Modular Computers ®

CP351

Intelligent PROFIBUS Controller for CompactPCI Systems

Manual ID 18983, Rev. Index 0101
Jan 99

CE

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

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Preface

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2.1 Revision History

Revision History			
Manual/Product Title:	**CP351**		
Manual ID Number:	**18983**		
Rev. Index	**Brief Description of Changes**	**Board Index**	**Date of Issue**
0100	Initial Issue	--	Aug. 98
0101	Electronic/paper manual ID numbers assigned	--	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.

2.1 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.

2.1 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*.

PEP Modular Computers warrants their own products, excluding software, to be free from manufacturing and material defects for a period of 24 consecutive months from the date of purchase. This warranty is not transferable nor extendible to cover any other users or long-term storage of the product. It does not cover products which have been modified, altered or repaired by any other party than *PEP Modular Computers* or their authorized agents. Furthermore, any product which has been, or is suspected of being damaged as a result of negligence, improper use, incorrect handling, servicing or maintenance, or which has been damaged as a result of excessive current/voltage or temperature, or which has had its serial number(s), any other markings or parts thereof altered, defaced or removed will also be excluded from this warranty.

If the customer's eligibility for warranty has not been voided, in the event of any claim, he may return the product at the earliest possible convenience to the original place of purchase, together with a copy of the original document of purchase, a full description of the application the product is used on and a description of the defect. Pack the product in such a way as to ensure safe transportation (see our safety instructions).

PEP provides for repair or replacement of any part, assembly or sub-assembly at their own discretion, or to refund the original cost of purchase, if appropriate. In the event of repair, refunding or replacement of any part, the ownership of the removed or replaced parts reverts to *PEP Modular Computers*, and the remaining part of the original guarantee, or any new guarantee to cover the repaired or replaced items, will be transferred to cover the new or repaired items. Any extensions to the original guarantee are considered gestures of goodwill, and will be defined in the "Repair Report" issued by *PEP* with the repaired or replaced item.

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Chapter 1

Introduction

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1. IntroductionSystem 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.

1.0.1 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.

1.0.2 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.

1.1 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

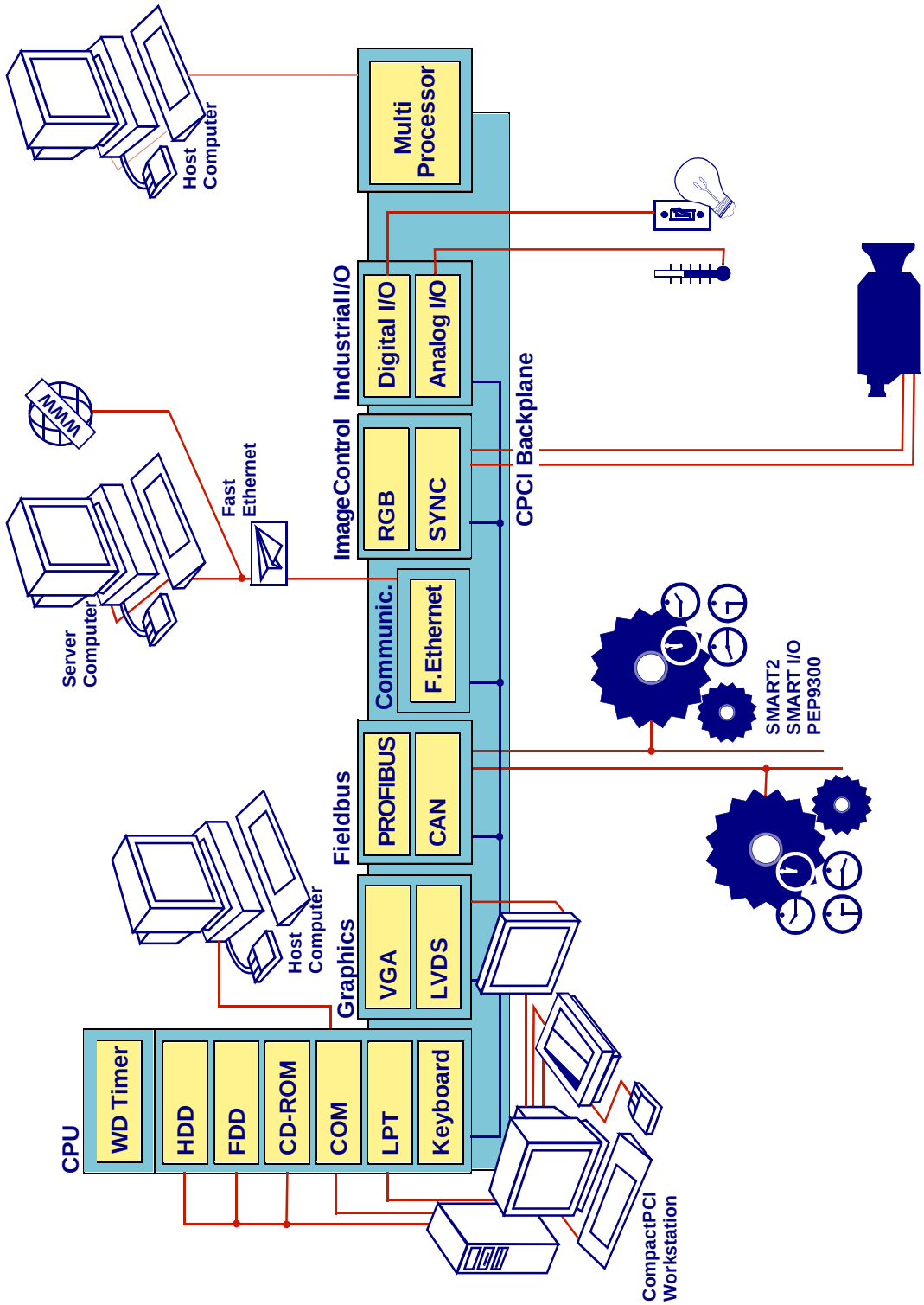
For a detailed description of the *PEP Modular Computers* CompactPCI modules please consult the specific components' manuals or data sheets.



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



1.2 Board Introduction

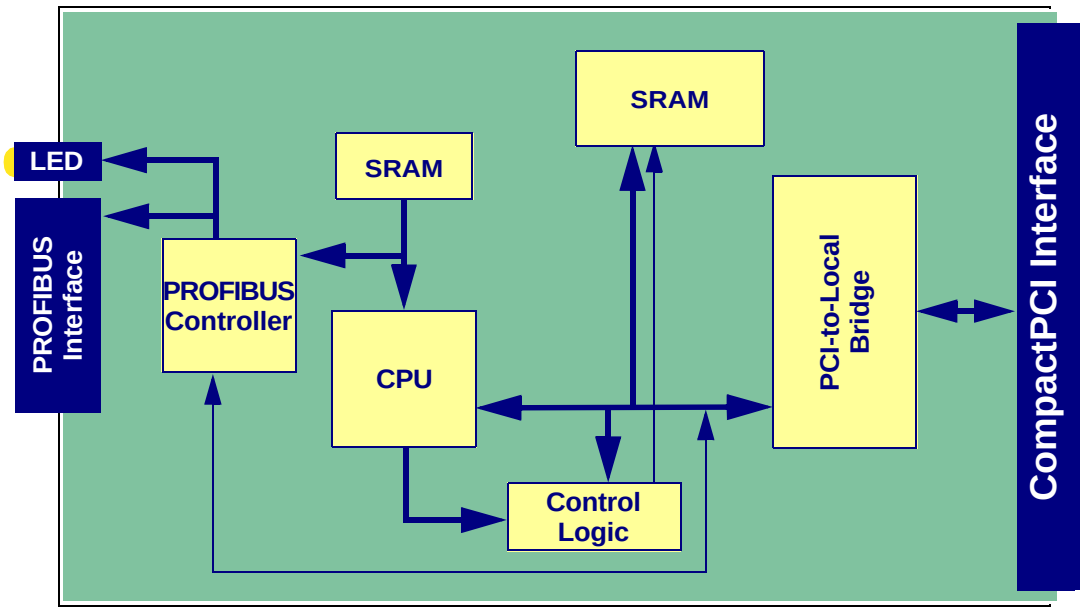
1.3 Product Overview

The CP351 is an intelligent PROFIBUS controller board providing PROFIBUS FMS master/slave and PROFIBUS functionality with high communication speeds. The PROFIBUS protocol FMS is particularly well suited for general purpose communication at cell or field level, while DP is designed for time-critical communication between systems and distributed peripherals.

To exchange data between the Motorola M68360 host CPU and the CPU bus, a CPU-to-PCI processor bridge, an SRAM interface architecture and an interrupt mechanism are realized.

1.4 Functional Block Diagram

Figure 1-2: CP351 Functional Block Diagram



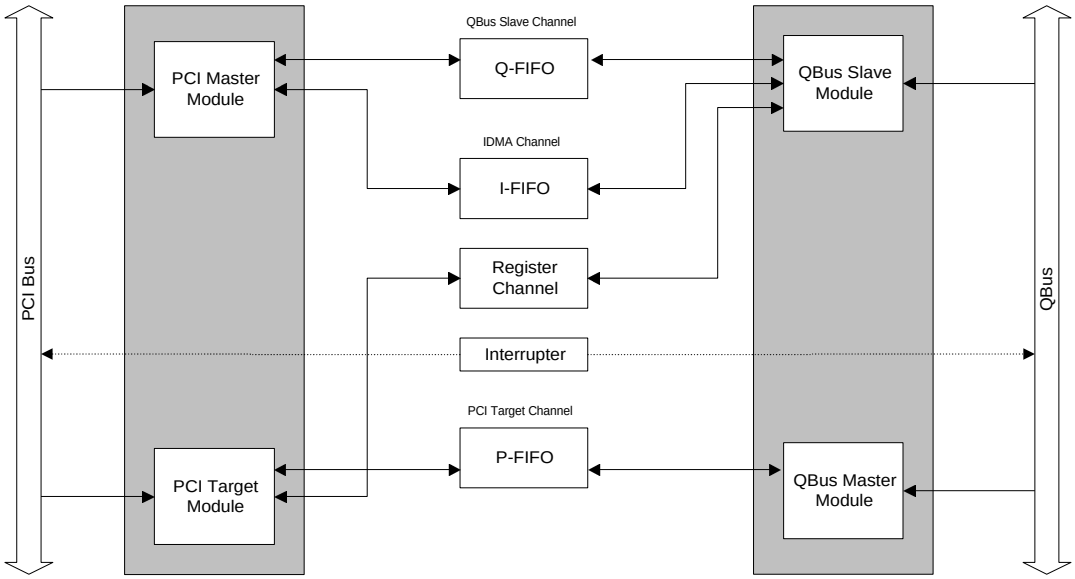
1.5 Board Interfaces

1.5.1 PCI Bus Interface Block

The CP 351 is interfaced to the PCI bus via the TUNDRA PCI-to-local processor bridge (QSPAN chip).

- 32-bit PCI interface capabilities on both the local bus (QBUS) and the PCI Bus
- Master and slave capability on both busses
- Decoupled transfer technology: FIFO
- Four user programmable images
- Serial EEPROM interface for plug & play compatibility
- Interrupt generator on PCI and processor bus
- QSPAN control and status register accessible both from PCI and processor bus

Figure 1-3: PCI-to-Local Bridge Functional Block Diagram



1.5.2 PCI-to-Local Interface Block

The QSPAN PCI interface is made up of a PCI Master Module and a PCI Target Module. For transfers from Qbus to the PCI Bus the QSPAN provides the QBUS slave channel. A transfer from the Qbus to the PCI bus is initiated by a dedicated chip select signal (CSPCI) whereas two independent, progammable slave images access PCI memory and I/O spaces. Data transfers from Qbus to PCI Bus are either posted (64-Byte FIFO for zero wait state bursting on the PCI bus) or delayed accesses.

For the transfers from PCI to the Qbus the PCI target channel is used. Two programmable target images can be mapped anywhere in memory or I/O space. The transfers from PCI to Qbus can also be posted or delayed whereas these transactions are always buffered. Therefore delayed single transfers are buffered in the single transfer buffer, all the other transfers are buffered in a 64-Byte FIFO. Higher transfer performance can be reached by the use of the IDMA channel.

For the configuration of the QSPAN`s transfer channels as described above, 4 kBytes of configuration and status registers are provided, which can be accessed both from PCI and local side (QBUS).

Further the PCI interface allows the generation of interrupts to the PCI and the QBUS (one dedicated interrupt pin per side).

For the realization of plug & play compatibility it is possible to programm certain QSPAN registers from a serial EEPROM at system reset or power up.

1.6 Fieldbus Interface

The fieldbus interface is an opto-isolated RS485 interface providing RxD and TxD lines. The RTS signal is used to enable the transmitter and the serial interface is opto-isolated between the ASPC2 and the transceiver.

The RS485 interfaces are routed to a 9-pin D-Sub connector. This interface is used in conjunction with external connectors providing integrated termination, as the PROFI-BUS interface itself is not provided with termination resistors. A list of recommended external connectors is given in chapter 3 of this manual.

A zero ohm resistor is also present on the board to disconnect the local supply from the fieldbus. This is used for those applications that may require an external supply. The standard installation is with isolated 5V termination power.

1.6.1 On-Board Bus Error Timer

The CP 351 provides an on-board bus error timer monitoring the cycle lengths of data transfers to and from locations beyond the CPU data bus buffer.

1.6.2 Watchdog Timer

The on-board system reset generator is triggered at timeout by a watchdog timer.

1.7 Board Layout

Figure 1-4: CP351 Board Layout (Front Side)

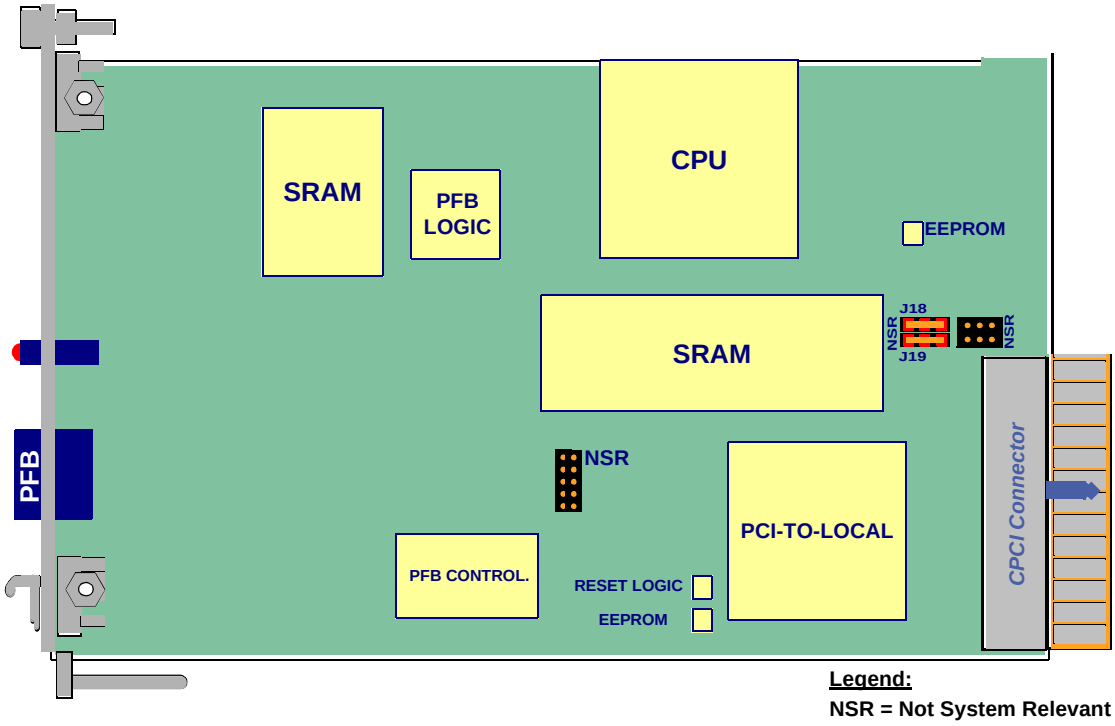
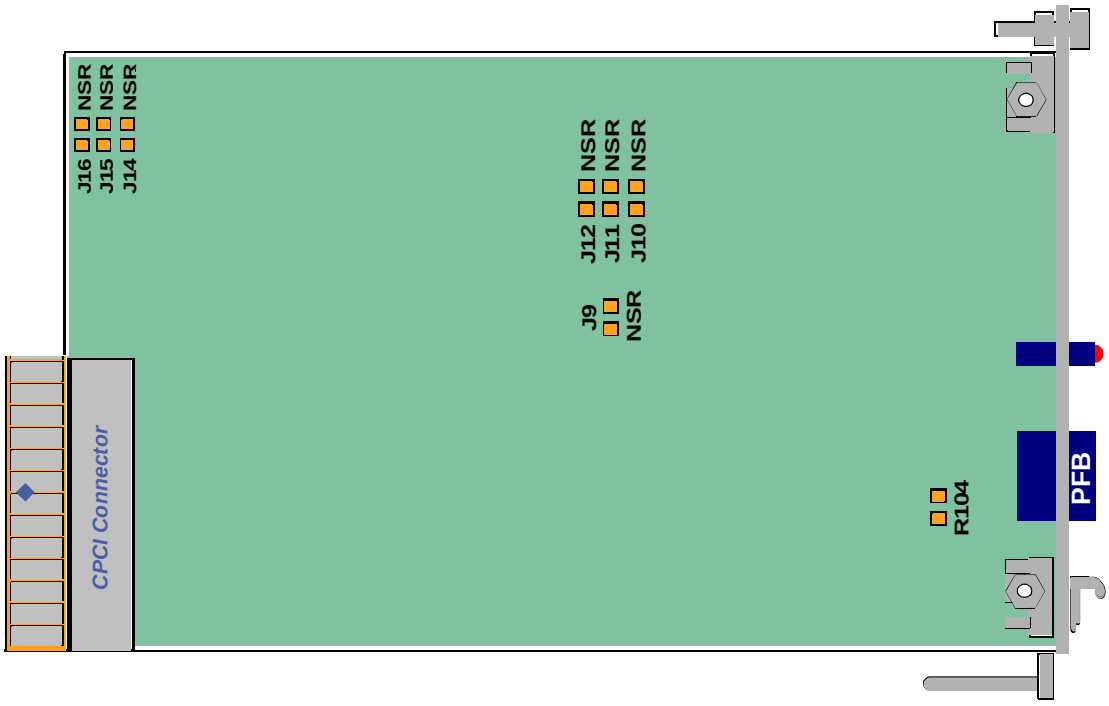


Figure 1-5: CP351 Board Layout (Reverse Side)



1.8 Front Panel

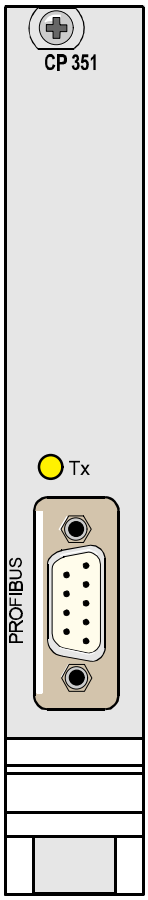


Figure 1-6: CP351 Front Panel

The CP351 front panel is provided with a female 9-pin DSUB connector according to DIN 19245 supplying a potential-free termination power.

A yellow LED signalling the RTS status is provided:

LED “ON” = Transmission active.

1.9 Technical Specifications

Table 1-1: CP351 Technical Specifications

CP351		Specifications
PCI Bus Interface	**PCI interface**	PCI Master Module / PCI Target Module;QBUS Master Module/ QBUS Slave Module: 32-bit; 33MHz
	Configuration Space	4 kByte size, accessible both from PCI and from local side (QBUS)
	Memory	2 MByte shared SRAM
	PCI Interrupt	INTA #
	Special Functions	Serial EEPROM (512 x 8 Bit) for plug & play compatibility

Table 1-1: CP351 Technical Specifications

CP351		Specifications
CPU Interface	**CPU**	MC68360 at 25 MHz
	Memory	• SRAM: 2 MByte (32-bit access, no back-up); • EEPROM: 2 kBit (serial, 256 x 8), 1 kBit available for applications
	Local Interrupts	QINT (CPU 360 level 5)
	Timers	• TICK: Periodic-interrupt timer, programmable; • General purpose timer: 4x16 bit or 2x32 bit, programmable; • Watchdog: 512 ms time-out for reset, programmable; • On-board bus error timer: 128 µs, programmable
	Special Functions	• Serial EEPROM: 1 kBit for board-specific data (serial number etc.) + 1 kBit for application purposes; • DMA: 2 independent channels (transfers between SRAM, Flash EPROM and PROFIBUS)
PROFIBUS Interface	**Interface**	Opto-isolated 12 MBd serial interface (RS485) with 9-pin female D-Sub connector
	Controller	• Device: Siemens ASPC2 PROFIBUS controller • System clock: 48 MHz • Transmission Speed: 9.6 kBaud .. 12 MBaud, software programmable • Interface: 8/16 bit • Participants: 127, mixed active/passive • Address range: 1 Mbyte, 64 Byte internal FIFO for send/receive
	Isolation	1 kVDC for the PROFIBUS interface
	Memory	256 kByte local shared SRAM, accessible by the ASPC2 and the CPU360
	Interface IDs	HEX 17 and HEX FF

1.10 Applied Standards

1.10.1 CE Compliance

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

- EmissionEN50081-1
- ImmissionEN50082-2
- Electrical SafetyEN60950

1.10.2 Mechanical Compliance

- Mechanical DimensionsIEEE 1101.10

1.10.3 Environmental Tests

- Vibration/Broad-BandIEC68-2-6
  Random VibrationIEC68-2-64 (3U boards)
- Permanent ShockIEC68-2-29
- Single ShockIEC68-2-27

1.11 Related Publications

CompactPCI Specification, V. 2.0, Rev. 2.1.

TUNDRA QSPAN PCI to Motorola Bridge Manual

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Chapter 2

Functional Description

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2. Functional Description

2.1 CP351 Address Map

The CP351 CPU360 address map shown in the table below is based on the recommended default initialization of 68360 chip select logic.

Table 2-1: CP351 Address Map

Address (Hex)	Device
HEX 00 xx xx xx	SRAM
HEX 04 xx xx xx	SRAM
HEX 07 00 0x xx	68360 internal RAM / register
HEX 0A xx xx xx	QSPAN configuration / status registers
HEX 10 00 00 00	PROFIBUS Interface
HEX 0C xx xx xx	RTC
HEX 0D xx xx xB	board control/status register
HEX 40 00 00 00	PCI image 0
HEX c0 00 00 00	PCI image 1

2.2 Board Control/Status Register

An additional register for CP 351 control and status purposes is implemented in the glue logic part of the QUICC-QSPAN interface. This register can also be accessed from the PCI and the local side (QBUS).

Address: CS7 + HEX B

Format: Byte

Access: Read/Write

Value after reset: HEX 00

Table 2-2: Board Control/Status Register Bitmap

7	6	5	4	3	2	1	0
WDG	S_BRB	BERR1	EN_WDG	TR_WDG	EN_BERR1	ABORT	LED_G

2.2.1 Register Description

Table 2-3: CP351 Register Description

Name	Value	Access	Description
WDG		Read/Write	Set by watchdog timer when timeout has been reached. Used to differentiate between resets caused by the watchdog and resets caused by a reset button (power up resets can be identified within the 68360)
S_BRB		Read	Boot jumper (S_BOOT) read back
BERR1		Read/Write	Set by on-board bus error timer when timeout has been reached. Used to identify BERR caused by this timer.
EN_WDG	1	Read/Write	Enable the watchdog timer. It can only be set once, and remains enabled until the next reset.
TR_WDG	1	Read/Write	Triggers the watchdog timer.
EN_BERR1	1	Read/Write	Enables the on-board bus error timer. It also monitors all on-board I/O cycles, including the time from the VME bus request to the VME bus grant.
ABRB	1	Read	ABORT read back
LED_G		Read/Write	General purpose LED driver

2.2.2 Watchdog Timer

A 512ms watchdog timer triggers the on-board system reset generator at timeout. Once enabled via the board control/status register, the watchdog timer cannot be reset by software. It must be re-triggered via the corresponding bit in the board control/status register periodically within the timeout period.

2.2.3 On-Board Bus Error Timer

A 128µs timeout monitors the cycle lengths of data transfers to and from locations beyond the CPU data bus buffer, including the on-board I/O and PROFIBUS interface. After a timeout occurs, it generates an on-board BERR signal for error termination. This timer is enabled/disabled via the board control/status register, which also supplies a timeout status bit in order to identify bus errors generated by the on-board bus error timer.

There are two cases of bus error which are described in the following table.

Table 2-4: Bus Error Description

Cause	Timeout	Enable/Disable Possible
Reserved Address BERR0	100 ns	Permanently enabled
On-Board BERR1	128 us	Set in board control register

Chapter 3

Configuration

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3. Configuration

3.1 Jumper Setting

Table 3-1: Jumper “R104” – Terminative Power

Jumper	Default	Description
R104	Closed	Set DC/DC coupled power supply to PB connector, as terminative power

3.2 Pinouts

3.2.1 PROFIBUS Interface Connector

Table 3-2: PROFIBUS Connector Pinouts

Pin	Signal	Description
1	SHIELD	Shield
2	Res.	Reserved
3	RxD+/TxD+	Recieve/Transmit positive data
4	Res.	Reserved
5	GND	Ground
6	VCC	Voltage plus
7	Res.	Reserved
8	RxD-/TxD-	Receive/Transmit negative data
9	Res.	Reserved

The PROFIBUS interface connector can be used with external bus terminals providing integrated fieldbus termination. A list of recommended external connectors, which are supplied by *PEP Modular Computers* is given below.

3.2.2 External Fieldbus Terminals

Table 3-3: External Fieldbus Terminals

SIEMENS Sinec L2	SIEMENS Sinec L2F0 “SF”	SIEMENS Sinec L2F0 “PF”
RS485 bus terminal	Silica fiber bus terminal	Plastic fiber bus terminal
9.6 kBaud to 12 MBaud	9.6 kBaud to 1.5 MBaud	9.6 kBaud to 1.5 MBaud
4.75V..5.25V DC 5mA max.	4.75V..5.25V DC 90mA max./65mA typically	4.75V..5.25V DC 90mA max./65mA typically
9-pin DSUB male connector, Row of 6 connectors for wire (max. 1.5mm²)	LWL connector: 2 x ST DTE connector: 9-pin DSUB	LWL connector: 1 x Hp duplex DTE connector: 9-pin DSUB
Max. distance: • 1200m at 9.6kBaud • 100m at 12 MBaud	Max. distance: 1400m	Max. distance: • 5m..25m at 0°C..40°C • 10m..20m at 40°C..55°C

Chapter 4

Programming

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4. Programming

The following table helps you to determine which PROFIBUS software manuals refer to your *PEP Modular Computers* hardware:

Table 4-1: PEP PROFIBUS Documentation

CXM-PFB12	PROFIBUS Application Program Interface	ID 19021 ID 14783
	PROFIBUS DP Services	ID 19021 ID 14783
V(6)PFB	PROFIBUS Application Program Interface	ID 19021 ID 14783
	PROFIBUS Intelligent Controller	ID 18976 ID 18978
	PROFIBUS DP Services	ID 19021 ID 14783
CP351	PROFIBUS Application Program Interface	ID 19053 ID 19054
	PROFIBUS OLE for Process Control (OPC Server)	ID 19056 ID 19057
	PROFIBUS DP Services	ID 19021 ID 14783

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