Modular Computers ®

CP350

Intelligent CAN Interface
for CompactPCI Applications

Manual ID 19875, Rev. Index 0104
Jan 99

CE

The product described in this manual is in compliance with all applied CE standards.

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Revision History

Revision History				
Manual/Product Title:	**CP350**			
Manual ID Number:	**19875**			
Rev. Index	**Brief Description of Changes**	**Board Index**		**Date of Issue**
0100	Initial Issue	01	01	Jan. 1998
0101	Sections 1.1-1.2, 1.8-1.9, 4.8	01	01	Aug. 98
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0103	Section 3.2 deleted, minor change section 1.5.3	01	01	Dec. 98
0104	Electronic and Paper Manual numbers assigned	01	01	Jan. 99

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Explanation of Symbols



CE Conformity

This symbol indicates that the item described in this manual is in compliance with all applied CE standards. See also the section “Applied standards” of this manual.



Caution!

This symbol and title warn you of hazards due to electrical shocks (> 60 V) when touching products or parts of them. The non-observance of the measures indicated and/or prescribed by the law may cause harm to your product and/or life/health.

See also the section “High Voltage Safety Instructions”.



ESD-Sensitive Device!

This symbol and title inform you that electronic boards and their components are sensitive to static electricity. Therefore, care must be taken during all handling operations and inspections of this product, in order to ensure product integrity at all times.

Please read also the section “Special Handling and Unpacking Instructions” of this manual.



Attention!

This symbol and title emphasize aspects which, if not read through carefully by the reader, might cause hazards to health and/or damages to material.



Note:

This symbol and title emphasize aspects the reader should read through carefully for his or her own advantage.



PEP Advantage

This symbol and title emphasize advantages or positive aspects of a product and/or procedure.



Troubleshooting

This symbol and title characterize a message containing useful information on troubleshooting and problem solving.

For your safety

Your new *PEP* product was developed and tested carefully to provide all features necessary to ensure the renown electrical safety requirements. It was also designed for a long fault-free life. However, the life expectancy of your product can be drastically reduced by improper treatment during unpacking and installation. Therefore, in the interests of your own safety and of the correct operation of your new *PEP* product, you are requested to conform with the following guidelines.

High Voltage Safety Instructions



Warning!

All operations on this device must be carried out by sufficiently skilled personnel only.



Caution!

However, serious electrical shock hazards exist during all installation, repair and maintenance operations with this product. Therefore, always unplug the power cable to avoid exposure to hazardous voltage.
Before installing your new *PEP* product into a system always ensure that your mains power is switched off. This applies also to the installation of piggybacks.

Special Handling and Unpacking Instructions



ESD Sensitive Device!

Electronic boards and their components are sensitive to static electricity. Therefore, care must be taken during all handling operations and inspections of this product, in order to ensure product integrity at all times.

- Do not handle this product out of its protective enclosure while it is not used for operational purposes, unless it is otherwise protected.
- Whenever possible, unpack or pack this product only at EOS/ESD safe work stations. Where safe work stations are not guaranteed, it is important for the user to be electrically discharged before touching the product with his/her hands or tools. This is most easily done by touching a metal part of your system housing.
- It is particularly important to observe standard anti-static precautions when changing piggybacks, ROM devices, jumper settings etc. If the product contains batteries for RTC or memory back-up, ensure that the board is not placed on conductive surfaces, including anti-static plastics or sponges. They can cause short circuits and damage the batteries or tracks on the board.

General Instructions on Usage

- In order to maintain *PEP's* product warranty, this product must not be altered or modified in any way. Changes or modifications to the device, which are not explicitly approved by *PEP Modular Computers* and described in this manual or received from *PEP* Technical Support as a special handling instruction, will void your warranty.
- This device should only be installed in or connected to systems that fulfill all necessary technical and specific environmental requirements. This applies also to the operational temperature range of the specific board version, which must not be exceeded. If batteries are present, their temperature restrictions must be taken into account.
- In performing all necessary installation and application operations, please, follow only the instructions supplied by the present manual.
- Keep all the original packaging material for future storage or warranty shipments. If it is necessary to store or ship the board please re-pack it as nearly as possible in the manner in which it was delivered.
- Special care is necessary when handling or unpacking the product. Please, consult the special handling and unpacking instruction on the following page of this manual.

Two Years Warranty

PEP Modular Computers grants the original purchaser of *PEP* products a ***TWO YEARS LIMITED HARDWARE WARRANTY*** as described in the following. However, no other warranties that may be granted or implied by anyone on behalf of *PEP* are valid unless the consumer has the express written consent of *PEP Modular Computers*.

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Chapter 1

Introduction

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1. Introduction

1.1 System Overview

The *PEP Modular Computers* CompactPCI systems described in this chapter operate with the PCI bus architecture to support additional I/O and memory-mapped devices as required by various industrial applications. In the following you will find the most important information on all system relevant CompactPCI features. For more detailed information concerning the CompactPCI standard, please consult the complete Peripheral Component Interconnect (PCI) and CompactPCI Specifications. For any further information connect to the homepage of the *PCI Industrial Computer Manufacturers Group (PICMG)*. PICMG is a consortium of companies involved in utilizing PCI for embedded applications.

1.1.1 Note on CompactPCI

CompactPCI is an extension of the PCI specification. It has been optimized for industrial and embedded applications that require a more robust mechanical form factor as compared to Desktop PCI. CompactPCI systems use industry standard mechanical components and high performance connector technologies to provide systems that are well suited for rugged applications. CompactPCI stands for systems that are electrically compatible with the PCI Specification, allowing low cost PCI components to be used. CompactPCI is an open specification supported by PICMG.

1.1.2 Main Features of CompactPCI Systems

Some of the outstanding features of the CompactPCI systems compliant with Specification 2.0, Release 2.1 are:

- PCI signalling
- 32 and 64 bit data transfer at 33 MHz
- up to 8 PCI slots per backplane
- industry standard software support
- 3U small form factor (100 mm by 160 mm)
- 6U form factor (233 mm by 160 mm)
- Eurocard packaging
- wide variety of available I/O functions
- industry support from over 350 members.



PEP Advantage

PEP Modular Computers' CompactPCI systems are designed as open systems, able to be expanded at any time, so that their backplanes can be equipped with precisely the CPCI boards that correspond to a customer's specific needs. However, in order to supply you with an appropriate choice of workstations, the *PEP* basic equipment is divided into pre-configured sets and custom solutions.

1.2 System Components

PEP Modular Computers have devised their CompactPCI systems as a comprehensive open solution for industrial environments, offering different workstation configurations which are capable of including all the components necessary to fulfill the requirements of virtually all existing system functionalities.

CompactPCI Backplane(s)

- 4-slot backplane;
- 6-slot backplane;
- 8-slot backplane;
- 16-slot backplane.

CPU Function

PEP Modular Computers provides CPU boards corresponding in size and characteristics to the special features of the *PEP* systems.

Display Related Functions

Display related functions such as graphics control and frame grabbing are supported by dedicated boards.

Communication

Communication boards are provided for the currently relevant industrial communication systems such as Fast Ethernet.

Fieldbus Control

Fieldbus control boards provide data exchange with field control and automation subsystems like *PEP Modular Computers'* SMART2 or VMEbus systems using up-to-date transmission standards e.g.:

- CAN fieldbus control
- PROFIBUS control

Industrial I/O Functions

PEP's CompactPCI systems support an ever increasing number of industrial I/O functionalities in the fields of:

- Digital I/O
- Analog I/O

Self-Testing

A special *PEP* self-testing board provides a trouble-spotting capability within your *PEP* system.

System Hardware

The *PEP* CompactPCI system hardware includes housings, storage devices, power supply units, network adapters etc. The most important system hardware elements with which to configure your CompactPCI system are as follows:

Multiprocessor

In a CompactPCI multi-processer system, a system controller (CP610) communicates with other CPU's through a non-transparent PCI / PCI bridge

Housings

- Board cages for 19-inch cabinets or wall mounting
- PCI tower
- PCI desktop housing

Mass Storage Devices

- Hard-disk drive
- Floppy-disk drive
- CD-ROM drive

Power Supply Units

- 19-inch "M", 180 W, 120/230 V AC, 3.3V/14A, 5.1V/20A, 12V/2A, -12V/1A
- "ATX", 235 W, 120/230 VAC, 3.3V/14A, 5V/22A, 12V/8A,-12V/1A, -5V/0.5A, 5VSB/0.1A

Please note that the following units of measurement are used to express the dimensions of PEP cards and housings:

- Height: 1 U = 44.45 mm
- Width: 1 HP = 5.08 mm

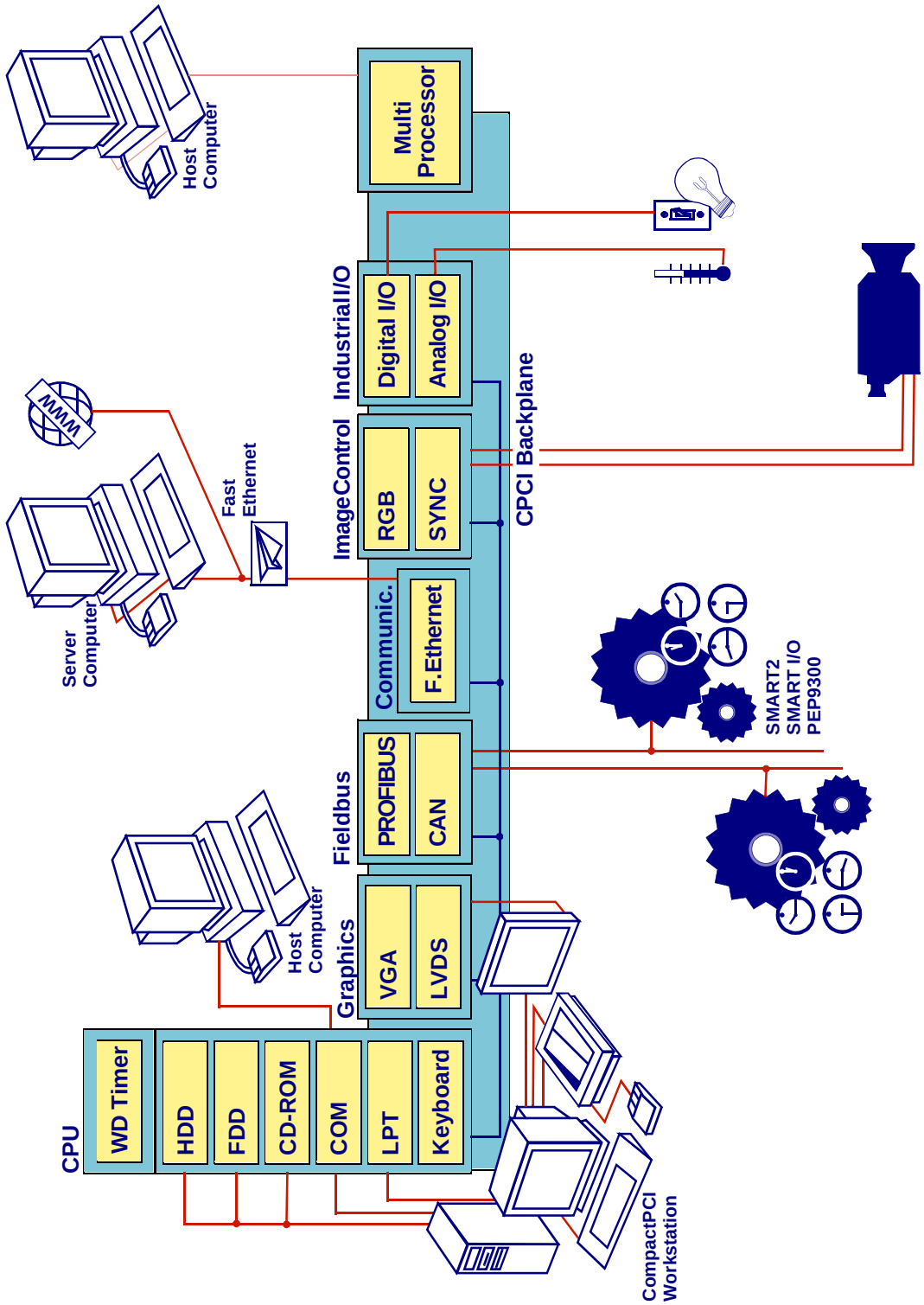
For a detailed description of the *PEP Modular Computers* CompactPCI modules please consult the specific components' manuals or data sheets.



PEP Advantage

As the *PEP Modular Computers* CompactPCI system provides comprehensive open solutions. New features and functionalities may be added to our range. To keep abreast of the latest developments, please contact your local *PEP Sales Office* or visit the ***PEP Web Site***.

Figure 1-1: Example of a *PEP Modular Computers* CompactPCI System



1.3 Board Overview

The CP350 is provided with the Siemens SAB C165 microcontroller. The controller, a member of the Siemens C166 family, is capable of addressing up to 16 Mbyte of address space.

Designed for stability and packaged in a rugged format, the board fits into all applications situated in industrial environments. A main controller board like, for instance, the controller boards of the *PEP* CPU family provides applicational system integration for the CP350 fieldbus board.

The board is available in two different versions. Depending on the version your systems runs with, either one or two physical CAN interfaces are present on the board and, thus, one or two CAN circuits are supported.

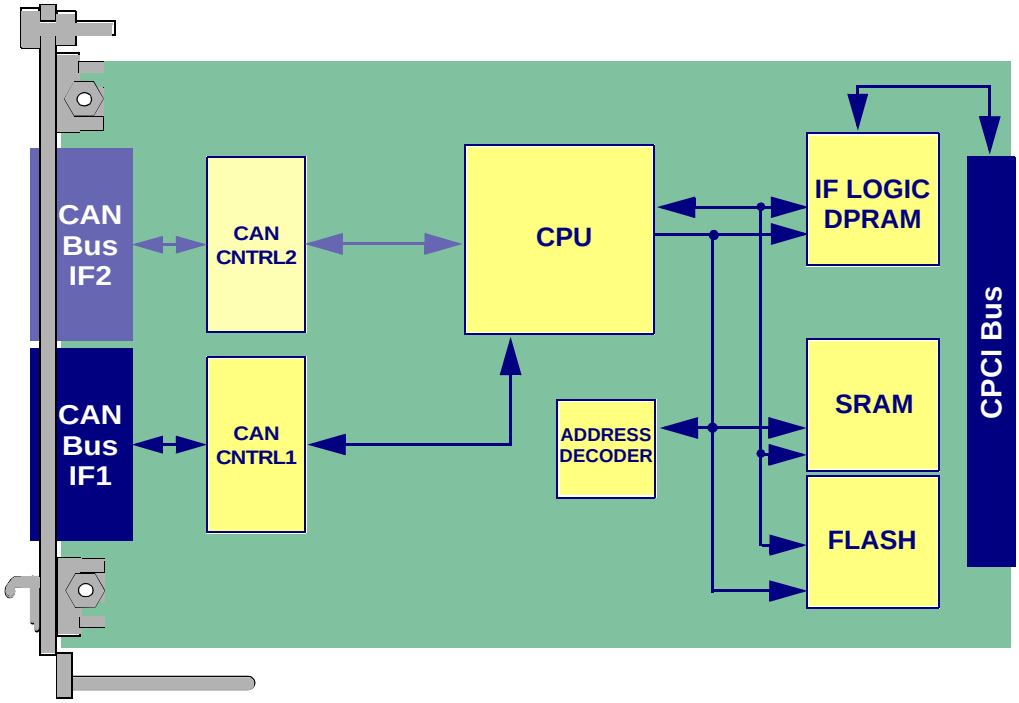
CP350 is an intelligent fieldbus controller board run by an on-board Siemens SAB C165 CPU. Depending on the version you have ordered, your CP350 may manage one or two opto-isolated CAN circuits. It is a CompactPCI board specifically designed for use in highly integrated platforms with solid mechanical interfacing for a wide range of industrial environment applications.

Some of the CP350's outstanding features are:

- 32 bit CompactPCI board;
- 32 bit memory-mapped access (8 kByte of address space are reserved);
- base address and PC interrupts via PCI plug & play Bios;
- 40 MHz Siemens SAB C165 microcontroller;
- one or two Philips SJA 1000 communication processors controlling one ore two CAN circuits;
- CAN bus interface according to ISO/IS 11898;
- 8 kByte Dual-Port-RAM, 16 semaphore registers;
- 256 kByte SRAM;
- 256 kByte FLASH memory;
- EMC-safe design of circuit board (4 layer PCB).

1.4 Functional Block Diagram

Figure 1-2: CP350 Functional Block Diagram



1.5 Main Features

The following description illustrates the main features of the principal functional blocks of the CP350 fieldbus controller board.

1.5.1 On-Board CPU

The CP350 supports the Siemens SAB C165 processor having a clock frequency of 40 MHz. Thanks to the intelligent conception of the CP350 and its on-board processor, high data transfer rates and an optimum system performance are achieved.

1.5.2 Memory

The CP350 version is delivered with 256 kByte of SRAM, 256 kByte of FLASH memory and 8 kByte of DPRAM for data exchange between the CP350 and the system controller.

1.5.3 CAN Interfaces

The CP350 fieldbus controller board provides one or two high-performance, ISO 11898-compliant CAN interfaces having a throughput capacity of up to 1 MBaud and managed by two CAN controllers.

The CP350 CAN interfaces support the extended CAN protocol V2.0B as well as the higher-level protocols CANopen. The protocol stacks are loadable.

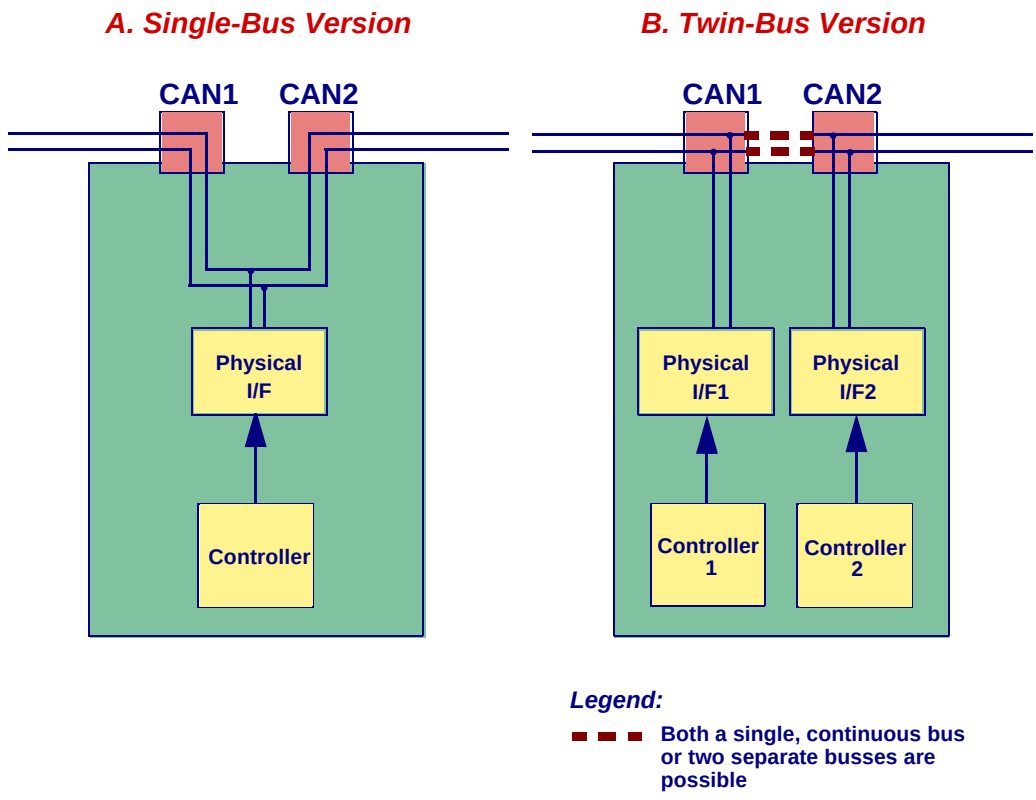
The CP350 exists both as a single-bus version having one single physical CAN controller and interface, and as a twin-bus version having two physical CAN controllers and two interfaces.

In the first case the CAN controller is routed via one interface to both front panel connectors. In the second case the second CAN controller is routed via the second interface to the CAN2 connector. This option includes two separate channels with two independet interfaces routed to two separate connectors..

Attention!

With the twin-bus version, bus interfaces CAN1 and CAN2 may be connected either to the same fieldbus or to two different buses (compare dashed lines in figure 1-3.B). Therefore, it is not possible to access one interface via two controllers.

Figure 1-3: Variants of CP350 Bus Interface Configuration



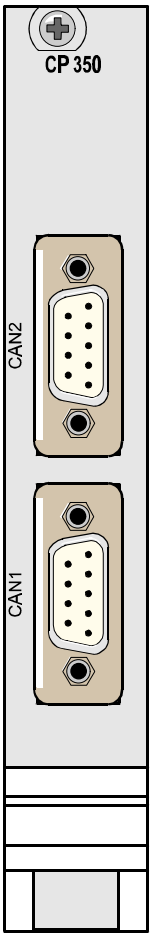


Figure 1-4: CP350 Front Panel View

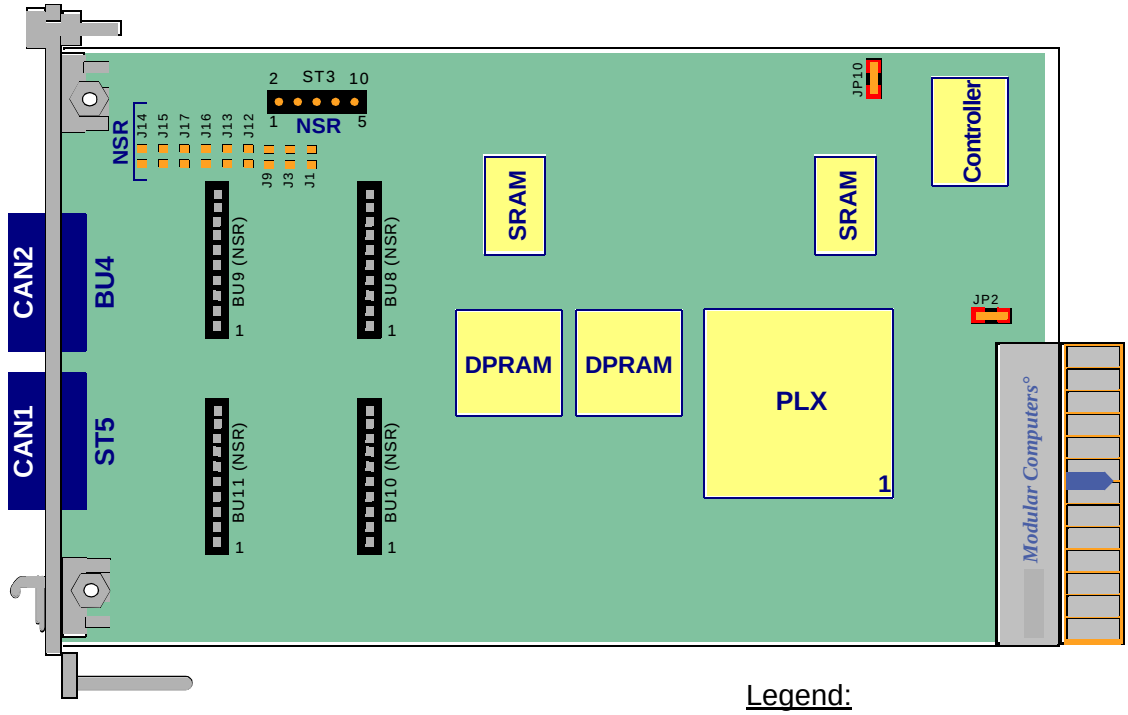
1.5.4Front Panel

Both variants of the CP350 are provided with the same single-width IEC standard front panel characterized by two DSUB-9 pin-row connectors, one of which is male (CAN1) and one female (CAN2).

With the single-bus version, CAN1 is assigned the function of the input interface and CAN2 that of the output interface.

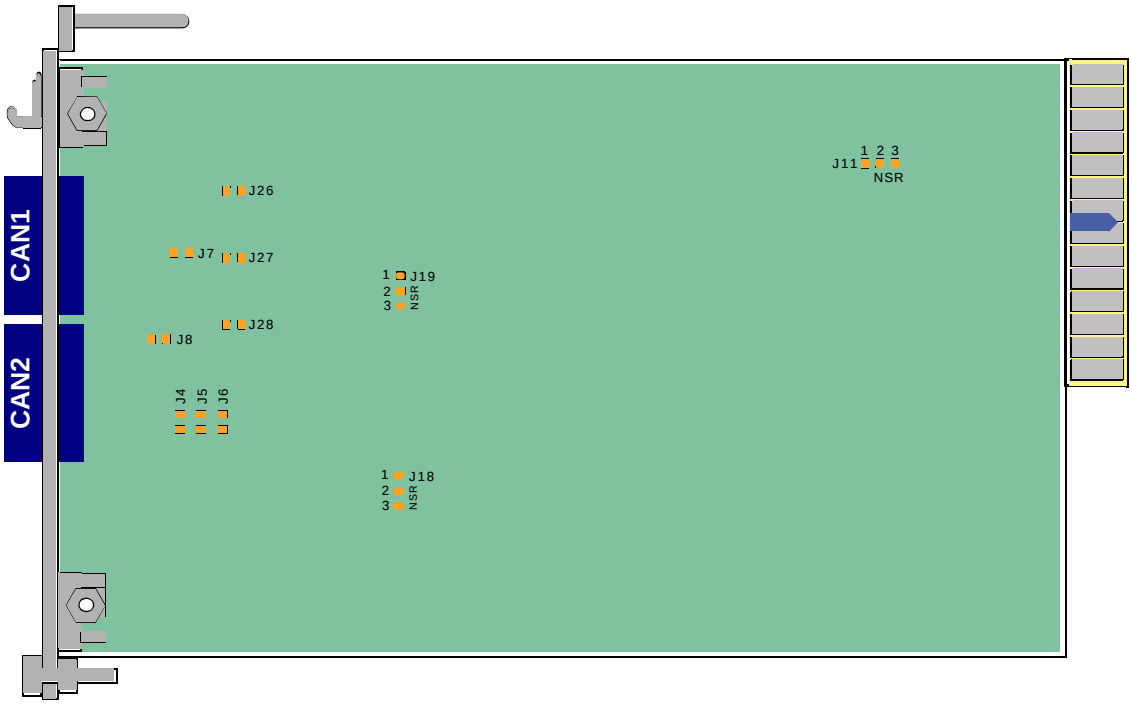
1.6 Board Layout

Figure 1-5: CP350 Board Layout (Front Side)



Legend:
NSR = Not system-relevant

Figure 1-6: CP350 Board Layout (Reverse Side)



1.7 Technical Specification

Table 1-1: CP350 Main Features

CP350	Specification
CPU	Siemens SAB C165
CPU Speed	40 MHz
CAN Controller	1 or 2 Philips SJA 1000
Power Supply	5 V DC ±5%
Input Current	Typ. 250 mA; max. 800 mA
DPRAM	8 kB
SRAM	256 kB
FLASH	256 kB
Temperature:	• Operating: 0°C to +60°C • Extended: -25°C to +75°C • Storage: -55°C to +85°C
Dimensions	105 x 180 (without connectors), 16 mm overall height
Weight	Approx. 160 g

1.8 Applied Standards

1.8.1 CE Compliance

The *PEP Modular Computers'* CompactPCI systems comply with the requirements of the following CE-relevant standards:

- Emission EN50081-1
- Immission EN50082-2
- Electrical Safety EN60950

1.8.2 Mechanical Compliance

- Mechanical Dimensions IEEE 1101.10

1.8.3 Environmental Tests

- Vibration/Broad-Band Random Vibration IEC68-2-6 IEC68-2-64 (3U boards)
- Permanent Shock IEC68-2-29
- Single Shock IEC68-2-27

1.9 Related Publications

CompactPCI Specification, V. 2.0, Rev. 2.1.

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Chapter 2

Configuration

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2. Configuration

2.1 Pinouts

2.1.1 CAN Bus Interface

The 1st CAN circuit is connected to the 9 pole pin/sleeve BU4/ST5. If both CAN circuits are installed and connected one to the other, they will be connected also via these front panel connectors.

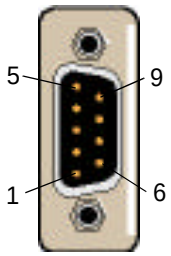
In case of galvanically decoupled bus interfaces, the GND and VCC signals are also galvanically decoupled from the CP350 GND and VCC signals.

2.1.2 CAN Interface Pinout

The CP350 is available as a single port or as a twin-port version. The single-port version is provided with one male and one female 9-pin DSUB connector. In this case, the pins of the male connector CAN1 are through-connected to those of the female one. Therefore, their pinouts are electrically identical, as is shown in tables 2-1 and 2-2.

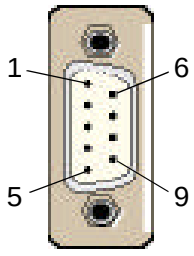
The twin-port version instead is provided with to separate male 9-pin DSUB connectors. Consequently, their pinouts are identical and correspond to the one shown in table 2-1.

Table 2-1: FM-CAN CANbus Connector Pinouts

—	**Pin 1**		**Pin 6**	Ground
Differential transceiver low	**Pin 2**		**Pin 7**	Differential transceiver high
Ground	**Pin 3**		**Pin 8**	—
—	**Pin 4**		**Pin 9**	*5 V**
Shield	**Pin 5**			

* Pin 9 is connected to the 5V on-board circuitry according to jumper setting (optional)..

Table 2-2: FM-DP PROFIBUS Connector Pinouts

Shield	**Pin 1**		**Pin 6**	5 V
—	**Pin 2**		**Pin 7**	—
Positive data	**Pin 3**		**Pin 8**	Negative data
—	**Pin 4**		**Pin 9**	—
Ground	**Pin 5**			

2.2 Jumper Settings

2.2.1 Execution of Program Code after Reset

If JP10 is open the program is executed from the flash memory. The program in the flash memory first checks whether the signature “APP” is present in the DPRAM, starting at address 1FFAh. If the signature is found, an application program previously loaded in the RAM is started. Otherwise the program loader is started.

2.2.2 Bootstrap Loader

With JP10 closed (developer option) the integrated bootstrap loader of the SAB C165 is activated after a hardware reset. To use the bootstrap loader for a program download the serial interface (RS232) must be installed (developer option). The bootstrap loader is described in detail in the data book of the SAB C165.

Table 2-3: Jumper for Bootstrap Loader

JP10	Bootstrap Loader
Open	*Not active*
Closed	Active

The default setting is indicated by italics.

It is not necessary that the hardware is initialized by an application program executed in the RAM, since the hardware is initialized by the program stored in the flash memory, which starts first.

2.2.3 Bus Interface Jumpers

VCC resp. GND can be connected to the CAN connectors by means of the solder jumpers J4, J5, J6, J26, J27 an J28.

Table 2-4: Bus Interface Jumpers

CAN1				CAN2			
Jumper	**Setting**	**Pin**	**Signal**	**Jumper**	**Setting**	**Pin**	**Signal**
J4	*Closed*	*3*	*GND*	*J26*	*Closed*	*3*	*GND*
J6	*Open*	*6*	*Open*	*J27*	*Open*	*6*	*Open*
J5	*Open*	*9*	*Open*	*J28*	*Open*	*9*	*Open*
J4	Open	3	Open	J26	Open	3	Open
J6	Closed	6	*GND*	J27	Closed	6	GND
J5	Closed	9	VCC	J28	Closed	9	GND

The default settings are indicated by italics.

If the corresponding bus interface is galvanically decoupled, also the GND and VCC connected to the plug connector are galvanically decoupled from the CP-350 by means of the solder jumpers.

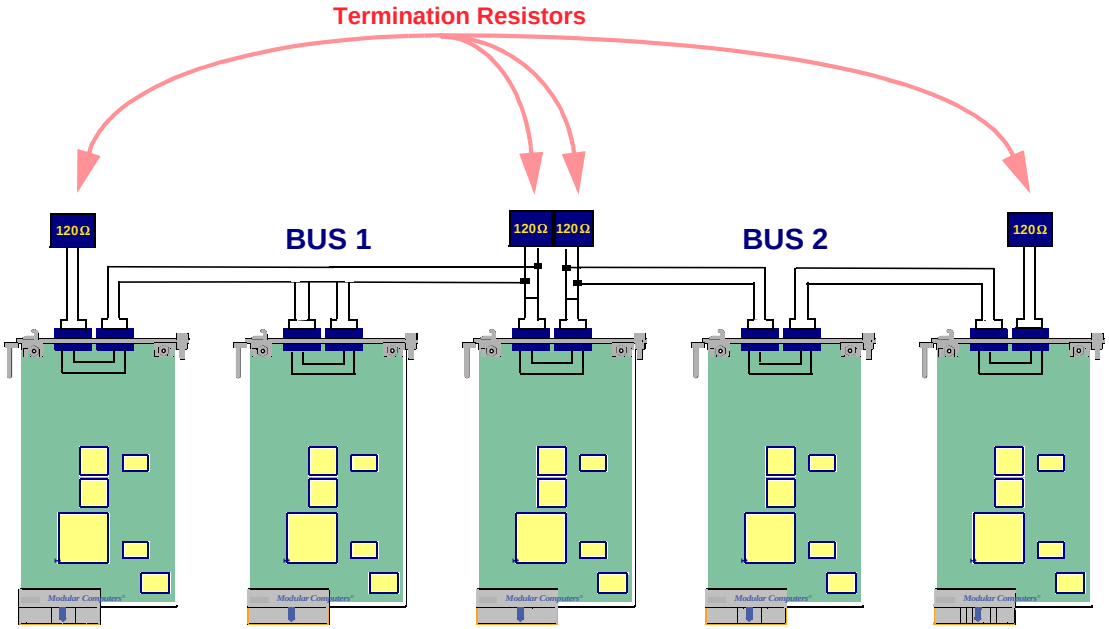
2.2.4 Board Termination

When connecting several CP350 boards to a CAN fiedbous network, both ends of the CAN bus must be provided with a 120-ohm, 0.25W termination resistor each.

Note:

No T-bus architecture is allowed in a CAN bus network.

Figure 2-1: CP350 Termination Example



2.2.5 Cable Connection

The diagram below displays how two cables are connected.

Figure 2-2: Bus Cable Diagram

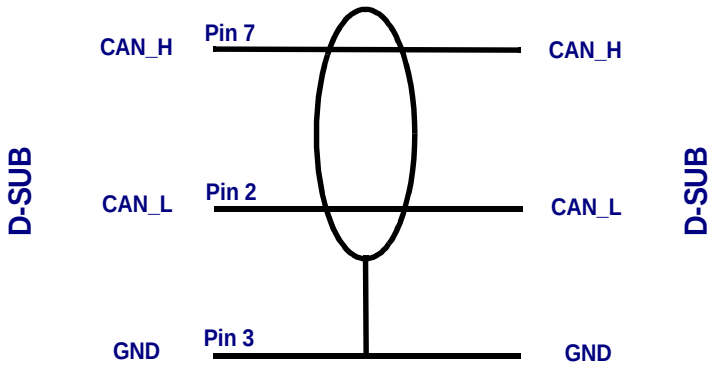


Table 2-5: Maximum Transmission Network Length

Rate [kBaud]	Length [m]
500	112
300	200
200	310
100	640
50	1300

2.2.6 Reset

A reset jumper JP2 is provided on the CP350. If closed, the local reset circuit is enabled.

Chapter 3

Installation

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3. Installation

3.1 Board Installation



Caution!

If your board type is not specifically qualified as hot-swap capable, please switch off the CompactPCI system before installing the board in a free CompactPCI slot. Failure to do so could endanger your life/health and may damage your board or system.



Note:

Certain CompactPCI boards require bus master and/or rear I/O capability. If you are in doubt whether such features are required for the board you intend to install, please check your specific board and/or system documentation to make sure your system is provided with an appropriate free slot to insert the board.



ESD Equipment!

Your CompactPCI board contains electrostatically sensitive devices. Please observe the necessary precautions to avoid damage to your board:

- Discharge your clothing before touching the assembly. Tools must be discharged before use.
- Do not touch components, connector-pins or traces.
- If working at an anti-static workbench with professional discharging equipment, please do not omit to use it.

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Chapter 4

Programming

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4. Programming

4.1 Software Installation

To carry out the installation of the CP350 under Windows NT you need system administrator rights. The installation itself is accomplished by installing an application software package for Windows NT like CAN layer 2 (VCI) or CAN open.

The installation is tested by running the application software.

4.2 Troubleshooting

If the board cannot be found by the application, please check whether the driver has initialized the board successfully by carrying out the following operations:

a) Go to Windows NT Diagnostics (`START/PROGRAMMES/ADMINISTRATIVE TOOLS/`);

b) Turn over to the “Resources” panel.

On the “Resource” panel there are two buttons that can lead you to further help information:

- ”IRQ...” displaying the board interrupts;
- “Memory...” displaying the DPRAM and semaphores.

Figure 4-1: Ressource Panel “IRQ” Screen

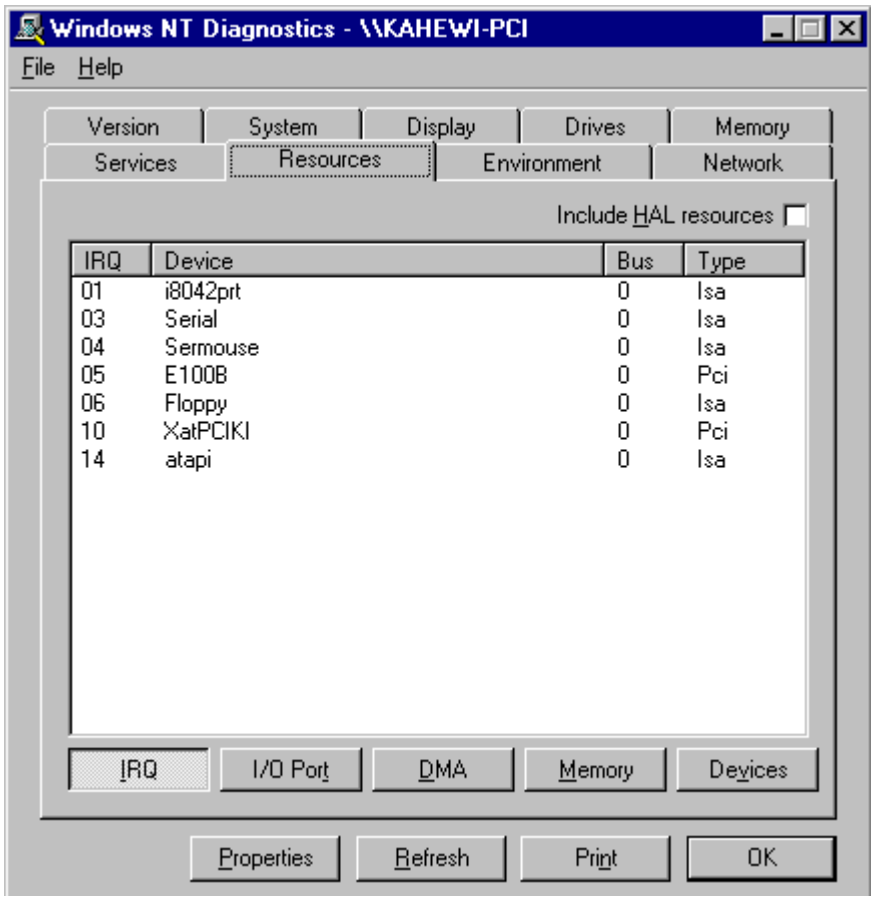
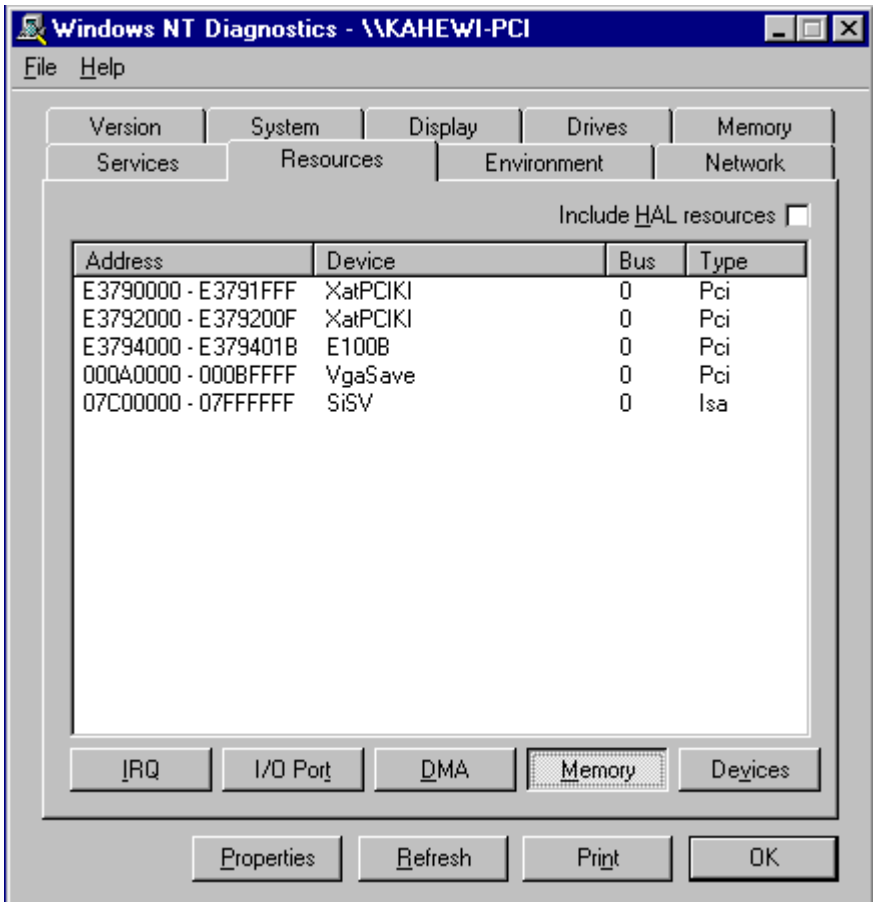


Figure 4-2: Ressource Panel "Memory" Screen



c) Check if the device XatPCIKI allocated an IRQ and a 8kByte wide area of DPRAM and a 16Byte memory for semaphores. If the driver wasn't started do as follows:

- Go to the Devices Panel (START/CONTROL PANEL/)
- Select XatPCIKI in the devices list
- Start the driver
- Change the startup-option in to 'Automatic'

Note:

The CP350 board doesn't support any DOS-utilities accessing the DPRAM directly, as it is mapped into a 32-Bit wide space by the BIOS. DOS requires the DPRAM to be allocated below 1MB.

4.3 Software Application

For further details on accessing and programming the CP350 by means of an application layer software please refer to the manuals for the *PEP Modular Computers* software packages CAN-Layer2, VCI-API and CAN-API.