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SST-PB3-VME-1 and SST-PB3-VME-2

Hardware Reference Guide

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This document applies to the SST-PB3-VME-1 and SST-PB3-VME-2 interface cards.

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Preface

Preface Sections:

- Purpose of this Guide
- Conventions

Purpose of this Guide

This guide contains technical and product-related information on the SST-PB3-VME-1 and SST-PB3-VME-2 network interface cards.

The SST-PB3-VME-1 consists of a single Profibus network interface (or *channel*), and the SST-PB3-VME-2 comprises two independent interfaces, controlled by independent CPUs. Each CPU executes downloadable application firmware modules, which enable application-level product behavior. For more details, refer to relevant firmware documentation.

Note

An application running on one channel does not affect the performance of other channels, as it does not share memory or processor resources with them.

Note

In this manual, the SST-PB3-VME-1 and SST-PB3-VME-2 will be referred to as the *card*, except where product differences apply.

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 would type into a field
Underlining	indicates a hyperlink
“>” delimiter	indicates how to navigate through a hierarchy of menu selections/options
“0x” or “-H”	indicates a hexadecimal value

Terminology

The following special terms are used throughout this guide:

Card	the SST-PB3-VME-1 or SST-PB3-VME-2 network interface card
Channel	a Profibus network interface on the card
Firmware Module	the embedded software module that gets loaded to the card's memory and runs on the card. This is the operating system of the card, enabling it to respond to commands from the host and manage network communications.
Host	the computer system in which the card is installed
.bin	an unencrypted firmware module for the card
.ss3	an encrypted firmware module for the card

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.

Contents

1
Card Overview

Chapter Sections:

- Warnings and Cautions
- Card Features
- Byte Ordering
- Hardware Description

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.

1.2 Card Features

The card is a VME interface for communication with Profibus networks. Each channel can:

- 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
- Support 16-bit transfers (VME D16) with both VME A24 (standard) and A16 (short I/O) address transfers

Note

For A16 short I/O cycles, registers are located on the odd byte addresses (0x01, 0x03, and so on) and are 8 bits wide.

Note

Applications running on one channel do not affect the performance of other channels and do not share memory or processor resources with other channels.

1.3 Byte Ordering

The card uses Intel-style (little endian) byte ordering for multi-byte entities LSB-low address and MSB-high address. If your host system uses Motorola (big endian) byte ordering (MSB-low address and LSB-high address), you must compensate for byte ordering in software.

The following language macro will compensate for byte ordering in a 16-bit data entity:

```
#define SWAP_WORD (WordData) ((WordData<<8) | (WordData>>8))
```

1.4 Hardware Description

The main features of the card are described in more detail in the following sections.

Figure 1: The SST-PB3-VME-1 and SST-PB3-VME-2 Interface Card

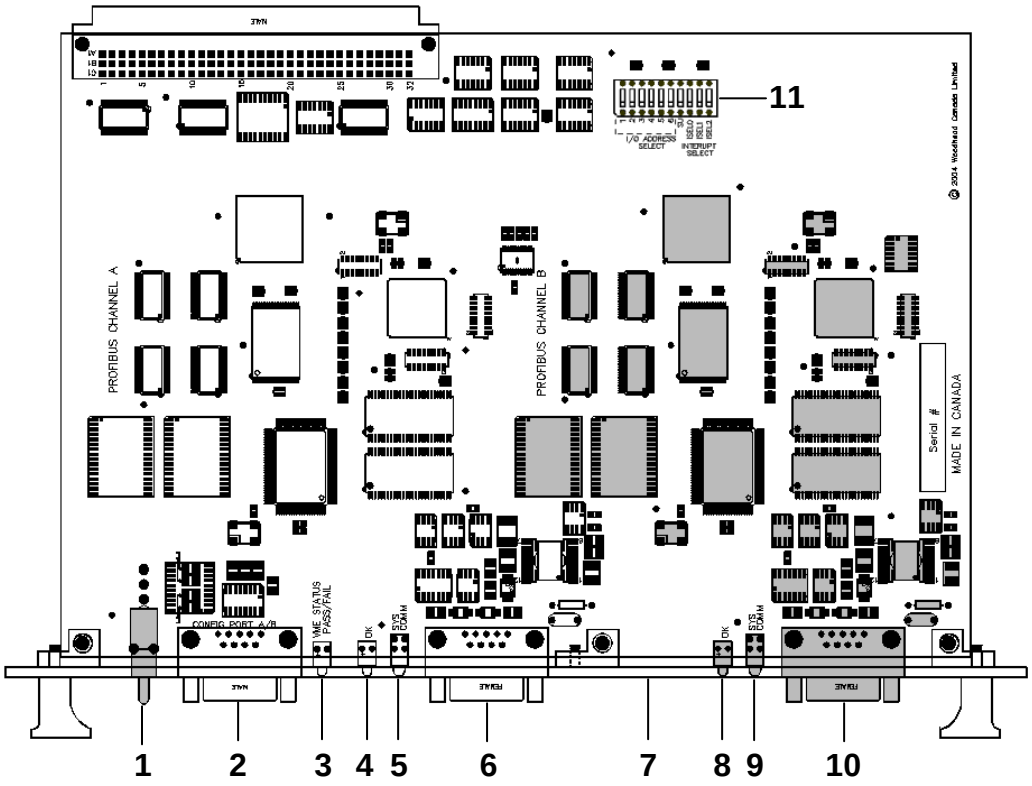


Table 1: Component Names

Component	Description
1	Serial Port Selector Switch
2	Serial Port
3	SysFail LED
4	Channel A Watchdog LED
5	Channel A Comm LED and SYS LED
6	Channel A Profibus Connector
7	Chassis Ground
8	Channel B Watchdog LED
9	Channel B Comm LED and SYS LED
10	Channel B Profibus Connector
11	DIP Switch

Legend

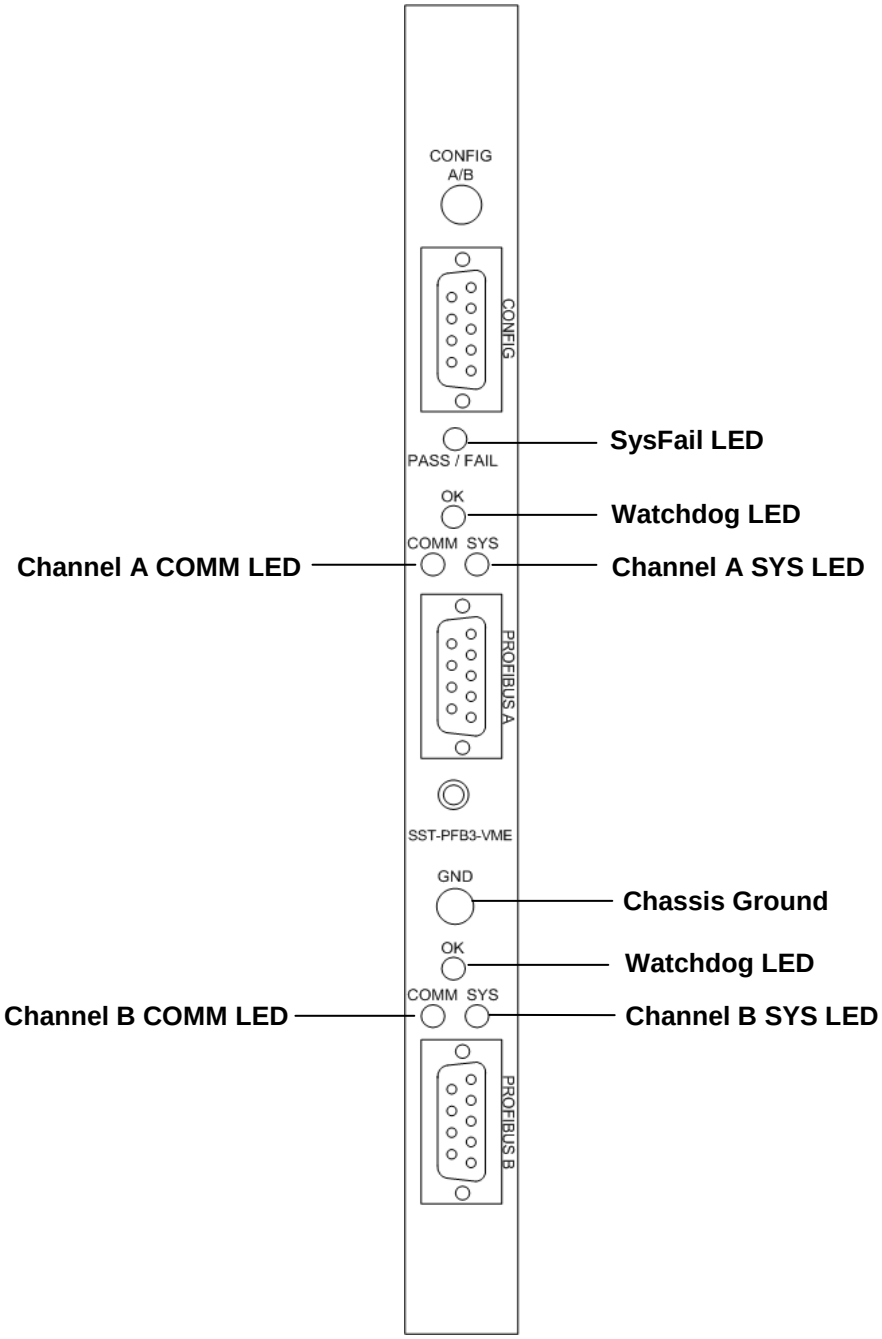
1- and 2-channel

2-channel only

1.4.1 LEDs

The LEDs are illustrated in the following diagram and described below.

Figure 2: Assembled Mounting Bracket –Front View



1.4.1.1 SYSFail LED

The SysFail LED indicates the system's status.

Table 2: SysFail LED Behavior

LED State	Meaning
Green	This is the default power-up state. If the SysFail bit in the VME register is set to a logic "1", the LED will turn red.
Red	An error has occurred in the system. The system fail signal is asserted on the backplane.

1.4.1.2 Watchdog LED

The Watchdog LED indicates that a watchdog timeout has occurred on the channel.

Table 3: Watchdog LED Behavior

LED State	Meaning
Off	This is the default behavior at power up. Indicates that status is good and no timeout has occurred.
Red	A watchdog timeout has occurred

1.4.1.3 Sys LED

The Sys LED indicates the status of each channel on the card.

Table 4: Sys LED Behavior

LED State	Meaning
Off	Refer to the Firmware Reference Guide
Green	Refer to the Firmware Reference Guide
Red	Refer to the Firmware Reference Guide
Amber	This is the default power-up state until firmware is running.

For a list of errors that can occur during power-up, refer to Section A.2.2, Fatal Hardware Self-Test Flash Codes. For runtime Sys LED behavior, refer to the Firmware Reference Guide.

1.4.1.4 Comm LED

The COMM LED indicates the communications status of each channel on the card.

Table 5: COMM LED Behavior

LED State	Meaning
Off	Channel is not online
Solid green	Channel is online and scanning an active network
Flashing green	Channel is online but not scanning
Red	Network error.

Note

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

Selecting the Proper Line Type

Use this table to determine which line type best suits system requirements.

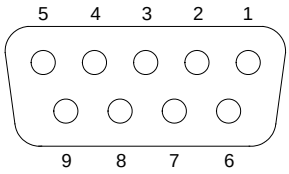
Table 6: Line Types

Baud Rate (bits/s)	Line A Distance (Max)	Line B Distance (Max)	Total Capacitance of all Drop Cables
v19.2k	1200 m**	1200 m**	*15nF
93.75k	1200 m**	1200 m**	*3nF
187.5k	1000 m**	600 m**	*1nF
500k	400 m**	200 m**	*0.6nF
1.5M	200 m**	NA	*0.2nF
3, 6 and 12M	100 m**	NA	*0.05nF
NA = Not Applicable *If using a combination of both line types, divide the lengths shown by two. **This is the sum of all bus segment and drop cable lengths.			

1.4.2 Profibus Connector

The card has one standard Profibus DB9 female connector per channel. Pin numbers are identified in the following figure.

Figure 3: The Profibus DB9 Female Connector



Note

The recommended male connector is the Brad Harrison PA9D01-42 Diagnostic D-Sub 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 2.5, Connecting to a Profibus Network.

1.4.3 DIP Switch (S1)

The card has a 10-position DIP switch that must be set before the card is installed. The DIP switch is used to set the base I/O address used to configure the card.

Figure 4: DIP Switch (Shown in Off Position)

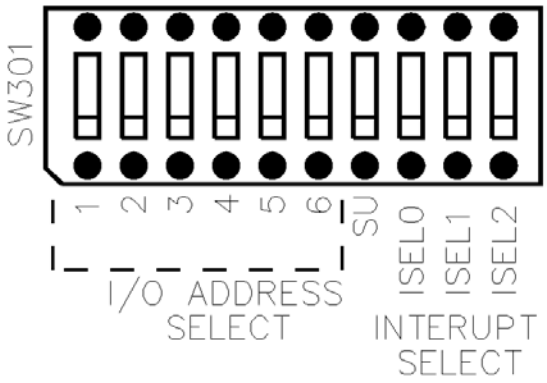


Table 7: Switch Positions and Settings

Position	Purpose
1-6	Short I/O address
7	Access privilege
8-10	Interrupt

1.4.3.1 Setting the Short I/O Base Address

The 1 Kbyte block of short address space occupied by the card is located on a 1 Kbyte boundary at an address selected by positions 1 through 6 of the switch. These switch positions correspond to address bits A15 through A10, respectively. Therefore, when all switches are ON, the base address for Channel A is 0x0000, with the channel responding to short space addresses 0001, 0003, 0005, 0007, and 0009; and the base address for Channel B is 0x200, with the channel responding to short space addresses 0x0201, 0x203, 0x205 and so on.

Table 8: Positions 1 Through 6

Position	Channel A/B Corresponding Address Line
1	A15
2	A14
3	A13
4	A12
5	A11
6	A10

Note

On a 1-channel card, selecting I/O address 0x0 actually uses 0x0 through 0x1FF, and on a 2-channel card, it uses 0 through 0x3FF.

Note

Switches 1-6 represent the channel's short I/O base address.

Table 9: DIP Switch Settings

In the following table, “ON” indicates that the switch is up, and “OFF” indicates that it is down.

Short Address Channel A	Short Address Channel B	SW1-6 (A15-A10)					
		1 A15	2	3	4	5	6 A10
0x0000	0x0200	ON	ON	ON	ON	ON	ON
0x0400	0x0600	ON	ON	ON	ON	ON	OFF
0x0800	0x0A00	ON	ON	ON	ON	OFF	ON
0x0C00	0x0E00	ON	ON	ON	ON	OFF	OFF
0x1000	0x1200	ON	ON	ON	OFF	ON	ON
0x1400	0x1600	ON	ON	ON	OFF	ON	OFF
0x1800	0x1A00	ON	ON	ON	OFF	OFF	ON
0x1C00	0x1E00	ON	ON	ON	OFF	OFF	OFF
0x2000	0x2200	ON	ON	OFF	ON	ON	ON
0x2400	0x2600	ON	ON	OFF	ON	ON	OFF
0x2800	0x2A00	ON	ON	OFF	ON	OFF	ON
0x2C00	0x2E00	ON	ON	OFF	ON	OFF	OFF
0x3000	0x3200	ON	ON	OFF	OFF	ON	ON
0x3400	0x3600	ON	ON	OFF	OFF	ON	OFF
0x3800	0x3A00	ON	ON	OFF	OFF	OFF	ON
0x3C00	0x3E00	ON	ON	OFF	OFF	OFF	OFF
0x4000	0x4200	ON	OFF	ON	ON	ON	ON
0x4400	0x4600	ON	OFF	ON	ON	ON	OFF
0x4800	0x4A00	ON	OFF	ON	ON	OFF	ON
0x4C00	0x4E00	ON	OFF	ON	ON	OFF	OFF
0x5000	0x5200	ON	OFF	ON	OFF	ON	ON
0x5400	0x5600	ON	OFF	ON	OFF	ON	OFF
0x5800	0x5A00	ON	OFF	ON	OFF	OFF	ON
0x5C00	0x5E00	ON	OFF	ON	OFF	OFF	OFF
0x6000	0x6200	ON	OFF	OFF	ON	ON	ON
0x6400	0x6600	ON	OFF	OFF	ON	ON	OFF
0x6800	0x6A00	ON	OFF	OFF	ON	OFF	ON
0x6C00	0x6E00	ON	OFF	OFF	ON	OFF	OFF
0x7000	0x7200	ON	OFF	OFF	OFF	ON	ON
0x7400	0x7600	ON	OFF	OFF	OFF	ON	OFF
0x7800	0x7A00	ON	OFF	OFF	OFF	OFF	ON
0x7C00	0x7E00	ON	OFF	OFF	OFF	OFF	OFF
0x8000	0x8200	OFF	ON	ON	ON	ON	ON
0x8400	0x8600	OFF	ON	ON	ON	ON	OFF
0x8800	0x8A00	OFF	ON	ON	ON	OFF	ON

Short Address Channel A	Short Address Channel B	SW1-6 (A15-A10)					
		1 A15	2	3	4	5	6 A10
0x8C00	0x8E00	OFF	ON	ON	ON	OFF	OFF
0x9000	0x9200	OFF	ON	ON	OFF	ON	ON
0x9400	0x9600	OFF	ON	ON	OFF	ON	OFF
0x9800	0x9A00	OFF	ON	ON	OFF	OFF	ON
0x9C00	0x9E00	OFF	ON	ON	OFF	OFF	OFF
0xA000	0xA200	OFF	ON	OFF	ON	ON	ON
0xA400	0xA600	OFF	ON	OFF	ON	ON	OFF
0xA800	0xAA00	OFF	ON	OFF	ON	OFF	ON
0xAC00	0xAE00	OFF	ON	OFF	ON	OFF	OFF
0xB000	0xB200	OFF	ON	OFF	OFF	ON	ON
0xB400	0xB600	OFF	ON	OFF	OFF	ON	OFF
0xB800	0xBA00	OFF	ON	OFF	OFF	OFF	ON
0xBC00	0xBE00	OFF	ON	OFF	OFF	OFF	OFF
0xC000	0xC200	OFF	OFF	ON	ON	ON	ON
0xC400	0xC600	OFF	OFF	ON	ON	ON	OFF
0xC800	0xCA00	OFF	OFF	ON	ON	OFF	ON
0xCC00	0xCE00	OFF	OFF	ON	ON	OFF	OFF
0xD000	0xD200	OFF	OFF	ON	OFF	ON	ON
0xD400	0xD600	OFF	OFF	ON	OFF	ON	OFF
0xD800	0xDA00	OFF	OFF	ON	OFF	OFF	ON
0xDC00	0xDE00	OFF	OFF	ON	OFF	OFF	OFF
0xE000	0xE200	OFF	OFF	OFF	ON	ON	ON
0xE400	0xE600	OFF	OFF	OFF	ON	ON	OFF
0xE800	0xEA00	OFF	OFF	OFF	ON	OFF	ON
0xEC00	0xEE00	OFF	OFF	OFF	ON	OFF	OFF
0xF000	0xF200	OFF	OFF	OFF	OFF	ON	ON
0xF400	0xF600	OFF	OFF	OFF	OFF	ON	OFF
0xF800	0xFA00	OFF	OFF	OFF	OFF	OFF	ON
0xFC00	0xFE00	OFF	OFF	OFF	OFF	OFF	OFF

1.4.3.2 Access Privileges

The card provides 8-bit access to objects in the short address space and 8- and 16-bit access to objects in the standard address space. The VME master selects whether a particular bus cycle accesses short, standard, extended, or long (extended and long are not used on the card) address spaces, and the type of access, through the use of the address modifier codes. The card decodes these address modifier codes and determines the object to be accessed.

In addition to selecting one of four spaces available on the VMEbus, address modifier codes also select:

- Whether the master is making a supervisory or non-privileged access
- Whether the access is to program or data space (for all but short address space accesses)
- Whether it is to be a single-object or block access

The card can respond to address modifier codes 0x03D, 0x039, 0x02D, and 0x029. Supervisory or non-privileged data accesses may be made to standard address space (0x03D and 0x039 respectively). Supervisory or non-privileged accesses may be made to short address space (0x02D and 0x029 respectively). An access to the card with an address modifier code that is not supported causes a VMEbus error.

Position 7 of the card's DIP switch selects whether only supervisory accesses or both supervisory and non-privileged accesses are permitted. The following table shows the switch positions.

Table 10: Switch S1-Position 7

Position	Permitted Access
ON	Non-privileged
OFF	Supervisory only

Caution

If the host makes a non-privileged access to the card when this switch is in the supervisory only position, a VMEbus error occurs.

1.4.3.3 Interrupts

The card can generate and acknowledge interrupts on any one of VMEbus interrupt lines 1 through 7 (or none). The interrupt level is selected by positions 8 through 10 of switch S1, as detailed below:

Table 11: Switch Positions 8 through 10

8	9	10	Interrupt Level
ON	ON	ON	None
OFF	ON	ON	1
ON	OFF	ON	2
OFF	OFF	ON	3
ON	ON	OFF	4
OFF	ON	OFF	5
ON	OFF	OFF	6
OFF	OFF	OFF	7

The card interrupter is a ROAK (release-on-acknowledge) type. The interrupt request is removed from the VMEbus when the card responds to an interrupt acknowledge. However, the Card-IRQ bit in the Control register remains set until cleared by the host.

1.4.3.4 Default Switch Settings

The card is shipped with all switches ON. This corresponds to:

- Short I/O address 0000
- Supervisory and non-privileged access permitted
- Interrupts disabled

2
Hardware Installation

Chapter Sections:

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

2.1 System Requirements

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

- A controller that conforms to VMEbus spec VME64 (VITA 1.1 1997)
- Minimum 256K window in host memory map
- The ability to generate and accept 16-bit data transfers (VME D16) with both VME A24 standard address and VME A16 short I/O address transfers
- If interrupts are required, you will need a physical interrupt. On the 2-channel card, this will be shared between channels.

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 or bracket.
- When the card isn't in your computer, always store it in its protective anti-static bag.

2.3 Installing the Card

This section describes the steps necessary to configure and install the card in your computer.

To install the card in your computer:

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 and anti-static bag, being careful not to touch any of the connectors or pins.
6. Set the DIP switch to the selected short I/O address (refer to Section 1.4.3.1, Setting the Short I/O Base Address, for details).
7. Firmly press the card on to the VME connector.
8. Secure the card using the standoffs provided.
9. Re-connect any items unplugged in Step 3.
10. Replace the computer cover.

2.4 Downloading Firmware

For instructions on downloading firmware to the card, refer to Section C.1, Loading a Firmware Module.

2.5 Connecting to a Profibus Network

This section provides connection, termination, power and grounding details.

2.5.1 Connecting the DB9

The following table describes how to connect the Profibus DB9.

Table 12: DB9 Instructions

DB9 Pin Description	DB9 Pin #	DB9 Termination with Card
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	

2.5.2 Termination

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

2.5.3 Power

Profibus 5 VDC power is supplied by the channel.

2.5.4 Grounding

Refer to the Profibus network documentation for grounding directions.

3
Hardware Register Details

Chapter Sections:

- Introduction
- Host Register Layout
- Short I/O Registers

3.1 Introduction

This chapter provides technical hardware information. The following information is intended for programmers familiar with hardware-level PC programming.

3.2 Host Register Layout

Each channel has its own set of registers, located in short I/O space. The base I/O address is set via the switch.

Note

Upon card power up, or after a physical reset from the system, it typically takes 1 second for the channel to initialize (though it is recommended that applications wait up to 2 seconds). 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 13: Host Register Layout

The following “offsets” are offsets from the base address. A capital “X” means that the bit is reserved (writing to it will result in undefined behavior).

Offset	Register Name	Bit Name							
		7	6	5	4	3	2	1	0
01H	Control	CardRun (R/W)	MemEn (R/W)	IntEn (R/W)	WdTout (R)	HostIrq1 (R/W)	HostIrq0 (R/W)	CardIrq1 (R/W)	CardIrq0 (R/W)
03H	AddrMatch (R/W)	AM23	AM22	AM21	AM20	AM19	AM18	AM17	AM16
05H	BankAddress	BA19 (R)	BA18 (R)	BA17 (R/W)	BA16 (R/W)	BA15 (R/W)	BA14 (R/W)	BA13 (R/W)	BA12 (R)
07H	WinSize (R/W)	WS19	WS18	WS17	WS16	WS15	WS14	WS13	WS12
09H	HostIrqID (R/W)	IrqLevel ID							
0AH	LedReg (R)	X	X	X	X	CommRed	CommGrn	SYSRed	SysGrn
0CH	Debug (R/W)	HWReset	X	X	JTAGEN	CPUTRST	CPUTMS	CPUTDI	CPUTCK
0FH	HDR (R)	HostDataReg (written by CPU)							
11H	VMEReg (R/W)	X	X	X	X	X	X	X	SysFail
12H - 1FH		Reserved							

3.3 Short I/O Registers

The card contains the following short I/O registers.

3.3.1 Control Register

This register is a group of control and status bits.

Table 14: 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

Each channel has four interrupt flags, two for use in each direction. Setting CardIrq1 or CardIrq0 generates an interrupt to the card with the relevant flag set. When HostIrq1 OR HostIrq0 is '1' and IntEn is '1', the card drives the IRQ pin (as set by the DIP switch).

One flag could be used for a command interface, and another for changing I/O data.
The firmware module dictates how these flags are used. If the module uses only one flag, it will be Flag 0.

Table 15: Control Register Bit Descriptions

Bit Name	Description
CardRun	This bit controls and indicates whether or not the card's processor is running. • When this bit is 0, the processor is halted. • When this bit is 1, the processor is running normally. • When this bit is 1, and watchdog has timed out, processor is halted. 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 AddrMatch Register.
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

3.3.2 AddrMatch Register

This register controls the base memory address of the channel in host memory space.

Each channel may be at a different address. If two channels are used at the same address, use MemEn to turn on one channel at a time.

Caution

Setting two channels or two cards to the same address and enabling the channels could damage the card permanently.

Table 16: AddrMatch Register Settings

Bit	7	6	5	4	3	2	1	0
Name	AM23	AM22	AM21	AM20	AM19	AM18	AM17	AM16
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W
Reset	0	0	0	0	0	0	0	0

Table 17: AddrMatch Register Values

Bit and Value								Hex	Address
AM23	**AM22**	**AM21**	**AM20**	**AM19**	**AM18**	**AM17**	**AM16**		
0	0	0	0	0	0	0	0	0x00	0x000000
0	0	0	0	0	0	0	1	0x01	0x010000
0	0	0	0	0	0	1	0	0x02	0x020000
1	0	1	0	0	1	1	0	0xA6	0xA60000
1	0	1	0	1	0	0	0	0xA8	0xA80000
1	1	1	1	1	1	1	1	0xFF	0xFF0000

Table 18: AddrMatch Register Bit Descriptions

Bit Name	Description
AM23 – AM16	AM23-AM16 represent the upper address match required to decode memory. These bits select the base memory address, from 0x00 to 0xFF0000. For example, writing 0xD0 to this register selects 0xD00000 as the memory base address. Refer to Table 17: AddrMatch Register Values for more details. If a 16K window size is selected, AM17-AM16 are ignored and 16K boundaries are used for the memory address. As a result, only even-window boundaries may be chosen. The card could be set to 0xD0000 or 0xD4000 but 0xD2000 would be invalid. Refer to Table 22: WinSize Register Values for information on bit usage with other window sizes.

3.3.3 Bank Address Register

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

Table 19: Bank Address Register Values

In this table, the default values are highlighted.

Bit and Value								Window Size and Bank Number					
BA19	BA18	BA17	BA16	BA15	BA14	BA13	BA12	8k	16k	32k	64k	128k	256k
x	x	0	0	0	0	0	x	0	0	0	0	0	0
x	x	0	0	0	0	1	x	1	0	0	0	0	0
x	x	0	0	0	1	0	x	2	1	0	0	0	0
x	x	0	0	0	1	1	x	3	1	0	0	0	0
x	x	0	0	1	0	0	x	4	2	1	0	0	0
x	x	0	0	1	0	1	x	5	2	1	0	0	0
x	x	0	0	1	1	0	x	6	3	1	0	0	0
x	x	0	0	1	1	1	x	7	3	1	0	0	0
x	x	0	1	0	0	0	x	8	4	2	1	0	0
x	x	0	1	0	0	1	x	9	4	2	1	0	0
x	x	0	1	0	1	0	x	10	5	2	1	0	0
x	x	0	1	0	1	1	x	11	5	2	1	0	0
x	x	0	1	1	0	0	x	12	6	3	1	0	0
x	x	0	1	1	0	1	x	13	6	3	1	0	0
x	x	0	1	1	1	0	x	14	7	3	1	0	0
x	x	0	1	1	1	1	x	15	7	3	1	0	0
x	x	1	0	0	0	0	x	16	8	4	2	1	0
x	x	1	0	0	0	1	x	17	8	4	2	1	0
x	x	1	0	0	1	0	x	18	9	4	2	1	0
x	x	1	0	0	1	1	x	19	9	4	2	1	0
x	x	1	0	1	0	0	x	20	10	5	2	1	0

Bit and Value								Window Size and Bank Number					
BA19	BA18	BA17	BA16	BA15	BA14	BA13	BA12	8k	16k	32k	64k	128k	256k
x	x	1	0	1	0	1	x	21	10	5	2	1	0
x	x	1	0	1	1	0	x	22	11	5	2	1	0
x	x	1	0	1	1	1	x	23	11	5	2	1	0
x	x	1	1	0	0	0	x	24	12	6	3	1	0
x	x	1	1	0	0	1	x	25	12	6	3	1	0
x	x	1	1	0	1	0	x	26	13	6	3	1	0
x	x	1	1	0	1	1	x	27	13	6	3	1	0
x	x	1	1	1	0	0	x	28	14	7	3	1	0
x	x	1	1	1	0	1	x	29	14	7	3	1	0
x	x	1	1	1	1	0	x	30	15	7	3	1	0
x	x	1	1	1	1	1	x	31	15	7	3	1	0

* x = don’t care

Table 20: Bank Address Register Bit Descriptions

Bit Name	Description
BA17-13	These bits determine shared addressing sizes and ranges. The power-on state is 0.

3.3.4 WinSize Register

This register controls the window size by masking off the AM19-AM12 and BA19-12 bits in the AddrMatch and Bank Address registers. Table 22, WinSize Register Values, maps the WS bit values required for each valid window size.

Table 21: WinSize Register Settings

Bit	7	6	5	4	3	2	1	0
Name	WS19	WS18	WS17	WS16	WS15	WS14	WS13	WS12
Read/Write	R	R	R/W	R/W	R/W	R/W	R/W	R
Reset	0	0	1	1	1	1	1	1

Table 22: WinSize Register Values

In this table, the default values are highlighted.

Token	Bit and Value								Window Size	Description
	WS19	WS18	WS17	WS16	WS15	WS14	WS13	WS12		
A	0	0	0	0	0	0	0	1	8K	AM23-AM16 used, BA19-BA13 used, BA12 ignored
B	0	0	0	0	0	0	1	1	16K	AM23-AM16 used, BA19-BA14 used, BA13-BA12 ignored
C	0	0	0	0	0	1	1	1	32K	AM23-AM16 used, BA19-BA15 used, BA14-BA12 ignored
D	0	0	0	0	1	1	1	1	64K	AM23-AM16 used, BA19-BA16 used, BA15-BA12 ignored
E	0	0	0	1	1	1	1	1	128K	AM23-AM17 used, AM16 ignored BA19-BA17 used, BA16-BA12 ignored
F	0	0	1	1	1	1	1	1	256K	AM23-AM18 used, AM17-AM16 ignored BA19-BA18 used, BA17-BA12 ignored

Table 23: WinSize Register Bit Descriptions

Bit Name	Description
WS19-WS12	WS19-WS12 represent the window size, according to Table 22: Winsize Register Values. • Writing any value other than those above has no effect The size of the memory window affects the number of banks required to access all memory. Refer to Table 19: Bank Address Register Values, for more information.

3.3.5 HostIrq ID Register

This register contains an 8-bit IrqLevel ID value written by the host to distinguish the card from other devices that might share the same IRQ level (as set by the DIP switch). This ID is placed on the VME bus during an interrupt acknowledge cycle by the device that generated an IRQ to the host.

3.3.6 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 24: 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 25: 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

3.3.7 Debug Register

This register is reserved for future use.

3.3.8 HDR Register

This HDR register can be used to pass 1 byte of data from card to host. The use of this register is determined by firmware/boot code, and boot code power-on reset value is 0x41.

3.3.9 VMEReg Register

The VME register is used for VME-specific functions and only contains the VME SysFail bit at this time.

The Sysfail LED is directly controlled by the SysFail bit in this register. If this bit is set to a logic '1', the LED will turn red, which indicates a VME system error. It also will assert the VME System failure signal on the backplane.

4 Troubleshooting

Chapter Sections:

- COMM LED is Red
- Memory Conflict
- General Troubleshooting

For a list of hardware-related errors that can be generated by the card, refer to Section A.2, Card Errors.

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.

4.1 COMM LED is Red

This section describes strategies for troubleshooting a red COMM LED.

Note

For information on LED flash codes, refer to Section A.2.2, Fatal Hardware Self-Test Flash Codes.

If the COMM LED is red, the channel is not running or there has been a firmware run-time error. Check the WdTout bit (refer to Table 15, Control Register Bit Descriptions) to determine whether or not there has been a watchdog timeout, and consult the appropriate firmware manual if necessary. If you continue to experience difficulties, refer to Section 4.3, General Troubleshooting.

Note

The firmware must be reloaded to restart the channel.

4.2 Memory Conflict

If a memory conflict is detected, examine the resource allocations in the operating system. If the operating system does not manage resources, review the requirements of the other hardware installed in the machine to select a non-conflicting memory window. If you continue to experience difficulties, refer to Section 4.3, General Troubleshooting.

4.3 General Troubleshooting

If you experience problems with the card:

1. Check the website at http://www.molex.com/ for technical notes.
2. Check the FAQs on the website.
3. Refer to Section E.2, Technical Support.

A
Boot Code Operation

Appendix Sections:

- Serial Port
- Card Errors

A.1 Serial Port

The card's serial port allows the network configuration file and firmware module to be transferred to flash, and for named firmware to start automatically on reset.

The following sections describe the serial port's operation.

A.1.1 Connecting to the Serial Port

The serial cable for a standard PC COM port must have lines 2 and 3 swapped. No handshaking is required. Pins 2 and 3 are wired the same as a PC 9-pin COM port.

Connect to the serial port using any communication software (such as Hyper terminal). The serial port defaults to 115200 with no parity, 8 data bits and 1 stop bit. Baud rates from 9600 to 115 Kbaud can be set in Boot.ini. Pressing any key within 3 seconds (default value) of a channel reset will enter serial communication mode.

Serial Port Commands

The following table defines the allowed commands.

Table 26: Serial Port Commands

Command	Description
Help	The Help command can be accessed by entering an empty command, '?', 'h' or 'help' at the command prompt.
ID	The ID command lists card information. Refer to Figure 5, ID Command.
DIR	The DIR command displays the contents of the flash file system, including file names, dates, sizes and read-only attributes.
Run <filename>	The Run command takes a single parameter, specifying a file to be run. If the file parameter is omitted, or the file is not a valid firmware file, the run operation will fail; otherwise, the specified file will be transferred to local RAM and executed. Quotation marks are used to enclose a <filename> parameter containing spaces.
Set [Key=value]	The Set command configures the variables found in Boot.ini. Typing Set by itself lists all key/value pairs contained in Boot.ini. Typing Set with a key=value argument, when that key is supported by Boot.ini, will write a key/value pair to Boot.ini; otherwise, the operation will fail. Refer to Figure 6, Set Command.
Del <filename>	The Del command takes a single parameter, specifying a file to be erased. If the file is read-only, the delete operation will fail, otherwise, the file will be erased. Quotation marks are used to enclose a <filename> parameter containing spaces.
Ry	The Ry command receives a file, including its name, date and size, using the Y-modem protocol.
Sy <FileName>	The Sy command sends a file, using the Y-modem protocol. The file name must be specified on the command line, or the Sy command will fail. Quotation marks are used to enclose a <filename> parameter containing spaces.
Reset	The Reset command resets the CPU and causes the boot code to re-execute the start-up sequence.
Ren <filename> <newname>	The Ren command renames the specified file to the specified new name. If the filename is not found, or the file specified is Boot.ini, the rename command will fail. Quotation marks are used to enclose a <filename> or <newname> parameter containing spaces.
Ver [filename]	The Ver command reports the boot code version.

Note

If you are using the card in a VME Controller or PLC, the AutoRun variable can be set to automatically run the firmware when the channel is reset. I.e., `set AutoRun = <firmwarefilename.ss3>`.

Figure 5: ID Command

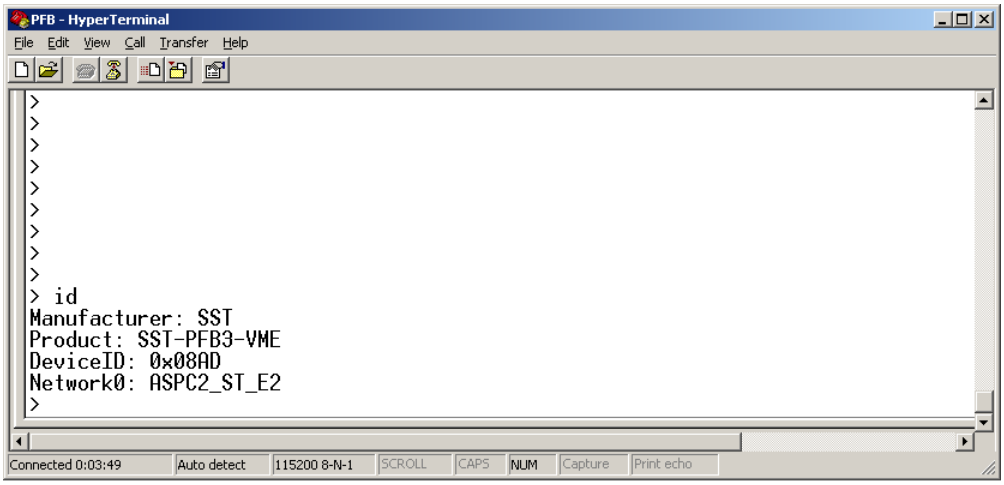
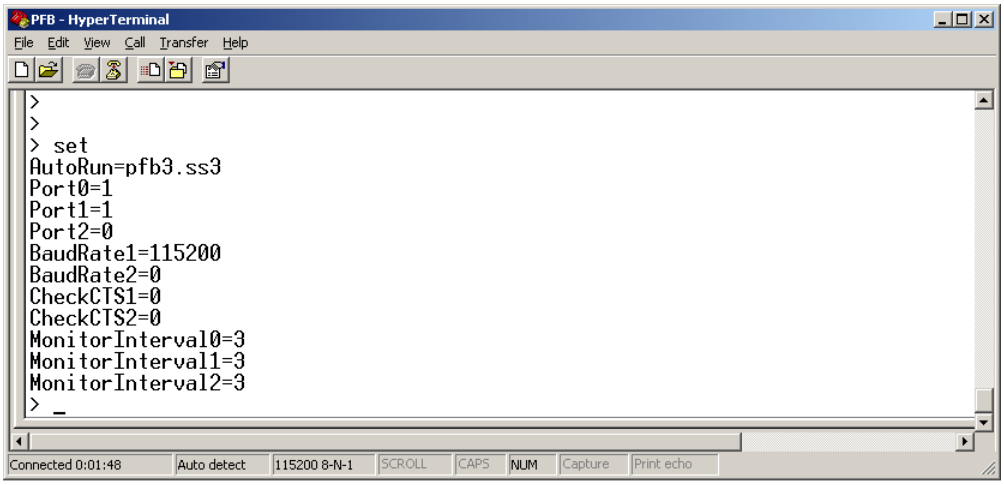


Figure 6: Set Command



A.1.2 Loading Configuration Files to the Flash File System

The boot code allows you to add or update files on the Flash File System via the Ry command (refer to Table 26, Serial Port Commands, for more details).

Note

Version 1.12 or greater of the firmware module (PFB3.SS3) accepts .bss files for configuration. The file must be named “config.bss” to be recognized by the firmware.

Note

Firmware module versions prior to 1.12 require that you generate the .bss file and then use the “wabfview.exe” configuration tool to create a “bincfg” file. The “bincfg” file is then loaded to the flash file system and used by the firmware module to configure the card.

A.2 Card Errors

The following errors may be reported during the card's startup self-test.

A.2.1 HDR Messages

If HDR reads anything other than 0x41, the card hasn't been found. To fix the problem, follow these steps:

1. Double-check the switch settings and make sure they match up with the I/O driver port address setting in the software application.
2. Make sure you have waited up to 2 seconds after the channel reset has been negated before trying to access it.
3. Check for an I/O conflict.
4. If you continue to experience difficulties, please refer to Section 4.3, General Troubleshooting.

Note

The default value for boot code is 0x41, but this can be changed by the firmware. Refer to the Firmware Reference Guide for more details.

A.2.2 Fatal Hardware Self-Test Flash Codes

Fatal failures during startup are accompanied by an 8-bit fault code, flashed on the COMM LED. The fault code will be output MSB first, with a 1 (one) bit shown as a green LED, and a zero (0) bit shown as a red LED. This will occur for a period of 900ms, followed by 100ms of off time. The LSB will be followed by an additional 1000ms of off time, after which the sequence will repeat.

The following table describes each possible fault code. If you see any of these codes, please contact Technical Support.

Table 27: LED Flash Codes

Value	Name	Description
0x01	BITTEST8	Bit test failure of an 8-bit memory range
0x02	BITTEST16	Bit test failure of a 16-bit memory range
0x03	BITTEST32	Bit test failure of a 32-bit memory range
0x04	ADDRTEST8	Address test failure of an 8-bit memory range
0x05	ADDRTEST16	Address test failure of a 16-bit memory range
0x06	ADDRTEST32	Address test failure of a 32-bit memory range
0x07-0x09	-	Reserved for future fatal start-up errors
0x10	JTAGFAILED	JTAG download failed
0x11	JTAG_ ERROR_UNKNOWN	JTAG programming error
0x12	JTAG_TDOMISMATCH	JTAG output data failed to match expected pattern
0x13	JTAG_MAXRETRIES	JTAG output data failed to match expected pattern after several attempts
0x14	JTAG_ILLEGALCMD	JTAG programming file contained an unknown/malformed command
0x15	JTAG_ERROR_ILLEGALSTATE	JTAG programming file commanded an illegal TAP state transition
0x16	JTAG_ERROR_DATAOVERFLOW	JTAG programming file contained a shift pattern in excess of MAX_LEN * 8 bits
0x20-0xFF	-	Reserved for firmware-specific fatal errors

B
Technical Specifications

Appendix Sections

- Technical Specifications

B.1 Technical Specifications

The following tables list the technical specifications for the card.

Table 28: Environmental Specifications

Ambient Conditions	Storage temp:	-25°C to 70°C
	Operating temp:	0°C to 50°C
	Operating Humidity:	5% to 90% non-condensing
Typical Current Draw		+5V +/- 5% 1-channel card: 800 mA 2-channel card: 1400 mA
VME Compliance		VMEBus Spec VME64-compliant (Vita 1.1 1997)

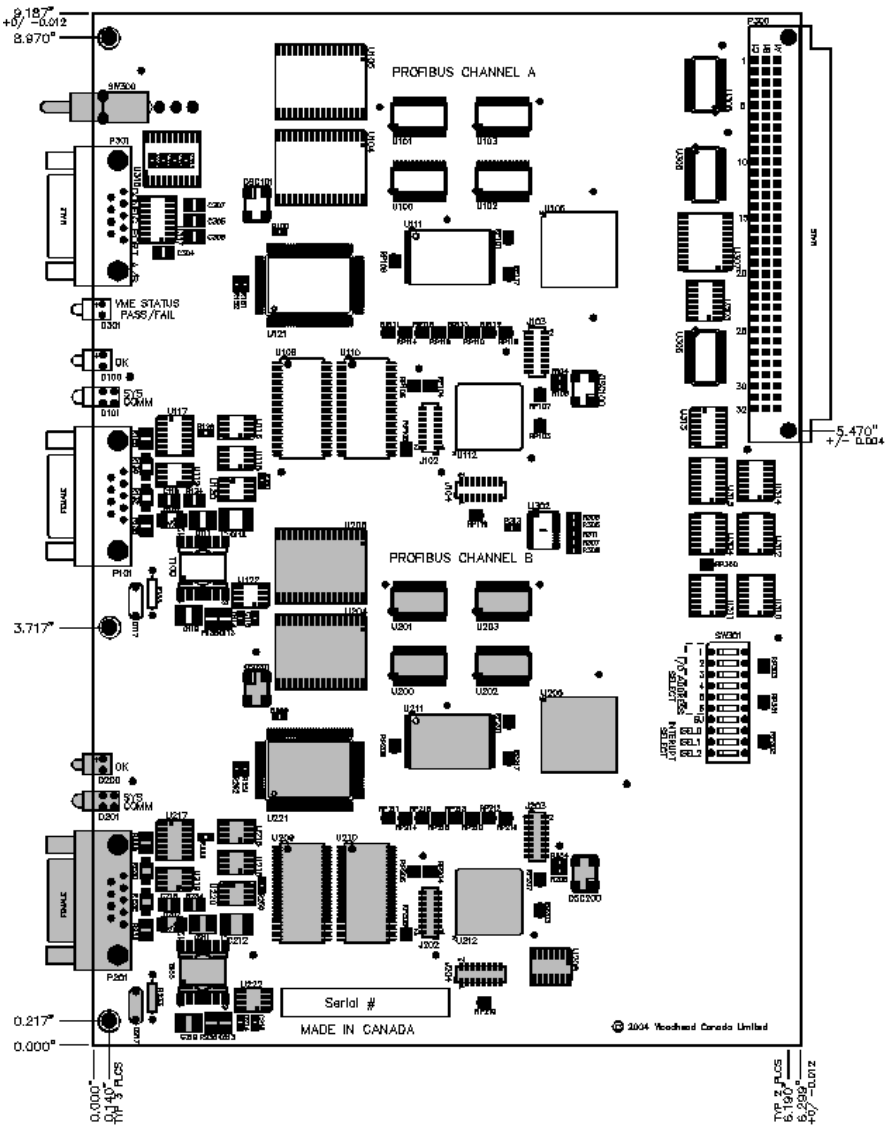
Table 29: Network Specifications

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

Table 30: VME Bus Specifications

Size	Double-height (6U) module
Resources	(memory) 256k x 16-bit window per channel, located anywhere in VME standard space (I/O) 32-byte range per channel, located on a 1k boundary determined by the DIP switch settings. Refer to Section 1.4.2.1.

Figure 7: Card Dimensions



Legend

- 1- and 2-channel
- 2-channel only

For information on card components, refer to Section 1.4, Hardware Description.

C
Loading a Firmware Module

Appendix Sections:

- Loading a Firmware Module

Note

This appendix describes how to load the card manually, or how to write your own loader.

C.1 Loading a Firmware Module

Firmware modules for the card are supplied as .ss3 files, found on the software CD-ROM or on the website at http://www.molex.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 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 at least 1 second (though 2 is recommended).
3. Verify a Control Register value of 0x41.
4. If HDR reads anything other than 0x41, the card is still in Reset or hasn't been found. Double-check that the Short I/O address matches the DIP Switch setting. If you continue to experience difficulties, contact technical support (refer to Section E.2 Technical Support, for details).

C.1.2 Check for Conflicting RAM

Before the shared memory on the card can be safely enabled, it must be determined that no other devices in the system are using the intended memory address range.

Note

Any task switching, interrupts or processes should be disabled during this procedure.

To check for conflicting RAM, follow these steps:

1. Write zero (0) to the Control Register to disable the card.
2. Read a word from the target memory window and save it.
3. Write 0xAA55 to the target address.
4. Read the target address. It should not contain 0xAA55.
5. If 0xAA55 is read, a conflict exists. Perform the following steps:
   - Restore the saved value to the target address
   - Abort the load procedure
   - Examine the resource allocations in your operating system. If your operating system does not manage resources, review the requirements of the other hardware installed in your machine to select a non-conflicting memory window. If you continue to experience difficulties, contact technical support (refer to Section E.2, Technical Support, for details).

Note

If you are unsure of the system's memory usage, you may want to do a full memory window verification to ensure that there are no memory conflicts.

C.1.3 Test Card RAM

To test the card RAM, follow these steps:

1. Write the upper byte of the desired 23-bit base address to the AddrMatch Register.
2. Write the desired window size to the WinSize register (refer to Section 3.3.4, WinSize Register, for details). The default value in the window size is 0x3F.
3. Write 0x40 (MemEn) to the Control Register at offset 1.
4. Fill the shared memory with a test pattern.

Note

SST recommends a test pattern with a unique value for each word in a given bank. In C language, this could be:

```
~offset + bank.
```

5. Repeat steps 3-4 for all memory banks.
6. Verify the test pattern.

C.1.4 Load and Start the Firmware Module

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

1. Write the contents of the entire firmware file into shared memory, starting at bank zero (0), offset zero (0).

2. If the application requires interrupts from the card, write the interrupt ID to the IrqID Register and bit-wise OR the value 0x20 (IntEn) to the Control Register.

3. Bit-wise OR the value 0x80 (CardRun) to the Control Register to start the firmware module.

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

5. 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.

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

D
Regulatory Compliance

D.1 CE Compliance

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

- EN 61326:1998 including amendments A1 and A2: - “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).

D.2 Rep. of Korea Compliance

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

- Technical Requirements for Electromagnetic Susceptibility - RRA Notification 2011-17 (July 05,2011)

- Technical Requirements for Electromagnetic Interference – RRA Notification 2011-18 (July 05, 2011)

User Notice

Classification	User Notice
Class A Device (Device for use in a commercial, industrial or business environment)	This device complies with Class A requirements and sellers and users should be cautious of this. This device is intended for use in any environment except residential areas.

사용자안내문

기종별	사용자안내문
A급 기기 (업무용 방송통신기자재)	이 기기는 업무용(A급) 전자파적합기기로서 판매자 또는 사용자는 이 점을 주의하시기 바라며, 가정 외의 지역에서 사용하는 것을 목적으로 합니다.

E

Warranty and Support

Appendix Sections:

- Warranty
- Technical Support

E.1 Warranty

For warranty information, refer to
http://www.molex.com/images/woodhead/woodhead_limited_warranty.pdf

E.2 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: firmware module type and version, target network and circumstances that may have caused the problem

E.2.1 Getting Help

Technical support is available during regular business hours by telephone, fax or email from www.Molex.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.

North America

Canada:
Tel: +1-519-725-5136
Fax: +1-519-725-1515
Email: ic.support.eu@molex.com

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For the most current contact details, please visit http://www.molex.com.