PCI302

smar

FIRST IN FIELDBUS

OPERATION & MAINTENANCE INSTRUCTIONS MANUAL

Process Control Interface

MAR / 03

PCI302

Version
1.1 / 1.2 / 2.0

PCI 302OMME

smar

web: www.smar.com

Specifications and information are subject to change without notice.
For the latest updates, please visit the SMAR website above.

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Introduction

The **PCI302** (*Process Control Interface*) is a high performance Fieldbus interface that combines advanced process control with multiport communications management.

PCI302 is a card designed to work inside industrial or commercial PCs. Featuring independent Fieldbus H1 (31.25Kbps) master ports and powered by a 32-bit RISC CPU. Directly connected to the PC bus (through PCI bus or ISA bus), it provides a fast communication path between the Fieldbus and PC applications.

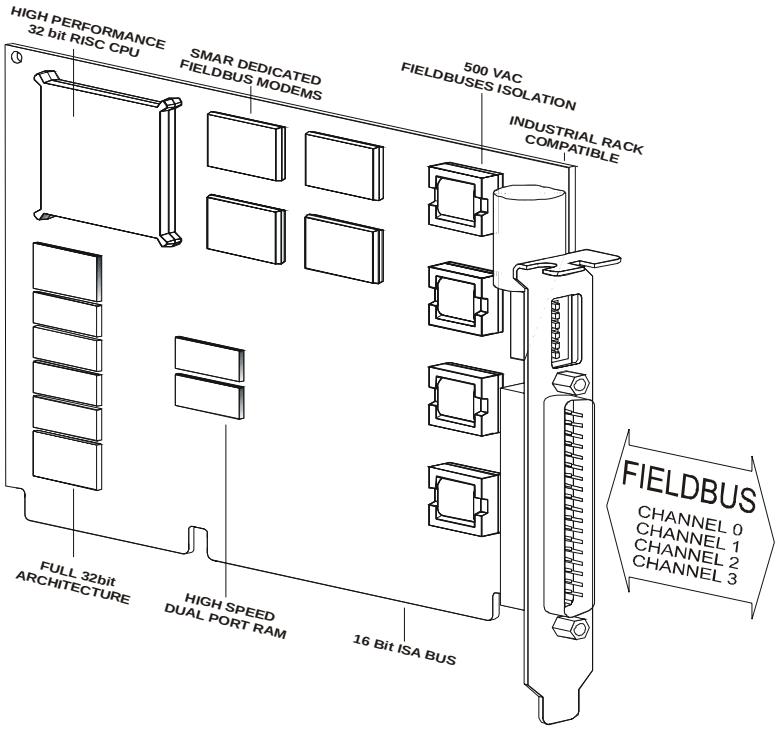


Figure 1 - Perspective View of a PCI302 card Version 1.1x.

Part Number
PCI302 Process Control Interface

General Features

Powerful Hardware Architecture
The 32-bit super-scalar RISC CPU and dual port memory based architecture ensure high processing power to PCI302. All communication and process control tasks are internally executed, keeping the PC free to implement the best HMI and the Smar PCI OLE Server.

Open Software Architecture
The PCI OLE Server interconnects one or more simultaneous client applications with Fieldbus interfaces. Clients can access the server located on the same PC or on a remote through LAN/WAN. This enables the same distributed Fieldbus database to be widely shared among workstations.

Easy Installation & Expansibility
The PCI302 PCI (Peripheral Component Interconnect) bus version can be easily installed. (PCI bus specification v2.1) (*). Unique hardware design allows the installation of up to eight PCI302 cards (depending on the number of free PCI bus slots) on one PC bus. No board configuration is necessary for the installation. The PC's plug and play system allocates the addressing resources for the board operation.

The PCI302 ISA bus version can also be easily installed on the ISA or EISA bus of any AT-compatible PC. Unique hardware design allows the installation of up to eight PCI302 cards (depending on the number of free ISA slots) on one PC bus, sharing the same I/O port and interrupt.

Fieldbus Link Master
The PCI302 can manage each of its Fieldbus ports as a link master device.

Process Supervision
Exploring advanced communication features of the Fieldbus protocol, the PCI302 can be used as an efficient supervision interface. The function block parameters of field devices can be monitored (cyclic or acyclic reads) or actuated (acyclic writes) through the PCI302 supervision services. HMIs like supervisory systems and configurators, running on the host PC, can interface to the PCI302s, keeping complete hardware and Fieldbus protocol transparency.

Flexible Bridge
The PCI302 open software architecture enables data sharing between independent Fieldbus ports.

Upgradeable Firmware
PCI302's firmware (on-board executable program) remains in FLASH memory. As these memories are in-circuit programmable, the user can change the PCI302 firmware (upgrade software release, change protocol, etc.) without removing components - just run the FBTools utility and everything is done by software.

Isolated Passive Fieldbus MAU
Its galvanically isolated Medium Attachment Unit is passive (not powered by the Fieldbus network). This enables the user to plug any PCI302 port on a fully loaded Fieldbus.

Description

At both, hardware and software levels, the PCI302 card was designed to handle all necessary communication and process control tasks, minimizing the PC overload.

Typical Applications
The PCI302 can be used in a wide range of Fieldbus-based applications. The next figure shows a generic Field Control System from which many real applications can be derived.

***** See note page 16.

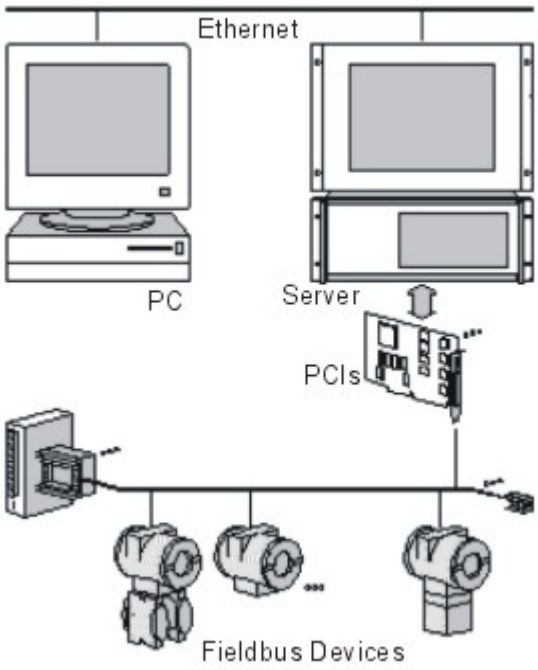


Figure 2 - Fieldbus Typical Application using PCI302 cards.

Remarks
• 1 to 8 PCI302 cards can be installed in the same PC Server. • Up to 4 ports in each PCI302 Fieldbus line connected. • Redundant operation (1 to 4 PCI302s on each Fieldbus, distributed on different PCs). • Fieldbus configuration, management and supervision. • Network access via Ethernet (Client/Server architecture via DCOM).

Hardware Overview

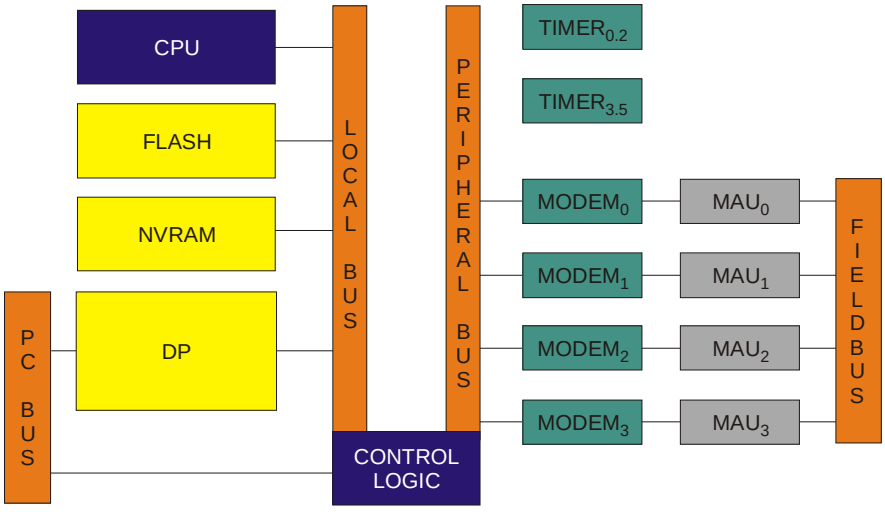


Figure 3 – PCI302 Hardware Diagram.

CPU (Central Processing Unit)
A 32-bit super-scalar RISC processor that handles all communication and control tasks performed by the PCI302.

DP (Dual Port RAM)
16-bit data memory shared with the PC through the PC bus. Both PCI302 and PC CPUs have simultaneous access to this memory, providing an efficient communication path between them.

Control Logic
Internal control logic to handle the CPU access to all devices (RAM, NVRAM, FLASH, TIMERs, MODEMs), and the DP arbitration mechanism.

PC Bus (Computer Expansion Bus)
A PCI bus (specification v2.1) (*), 16-bit ISA or 32-bit EISA bus, on which the PCI302 cards are plugged. It provides power and PC access to the card.

Local Bus (High Speed Wide Bus)
A 32-bit internal bus that interconnects the CPU to fast devices (RAM, NVRAM, FLASH and DP).

Peripheral Bus
8-bit peripheral bus used by the CPU to connect to slow devices (TIMERs and MODEMs).

$Timer_{0-5}$
8/16-bit 3-channel universal timers, used by the PSM-Real Time Kernel as a time base for task switching and the Fieldbus communication timing.

$Modem_{0-3}$ (Fieldbus Communications Controller)
The Smar Fieldbus chips that serialize the data communication at a 31.25Kbps baud rate. It is ISA-SP50 Fieldbus Physical Layer Specification compliant.

MAU_{0-3} (Fieldbus Medium Attachment Unit)
A signal conditioning and isolation circuit that adapts the digital signal (0/5V) from the modem to the Fieldbus lines, according to the ISA-SP50.02-1992 Fieldbus Physical Layer Specification. The PCI302 MAU is passive, that is, not powered by the bus.

NVRAM (Non-Volatile Random Access Memory)
The 32-bit data memory is where the PCI302 data structures and objects are stored.

FLASH (Flash Memory)
32-bit code memory, where the PCI302 program is stored.

Software Overview

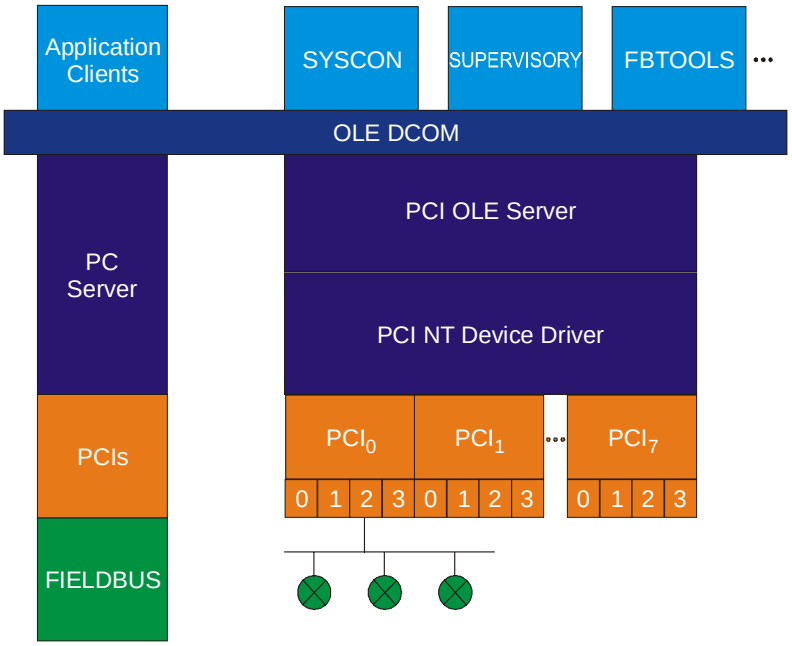


Figure 4 – PCI302 Hierarchy Layers.

HMI (Human-Machine Interface)
User application program (configurator, supervisory, analyzer, etc.) running on PC(s) and interfacing with the PCI302 card through a specific server for the services.

PCI OLE Server
Server for PCI302s based on Client/Server architecture, providing a consistent set of functions for Supervision and Configuration. It standardizes and simplifies the HMI access to the hardware.

PCI302 Device Driver
Specific hardware driver for Windows NT and 2000 Operating System, implementing effectively the access to local PCI302s.

DP (Dual Port RAM)
Memory shared by the PCI302 and PC, at hardware and software levels, which contains all structures required for data and command transfer between them.

$CH_{0\text{ - }63}$ (PCI302 Fieldbus ports 0 - 63)
The card independent ports, running inside the PCI302. Each one includes the Physical layer and part of the Data Link layer.

$PCI302_{1/8}$ (Process Control Interface 1 to 8)
A maximum of 8 PCI302 cards may coexist in a PC bus, totaling 32 ports.

Interfacing with HMI (Human-Machine Interface)

A generic HMI (Human-Machine Interface), like supervisory systems, configurators, etc., interfaces with Smar Fieldbus devices through the PCI302 card, using the PCI OLE Server specification. The generic HMI may work under Windows 95, NT and 2000.

The PCI OLE Server is a 32-bit version server for Windows NT (in compliance with OPC - OLE for Process Control specification). This enables OPC clients to supervise the Fieldbus system through Smar interfaces, in a standardized way (without specific drivers).

For other platforms (OS/2, QNX, etc.), system integrators may also write drivers that access the PCI302 directly, since Smar provides no drivers for them.

PCI302 Technical Specifications

PC Bus

	PCI302 Version 1.xx	PCI302 Version 2.0
Type	ISA (16-bit slot) or EISA	PCI (specification v2.1) (*)
Hardware Interrupt	IRQ 5, 10, 11, 12 or 15	none
I/O Port Base	240H, 280H, 300H or 340H	Plug and Play allocation
I/O Port Area	48 contiguous bytes	48 contiguous bytes (interface) 80 contiguous bytes (configuration)
I/O Access	16-bit	16-bit
Dual Port RAM (I/O accessed)	256KB, 16-bit	256KB, 16-bit

CPU

	PCI302
Type	32-bit RISC
Sustainable Performance	50 MIPS
Peak Performance	75 MIPS

Memory

	PCI302 Version 1.1x	PCI302 Versions 1.2x and 2.0
Code Area	1MB, 32-bit Flash Memory (Upgradeable firmware)	1MB, 32-bit Flash Memory (Upgradeable firmware)
Data Area	512KB, 32-bit NVRAM (Data and configuration retention)	2MB, 32-bit NVRAM (Data and configuration retention)

Fieldbus Interface

	PCI302
Number of ports	4, independents with DMA
Physical Layer Standard	ISA-S50.02-1992
Baud Rate	31.25Kbps (H1)
MAU Type	Passive (not bus powered)
Intrinsic Safety	NOT compliant
Isolation	500 VAC (each port)
Connector	37-pin D-SUB, male

General

	PCI302 VERSIONS 1.XX	PCI302 Version 2.0
Operating Conditions	0ºC to +50 ºC @ 5% to 90% RH	0 ºC to +50 ºC @ 5% to 90% RH
Non-operating Conditions	-30 ºC to +70 ºC @ 5% to 90% RH	-30ºC to +70ºC @ 5% to 90% RH
Operating Voltage	+5V ±5%	+5V ±5% and +3.3V ± 10%
Operating Current	1.2A (typ)	1.19A (typ) / +5V Power Supply 0.085A (typ) / +3.3V Power Supply

Physical Dimensions

	PCI302 Version 1.1x	PCI302 Version 1.2x	PCI302 Versions 2.0
Standard	ISA 16-bit	ISA 16-bit	PCI bus
External Dimensions	173.0 x 21.6 x 141.6mm (max) 6.85 x 0.85 x 5.57"	194.5 x 21.6 x 141.6 mm (max) 7.65 x 0.85 x 5.57"	234.9 x 21.6 x 125.0 mm (max) 9.25 x 0.85 x 5"

Appendix A

Dip Switches and LEDs

PCI302 Version 1.xx

W1	W2	W3	Card
0	0	0	0*
0	0	1	1
0	1	0	2
0	1	1	3
1	0	0	4
1	0	1	5
1	1	0	6
1	1	1	7

W4	W5	I/O PORT
0	0	240 - 26FH
0	1	280 - 2AFH*
1	0	300 - 32FH
1	1	340 - 36FH

W6	NVRAM BATTERY
0	ON (data retention)
1	OFF (data loss)*

0 = ON = LOWER POSITION
1 = OFF = UPPER POSITION
*** = Factory default setting**

Table 1 – PCI302 1.xx Dip Switches.

NOTES
The interrupt (IRQ5, IRQ10, IRQ11, IRQ12 or IRQ15) is software configured with the FBtools or ItfSetup programs.

WARNING!
The switch W6 (NVRAM BATTERY) is factory set to the OFF position in order to avoid energy loss while the card is at Smar`s stock or on the Customer's shelf. **BEFORE USING THE PCI302 V1.xx, THE DIP6 SHOULD BE TURNED ON**.

PCI302 Version 2.0

LED	Color	Name	Description
1	Red	FAIL	When ON, it indicates reset condition or CPU failure.
2	Green	Dual Port	When blinking, it indicates communication through the Dual Port.
3	Green	FF H1-1	Indicates transmission through the first H1 port.
4	Green	FF H1-2	Indicates transmission through the second H1 port.
5	Green	FF H1-3	Indicates transmission through the third H1 port.
6	Green	FF H1-4	Indicates transmission through the fourth H1 port.

Table 2 – PCI302 2.00 LEDs.

Appendix B

Physical Dimensions

PCI302 Version 1.1x

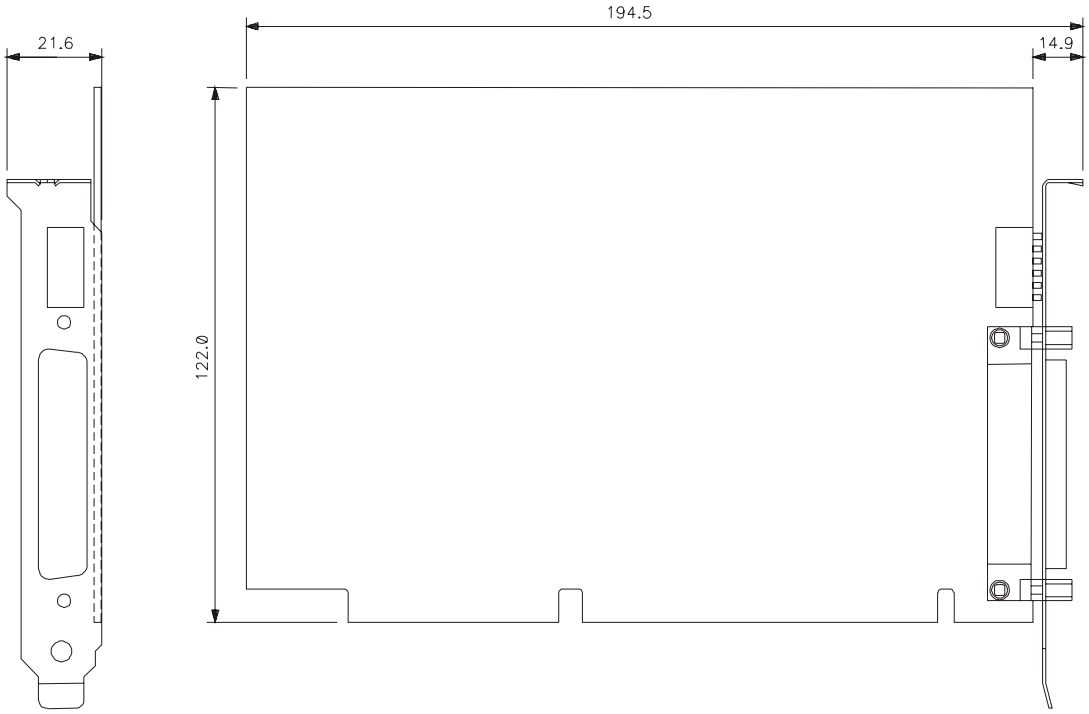


Figure 5 - PCI302 card V1.1x Physical dimensions (mm).

PCI302 Version 1.2x

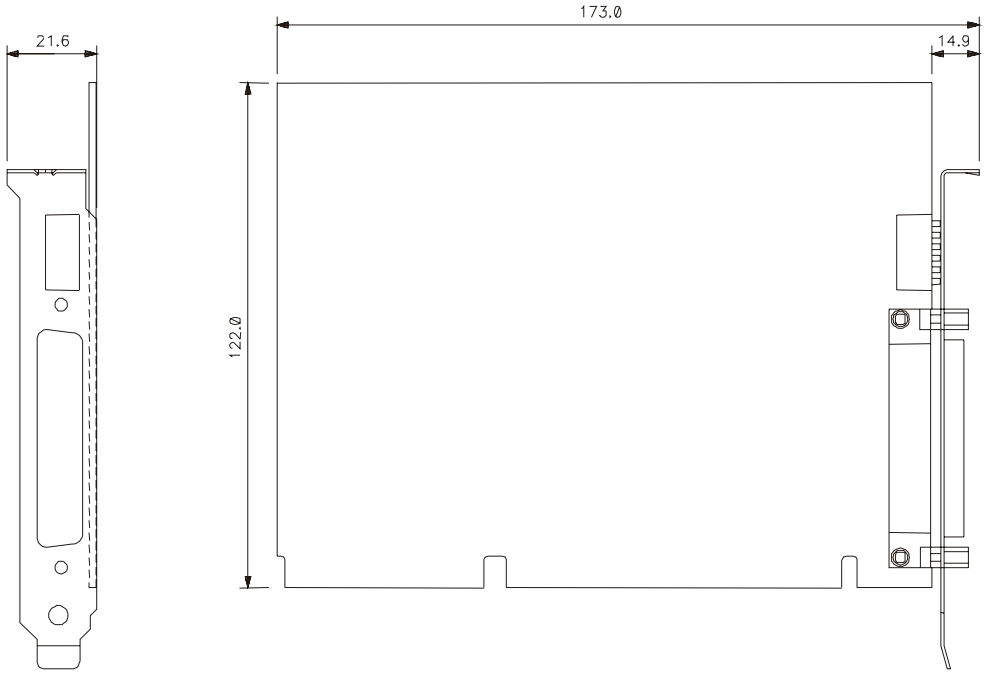


Figure 6 - PCI302 card V1.2x Physical dimensions (mm).

PCI302 Version 2.0

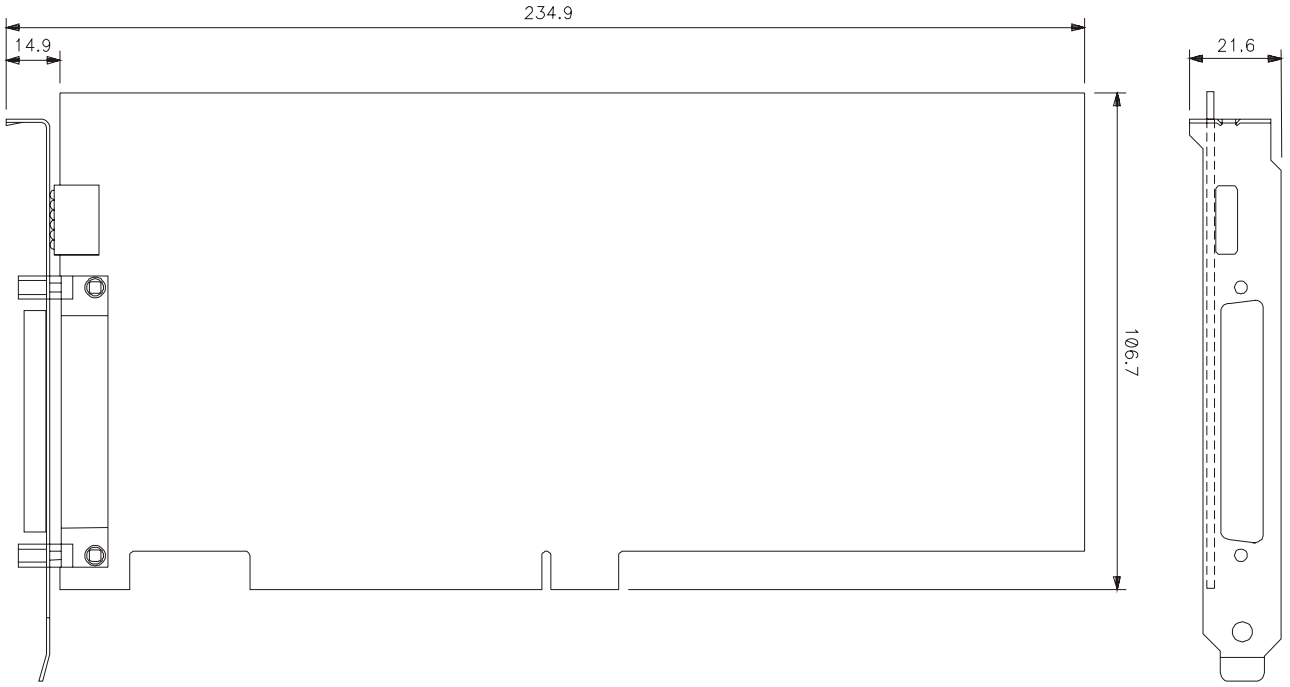


Figure 7 - PCI302 card V2.0 Physical dimensions (mm)

Appendix C

SC71 Cable Specification

PIN Description

1	Signal	2
18	0DATA+	0D+
36	0DATA-	0D-
16	1DATA+	1D+
34	1DATA-	1D-
14	2DATA+	2D+
32	2DATA-	2D-
12	3DATA+	3D+
30	3DATA-	3D-
NC	GND (shield)	GND

Table 1 - SC71 Pin Description

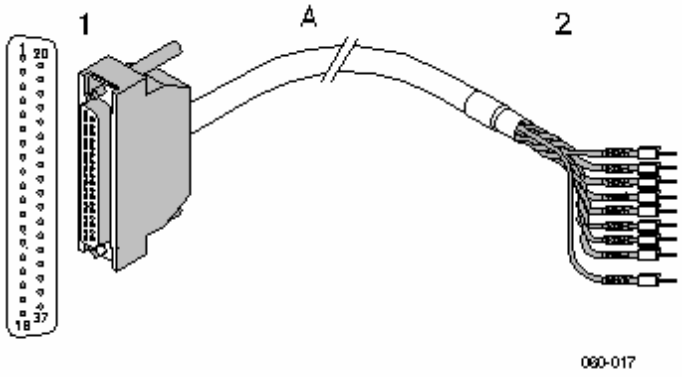


Figure 8 - SC71 Pin view.

Appendix D

Installation

Any user can do the PCI302 hardware and software installation quite easily, with a reasonable knowledge in Fieldbus and PCs.

Hardware Configuration

PCI302 V2.0
No hardware configuration is necessary for PCI302 V2.0.

PCI302 V1.xx
The first step is to verify the PC settings and identify the I/O address and the available interruptions for the PCI302 v1.xx card.

IMPORTANT
All of the PCI302 cards installed in the PC bus must be set with the same I/O port and same IRQ, but each one of them with a different card number. The I/O and IRQ of the PCI302 must not conflict with all the other cards (besides PCI302s) already installed in the PC.

Select a card number (usually starting from 0) to each PCI302 card to be installed in the PC. Take note of each card and its respective serial number.

The PCI302 *hardware* is set through the *dip switches* located in the back of the card (see figure 9).

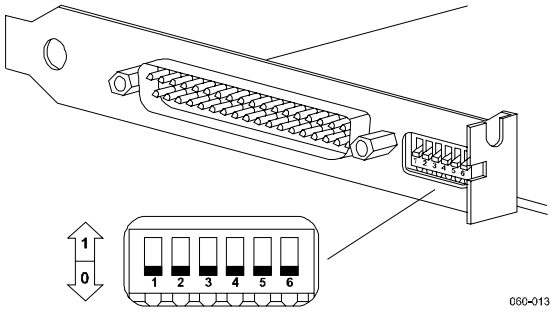


Figure 9- Dip Switches of PCI302 v1.xx card

PCI302 DIP SWITCHES								
W1	W2	W3	CARD	W4	W5	I/O	W6	NVRAM BATTERY
0	0	0	0*	0	0	240- 26FH	0	ON DATA RETENTION
0	0	1	1	0	1	280- 2AFH*		
0	1	0	2	1	0	300- 32FH	1	OFF* DATA LOSS
0	1	1	3	1	1	340- 36FH		
1	0	0	4					
1	0	1	5					
1	1	0	6					
1	1	1	7					

*FACTORY SETTINGS

ATTENTION
The Dip switches have external access even after the card have been installed in the PC. The user can change its positions while the PC is on, but NEVER when an application in the PC that accesses the PCI302 is running.

NOTES
1- In some PCs, IRQ15 is reserved for the secondary HDD control. In case it is necessary to free the IRQ15 to use in the PCI302s, disable this controller (when not in use), running the PC setup. 2- The IRQ 12 is usually saved for the mouse PS/2. 3- The PCI302 v1.2 interruption (IRQ5, IRQ10, IRQ11, IRQ12 or IRQ15) is set via tool software FBtools or ItfSetup.

IMPORTANT
The W6 Dip_Switch (NVRAM battery) is set in factory to OFF, in order to avoid energy loss while the card is kept in stock in the Smar's installations or Customer's installations. The W6 DIP_Switch must be turned ON before using the PCI302 V1.2

Hardware Installation

PCI302 V2.0

First, install the SYSTEM302 with the PCI302 V2.0 option, then, connect the PCI302 V2.0 to the computer. Thus, all of the Windows installation procedures will be performed automatically.

If the SYSTEM302 is not installed and a PCI302 V2.0 is connected to the PC, the Windows program will request a device driver for the PCI302 V2.0. In this case, insert the SYSTEM302 installation CD and instruct the Windows' Hardware installation program to install the device driver through the CD_ROM.

PCI302 V2.0 can be easily installed in the PCI bus (specification v2.1) (*) of every commercial or industrial PC. Refer to the computer manual for instructions on how to install and remove PCI cards. Turn off the PC before inserting or removing the PCI302s from the bus. There is a limit of up to 8 PCI302 cards in the PC bus.

NOTES
For appropriate refrigeration to the PCI302 cards keep the PC cabinet closed while it is ON.
The PCI302 V2.0 is not compatible with PCI302 V1.xx. The two types of cards can be physically installed on the same computer but just one will work with the SYSTEM 302.

PCI302 V1.xx

After the hardware configuration, turn on your PC again and check the functionality of all the hardwares installed in your PC to detect possible conflicts after the installation of the PCI302. If there is any abnormal operation, start again with the installation procedures.

After the hardware configuration have been done, the PCI302 v1.xx can be installed in the ISA bus (16 bits slots) or EISA of every commercial or industrial PC. Refer to the computer manual for instructions on how to install and remove ISA cards. Turn off the PC before inserting or removing the PCI302s from the bus. There is a limit of up to 8 PCI302 cards in the PC bus.

NOTES
For appropriate refrigeration to the PCI302 cards. Keep the PC cabinet closed while it is ON.
The PCI302 V1.0 is not compatible with PCI302 V1.2. In case it is necessary to install the PCI302 V1.0 and V1.2 in the same PC, please contact Smar Technical Support and make a request to exchange the PCI302 V1.0 for PCI302 V1.2.
PCI302 V1.1 is fully compatible with PCI302 V1.2.

Software Installation

During the SYSTEM302 installation process, a dialog box will appear requesting the type of PCI302 to be used (versions between 1.x and 2.0) or not to use a PCI302.

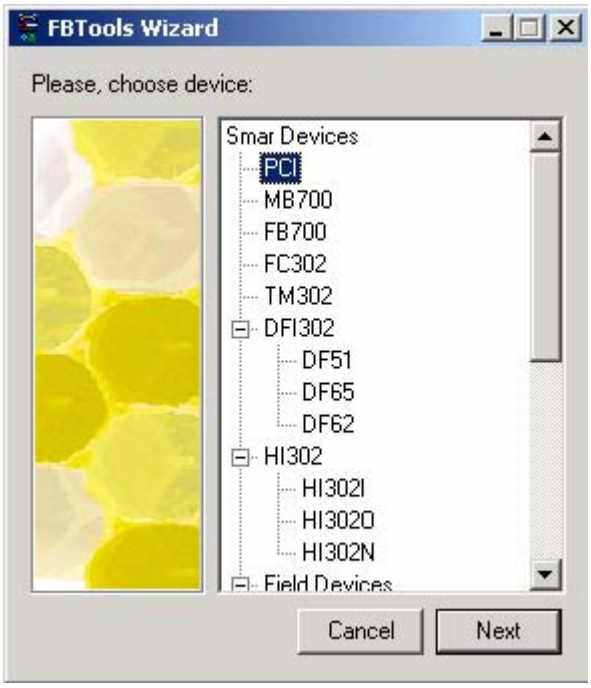
The option chosen by the user can be changed later by using the Interface Setup (ItfSetup) program of the SYSTEM302.

Please refer to the System 302 documentation for more details.

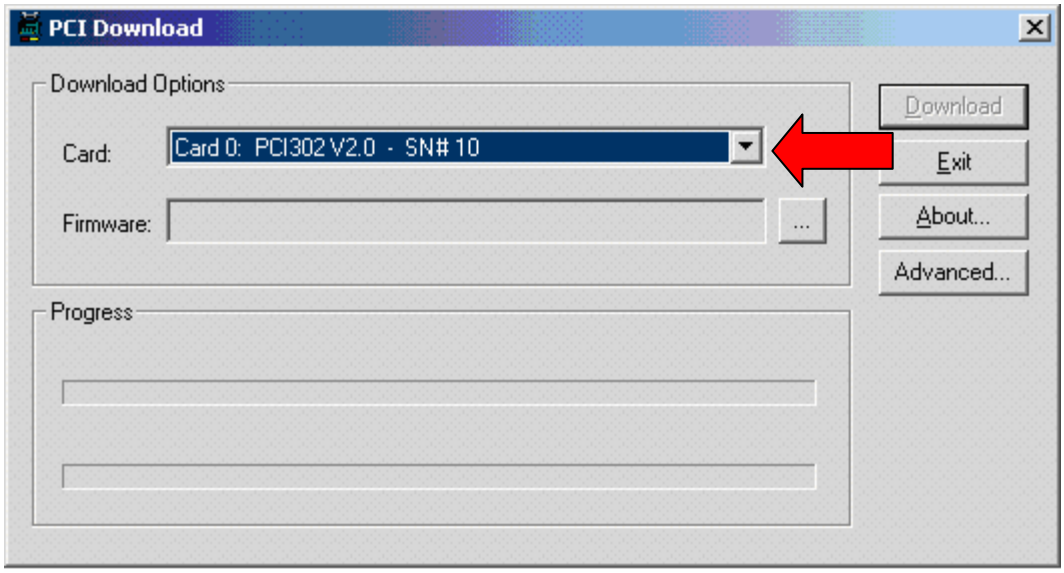
Updating the firmware

ATTENTION
While downloading a PCI302 firmware, all fieldbus activities in the PCI302 will stop. After the firmware download is done, it will be necessary to download the PCI302 configuration via Syscon.

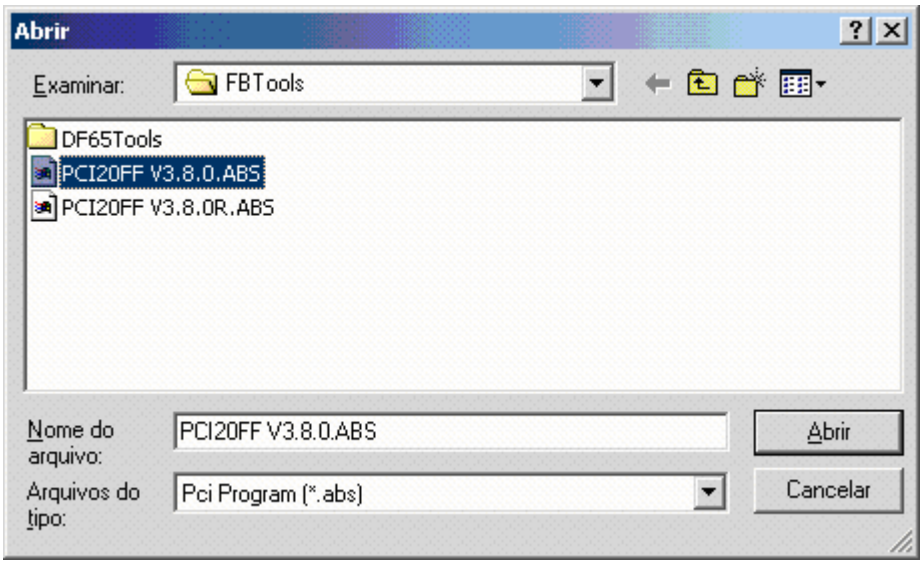
1. Fulfill the FBTools Wizard, located in the ***Start menu → Programs → System302 → FBTools Wizard***.



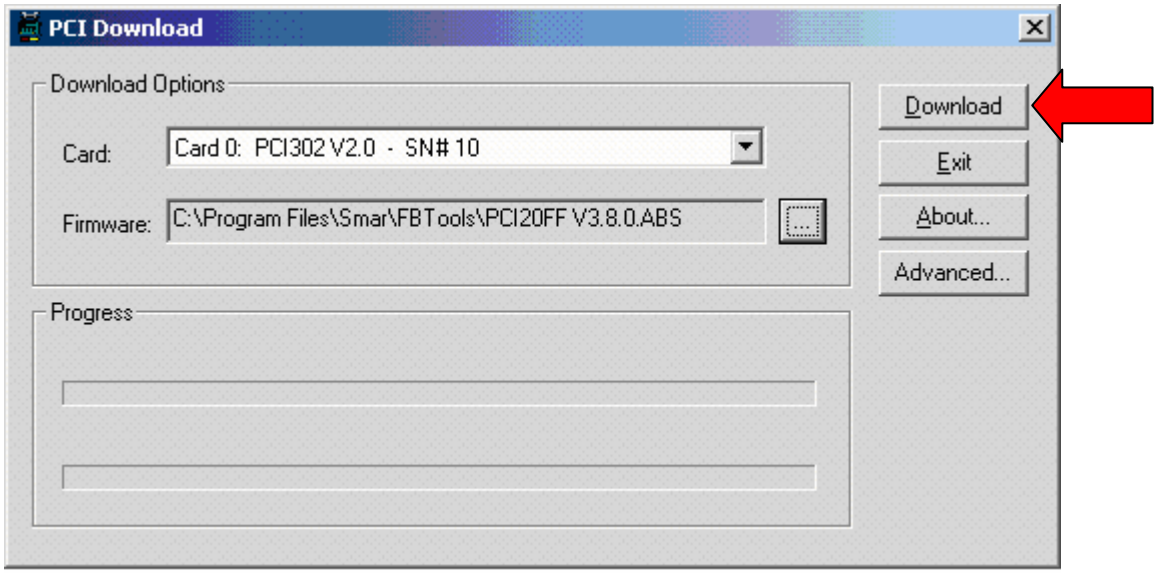
2. Select PCI and click **Next**.
3. Select the desired PCI card.



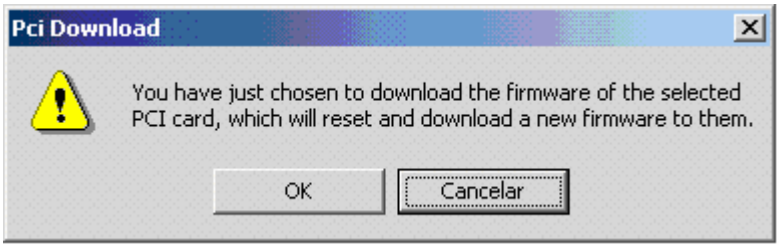
4. Click the **Browse...** button to select the firmware file to be downloaded (PCI*.abs file).



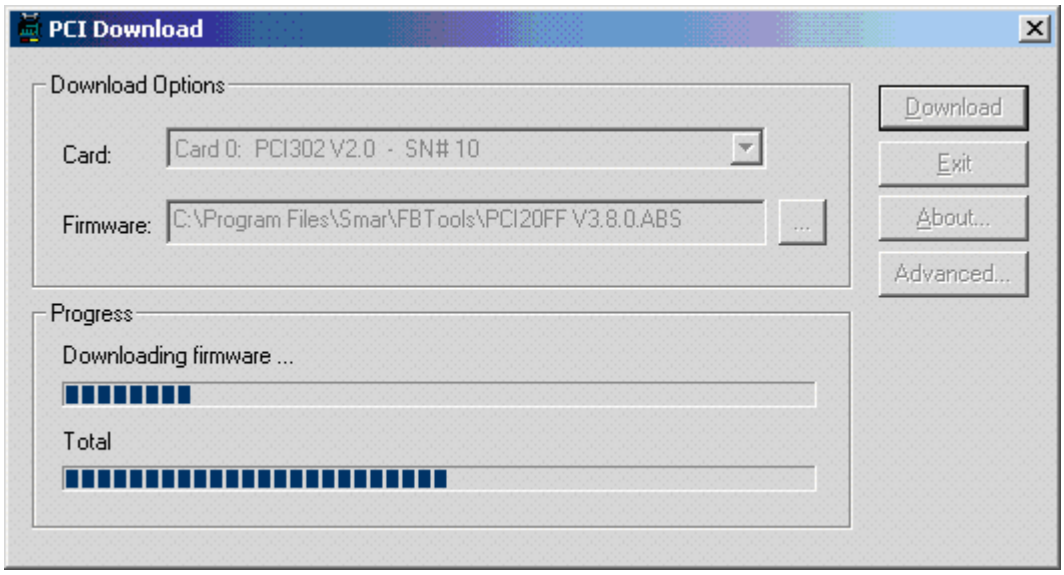
5. After selecting the firmware file, the **Download** button will be enabled. Click on it to initiate the firmware download.



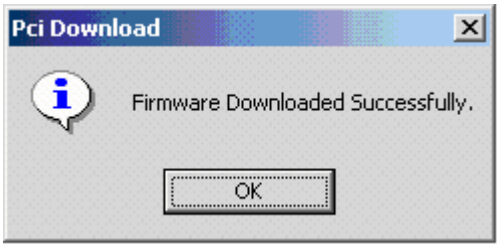
6. A message box will come up requesting a confirmation. Click Ok to continue.



7. The progress bar at the bottom of the dialog box will show the progress of the operation.



8. When the download is complete, a dialog box will appear confirming that the program was downloaded successfully. Click **OK** and wait a few minutes while the information is updated.



9. Click **Close** to exit the PCI Download dialog box.

NOTE (*)

PCI302 v2.0 card follows PCI bus specification version 2.1. However it is recommended to be used on PCI bus specification version 2.2 systems.

To operate on a PCI v2.1 specification system, the 5 volts keyed PCI connectors must provide 3.3 volts power. This characteristic is optional in PCI 2.1 specification but many of such systems provide 3.3 volts on all connectors. In PCI 2.2 specification this 3.3 volts supply is a requirement. Therefore PCI302v2.0 operates normally on PCI 2.2 specification systems.

To identify the PCI bus specification version, it is necessary to check the PC´s manufacturer documentation. The PCI specification version 2.2 was released in December of 1998. Since then, many PC systems have been built PCI bus specification 2.2 compliant.