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SST-PFB3-PCI

Hardware Reference Guide

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This document applies to the SST-PFB3-PCI interface card.

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What Has Changed?

The following changes have been made to this document:

Edition	Affected Section	Change Description

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Preface

Preface Sections:

- Purpose of this Guide
- Conventions

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Purpose of this Guide

This guide contains technical and product-related information on the SST-PFB3-PCI interface card and derivatives.

The SST-PFB3-PCI has its own CPU that executes downloadable application firmware modules. The main function of these modules is to enable application-level product behavior. For more details, refer to relevant firmware documentation.

Conventions

This guide uses stylistic conventions, special terms, and special notation to help enhance your understanding.

Style

The following stylistic conventions are used throughout this guide:

Bold	indicates field names, button names, tab names, and options or selections
Italics	indicates keywords (indexed) or instances of new terms and/or specialized words that need emphasis
CAPS	indicates a specific key selection, such as ENTER, TAB, CTRL, ALT, DELETE
`Code Font`	indicates command line entries or text that you'd type into a field
Underlining	indicates a hyperlink
">" delimiter	indicates how to navigate through a hierarchy of menu selections/options
"0x"	indicates a hexadecimal value

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Special Terms

The following special terms are used throughout this guide:

Card	the SST-PFB3-PCI interface card
Firmware	the software running on the card
Module	a synonym for *firmware*

Special Notation

The following special notations are used throughout this guide:



Warning

Warning messages alert the reader to situations where personal injury may result. Warnings are accompanied by the symbol shown, and precede the topic to which they refer.



Caution

Caution messages alert the reader to situations where equipment damage may result. Cautions are accompanied by the symbol shown, and precede the topic to which they refer.



Note

A note provides additional information, emphasizes a point, or gives a tip for easier operation. Notes are accompanied by the symbol shown, and follow the text to which they refer.

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1 Card Overview

Chapter Sections:

- Warnings and Cautions
- Card Features
- Hardware Description

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1.1 Warnings and Cautions

The card is an electrical component and must be treated with the following precautions:



Warning

Only qualified electrical personnel familiar with the construction/operation of this equipment and the hazards involved should install, adjust, operate, and/or service this equipment. Read and understand this guide in its entirety before proceeding. Failure to observe this precaution could result in severe bodily injury or, in extreme cases, loss of life.



Warning

You must provide an external, hand-wired emergency stop circuit outside the programmable controller circuitry. This circuit must disable the system in case of improper operation. Uncontrolled machine motion may result if this procedure is not followed. Failure to observe this precaution could result in bodily injury.



Caution

The card contains static-sensitive components. Careless handling may severely damage the card. Do not touch any of the connectors or pins on the card. When not in use, the card should be stored in an anti-static bag. Failure to observe this precaution could result in damage to or destruction of the equipment.

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1.2 Card Features

The SST-PBF3-PCI is the next Generation Profibus PCI card. It can perform the following functions:

- Act as a DP master
- Act as a DP slave
- Send and receive FDL (layer 2) messages
- Support Master Class 1 and Master Class 2 messaging
- Support simultaneous operation in all of the above modes
- Support the standard Profibus baud rates of 9.6K, 19.2K, 93.75K, 187.5K, 500K, 1.5M, 3M, 6M and 12M baud

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1.3 PCI Compatibility

1.3.1 Overview

The following table outlines the requirements of different PCI revisions and the PCI requirements of the SST-PFB3-PCI card.

Table 1: PCI Compatibility Table

PCI Revision	Supply Voltage Provided by Motherboard		PCI I/O signaling voltage level of Motherboard	
	3.3V	5V	3.3V	5V
2.1	[1]Optional	Required	Not supported	Supported
2.2	Required	Required	Supported	Supported
2.3	Required	Required	Supported	Not supported
SST Product				
SST-PFB3-PCI	Required	Required	[2]Supported	[2]Supported

[1] The SST-PFB3-PCI requires both 3.3V and 5V to be supplied by the motherboard. Because 3.3V supply voltage is optional in PCI revision 2.1, the SST-PFB3-PCI may not function in some PCI 2.1-compliant motherboards.

[2] The SST-PFB3-PCI will auto-detect the motherboard PCI I/O signaling level and adjust its signaling level accordingly, allowing it to function in PCI systems that support either 5V or 3.3V I/O signaling levels.

Summary

The SST-PFB3-PCI's compatibility can be summarized as follows:

- Will operate in PCI 2.2- and 2.3-compliant systems
- Will also operate in PCI 2.1-compliant systems that have implemented the optional 3.3V supply voltage

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1.4 Hardware Description

The main features of the SST-PFB3-PCI interface card are described in more detail in the following sections:

Figure 1: The SST PFB3-PCI Interface Card

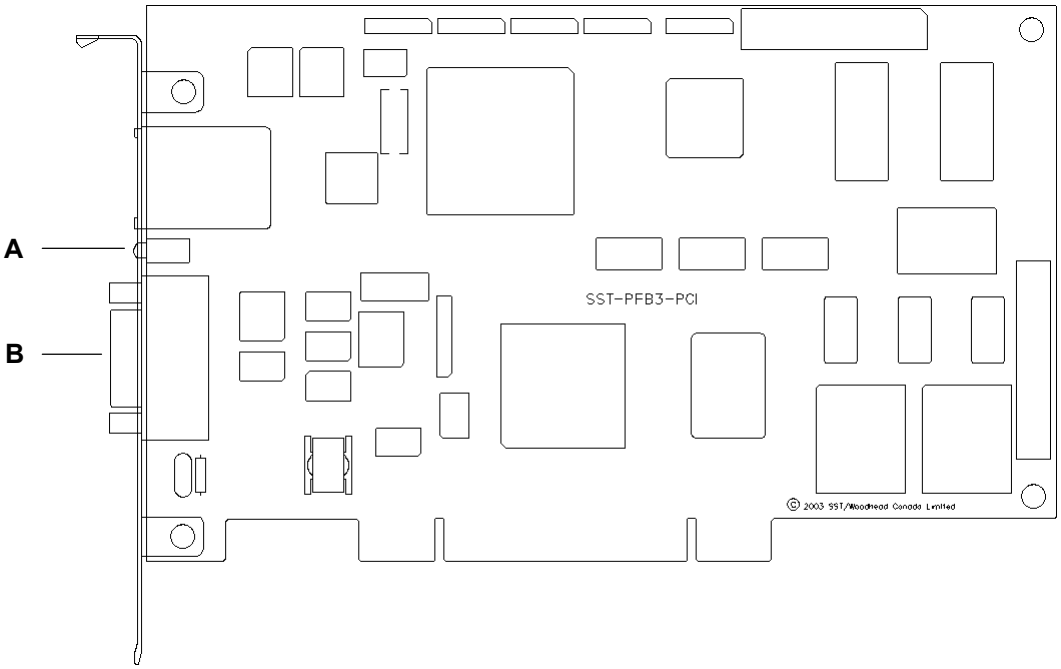


Table 2: Card Components

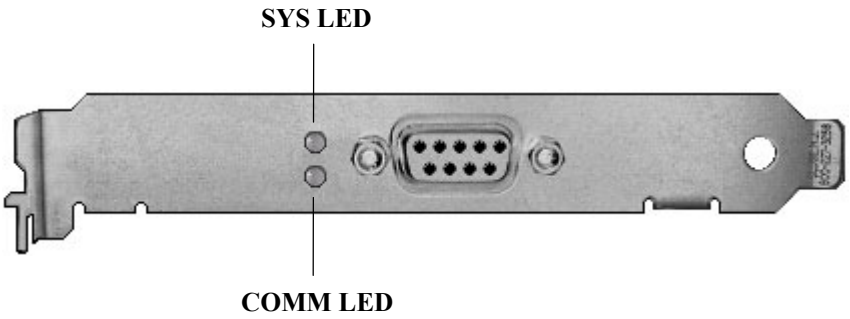
Feature	Description
A	LEDs
B	Profibus DB9 Connector

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1.4.1 LEDs

There are two LEDs on the card: communications (COMM), and system (SYS). The LEDs are identified in the following figure.

Figure 2: Card Bracket



During power-up, the COMM LED is *off*, and the SYS LED is *amber*. Once a module has been loaded, the LEDs are under firmware control. Refer to the firmware reference guide for more details.

If, during power-up, a fault is detected by the boot code, an error is flashed on the SYS LED. Refer to Section A.3, Fatal Hardware Self-Test Flash Codes, for more details.

Note

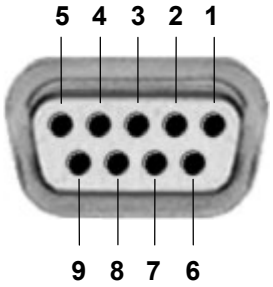
For information on troubleshooting using LEDs, refer to Section 4.1, SYS LED is Red.

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1.4.2 Profibus Connector

The card contains a standard Profibus DB9 connector. Pin numbers are identified in the figure below.

Figure 3: The DB9 Connector



The recommended cable is Belden 3079A. Examples Include:

- Brad Harrison 85-0001 PVR 2 conductor with shield, UL-listed Profibus cable
- Bosch Comnet DP #913 548 Flexible Profibus Cable
- Bosch Comnet DP #917 201 Trailing Profibus Cable
- Bosch Comnet DP #917 202 Massive Profibus Cable

Note

For instructions on connecting to a Profibus network, refer to Section 2.4, Connecting to a Profibus Network.

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2
Installation

Chapter Sections:

- System Requirements
- Handling Precautions
- Installing the Card
- Connecting to a Profibus Network

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2.1 System Requirements

To install and operate the card, the following system requirements must be met:

- An available PCI 2.2 or 2.3 slot. The card will also operate in some PCI 2.1-compliant systems. Refer to Section 1.3, PCI Compatibility, for details.
- One physical interrupt

2.2 Handling Precautions

The card contains components that are sensitive to electrostatic discharge (ESD). Do not touch the card without following these precautions:



Caution

- Always follow correct ESD procedures before handling the card. We strongly recommend the use of a grounding wrist strap.
- Never touch any of the card's connectors or pins. Handle the card by its edges.
- When the card isn't in your computer, always store it in its protective bag.

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2.3 Installing the Card

This section provides general directions for installing the SST-PFB3-PCI card in your computer.

To install the SST-PFB3-PCI:

1. Ensure that all power to your computer is *off*.
2. Adequately ground yourself, as explained in Section 2.2, Handling Precautions.
3. Unplug the power cord, modem (if applicable), and any network cables.
4. Remove the computer cover. Consult your computer user's guide for information on installing add-in boards.
5. Take the card out of its shipping container, being careful not to touch any of the connectors or pins.
6. Firmly press the SST-PFB3-PCI interface card on to the PCI connector.
7. Secure the card to the case, according to the computer user's guide.
8. Replace the computer cover.

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2.4 Connecting to a Profibus Network

2.4.1 DB9 Instructions

The following table describes how to connect the Profibus DB9.

Table 3: DB9 Instructions

DB9 Pin Description	DB9 Pin #	DB9 Termination with SST-PFB3-PCI
Chassis ground	1	
Reserved	2	
Data +	3	Connect this pin to Pin 8 (data -) with 220 ohm resistor
Tx enable	4	
Isolated ground	5	Connect this pin to Pin 8 (data -) with 390 ohm resistor
Voltage plus	6	Connect this pin to Pin 3 (data +) with 390 ohm resistor
Reserved	7	
Data -	8	
Reserved	9	

2.4.2 Termination

Always refer to Profibus documentation for proper network termination and wiring directions.

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3
Hardware Register Details

Chapter Sections:

- PFB3 Card Configuration Registers

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3.1 PFB3-PCI Card Configuration Registers

This section provides hardware register details for the SST-PFB3-PCI card.

3.1.1 Host Register Layout

The SST-PFB3-PCI host registers are mapped into a separate region of PCI memory space (PCI Region 3). The base mapping address in the host system can be found by reading the PCI configuration space at offset 0x1C. Refer to Section 3.2, SST-PFB3-PCI Configuration Space, for PCI configuration space information.



Note

When power is applied to the card, or after a physical reset from the system, it may take up to 2 seconds for the card to initialize. Successful initialization can be confirmed by monitoring the LEDs or by reading the HDR register, as described in Section C.1.1, Verify Card Presence.

Table 4: Host Register Layout

The following table maps the host register layout.

Offset	Register Name	Bit Name							
		7	6	5	4	3	2	1	0
00h	Control	CardRun	MemEn	IntEn	WdTout	HostIrq1	HostIrq0	CardIrq1	CardIrq0
01h	AddrMatch	1	AM18	AM17	AM16	AM15	AM14	Reserved	Reserved
02h	BankAddress	0	0	0	BA16	BA15	BA14	Reserved	Reserved
03h	WinSize	WS19	WS18	WS17	WS16	WS15	WS14	WS13	WS12
04h	HostIrq	Reserved	Reserved	Reserved	Reserved	IrqLevel			
05h	LedReg	Reserved	Reserved	Reserved	Reserved	CommRed	CommGrn	SYSRed	SYSGrn
06h		HWReset	Reserved	Reserved	JTAGEN	CPUTRST	CPUTMS	CPUTDI	CPUTCK
07h	HDR	HostDataReg (written by CPU)							
08h-01Fh	Reserved								

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3.1.2 Control Register

This register is a group of control and status bits.

Table 5: Control Register Settings

Bit	7	6	5	4	3	2	1	0
Name	CardRun	MemEn	IntEn	WdTout	HostIrq1	HostIrq0	CardIrq1	CardIrq0
Read/Write	R/W	R/W	R/W	R	R/W	R/W	R/W	R/W
Reset	0	0	0	0	0	0	0	0

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Table 6: Control Register Bit Descriptions

Bit Name	Description
CardRun	This bit controls and indicates whether or not the card's processor is running. It also affects the card's SYS LED. • When this bit is 0, the processor is halted, and the SYS LED is RED • When this bit is 1, the processor is running normally, and the LED is under processor control • When this bit is 1, and watchdog has timed out, processor is halted, and the SYS LED is RED This bit must remain low for at least 50 μs to guarantee proper reset.
MemEn	High (1) enables shared memory decoding of addresses in this board's range. This board's range is defined by the plug and play BIOS or operating system.
IntEn	High (1) enables interrupts on IrqLevel when a HostIrq bit is high (1). • Writing 1 enables interrupts • Writing 0 disables interrupts (the IrqPending flag still functions as described)
WdTout	WdTout high ('1') indicates that a watchdog timeout has occurred, or that the CPU has been held in RESET by some other means. To restore this bit to 0, clear CardRun.
HostIrq1	This bit is used by the card processor to send interrupts to channel 1 of the host • Writing 1 acknowledges the interrupt and clears it • Writing 0 has no effect • Reading 1 indicates interrupt in progress • Reading 0 indicates interrupt complete
HostIrq0	This bit is used by the card processor to send interrupts to channel 0 of the host • Writing 1 acknowledges the interrupt and clears it • Writing 0 has no effect • Reading 1 indicates interrupt in progress • Reading 0 indicates interrupt complete
CardIrq1	This bit is used by the host to send interrupts to channel 1 of the card processor • Writing 1 generates an interrupt to the card • Writing 0 has no effect • Reading 1 indicates interrupt in progress • Reading 0 indicates interrupt complete
CardIrq0	This bit is used by the host to send interrupts to channel 0 of the card processor • Writing 1 generates an interrupt to the card • Writing 0 has no effect • Reading 1 indicates interrupt in progress • Reading 0 indicates interrupt complete

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3.1.3 AddrMatch Register

Table 7: AddrMatch Register Bit Descriptions

Bit Name	Description
AM19 – AM12	Reserved. This register always reads zero, and writing these bits has no effect.

3.1.4 WinSize Register

Table 8: WinSize Register Bit Descriptions

Bit Name	Description
WS19-WS12	Reserved. This register always reads 0x3F, and writing this register has no effect.

3.1.5 Bank Address Register

This register is used to switch banks of shared memory into host memory space.

Table 9: Bank Address Register Bit Descriptions

Bit Name	Description
BA17-13	Reserved. This register always reads zero, and writing these bits has no effect.

3.1.6 HostIrq Register

Table 10: HostIrq Register Bit Descriptions

Bit Name/ Value	Description
IrqLevel3-IrqLevel0	Reserved. This register always reads zero, and writing this register has no effect

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3.1.7 LedReg Register

This register reflects the state of card LEDs, allowing host software to monitor the LEDs and display them on-screen.

The LedReg register represents the state of the card LEDs. The state of this register is controlled by firmware. Reading the register will reflect the following LED states:

Table 11: LedReg Register Settings

Bit	7	6	5	4	3	2	1	0
Name	Reserved				COMMRed	COMMGrn	SYSRed	SYSGrn
Read/Write	R	R	R	R	R	R	R	R
Reset	0	0	0	0	0	0	0	0

Table 12: SYS and COMM LED Status

Bit Name/Value		Description
SYSGrn	SYSRed	These bits indicate the state of the card's SYS LED.
0	0	LED is off
0	1	LED is red
1	0	LED is green
1	1	LED is amber
CommGrn	CommRed	These bits indicate the state of the card's communications LED
0	0	LED is off
0	1	LED is red
1	0	LED is green
1	1	LED is amber

3.1.8 Debug Register

Reserved for future use.

3.1.9 HDR Register

Reserved for future use.

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3.2 SST-PFB3-PCI Configuration Space

Table 13: SST-PFB3-PCI Configuration Space

PCI CFG Register Address	Register Function 31 24 23 16 15 8 7 0					PCI Writable
0x00	Device ID 0x0033			Vendor ID 0x133D		N
0x04	Status			Command		Y
0x08	Class Code			Revision ID		N
0x0C	BIST	Header ID	PCI Latency	CacheLineSize		Y[7:0]
0x10	PCI Base Address 0 Memory, 128 bytes, Reserved					Y
0x14	PCI Base Address 1 Not Used					Y
0x18	PCI Base Address 2 Memory, 256K bytes Profibus Interface Refer to the relevant firmware documentation for details.					Y
0x1C	PCI Base Address 3 Memory, Host Interface Registers See Section 3.1, PFB3-PCI Card Configuration Registers, for details.					Y
0x20	PCI Base Address 4 Not Used					Y
0x24	PCI Base Address 5 Not Used					Y
0x28	Cardbus CIS Pointer (Not Supported)					N
0x2C	Subsystem Device ID 0x9030			Subsystem Vendor ID 0x10B5		N
0x30	PCI Base Address for Local Expansion ROM					Y
0x34	Reserved					N
0x38	Reserved					N
0x3C	Max_Lat	Min_Gnt	Interrupt Pin	Interrupt Line		Y[7:0]

Note

Refer to the PCI specification and your particular OS documentation for the function of all other PCI configuration space registers and their typical uses.

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Note

Typically, the PCI configuration space registers do not need to be written to by the host system driver. A plug and play BIOS and/or host operating system will ensure there are no resource conflicts in the system.

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4 Troubleshooting

Chapter Sections:

- SYS LED is Red

For a list of hardware-related errors that can be generated by the card, refer to Appendix A, Error Messages.

Warning

Only qualified electrical personnel familiar with the construction and operation of this equipment and the hazards involved should install, adjust, operate, or service this equipment. Failure to observe this precaution could result in severe bodily injury or loss of life.

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4.1 SYS LED is Red

If the SYS LED is red, the card is not running or there's been a firmware run-time error. Check the WdTout bit for a timeout, and consult the appropriate firmware manual if necessary. If you continue to experience difficulties, contact technical support (refer to Section D.3, Technical Support, for details).



Note

For information on LED flash codes, refer to Section A.3, Fatal Hardware Self-Test Flash Codes.

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A

Error Messages

Appendix Sections:

- Introduction
- HDR Messages
- Fatal Hardware Self-test Flash Codes

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A.1 Introduction

The following errors may be reported during the card's startup self-test. Error messages are posted in the message area (0x0200) of the host interface and can be displayed using the status applications provided with the card.

A.2 HDR Messages

If HDR reads anything other than 0x41, the card hasn't been found. If you continue to experience difficulties, contact technical support (refer to Section D.3, Technical Support, for details).

A.3 Fatal Hardware Self-Test Flash Codes

Fatal failures during startup are accompanied by one of the following 8-bit fault codes, flashed on the HealthLed.

Table 14: LED Flash Codes

Value	Name	Description
01	BITTEST8	Bit test failure of an 8-bit memory range
02	BITTEST16	Bit test failure of a 16-bit memory range
03	BITTEST32	Bit test failure of a 32-bit memory range
04	ADDRTEST8	Address test failure of an 8-bit memory range
05	ADDRTEST16	Address test failure of a 16-bit memory range
06	ADDRTEST32	Address test failure of a 32-bit memory range
07-10	-	Reserved for future fatal start-up errors
11	JTAG_ UNKNOWN	JTAG programming error
12	JTAG_TDOMISMATCH	JTAG output data failed to match expected pattern
13	JTAG_MAXRETRIES	JTAG output data failed to match expected pattern after several attempts
14	JTAG_ILLEGALCMD	JTAG programming file contained an unknown/malformed command
15	JTAG_ILLEGALSTATE	JTAG programming file commanded an illegal TAP state transition
16	JTAG_DATAOVERFLOW	JTAG programming file contained a shift pattern in excess of MAX_LEN * 8 bits
20-FF	-	Reserved for firmware-specific fatal errors

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B

Technical Specifications

Appendix Sections:

- Technical Specifications

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B.1 Technical Specifications

The following tables list the technical specifications for the card.

Table 15: Environmental Specifications

Ambient Conditions	Storage temp:	-40°C to +85°C
	Operating temp:	0°C to 60°C
	Humidity:	5% to 95% non-condensing
Typical Current Draw		600mA
PCI Compliance		Compliant with PCI 2.2; will operate in 2.3 and some 2.1-compliant systems. Refer to Section 1.3, PCI Compatibility, for more information.

Table 16: Network Specifications

Isolation	1000V
Protocol	RS485
Data Rate	All Profibus data rates up to 12Mbps

Table 17: PCI Bus Specifications

Dimensions	Height:	4.2 inches
	Width:	6.875 inches
Resources		PCI Region 0 = 128 bytes of PCI memory PCI Region 2 = 256K of 32-bit PCI memory PCI Region 3 = 32 bytes of 32-bit PCI memory One PCI interrupt

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C

Loading Firmware

Appendix Sections:

- Loading Firmware



Note

This appendix describes how to load the card manually, or how to write your own loader. If you are using a Windows loader provided by SST, the following instructions are not required.

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C.1 Loading Firmware

Firmware modules for the SST-PFB3-PCI card are supplied as .ss3 files, found on the software CD-ROM or on the website at http://www.mysst.com/.

If you are developing a driver for the card or producing a stand-alone embedded application, the following section describes the basic sequence of steps to manually load a module onto the SST-PFB3-PCI card.



Note

For register descriptions, refer to Chapter 3, Hardware Register Details.

C.1.1 Verify Card Presence

To verify the card's presence, follow these steps:

1. Start up your computer.
2. Following release of the backplane reset, wait 2 seconds.
3. Query the BIOS/OS for a PCI card with Vendor ID 0x133D and Device ID 0x0033 (refer to Section 3.2, SST-PFB3-PCI Configuration Space for more information).

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C.1.2 Load and Start the Firmware Module

To load and start the firmware module, follow these steps:

1. Bit-wise AND the value 0x00 to the Control Register.

2. Write the contents of the entire firmware file into shared memory, starting at offset zero (0). The location of shared RAM can be found by reading PCI Base Address 2 from the SST-PFB3-PCI configuration space. Refer to Section 3.2, SST-PFB3-PCI Configuration Space, for details.

3. If the application requires interrupts from the card, write the interrupt level to the HostIrq register and bit-wise OR the value 0x20 (IntEn) to the Control register.

4. Bit-wise OR the value 0xC0 (CardRun and MemEn) to the Control register to start the firmware module.

5. Start a 2-second timeout timer and wait for bit 0 (HostIrq0) in the Control register to set.

6. If the timer expires, the firmware module failed to start. Write zero to the Control register to disable the card. If this problem persists, contact technical support for assistance.

7. Check the load status, as per the firmware manual.

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D

Warranty and Support

Appendix Sections:

- Warranty
- Reference Documents
- Technical Support

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D.1 Warranty

For warranty information pertaining to the card, refer to http://www.mysst.com/warranty.asp.

D.2 Reference Documents

For information on Profibus, refer to one of the following:

- Profibus standard DIN 19 245 parts 1, 2 and 3. Part 1 describes the low-level protocol and electrical characteristics, Part 2 describes FMS, and Part 3 describes DP.
- European Standard EN 50170

D.3 Technical Support

Please ensure that you have the following information readily available before calling for technical support:

- Card type and serial number
- Computer's make, model and hardware configuration (other cards installed)
- Operating system type and version
- Details of the problem you are experiencing: application module type and version, target network, and circumstances that may have caused the problem

D.3.1 Getting Help

Technical support is available during regular business hours by telephone, fax or email from any Woodhead Software & Electronics office, or from www.mySST.com. Documentation and software updates are also available on the Web site.



Note

If you are using the card with a third-party application, refer to the documentation for that package for information on configuring the software for the card.

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Email: supportfr@applicom-int.com

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E

CE Compliance

Appendix Sections:

- CE Compliance

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E.1 CE Compliance

This device meets or exceeds the requirements of the following standard:

- EN 61326:1998 including amendments A1 and A2: - Class A - "Electrical equipment for measurement, control and laboratory use - EMC requirements.

Warning

This is a Class A product. In a domestic environment this product may cause radio interference in which case you may be required to take adequate measures.

Caution

This equipment is neither designed for, nor intended for operation in installations where it is subject to hazardous voltages and hazardous currents.

Marking of this equipment with the symbol CE indicates compliance with European Council Directive 89/336/EEC - The EMC Directive as amended by 92/31/EEC and 93/68/EEC.

Note

To maintain compliance with the limits and requirements of the EMC Directive, it is required to use quality interfacing cables and connectors when connecting to this device. Refer to the cable specifications in the Hardware Guide for selection of cable types.

Note

The backplane voltage supply for this equipment must be delivered as Separated Extra Low Voltage (SELV).

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