

## Why PC-Based Control?

Automation engineers have argued for years over the place of PC-based control in the industry. Even as hardware controllers have become more PC-like and PCs have become more reliable, differences still remain.

Your choice to use PC-based control depends on the needs of your specific situation. Here are some reasons you may want to choose PC-based control:

- Direct access to standard computer networks and communication interfaces, such as Ethernet
- Ability to use standard programming languages you may already know, such as C++, VB.NET, or another object-oriented programming tool
- Easier integration with a variety of systems, including company computer networks, manufacturing, business, and facility systems
- Lower cost due to use of commercial off-the-shelf technology
- Better performance in applications that require rapid reading or writing to files, or complex calculations
- Extensive storage capacity for applications that accumulate large quantities of data
- Protection of intellectual property, such as control algorithms
- Ability to run the control program and the human-machine interface (HMI) on the same hardware

## Options for PC-Based Control

So you've decided PC-based control is the way to go. What hardware and software do you need to make it work?

This document shows examples of system architecture for PC-based control, followed by detailed tables listing the hardware and software you can use for each example. Here are some things to think about as you look at the options.

**Programming language**—If you already know one or more programming languages (like flowchart-based PAC Control, or C#, or a .NET language), or have a specific one you need to work in, look for the options that support that language.

**Network**—Have an existing serial I/O network? Need to connect with devices on Ethernet? Need the speed of a direct connection to digital I/O? Or if you're setting

up a new system, how many points of I/O do you need to control? Options vary in terms of the network used for communicating with I/O, and networks vary in terms of how many I/O points or I/O units they can support.

**Protocol**—Like the network (and related to it), a specific protocol may be necessary for your application. Ethernet-based SNAP I/O uses the open OptoMMP protocol. Older serial-based I/O may use *mistic* or Optomux. Or perhaps you need high-speed Pamux for digital I/O. Check the options for the protocols they support, too.

**Distributed control**—An Opto 22 I/O unit consists of I/O modules and an I/O processor (*brain*), mounted on a rack. Brains provide distributed control for many functions, including counting, latching, thermocouple linearization, ramping, and much more—even PID loop control. Any option that uses brains lets you take advantage of this distributed control, so that these functions continue even if the I/O unit loses communication with the PC.

If you don't want distributed control, look for the option that provides direct control of I/O without brains.

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## Ethernet: PC-based Control using SoftPAC—System Example

Develop your control program (strategy) using **PAC Control** software.

Download the strategy to SoftPAC software-based programmable automation controller (on the same PC or on a different PC).

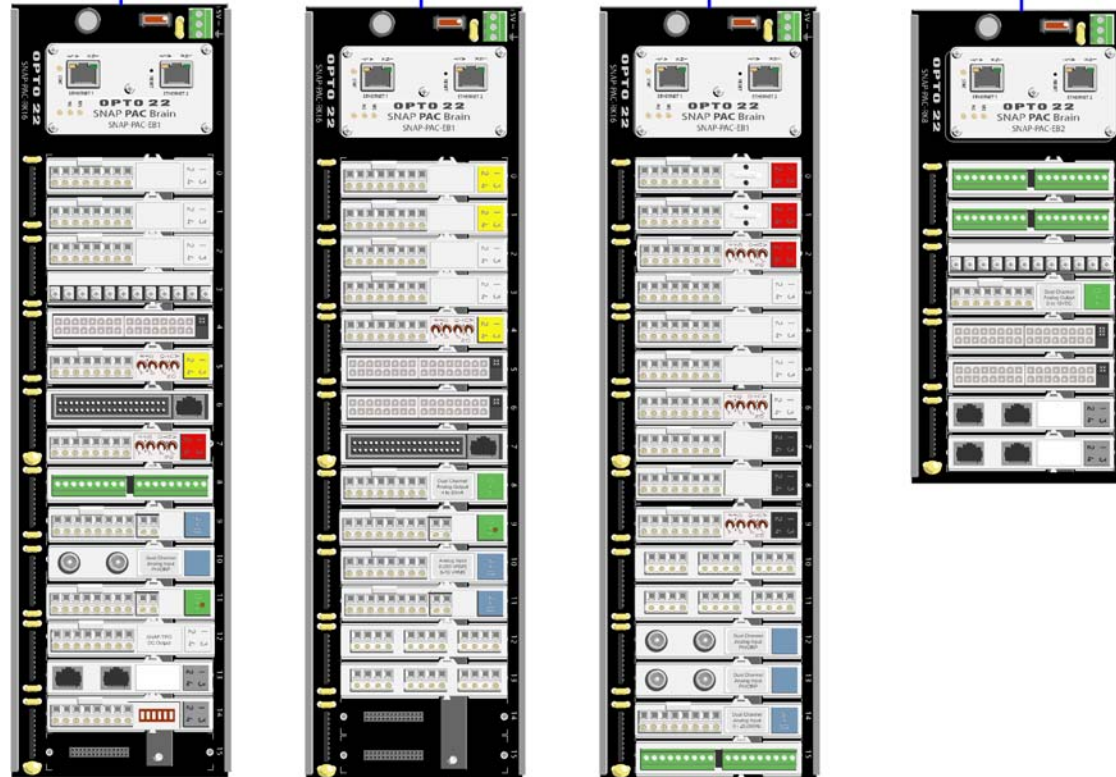


**SoftPAC** runs the control strategy on an embedded or standard PC and controls all I/O.

Ethernet network

SNAP PAC brains (I/O processors) and SNAP I/O modules (analog, digital, and serial, as needed)

See table on the following page for all supported brains and I/O.



## Ethernet: PC-based Control using SoftPAC—Details

If your I/O application requires...	Use this combination of equipment				
	Protocol	Software	Compatibility	Brain	Racks
Ethernet control of multiple digital and/or analog brains (I/O units)  No adapter card	SoftPAC software-based programmable automation controller (programmed with PAC Control)	Windows 7 Professional (32-bit & 64-bit) Windows Vista Business (32-bit) Windows XP Professional (32-bit, with SP2 or higher)	SNAP-PAC-EB1 SNAP-PAC-EB1-FM SNAP-PAC-EB1-W SNAP-PAC-EB2 SNAP-PAC-EB2-FM SNAP-PAC-EB2-W SNAP-PAC-R1 SNAP-PAC-R1-FM SNAP-PAC-R1-W SNAP-PAC-R2 SNAP-PAC-R2-FM SNAP-PAC-R2-W	All SNAP PAC racks	All SNAP I/O
			SNAP-B3000-ENET* SNAP-ENET-S64* SNAP-ENET-D64*	Brain-compatible SNAP rack	Brain-compatible SNAP I/O**

\* Not recommended for new designs

\*\* See the [Legacy and Current Products Comparison and Compatibility Charts](#), form 1693

## Ethernet: PC-based Control using OptoMMP Protocol—System Example

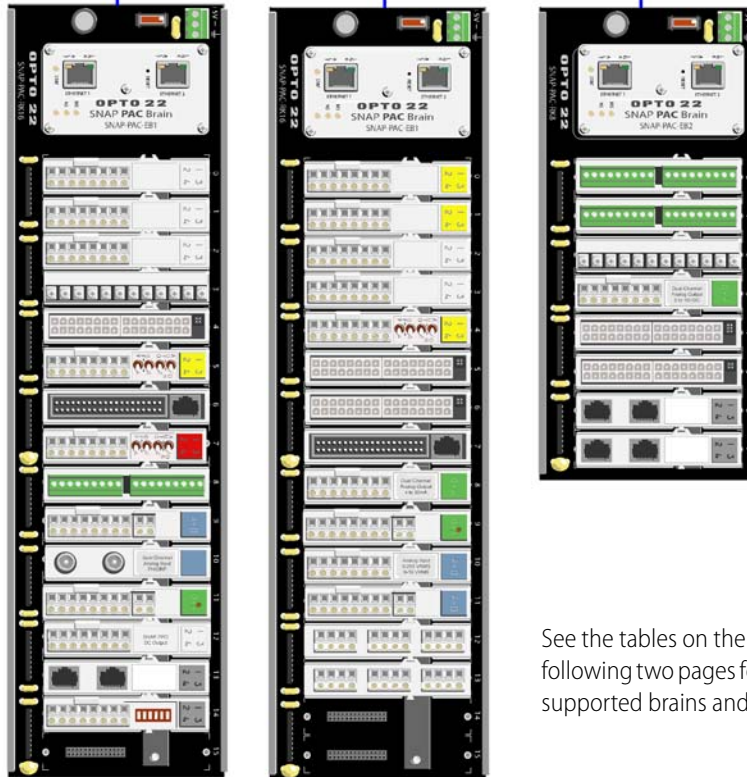
Develop your control program using the **SNAP PAC .NET OptoMMP SDK** (for newer Windows versions) or the OptoMMP Communication Toolkit (for older Windows versions)



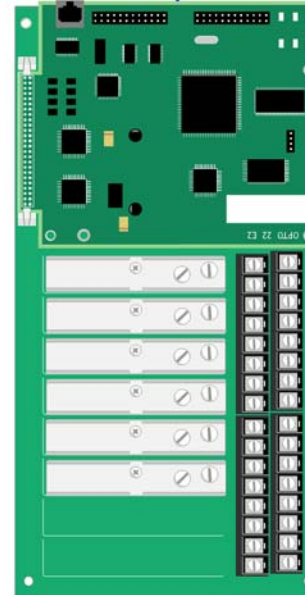
Your custom control program can control all OptoMMP-based brains (I/O units).

Ethernet network

SNAP PAC brains and SNAP I/O (analog, digital, and serial modules)



E2 analog brain board and I/O



E1 digital brain board and I/O



See the tables on the following two pages for all supported brains and I/O.

## Ethernet: PC-based Control using OptoMMP Protocol—Details

The table on this page shows combinations of equipment for newer Windows versions. The table on the following page covers older Windows versions.

If your I/O application requires...	Use this combination of equipment					
	Protocol	Software	Compatibility	Brain	Racks	I/O modules
Ethernet control of multiple digital and/or analog brains (I/O units)  No adapter card	OptoMMP	SNAP PAC .NET OptoMMP SDK	Windows 7 Professional (32-bit & 64-bit) Windows Vista Business (32-bit & 64-bit)  .NET 3.5 framework Visual Studio 2005, 2008, 2010	SNAP-PAC-EB1 SNAP-PAC-EB1-FM SNAP-PAC-EB1-W SNAP-PAC-EB2 SNAP-PAC-EB2-FM SNAP-PAC-EB2-W	All SNAP PAC racks	All SNAP I/O
				E1 for digital	G4PB8H G4PB16H G4PB16HC G4PB16J/K/L PB4H PB8H PB16H PB16HC PB16HQ PB16J/K/L	G4PB16J/K/L: Racks with integrated G4 I/O Other G4 racks: G4 digital I/O PB16HQ: Quad Pak PB16J/K/L: Racks with integrated G1 I/O Other PB racks: G1 (Standard) digital I/O
				E2 for analog	PB4AH PB8AH PB16AH	G1 (Standard) analog I/O
				G4EB2	G4PB32H PB32HQ	G4 rack: G4 digital I/O PB rack: Quad Pak
				G4D32EB2-UPG	G4D32RS	G4 digital I/O
				SNAP-B3000-ENET* SNAP-ENET-S64* SNAP-ENET-D64*	Brain-compatible SNAP rack	Brain-compatible SNAP I/O**

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If your I/O application requires...	Use this combination of equipment					
	Protocol	Software	Compatibility	Brain	Racks	I/O modules
Ethernet control of multiple digital and/or analog brains (I/O units)  No adapter card	OptoMMP	OptoMMP Communication Toolkit	Windows 2000 (SP4) Windows XP Professional (32-bit SP2)  ActiveX C++	SNAP-PAC-EB1 SNAP-PAC-EB1-FM SNAP-PAC-EB1-W SNAP-PAC-EB2 SNAP-PAC-EB2-FM SNAP-PAC-EB2-W	All SNAP PAC racks	All SNAP I/O
				E1 for digital	G4PB8H G4PB16H G4PB16HC G4PB16J/K/L PB4H PB8H PB16H PB16HC PB16HQ PB16J/K/L	G4PB16J/K/L: Racks with integrated G4 I/O Other G4 racks: G4 digital I/O PB16HQ: Quad Pak PB16J/K/L: Racks with integrated G1 I/O Other PB racks: G1 (Standard) digital I/O
				E2 for analog	PB4AH PB8AH PB16AH	G1 (Standard) analog I/O
				G4EB2	G4PB32H PB32HQ	G4 rack: G4 digital I/O PB rack: Quad Pak
				G4D32EB2-UPG	G4D32RS	G4 digital I/O
				SNAP-B3000-ENET* SNAP-ENET-S64* SNAP-ENET-D64*	Brain-compatible SNAP rack	Brain-compatible SNAP I/O**

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## Direct Control of I/O—No Brain (I/O Processor)—System Example

### PC with AC5-type adapter card:

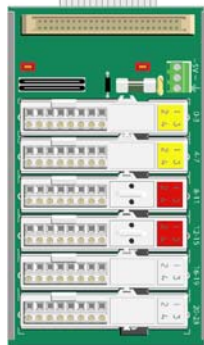
- PCIe bus: PCIe-AC5
- PCI bus: PCI-AC5
- ISA bus: AC5 or G4AC5

Use the **PC-Based Direct I/O SDK** to create a custom control program. The control program runs on your PC and directly controls I/O; no brain (I/O processor) is used.



50-pin ribbon cables

SNAP digital I/O  
(no brain)



G4 digital I/O  
(no brain board)

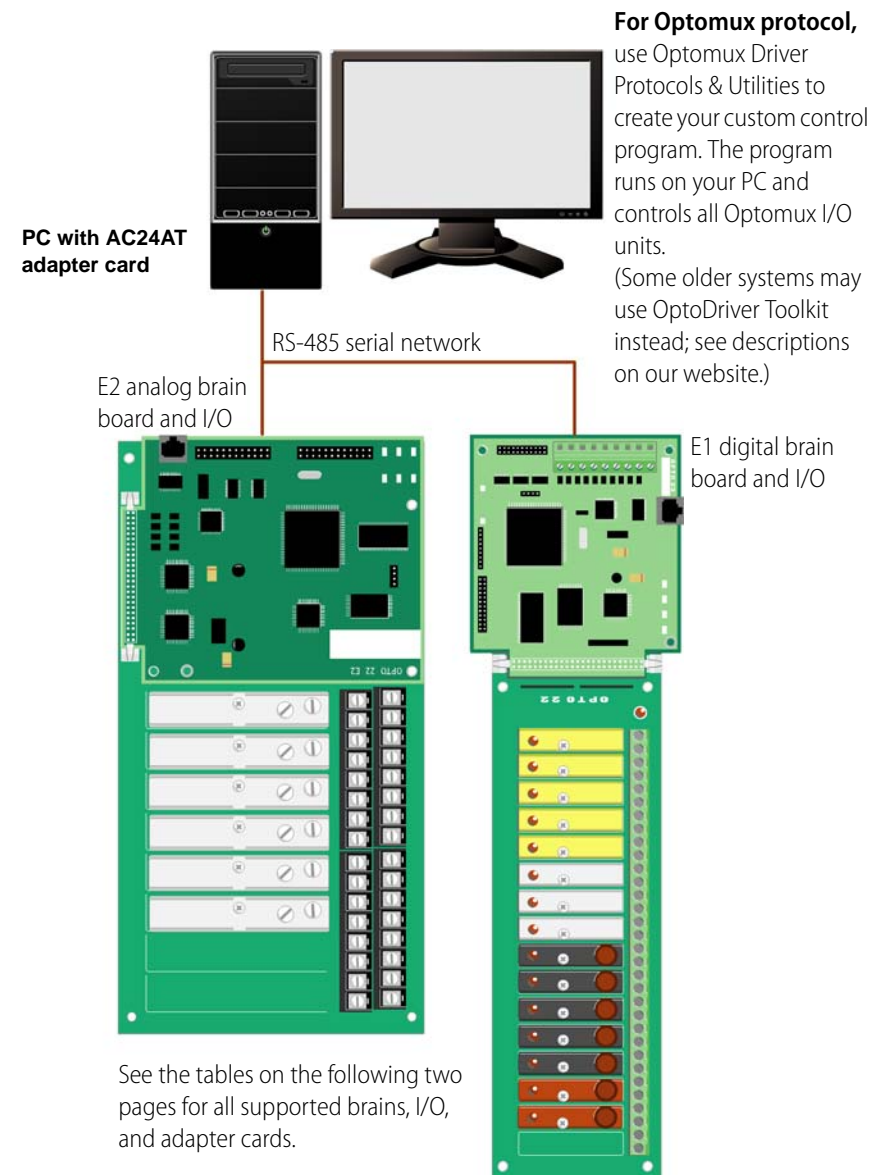
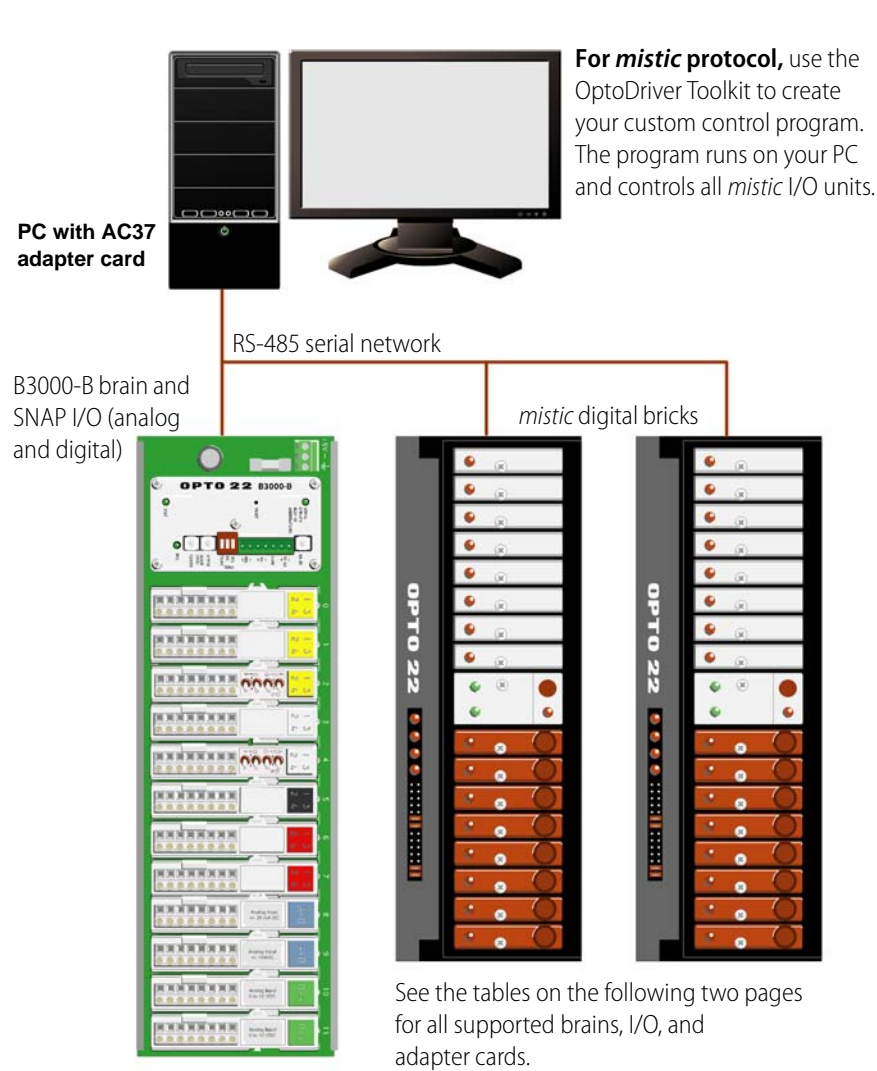
See the table on the following page for all supported I/O.

## Direct Control of I/O—No Brain (I/O Processor)—Details

If your I/O application requires...	Use this combination of equipment							
	Product Line or Protocol	PC Bus	Adapter card	Software Developer Toolkit	Compatibility	Brain	Racks	I/O modules
Direct, high-speed control of I/O points (24 or 48 points, depending on the card)	Direct I/O	PCI express	PCIe-AC5	PC-Based Direct I/O SDK	Windows 8 (32-bit & 64-bit) Windows 7 and Vista (32-bit and 64-bit) C#, VB.NET, and other .NET languages; also Visual Basic, C++	--None required--	SNAP-D6M SNAP-D6MC SNAP-D6MC-P SNAP-D12M SNAP-D12MC SNAP-D12MC-P G4PB8 G4PB16 G4PB24 PB24HQ	SNAP racks: SNAP 4-channel digital I/O G4 racks: All 5 VDC logic G4 digital I/O PB24HQ: Quad Pak
		PCI	PCI-AC5				Windows 2000/XP Visual Basic 6.0, Microsoft C++ 6.0	--None required--
Direct, high-speed control of I/O points (24 or 48 points, depending on the card)	Direct I/O	ISA	G4AC5 AC5	PC-Based Direct I/O SDK	Windows 95/98/ME, NT/2000/XP	--None required--	SNAP-D6M SNAP-D6MC SNAP-D6MC-P SNAP-D12M SNAP-D12MC SNAP-D12MC-P G4PB8 G4PB16 G4PB24 PB24HQ	SNAP racks: SNAP 4-channel digital I/O G4 racks: All 5 VDC logic G4 digital I/O PB24HQ: Quad Pak
							--None required--	PB8 PB16A PB16C PB24 PB24Q



## Serial: PC-based Control via Brain (I/O Processor)—System Example



## Serial: PC-based Control via Brain (I/O Processor)—Details

The table on this page covers PCs with a PCI bus. The table on the next page covers PCs with an ISA bus or no available slot.

If your I/O application requires...	Use this combination of equipment							
	Product Line or Protocol	PC Bus	Adapter card	Software Developer Toolkit	Compatibility	Brain	Racks	I/O modules
Serial control of multiple digital and/or analog brains  Support for up to 256 brains (I/O units), for a total of 4,096 I/O points on one 4000 ft. (1200 m.) RS-485 data link	<i>mistic</i>	PCI	PCI-AC48	AC28 and PCI-AC48 Adapter Card Toolkit	Windows 2000/XP Microsoft Visual Basic, Microsoft Visual C++	B3000-B B3000*	SNAP B-series racks	Compatible SNAP analog & digital I/O**
	Optomux	PCI	PCI-AC48	AC28 and PCI-AC48 Adapter Card Toolkit	Windows 2000/XP Microsoft Visual Basic, Microsoft Visual C++	E1 for digital B1 for digital	G4PB8H G4PB16H G4PB16HC G4PB16J/K/L PB4H PB8H PB16H PB16HC PB16HQ PB16J/K/L	G4PB16J/K/L: Racks with integrated G4 I/O Other G4 racks: G4 digital I/O PB16HQ: Quad Pak PB16J/K/L: Racks with integrated G1 I/O Other PB racks: G1 (Standard) digital I/O
						E2 for analog B2 for analog	PB4AH PB8AH PB16AH	G1 (Standard) analog I/O

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If your I/O application requires...	Use this combination of equipment							
	Product Line or Protocol	PC Bus	Adapter card	Software Developer Toolkit	Compatibility	Brain	Racks	I/O modules
<p>Serial control of multiple digital and/or analog brains</p> <p>Support for up to 256 brains (I/O units), for a total of 4,096 I/O points on one 4000 ft. (1200 m.) RS-485 data link</p>	mistic	ISA	AC37	OptoDriver Toolkit	Windows 2000/XP Windows 95/98/ME Microsoft Visual C++ Microsoft Visual Basic (using Microsoft Visual Studio 6)	B3000-B (analog/digital) B3000* (analog/digital)	SNAP B-series	Compatible analog & digital SNAP I/O**
						SNAP-BRS (digital)	SNAP-B8M SNAP-B8MC SNAP-B8MC-P	SNAP 4-channel digital I/O
						G4D16R brick (integrated brain, rack, and G4 digital I/O) G4D32RS brick (integrated brain, rack, and G4 digital I/O)		
						B100 for digital rack	G4PB8H G4PB16H PB4H PB8H PB16H	G4 digital racks: All G4 digital I/O PB digital racks: All G1 (Standard) digital I/O
	Optomux	ISA	AC24AT AC422AT	Optomux Driver Protocols & Utilities (serial Optomux and Ethernet Optomux)  OptoDriver Toolkit (serial Optomux only)	Windows 2000/XP Windows 95/98/ME Microsoft Visual C++ Microsoft Visual Basic (using Microsoft Visual Studio 6)	E1 for digital B1 for digital	G4PB8H G4PB16H G4PB16HC G4PB16J/K/L PB4H PB8H PB16H PB16HC PB16HQ PB16J/K/L	G4PB16J/K/L: Racks with integrated G4 I/O Other G4 racks: G4 digital I/O PB16HQ: Quad Pak PB16J/K/L: Racks with integrated G1 I/O Other PB racks: G1 (Standard) digital I/O
							E2 for analog B2 for analog	PB4AH PB8AH PB16AH
		No slot; external card	AC7A AC7B	Optomux Driver Protocols & Utilities (serial Optomux and Ethernet Optomux)  OptoDriver Toolkit (serial Optomux only)	Windows 2000/XP Windows 95/98/ME Microsoft Visual C++ Microsoft Visual Basic (using Microsoft Visual Studio 6)	E1 for digital B1 for digital	G4PB8H G4PB16H G4PB16HC G4PB16J/K/L PB4H PB8H PB16H PB16HC PB16HQ PB16J/K/L	G4PB16J/K/L: Racks with integrated G4 I/O Other G4 racks: G4 digital I/O PB16HQ: Quad Pak PB16J/K/L: Racks with integrated G1 I/O Other PB racks: G1 (Standard) digital I/O
							E2 for analog B2 for analog	PB4AH PB8AH PB16AH

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## Pamux: PC-based Control via Brain (I/O Processor)—System Example

PC with Pamux adapter card:  
For PCI bus: **PCI-AC51**  
For PCIe bus: **PCIe-AC51**

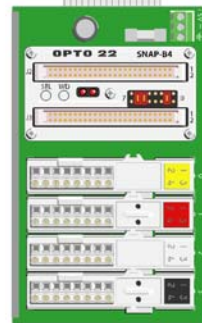
Use the **PAMUX Systems SDK** to create  
a custom program for PC-based control  
using the Pamux protocol.



50-pin ribbon cables

SNAP-B4 brains and  
SNAP digital I/O

See the table on the following page  
for all supported brains, I/O, and  
adapter cards.



B5 brain board  
and G4 digital I/O



## Pamux: PC-based Control via Brain (I/O Processor)—Details

If your I/O application requires...	Use this combination of equipment							
	Product Line or Protocol	PC Bus	Adapter card	Software Developer Toolkit	Compatibility	Brain	Racks	I/O modules
<p>High-speed control via brain of multiple digital and/or analog I/O points</p> <p>Access to up to 512 I/O points, located up to 500 ft. (150 m.) away, per adapter card</p>	Pamux	PCIe	PCIe-AC51	PAMUX Systems SDK	<p>Windows 8 (32-bit &amp; 64-bit) Windows 7 and Vista (32-bit and 64-bit) C#, VB.NET, and other .NET languages; also Visual Basic, C++</p> <p>Windows 2000/XP Visual Basic 6.0, Microsoft C++ 6.0</p>	SNAP-B4 (digital) SNAP-B6 (analog/digital)	SNAP B-series	Brain-compatible SNAP I/O**
						B4 (digital)	G4PB32H PB32HQ	G4 rack: G4 digital I/O PB32HQ: Quad Pak
						B5 (digital)	G4PB8H G4PB16H G4PB16HC G4PB32H G4PB16J/K/L PB4H PB8H PB16H PB16HC PB16HQ PB16J/K/L	G4PB16J/K/L: Racks with integrated G4 I/O Other G4 racks: G4 digital I/O PB16HQ: Quad Pak PB16J/K/L: Racks with integrated G1 I/O Other PB racks: G1 (Standard) digital I/O
		B6 for analog	PB4AH PB8AH PB16AH	G1 analog I/O				
		PCI	PCI-AC51	PAMUX Systems SDK		SNAP-B4 (digital) SNAP-B6 (analog/digital)	SNAP B-series	Brain-compatible SNAP I/O**
						B4 (digital)	G4PB32H PB32HQ	G4 rack: G4 digital I/O PB32HQ: Quad Pak
B5 (digital)	G4PB8H G4PB16H G4PB16HC G4PB32H G4PB16J/K/L PB4H PB8H PB16H PB16HC PB16HQ PB16J/K/L				G4PB16J/K/L: Racks with integrated G4 I/O Other G4 racks: G4 digital I/O PB16HQ: Quad Pak PB16J/K/L: Racks with integrated G1 I/O Other PB racks: G1 (Standard) digital I/O			
B6 for analog	PB4AH PB8AH PB16AH	G1 analog I/O						

If your I/O application requires...	Use this combination of equipment							
	Product Line or Protocol	PC Bus	Adapter card	Software Developer Toolkit	Compatibility	Brain	Racks	I/O modules
<p>High-speed control via brain of multiple digital and/or analog I/O points</p> <p>Access to up to 512 I/O points, located up to 500 ft. (150 m.) away, per adapter card</p>	Pamux	ISA	AC28*	AC28 and PCI-AC48 Adapter Card Toolkit	Windows 95/98/ME, 2000/XP Microsoft Visual Basic Microsoft Visual C++	SNAP-B4 (digital) SNAP-B6 (analog/digital)	SNAP B-series	Brain-compatible SNAP I/O**
						B4 (digital)	G4PB32H PB32HQ	G4 rack: G4 digital I/O PB32HQ: Quad Pak
						B5 (digital)	G4PB8H G4PB16H G4PB16HC G4PB32H G4PB16J/K/L PB4H PB8H PB16H PB16HC PB16HQ PB16J/K/L	G4PB16J/K/L: Racks with integrated G4 I/O Other G4 racks: G4 digital I/O PB16HQ: Quad Pak PB16J/K/L: Racks with integrated G1 I/O Other PB racks: G1 (Standard) digital I/O
						B6 for analog	PB4AH PB8AH PB16AH	G1 analog I/O

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