS 232 signal ground
8	DCD	RS 232 data carrier detect
20	DTR	RS 232 data terminal ready
22	RI	RS 232 ring indicator
24	Tx+	RS 422 transmit
23	Tx-	RS 422 transmit
17	Rx+	RS 422 received /RS 485 received
16	Rx-	RS 422 received / RS 485 received
14	RTS+	RS 422 request to send+*
13	RTS-	RS 422 request to send-*
21	CTS+	RS 422 clear to send+*
19	CTS-	RS 422 clear to send-*
10	GND isola	Isolated ground
11	+Tx-CL-DATA	CL transmitted data
12	-Tx-CL-DATA	CL transmitted data
18	+RCV-CL-DATA	CL received data
25	-RCV-CL-DATA	CL received data
9	Current source out 1	Current source out 1
15	Current source out 2	Current source out 2

* **RS 422:** The signals on pins 13, 14, 19 and 21 are optionally available.

9 FUNCTIONS OF THE BOARD

9.1 Block diagram

Fig. 9-1: Block diagram of the PA 732



9.2 I/O mapping

Table 9-1: I/O mapping of the PA 732

	IORD			IOWR			
Base +0	RECEIVER BUFFER			TRANSMIT REGISTER			
Base +1	INTERRUPT ENABLE REGISTER						
Base +2	INTERRUPT IDENTIFICATION REGISTER						
Base +3	LINE CONTROL REGISTER						
Base +4	MODEM CONTROL REGISTER					RTS	DTR
Base +5	LINE STATUS						
Base +6	MODEM STATUS						
Base +7		IRQ TC	DATA DIR		TC-CLEAR	RD-EN	DATA DIR
		D1	**D0**		**D2**	**D1**	**D0**

You will find the meaning of the data bits for base + 7 in the following description.

WARNING!
The board cannot work simultaneously in several operating modes. Please make sure to plug only the jumpers which are necessary for the respective functions!

9.3 RS232

9.3.1 Jumper settings

Mode without modem control signals (DTR, CTS, RTS, DCD, DSR):

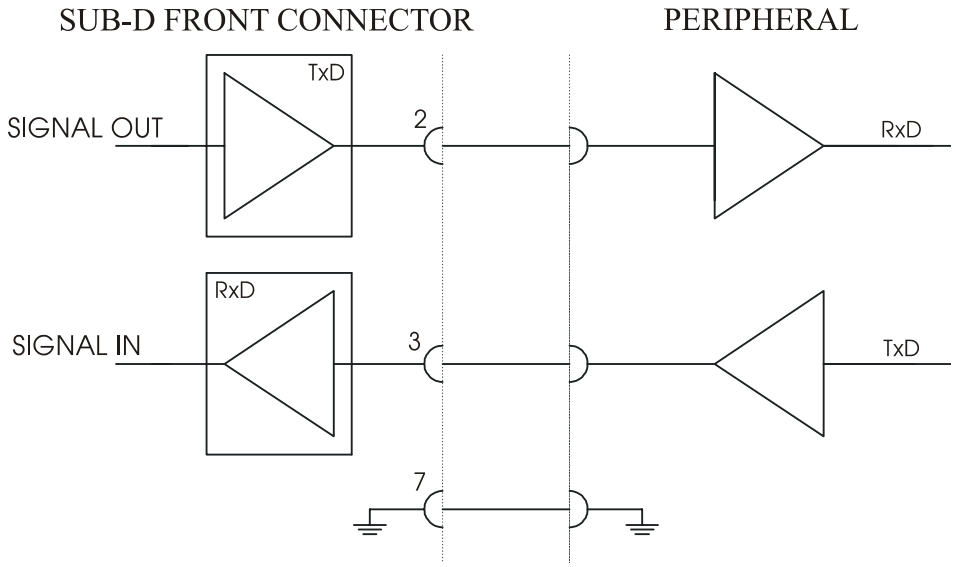
- J14 set → RS232 data receiver
- J21 not set
  The modem control signals are internally wired when J21 is not set:
  (DTR → DCD, DSR)
  (RTS → CTS)

Mode with modem control signals (DTR, CTS, RTS, DCD, DSR, RI):

- J14 set → RS232 data receiver
- J13 on position K → modem control signal CTS in RS232 mode
- J21 set → The input signals CTS, DCD, DSR, RI are controlled via the 25-pin SUB-D connector.

9.3.2 Wiring principle for RS232 mode

Fig. 9-2: Wiring for RS232 mode



9.4 RS422

9.4.1 Jumper settings

RS422 mode without modem control signals (DTR, CTS, RTS, DCD, DSR)

- J15 set → RS422 data receiver
- The modem control signals are internally wired **when J21 is not set**:
  (DTR → DCD, DSR)
  (RTS → CTS)
- J23 set in position P
- J18 set for releasing the RS422 sender

RS422 mode with modem control signals (CTS, RTS ⇒Option RC)

- J15 set → RS422 data receiver
- J13 in position L → modem control signal CTS in mode RS422 (Option RC)
- J21 set → The input signals RTS, CTS, DCD, DSR, DTR are controlled via the 25-pin SUB-D male connector. The signals DTR, DCD, DSR must be externally wired to the connector.
- J23 set in position P
- J18 set for releasing the RS422 sender

9.4.2 Release of the RS422 sender

If the board is connected to a network, the sender must then be blocked after having sent data. There are two ways to control the release of the sender via jumper J18 (see Fig. 9-3).

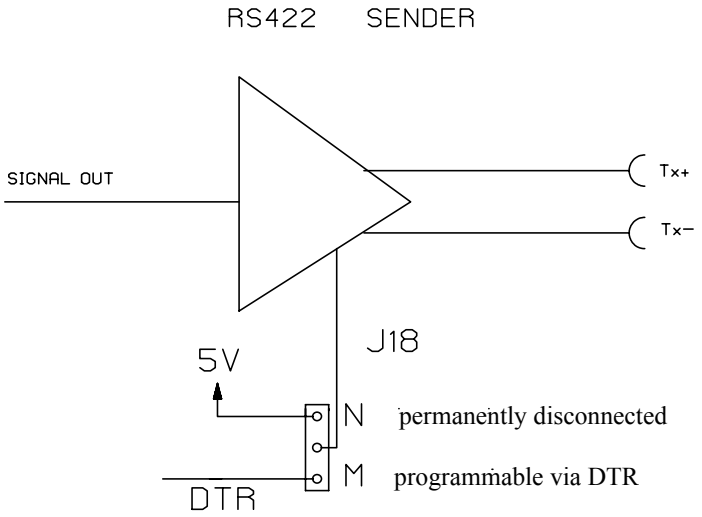
- RS422 sender permanently released (J18 on position N)
- The release of the sender can be programmed via the **DTR** bit (J18 on position M)

The **DTR** bit is the D0 bit of the modem control register on the address base + 4 of the USART.

- **DTR** bit = 0 → sender blocked (reset value)
- **DTR** bit = 1 → sender released

The **DTR** bit controls at the same time the hardware pin DTR of the USART.

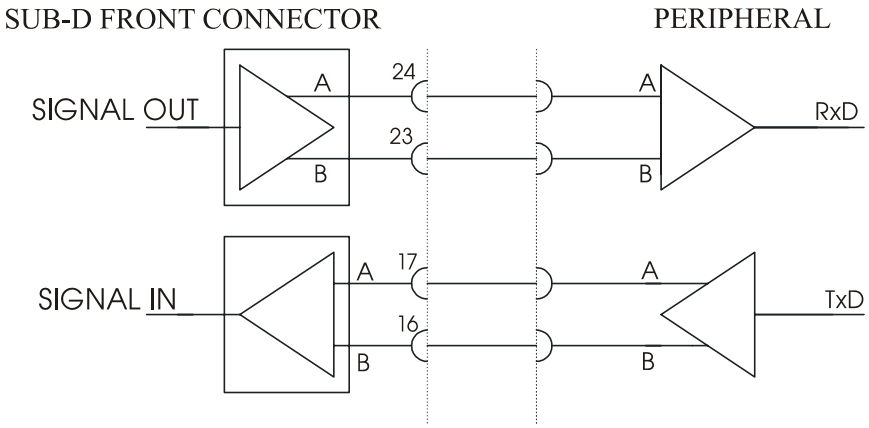
Fig. 9-3: RS422 sender release



Please make sure that the values of the data bits D1 - D7 remain when rewriting the register base+4!

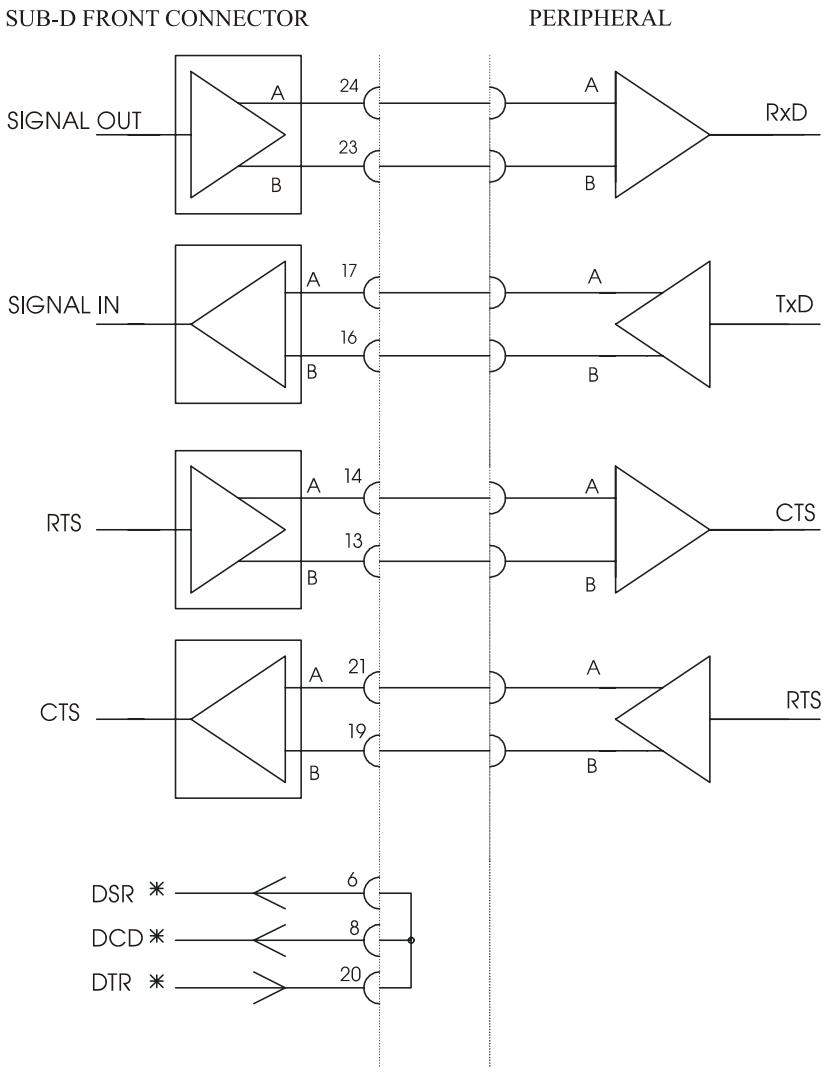
9.4.3 Wiring principle for RS422 mode

Fig. 9-4: RS422 wiring without modem control



Note: The control signals are to be wired on the board.

Fig. 9-5: RS422 wiring with modem control (Option RC)



*** The signals DSR, DCD and DTR must be wired in the connector.**

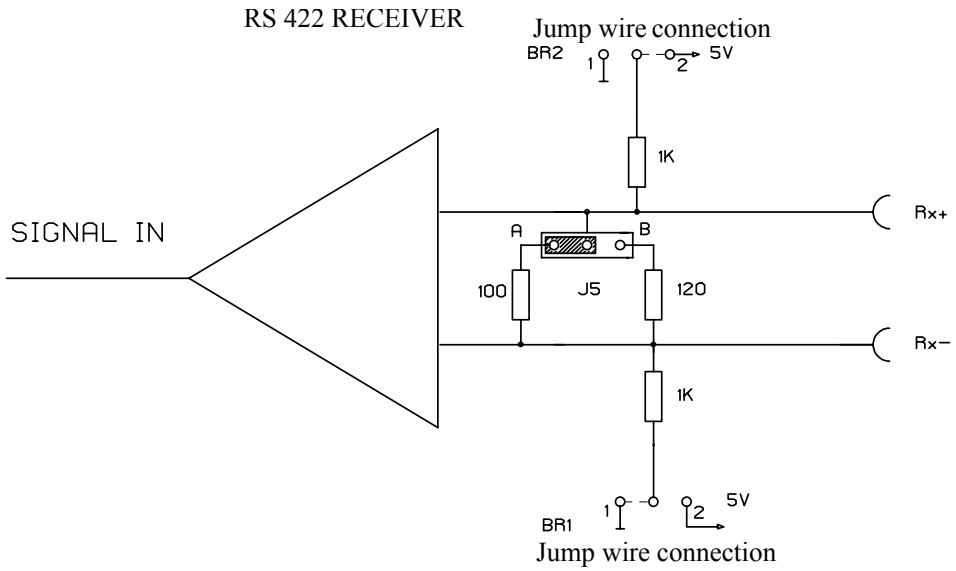
Terminal resistors for RS422

In mode RS422, the reception lines are connected to defined levels via 1kΩ resistors. You can also insert a terminal resistor via jumper J5 (see Fig. 9-6), if the board is located at the end of the network.

- Terminal resistor 100 Ohm (J5 in position A)
- Terminal resistor 120 Ohm (J5 in position B)

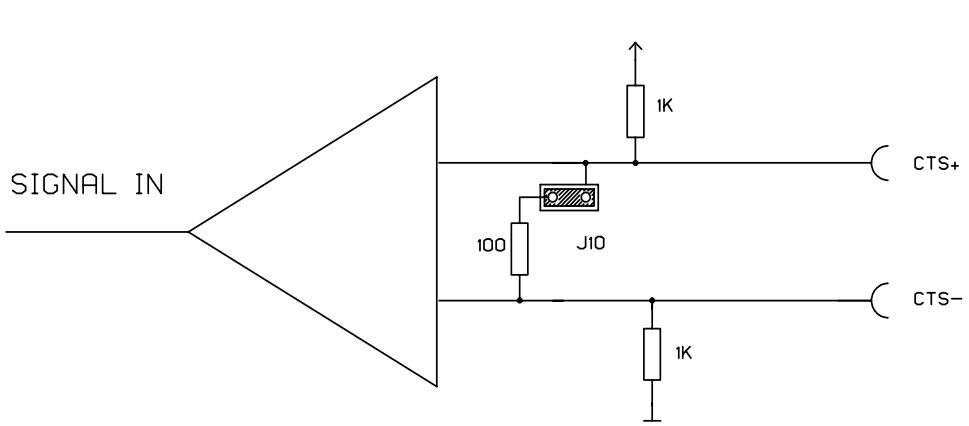
To ensure a line interruption in RS422 mode, a logic has been implemented which allows the reversal of the input levels when the line is open.
The setting is made via jump wire connections BR1 (Rx+) and BR2 (Rx-).

Fig. 9-6: Terminal resistor



At delivery the Rx+ und Rx- lines are not reversed (BR2 = 2, BR1 = 1). In order to reverse the input levels when the line is open, the jump wire connection must be set as follows:
BR2 = 1 and BR1 = 2

Fig. 9-7: Insertion of a terminal resistor in the CTS reception lines (Option RC)



9.5 RS485

9.5.1 Jumper settings

Mode without modem control signals only (RTS, CTS, DCD, DTR, DSR)

- J15 set → RS485 data receiver
- The modem control signals are internally wired **when J21 is not set**:
  (DTR → DCD, DSR)
  (RTS → CTS)

9.5.2 Sender release

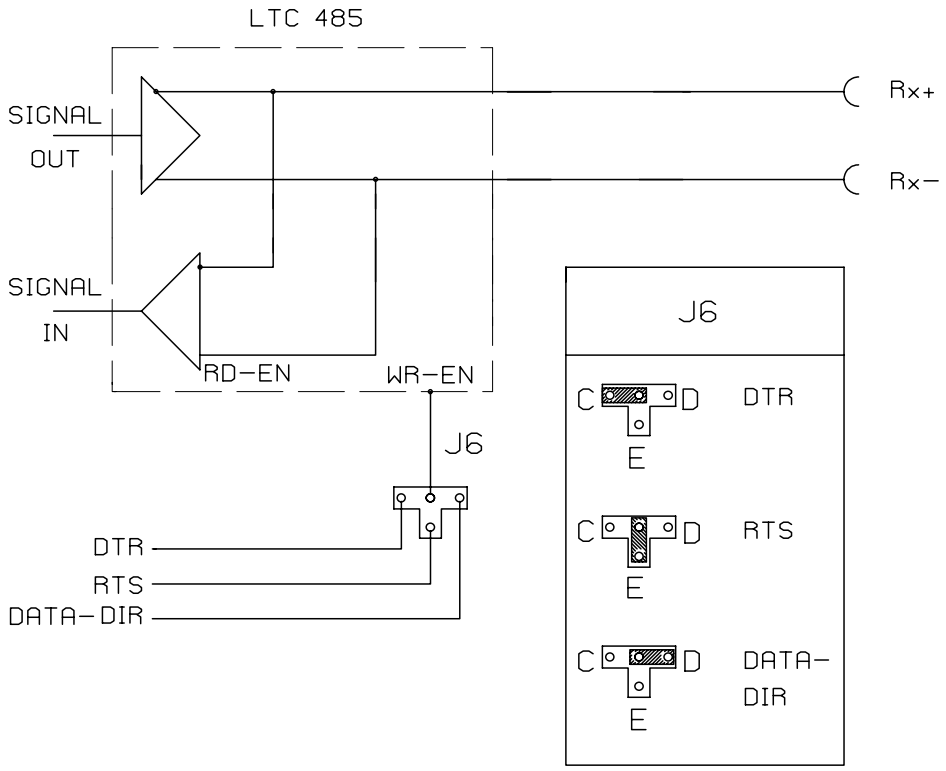
There are different ways for the user to release or block the RS485 sender via software. The control of the sender has to be pre-set via jumper J6 as follows:

- Control with **DTR** bit (bit D0 modem control register Base+4; J6 in position C)
  DTR bit = 0; → Sender blocked (reset value)
  DTR bit = 1; → Sender released
  Corresponds to the hardware pin of the USART

- Control with **DATA DIR** bit (bit D0 address base + 7; J6 in position D)
  DATA-DIR bit = 0 ; → Sender blocked (reset value)
  DATA-DIR bit = 1; → Sender released
  The **DATA DIR** bit can be read back on address base+7.

- Control with **RTS** bit (bit D1 modem control register - base+4; J6 in position E)
  RTS bit = 0 ; Sender blocked (reset value)
  RTS bit = 1; Sender released
  Corresponds to the hardware pin of the USART

Fig. 9-8: Setting of the sender release with the control signals DTR, RTS or DATA DIR via jumper J6



Please make sure that the values of the data bits D2 - D7 remain when rewriting the register base+4!

9.5.3 Control of the receiver

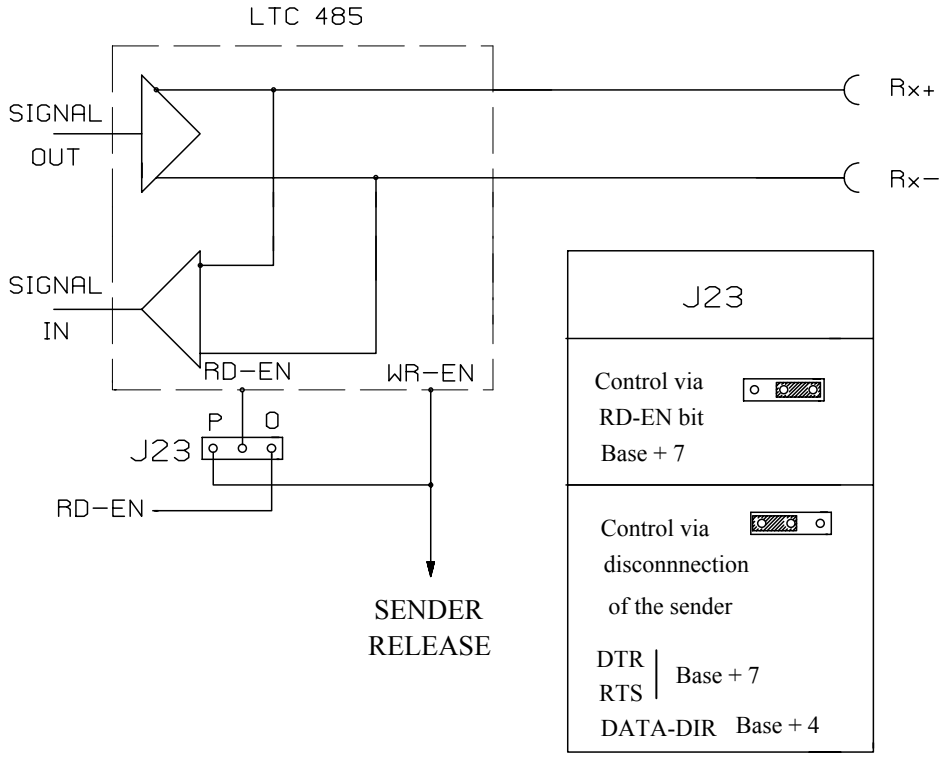
There are two ways for the user to control the receiver via jumper J23.

- J23 in position O → Control is made via **RD-EN** bit (bit D1, address base+7)
  RD-EN = 0 → Reception is possible (reset value)
  RD-EN = 1 → Reception is not possible

  After reset, **RD-EN** = 0. The system is in receiver mode.

- J23 in position P → Control is made via **RTS**, **DTR** or **DATA DIR** bit (depending on the position of jumper J6). With this setting, the sender and the receiver are reciprocally released.
  This means that:
  - if the sender is released, the receiver is blocked
  - if the sender is blocked, the receiver is released.

Fig. 9-9: Settings for the receiver release via J23



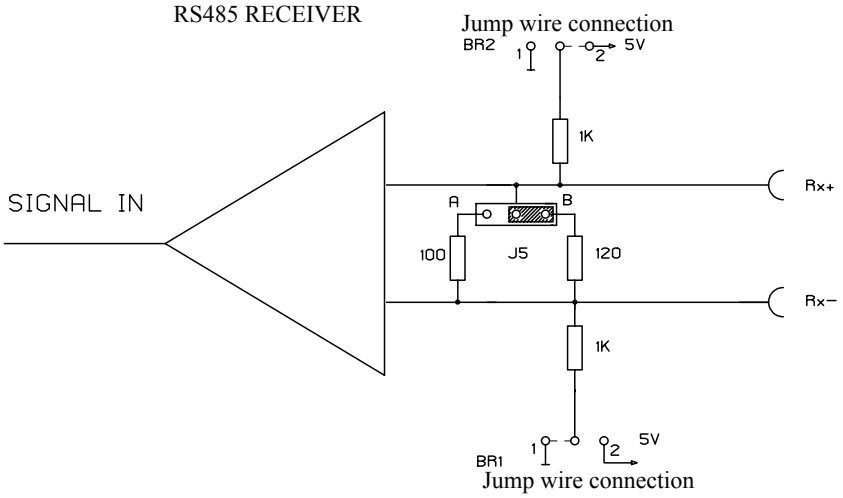
Terminal resistors in RS485 mode

In mode RS485, the reception lines are connected to defined levels via 1kOhm resistors. You can also insert a terminal resistor via jumper J5 (see Fig. 9-10) if the board is located at the end of the network.

- J5 in position A → terminal resistor 100 Ohm
- J5 in position B → terminal resistor 120 Ohm

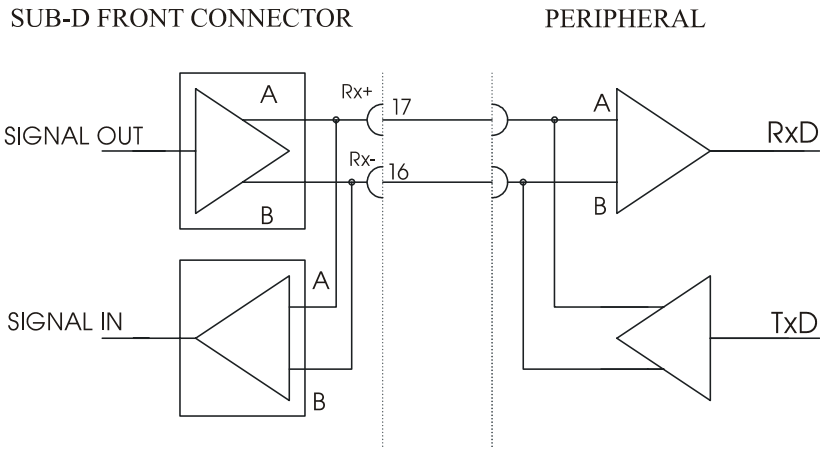
To ensure a line interruption in RS485 mode, a logic has been implemented which allows the reversal of the input levels when the line is open. The setting is made via jump wire connections BR1 (Rx+) and BR2 (Rx-)
See Fig. 9-10.

Fig. 9-10: Terminal resistor



At delivery the Rx+ und Rx- lines are not reversed (BR2 = 2, BR1 = 1). In order to reverse the input levels when the line is open, the jump wire connection must be set as follows:
BR2 = 1 and BR1 = 2

Fig. 9-11: Wiring for RS485



9.6 20mA current loop (TTY)

The board **PA 732** can be used as a current loop interface. It can send or receive data actively as well as passively.

You will find on the board one 20mA current loop source for the sender mode and one for the receiver mode.

9.6.1 Jumper settings

- J20 set
- J7 → 20mA current loop, preparation for data transmission
  See jumper settings
  The position of the jumper has to be adjusted to the peripheral of the current loop.
- J8 → 20mA current loop, preparation for data transmission
  See jumper settings
  The position of the jumper has to be adjusted to the peripheral of the current loop.
- The modem control signals are internally wired when J21 is not set:
  (DTR → DCD, DSR)
  (RTS → CTS)

9.6.2 Configuration of the current source

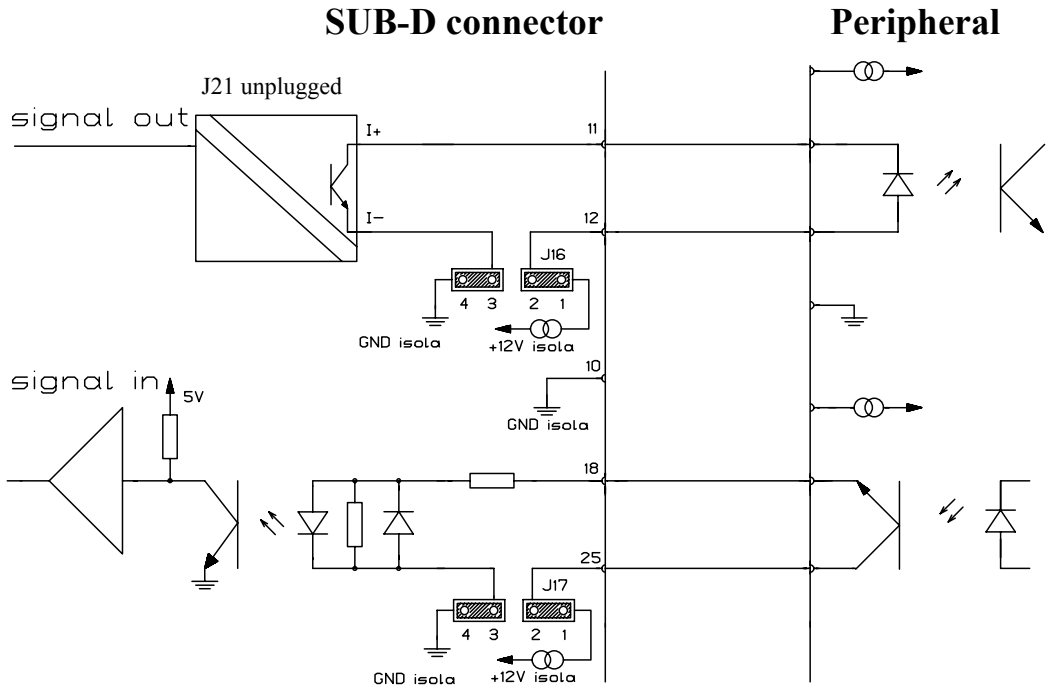
The current sources on the board are used to provide a constant 20mA current on the sender or the receiver line. In the passive mode, this constant current can also be provided by the device or the board on the opposite side.

Depending on the configuration, we speak of active transmission/reception or passive transmission/reception.
The selection occurs via the jumpers J16 (sender line) and J17 (receiver line).
See Jumper settings

9.6.3 Wiring for 20mA current loop (TTY)

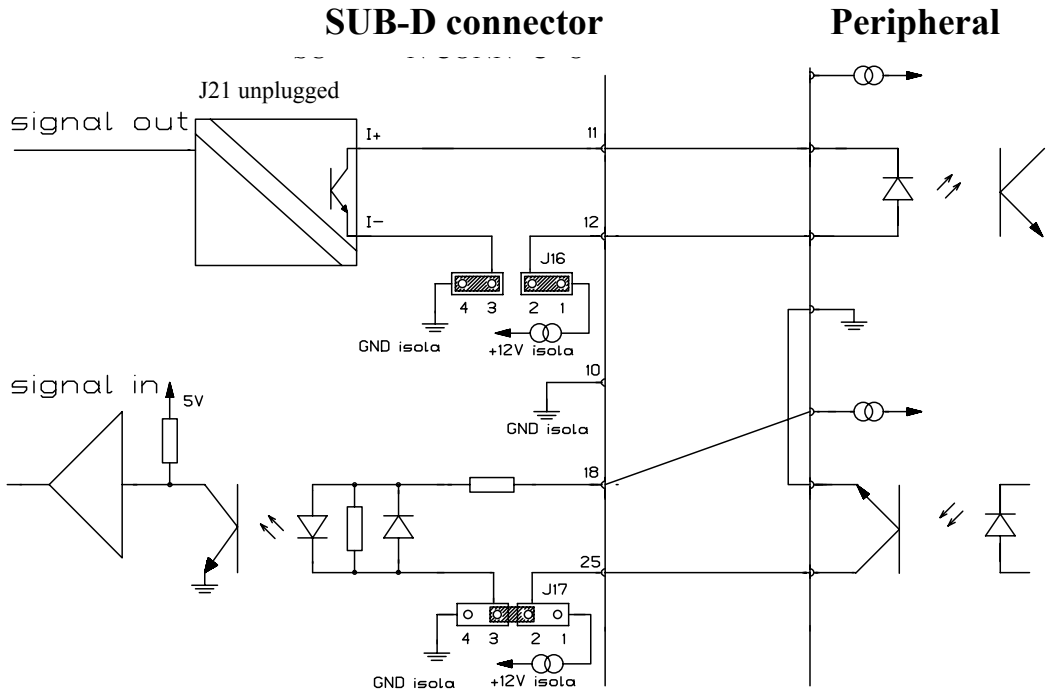
Active transmission/active reception

Fig. 9-12: Active transmission/active reception



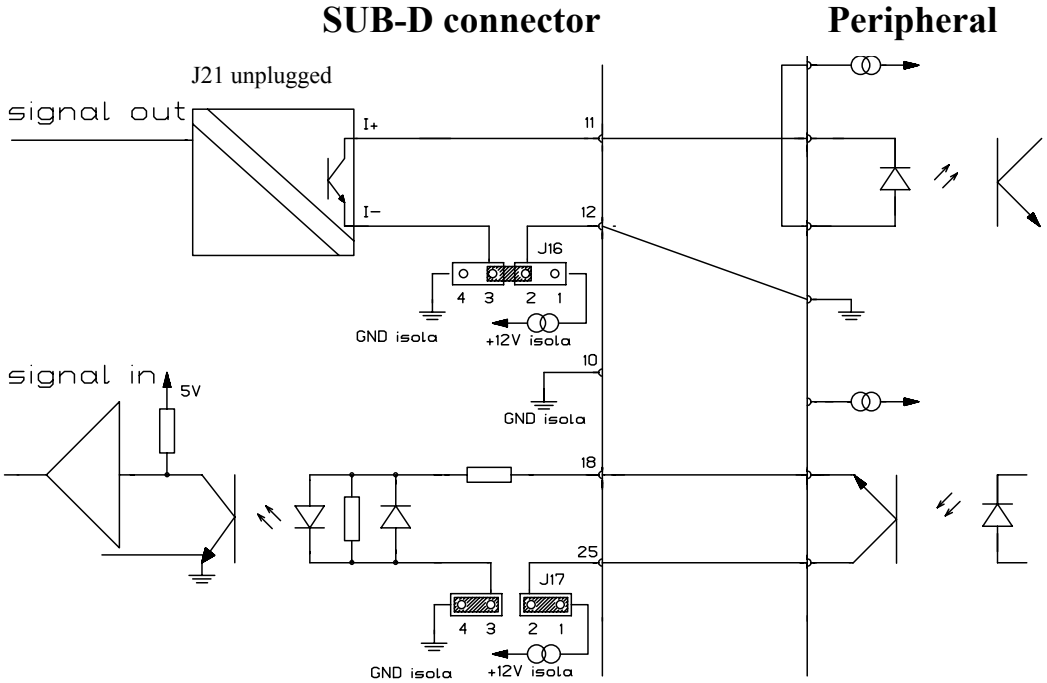
Active transmission/passive reception

Fig. 9-13: Active transmission/passive reception



Passive transmission/active reception

Fig. 9-14: Passive transmission/active reception



Passive transmission/passive reception

Fig. 9-15: Passive transmission/passive reception

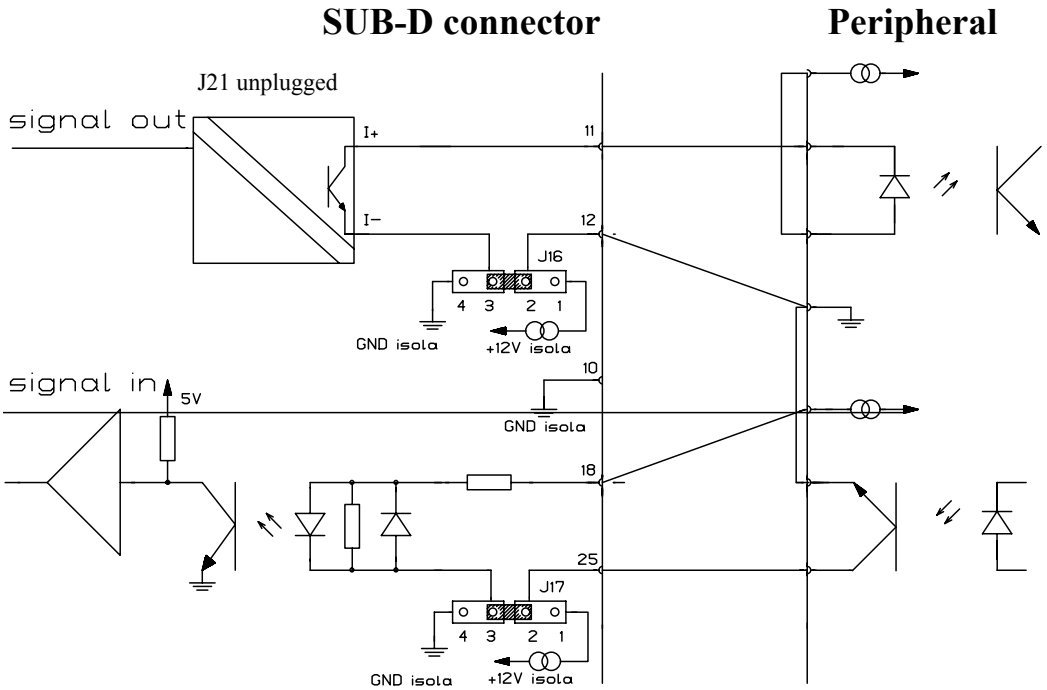
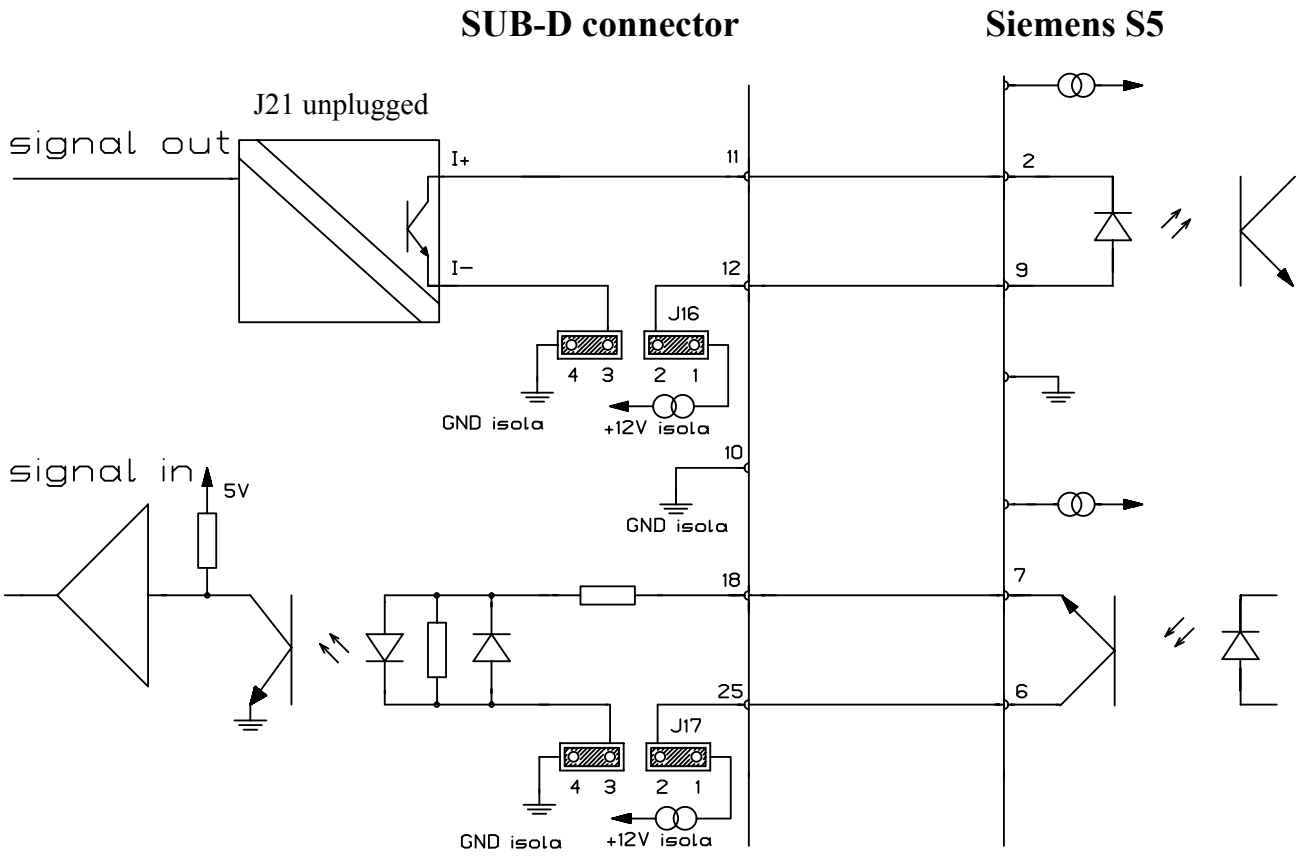


Fig. 9-16: Connection to a Siemens S5



9.7 Reference potential for the damping diodes

All input and output lines on the board **PA732** are protected against overvoltage via damping diodes located immediately after the connector to the peripheral.

- **RS232:** All lines (RTS, DTR, DSR, CTS,DCD,RI, TxD und RxD) are protected via TRANSIL damping diodes.
  Breakdown voltage = +/- 25V

- **RS422:** All lines are protected via TRANSIL damping diodes.
  Breakdown voltage = +/- 6,5V
  All lines are protected against short-circuits via PTC resistors.

- **RS485:** All lines are protected via TRANSIL damping diodes.
  Breakdown voltage = +/- 6,5V
  All lines are protected against short-circuits via PTC resistors.

- **20mA Current loop:** The current loops are protected via bi-directional TRANSIL
  damping diodes. Breakdown voltage : +/-26V

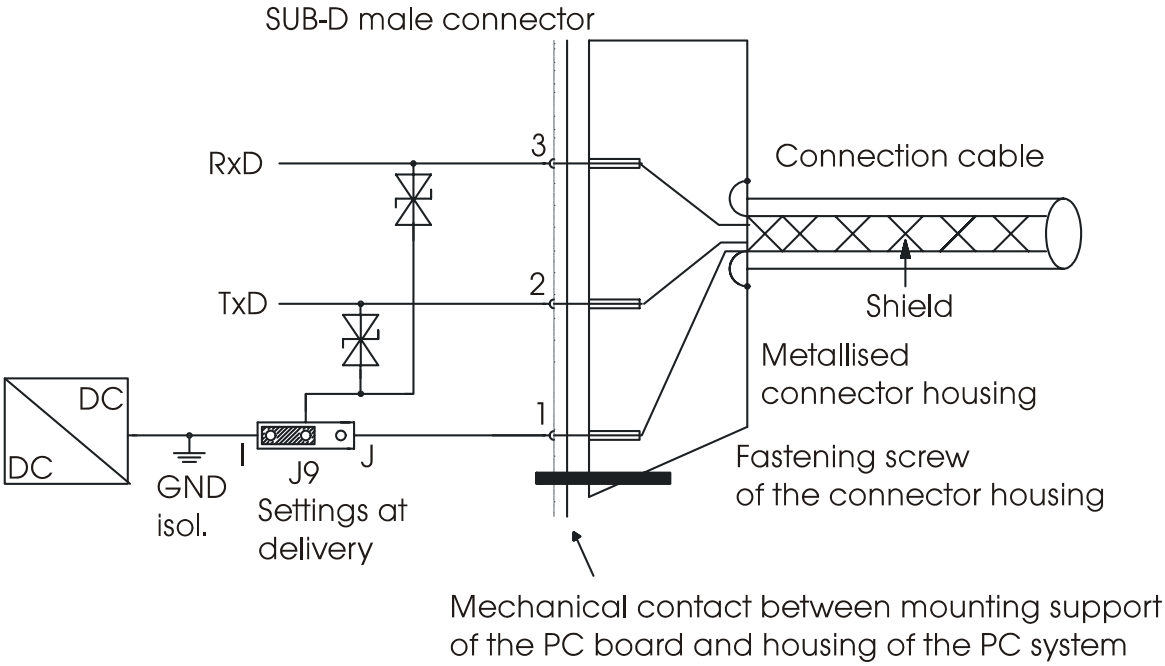
The user can select two reference potentials via jumper J9.

- J9 on pos. I → derivation of the interference voltage via secondary ground DC/DC converter

- J9 on pos. J → derivation of the interference voltage via pin 1 of the SUB-D connector

When adjusting the board this way, please make sure that the pin 1 of the 25-pin SUB-D connector is safely grounded externally.

Fig. 9-17: Selection of the reference potential for the damping diodes



If pin 1 of the SUB-D connector is used for derivation of the interference voltage,

then the pin 1 of the connecting cable must be connected:

- to the shield of the cable
  as well as
- to the housing of the female connector of the cable

9.8 DMA mode

The DMA mode of the PC allows data exchange between the PC memory and the board via the hardware of the PC system in the background of running processes. Consequently, the board is assigned memory space of the PC which is structured as a FIFO memory. The data exchange is controlled by the board via 3 control signals. Three DMA channels are available to the user:
DMA0, 1, 3.

For the selection of the DMA channel and the IRQ channel, see paragraph 5.2 Settings of the jumpers.

After the hardware configuration has been set, the DMA controller of the PC system has to be programmed. For that purpose, a software driver supplied with the board is available. Please make sure to use a free interrupt line with J4.

Description of the data bits relevant to the DMA mode on address base+7:

Reading of address base + 7, status bit **IRQ-TC** (bit D1 address base + 7)

- The **IRQ-TC** bit displays the status of a DMA transfer:
  IRQ-TC = 1 → DMA transfer is over
  IRQ-TC = 0 → DMA transfer is being done

Writing on the address + 7, control bit **TC-CLEAR** (bit D2 address base + 7):

- The **TC-CLEAR** bit is used in DMA mode to reset the interrupt flip-flop.
  TC-CLEAR = 1 → IRQ-FF reset
  TC-CLEAR = 0 → IRQ-FF not reset

Please make sure that the values of the data bits D0 to D1 of the address base+7 remain unchanged!

10 TROUBLE SHOOTING

10.1 No communication

Should communication between the **PA 732** and your terminal not take place, then you should control the settings of the board (base address, interrupts, operating mode) as well as the wiring.

10.2 Reception of wrong data

In this case, please control following settings:

- The baud rate and the data format of the communication boards
- The base address of the **PA 732** and of the other boards also installed in the PC system. Several addresses might overlap.
- Interrupt setting

10.3 Transmission possible, but no reception

Please control the setting of the operating mode of the receiver (chapter 9). The wrong jumpers might be set, or the receiver might be blocked (by RS422, RS485).

11 STANDARD SOFTWARE

To install the port of the **PA 732** please use the standard drivers which are delivered with Windows NT 4.0 and Windows 95/98. You can read additional information about the Windows API functions for the settings and the use of the serial interfaces in the manual delivered with the board:

"SERIAL COMMUNICATION in WIN32".

Moreover you will find application examples in Delphi 2.0 and VC ++ 5.0.

INDEX