PC-I 04/104

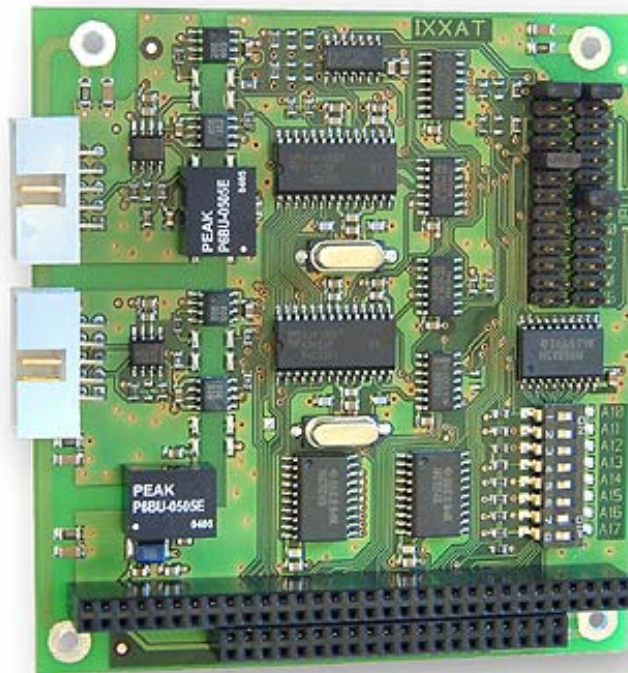**Passive PC/CAN Interface**

IXXAT

The expert for industrial and automotive communication

IXXAT

Headquarter
IXXAT Automation GmbH
Leibnizstr. 15
D-88250 Weingarten

Tel.: +49 (0)7 51 / 5 61 46-0
Fax: +49 (0)7 51 / 5 61 46-29
Internet: www.ixxat.de
e-Mail: info@ixxat.de

US Sales Office
IXXAT Inc.
120 Bedford Center Road
USA-Bedford, NH 03110

Phone: +1-603-471-0800
Fax: +1-603-471-0880
Internet: www.ixxat.com
e-Mail: sales@ixxat.com

Support

In case of unsolvable problems with this product or other IXXAT products please contact IXXAT in written form by:

Fax: +49 (0)7 51 / 5 61 46-29
e-Mail: support@ixxat.de

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Copyright IXXAT Automation GmbH   **PC-I 04/104 - Manual, Version 2.5**

1 Introduction

1.1 Overview

Congratulations on your purchase of the IXXAT PC/CAN Interface PC-I 04/104, a high-quality electronic component developed and manufactured according to the latest technological standards.

This manual is intended to familiarize you with your interface, also referred to in the following as PC-I 04/104. Please read this manual before beginning with the installation.

1.2 Features

The main technical features are as follows:

- Constructed as an 8 bit PC/104 interface

- Memory-mapped access: possible basic addresses are in the range from C000H to FFC0H (See also section 3.1.1). The basic address can be set in 1k steps via DIP switches. The interface occupies 1 kbyte address space

- One or two CAN lines each with Philips SJA1000 controller; 16 MHz clock

- Each CAN controller can be allocated to a separate PC interrupt line via a jumper field. The following 11 interrupt lines are available:
  3, 4, 5, 6, 7, 9, 10, 11, 12, 14 and 15

- CAN bus interface according to ISO 11898-2 high-speed on-board (galvanically isolated as an option)

- Separate bus interface for each CAN controller
- CAN connection via 10 pin header

1.3 Support

For more information on our products, FAQ lists and installation tips, please refer to the support section of our website (http://www.ixxat.com), which also contains information on current product versions and available updates.

If you have any further questions after studying the information on our website and the manuals, please contact our support department (support@ixxat.com). The support section on our website contains the relevant forms for your support request. In order to facilitate our support work and enable a fast response, please provide precise information on the individual points and describe your question or problem in detail.

If you would prefer to contact our support department by phone, please also send a support request via our website first, so that our support department has the relevant information available.

1.4 Returning hardware

If it is necessary to return hardware to us, please download the relevant RMA form from our homepage and follow the instructions on this form. In the case of repairs, please also describe the problem or fault in detail on the RMA form. This will enable us to carry out the repair quickly.

2 Installation

2.1 Software installation

A driver is required in order to operate the interface.
For the installation of the CAN driver VCI, please refer to the VCI installation manual.

2.2 Hardware installation

For all work on the PC and interface, you must be statically discharged. Work must be carried out on an earthed, anti-static work mat.

Take the following steps in sequence:

(1) Find a free memory segment on the PC of at least 1 kbyte in the range < 1MB (ISA memory range) and a free interrupt (IRQ). Refer to the manual of your PC for this.

(2) Set this memory segment and the IRQ on the interface, as described in section 3.1.

(3) Switch the PC off and remove the mains plug.

(4) Open the PC according to the instructions of the PC manufacturer and find a suitable place to plug in.
The interface is designed according to the PC/104 standard and can easily be installed. Do not use force when plugging in.

(5) Make sure the interface sits tightly in the PC.

(6) Close the PC; the hardware installation is now complete.

3 Configuration

3.1 Jumper settings

Figure 3-1 shows the positions of the connectors, DIP switches and jumpers on the interface.
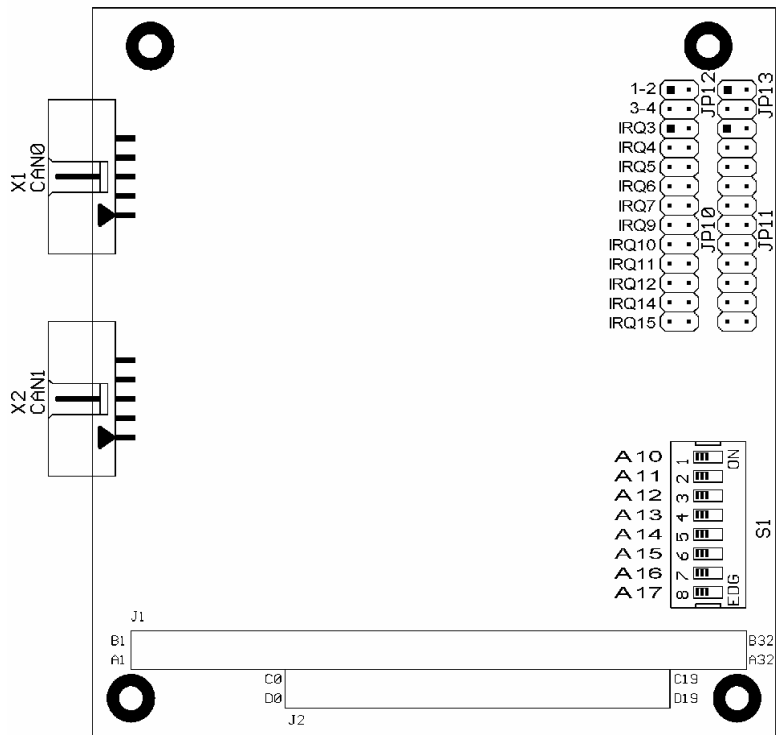
Fig. 3-1: PC-I 04/104 interface; jumpers, DIP switches and connectors, assembly side

3.1.1 Setting the basic address

The DIP switches A10 to A17 are used to set the basic address. The following table 3-1 shows which addresses are decoded for this with the aid of the example address D8C00h. The addresses with a white background indicate the setting range by means of DIP switches, the addresses marked with X cannot be influenced.

Beginning with the set basic address, the PC/CAN interface occupies an address space of 4 kbytes. In this address range the interface can be addressed as a normal RAM. No other interface may be present in the selected memory range.

D				8				C				0				0			
1	1	0	1	1	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
X	X	ON	OFF	OFF	ON	ON	ON	OFF	OFF	X	X	X	X	X	X	X	X	X	X
A19	A18	A17	A16	A15	A14	A13	A12	A11	A10	A9	A8	A7	A6	A5	A4	A3	A2	A1	A0

Table 3-1: Breakdown of bit positions of the basic address that can be set.

The following table 3-2 lists some examples of switch settings to set the basic address (def. = default setting).

Configuration

Basic address	A17	A16	A15	A14	A13	A12	A11	A10
C0000h	ON	ON	ON	ON	ON	ON	ON	ON
C0400h	ON	ON	ON	ON	ON	ON	ON	OFF
C0800h	ON	ON	ON	ON	ON	ON	OFF	ON
C0C00h	ON	ON	ON	ON	ON	ON	OFF	OFF
C1000h	ON	ON	ON	ON	ON	OFF	ON	ON
C2000h	ON	ON	ON	ON	OFF	ON	ON	ON
C3000h	ON	ON	ON	ON	OFF	OFF	ON	ON
C4000h	ON	ON	ON	OFF	ON	ON	ON	ON
C5000h	ON	ON	ON	OFF	ON	OFF	ON	ON
C6000h	ON	ON	ON	OFF	OFF	ON	ON	ON
C7000h	ON	ON	ON	OFF	OFF	OFF	ON	ON
C8000h	ON	ON	OFF	ON	ON	ON	ON	ON
C9000h	ON	ON	OFF	ON	ON	OFF	ON	ON
CA000h	ON	ON	OFF	ON	OFF	ON	ON	ON
CB000h	ON	ON	OFF	ON	OFF	OFF	ON	ON
CC000h	ON	ON	OFF	OFF	ON	ON	ON	ON
CD000h	ON	ON	OFF	OFF	ON	OFF	ON	ON
CE000h	ON	ON	OFF	OFF	OFF	ON	ON	ON
CF000h	ON	ON	OFF	OFF	OFF	OFF	ON	ON
D0000h (def.)	ON	OFF	ON	ON	ON	ON	ON	ON
D1000h	ON	OFF	ON	ON	ON	OFF	ON	ON
D2000h	ON	OFF	ON	ON	OFF	ON	ON	ON
D3000h	ON	OFF	ON	ON	OFF	OFF	ON	ON
D4000h	ON	OFF	ON	OFF	ON	ON	ON	ON
D5000h	ON	OFF	ON	OFF	ON	OFF	ON	ON
D6000h	ON	OFF	ON	OFF	OFF	ON	ON	ON
D7000h	ON	OFF	ON	OFF	OFF	OFF	ON	ON
D8000h	ON	OFF	OFF	ON	ON	ON	ON	ON
D8400h	ON	OFF	OFF	ON	ON	ON	ON	OFF
D8800h	ON	OFF	OFF	ON	ON	ON	OFF	ON
D8C00h	ON	OFF	OFF	ON	ON	ON	OFF	OFF
D9000h	ON	OFF	OFF	ON	ON	OFF	ON	ON
DA000h	ON	OFF	OFF	ON	OFF	ON	ON	ON
DB000h	ON	OFF	OFF	ON	OFF	OFF	ON	ON
DC000h	ON	OFF	OFF	OFF	ON	ON	ON	ON
DD000h	ON	OFF	OFF	OFF	ON	OFF	ON	ON
DE000h	ON	OFF	OFF	OFF	OFF	ON	ON	ON
DF000h	ON	OFF	OFF	OFF	OFF	OFF	ON	ON
E0000h	OFF	ON	ON	ON	ON	ON	ON	ON
E1000h	OFF	ON	ON	ON	ON	OFF	ON	ON

Basic address	A17	A16	A15	A14	A13	A12	A11	A10
E2000h	OFF	ON	ON	ON	OFF	ON	ON	ON
E3000h	OFF	ON	ON	ON	OFF	OFF	ON	ON
E4000h	OFF	ON	ON	OFF	ON	ON	ON	ON
E5000h	OFF	ON	ON	OFF	ON	OFF	ON	ON
E6000h	OFF	ON	ON	OFF	OFF	ON	ON	ON
E7000h	OFF	ON	ON	OFF	OFF	OFF	ON	ON
E8000h	OFF	ON	OFF	ON	ON	ON	ON	ON
E9000h	OFF	ON	OFF	ON	ON	OFF	ON	ON
EA000h	OFF	ON	OFF	ON	OFF	ON	ON	ON
EB000h	OFF	ON	OFF	ON	OFF	OFF	ON	ON
EC000h	OFF	ON	OFF	OFF	ON	ON	ON	ON
ED000h	OFF	ON	OFF	OFF	ON	OFF	ON	ON
EE000h	OFF	ON	OFF	OFF	OFF	ON	ON	ON
EF000h	OFF	ON	OFF	OFF	OFF	OFF	ON	ON
F0000h	OFF	OFF	ON	ON	ON	ON	ON	ON
F1000h	OFF	OFF	ON	ON	ON	OFF	ON	ON
F2000h	OFF	OFF	ON	ON	OFF	ON	ON	ON
F3000h	OFF	OFF	ON	ON	OFF	OFF	ON	ON
F4000h	OFF	OFF	ON	OFF	ON	ON	ON	ON
F5000h	OFF	OFF	ON	OFF	ON	OFF	ON	ON
F6000h	OFF	OFF	ON	OFF	OFF	ON	ON	ON
F7000h	OFF	OFF	ON	OFF	OFF	OFF	ON	ON
F8000h	OFF	OFF	OFF	ON	ON	ON	ON	ON
F9000h	OFF	OFF	OFF	ON	ON	OFF	ON	ON
FA000h	OFF	OFF	OFF	ON	OFF	ON	ON	ON
FB000h	OFF	OFF	OFF	ON	OFF	OFF	ON	ON
FC000h	OFF	OFF	OFF	OFF	ON	ON	ON	ON
FD000h	OFF	OFF	OFF	OFF	ON	OFF	ON	ON
FE000h	OFF	OFF	OFF	OFF	OFF	ON	ON	ON
FF000h	OFF	OFF	OFF	OFF	OFF	OFF	ON	ON
FF400h	OFF	OFF	OFF	OFF	OFF	OFF	ON	OFF
FF800h	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON
FFC00h	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF

Caution: The address range of the interface must not overlap with any other system components in the PC!

Table 3-2: Setting the basic address

3.1.2 Setting the PC interrupt

The required interrupt can be set separately for each CAN controller via the jumper boards JP 10 (for CAN 1) and JP 11 (for CAN2). To set an interrupt on the interface, the corresponding jumper must be closed. Only one interrupt may be selected for each CAN controller. If no interrupt is required, no jumper of the corresponding jumper board may be closed. The factory setting of the interface is IRQ 5 for the first CAN controller and (if present) IRQ 7 for the second CAN controller.

3.1.3 Setting the interrupt mode

The interface PC-I 04/104 provides three different types of interrupt triggering. These can be set for CAN1 via the jumpers JP12, JP14 and JP15 and (if present) for CAN2 via JP13, JP20 and JP21. The jumper settings are listed in the following table. The default setting is marked with def. = default setting.

Trigger type		JP12	JP14	JP15
Sides	ISA mode **(def.)**	1-2	X	2-3
Level	Shared Low (EISA)	1-2	X	1-2
	Shared High	3-4	closed[1]	2-3

Table 3-3: Setting of the interrupt mode for CAN1

Trigger type		JP13	JP20	JP21
Sides	ISA mode **(def)**	1-2	X	2-3
Level	Shared Low (EISA)	1-2	X	1-2
	Shared High	3-4	closed[1]	2-3

Table 3-4: Setting of the interrupt mode for CAN2

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[1] **Note on use of Shared High interrupt triggering:**

With interrupt triggering Shared High, an IRQ line is used by several interrupt sources (e.g. first CAN controller, second CAN controller, further ISA boards). The PC/104 specification stipulates that the interrupt line must have only one 1 k Ohm resistor between ground and IRQ line (see PC/104 specification Appendix C.3). A 1 k Ohm resistor can be connected via JP14 (CAN1) or JP20 (CAN2). If this trigger type is used with a PC-I 04/104 interface equipped with two CAN controllers, this means that either jumper JP14 <u>or</u> JP20 is to be closed.

3.1.4 Providing power supply via CAN connector

VCC (5 V) or GND can be connected to the 10 pin header with the soldered jumpers JP2, JP3, JP7 and JP8. For this, the jumpers listed in the following table must be closed. The soldered jumpers are located on the back of the PC-I 04/104 (Fig. 3-2).

Connector pin – signal	Default setting	X1	X2
2 - GND	open	JP7	JP2
8 - VCC	open	JP8	JP3

Caution: This voltage may be loaded with maximum 100 mA.

With galavanically isolated bus interfaces, GND and VCC are also galvanically isolated from the power supply of the PC.
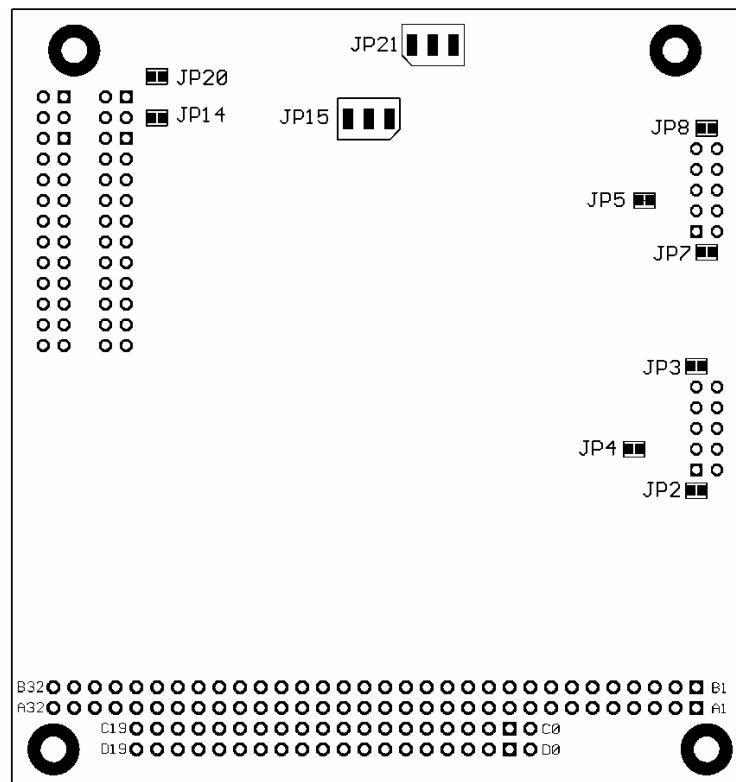

Fig. 3-2: Soldered jumpers of the PC-I 04/104 interface, back

3.2 Design of the CAN connectors

Two separate high-speed bus interfaces according to ISO 11898-2 can be mounted on the interface.

The signals of the first bus interface are connected to the 10 pin header X1. If the second bus interface is assembled, the signals for the CAN bus of the second bus interface are connected to the header X2.

3.2.1 Connection of the bus interface

Signals of the **first bus interface** on the 10 pin header X1:

Pin no. X1	Signal name
1	n.c.
2	GND (via JP7)
3	CAN_L
4	CAN_H
5	GND
6	n.c.
7	n.c.
8	VCC (via JP8)
9	n.c.
10	n.c.

Signals of the **second bus interface** on the 10 pin header X2:

Pin no. X2	Signal name
1	n.c.
2	GND (via JP2)
3	CAN_L
4	CAN_H
5	GND
6	n.c.
7	n.c.
8	VCC (via JP3)
9	n.c.
10	n.c.

With galavanically isolated bus interfaces, GND and VCC are also galvanically isolated from the power supply of the PC.

3.3 Bus termination

Bus termination resistors are assembled on the PC-I 04/104 board for the first and second CAN lines with 120 Ohms each, which can be connected for the first CAN line via the soldered jumper JP5 and for the second CAN line with JP4 (see Fig. 3-2). The bus is terminated with a 120 Ohm resistor between CAN low and CAN high. When delivered, the jumpers for termination are not active.

4 Architecture

4.1 PC memory allocation

The CAN controllers are displayed directly in the memory space of the PC. They can be accessed via basic address + Offset.
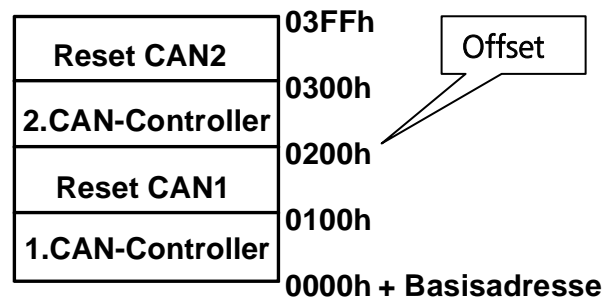

Fig. 4-1: PC memory allocation of the PC-I 04/104

4.1.1 Access to CAN controllers

Up to two CAN controllers either of type Philips SJA1000 can be assembled on the interface.

The first CAN controller is displayed in the range from 0000h to 00FFh, the second CAN controller in the range from 0200h to 02FFh plus basic address of the board. With access to the individual memory range, the corresponding CAN controller is automatically selected. The basic address can be configured as described in section 3.1.1.

The Output Control Register of the CAN controller must be loaded with the value DEh or 5Eh.

The exact index description of the SJA1000 is given in the corresponding data sheets of Philips (see Appendix C).

4.1.2 Resetting the CAN controllers from the PC

By writing a random value to an address of the Reset range (0100h to 01FFh for the first CAN controller and 0300h to 03FFh for the second CAN controller), a hardware reset is carried out on the corresponding CAN controller.

4.2 Triggering an interrupt on the PC

The CAN controllers can trigger interrupts on the PC. For configuration of the interrupts, see section 3.1.2

Appendix

Appendix A – Technical specifications

The following specifications refer to the version of the PC-I 04/104 with two Philips SJA1000 CAN controllers and separate bus interfaces.

Dimensions:	90 x 96 mm (without header), 10 mm overall height (without PC/104 connector)
Weight :	approx. 55 g
Working temperature range:	-20 .. +70 °C
Relative humidity:	10 - 95 %, non-condensing
Power supply:	5 V DC $\pm$ 5%
Power consumption:	typically: 80 mA max.: 150 mA
CAN controller:	Philips SJA1000
CAN transceiver:	Texas Instruments SN65HVD251
ESD-protection CAN bus:	12 k V (Human Body Model)
Max. number of CAN bus nodes:	120
Galv. isolation bus interface:	1000 V DC between CAN1, CAN2 and internal logic
Signal delay due to galv. isolation	typically 50 ns
EMC test according to:	DIN EN55022 (VDE 0878 part 22) /04.98 class B DIN EN61000-3-2 (VDE 0838 part 2) /03.96 DIN EN61000-3-3 (VDE 0838 part 3) /03.96 DIN EN50082-2 (VDE part 82-2) /02.96

Appendix B – Default settings

The default settings of the jumpers of the PC-I 04 are listed in the following. With special versions of the interface, individual settings may vary.

Basic address:D000h   A17   ON
                                          A16   OFF
                                          A15   ON
                                          A14   ON
                                          A13   ON
                                          A12   ON
                                          A11   ON
                                          A10   ON

Interrupt CAN 1:   IRQ 5
Interrupt CAN 2:   IRQ 7   (only if assembled)
Interrupt mode CAN line 1:   JP12 1-2 & JP15 2-3 (ISA mode)
Interrupt mode CAN line 2:   JP13 1-2 & JP21 2-3 (ISA mode)

Appendix C – Sources of data sheets

CAN controller Philips SJA1000:
www.semiconductors.philips.com

CAN transceiver Texas Instruments SN65HVD251:
www.ti.com

PC/104 specification:
www.pc104.org

Declaration of conformity

IXXAT Automation hereby declares that the product: PC-I 04/104

With the article numbers:
        1.01.0070.10100
        1.01.0070.10200
        1.01.0070.11110
        1.01.0070.11220

fulfils the requirements of the standards:
        DIN EN 55022/ 04.98 class B
        DIN EN 61000-3-2/ 03.96
        DIN EN 61000-3-3/ 03.96
        DIN EN 55082-2/ 02.96

In accordance with the following test report: IX853G02.DOC

The product is therefore in accordance with the EU directive: 89/336/EEC.

This declaration applies to all devices that bear the CE symbol and loses its validity if modifications are carried out on the product.

22.12.98, Dipl.-Ing. Christian Schlegel , Managing Director

IXXAT Automation GmbH
Leibnizstrasse 15
88250 Weingarten

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