WHY PC-BASED CONTROL?

Automation engineers have argued for years over the place of PC-based control in the industry. Before you choose a PC for control today, take a good look at Opto 22's *groov* EPIC edge programmable industrial controller. A Linux®-based controller, it has processing and data communications capabilities like a PC and can be programmed through secure access to its OS. But it also offers real-time control through traditional IEC 61131-3 programming languages, a built-in HMI, and industrial toughness for hazardous locations. An excellent replacement for an industrial PC, *groov* EPIC offers:

- Direct access to standard computer networks and communication interfaces, such as Ethernet, USB, and HDMI
- Ability to use standard computer programming languages you may already know, such as C++, Java, or Python™
- Easier integration with a variety of systems, including company computer networks; manufacturing, business, and facility systems; and cloud-based services & software
- Ability to run the control program and the human-machine interface (HMI) on the same hardware
- Built-in cybersecurity, including device firewall, encryption, authentication, user management (with LDAP support), security certificate options, and VPN client

Although *groov* EPIC can easily replace a PC in many cases, in some specific situations PC-based control may be a better choice. Here are some reasons you might want to choose PC-based control:

- Existing PCs in your machine or system design
- Better performance in applications that require rapid reading or writing to files, or complex calculations
- Extensive local storage capacity for applications requiring large quantities of data

OPTIONS FOR PC-BASED CONTROL

If 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 or need to work in a specific one (like flowchart-based PAC Control, IEC 61131-3 compliant languages, C++, C#, or .NET), look for the options that support that language.

Network—Need to connect with devices on Ethernet? Have an existing serial I/O network? 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 Opto 22 I/O uses the open OptoMMP protocol. Older serial-based I/O may use *mistic* or Optomux. Check the options for supported protocols.

Distributed control—An Opto 22 I/O unit consists of I/O modules and an I/O processor (sometimes called a *brain*). Processors provide distributed control for many functions, including counting, latching, thermocouple linearization, ramping, and much more—even PID loop control. An option that uses a processor 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 a processor.

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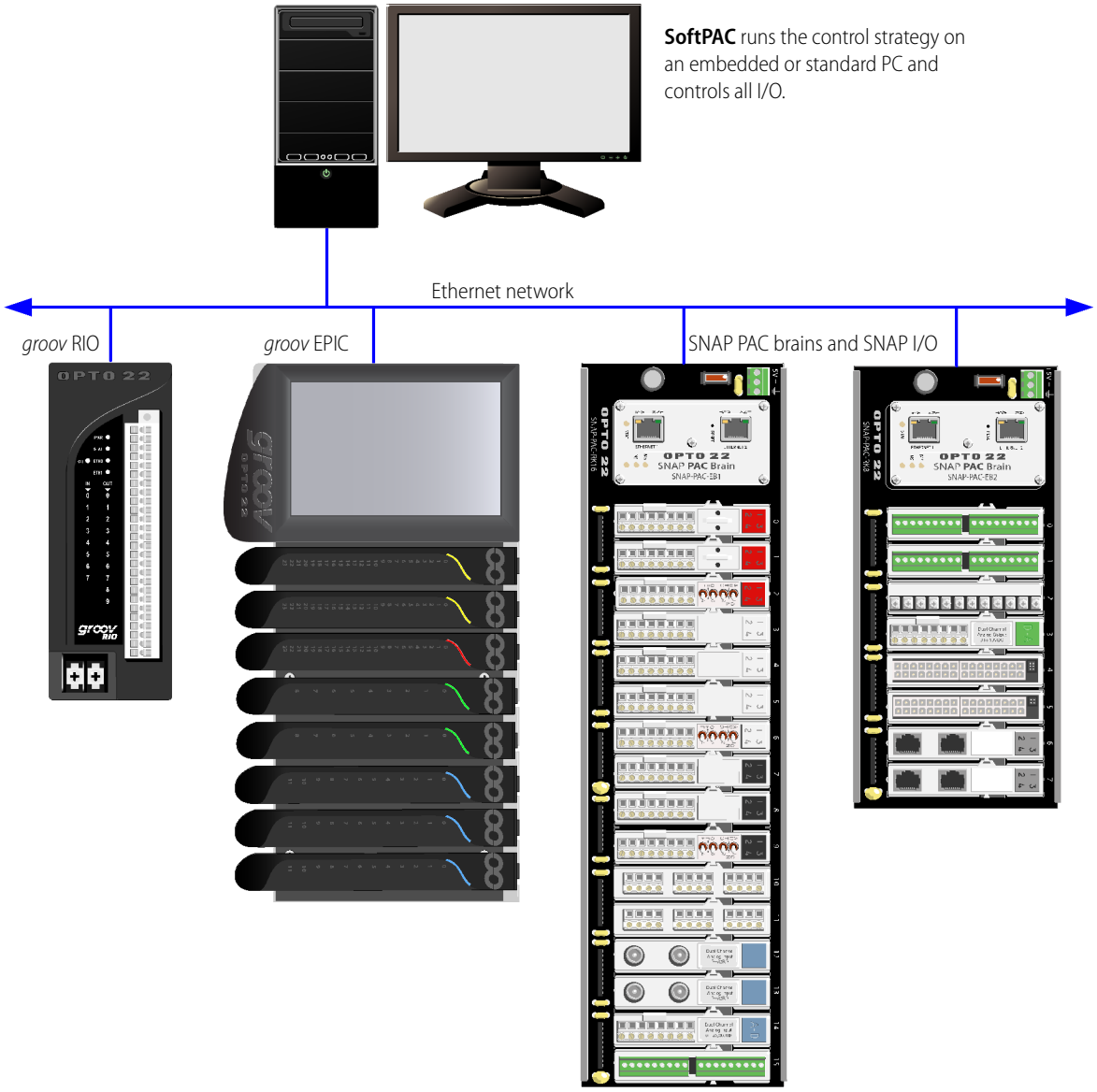
ETHERNET: PC-BASED CONTROL USING SOFTPAC—SYSTEM EXAMPLE

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).

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



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

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ETHERNET: PC-BASED CONTROL USING SOFTPAC—DETAILS

If your I/O application requires...	Use this combination of equipment					
	Protocol	Software	Compatibility	Processor	Racks	I/O modules
Ethernet control of multiple discrete and/or analog I/O units No adapter card	SoftPAC software-based programmable automation controller (programmed with PAC Control)		Windows® 10 Professional (32-bit & 64-bit)	GRV-EPIC-PR1 GRV-EPIC-PR2	All *groov* EPIC chassis	All *groov* I/O
				GRV-R7-MM1001-10 GRV-R7-MM2001-10 GRV-R7-I1VAPM-3	Integral	Integral
				SNAP-PAC-EB1[1] SNAP-PAC-EB1-FM[4] SNAP-PAC-EB2[1] SNAP-PAC-EB2-FM[4] SNAP-PAC-R1[1] SNAP-PAC-R1-FM[4] SNAP-PAC-R2[1] SNAP-PAC-R2-FM[4]	All SNAP PAC racks	All SNAP I/O
				SNAP-PAC-R1-B SNAP-UP1-ADS[2] SNAP-UP1-D64[2] SNAP-UP1-M64[2] SNAP-B3000-ENET[2] SNAP-ENET-S64[2] SNAP-ENET-D64[2]	Brain-compatible SNAP rack	Brain-compatible SNAP I/O[3]
				G4EB2 E1 E2	Brain-compatible rack	Brain-compatible I/O

[1] Obsolete -W models (for example, SNAP-PAC-EB1-W) are also compatible
[2] Not recommended for new designs
[3] See the *Legacy and Current Products Comparison and Compatibility Charts* (form 1693)
[4] Obsolete Product, contact Opto 22 Pre-Sales engineers for more information.

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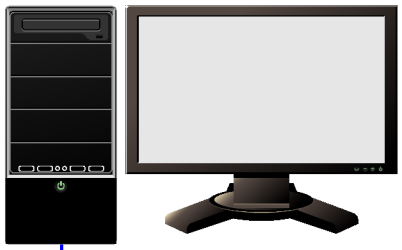
ETHERNET: PC-BASED CONTROL USING OPTOMMP PROTOCOL—SYSTEM EXAMPLE

Develop your control program using the **.NET OptoMMP SDK for SNAP PAC** or the **C++ OptoMMP SDK for SNAP PAC**.



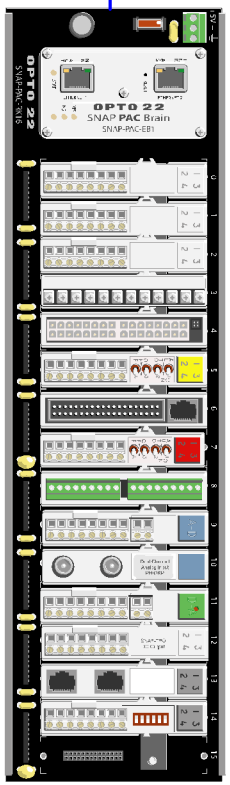
Your custom control program can control all OptoMMP-based processors (I/O units).

Ethernet network

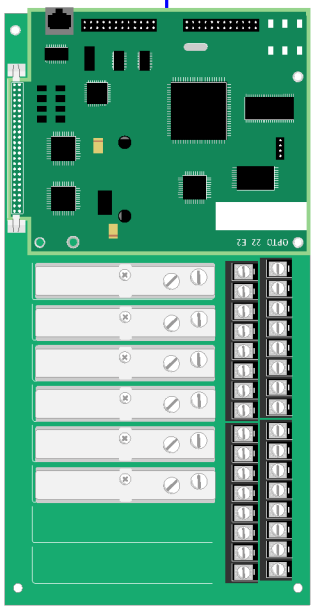
groov RIO

groov EPIC

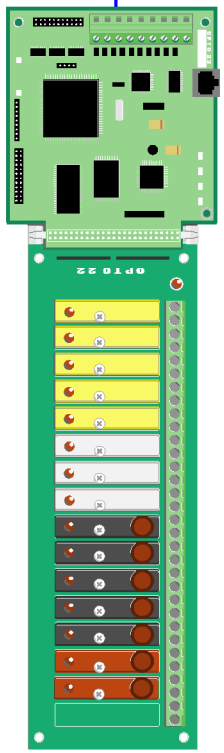
SNAP PAC brain and SNAP I/O



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.

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ETHERNET: PC-BASED CONTROL USING OPTOMMP PROTOCOL—DETAILS

The table on this page shows equipment compatible with our SDK for the .NET framework. For the C++ SDK, see the following page.

If your I/O application requires...	Use this combination of equipment					
	Protocol	Software	Compatibility	Processor	Racks	I/O modules
Ethernet control of multiple discrete and/or analog I/O units No adapter card	OptoMMP	.NET OptoMMP SDK for *groov* EPIC, *groov* RIO, and SNAP PAC (Part #: PAC-DEV-OPTOMMP-DOTNET)	Windows® 11 Professional Windows 10 Professional (32-bit & 64-bit) .NET® Framework: 4.6.1 through 4.8 .NET Core 1 through .Net 6 Ubuntu 21.10 for AMD64	GRV-EPIC-PR1 GRV-EPIC-PR2	All *groov* EPIC chassis	All *groov* I/O
				GRV-R7-MM1001-10 GRV-R7-MM2001-10 GRV-R7-I1VAPM-3	Integral	Integral
				SNAP-PAC-EB1[1] SNAP-PAC-EB1-FM[5] SNAP-PAC-EB2[1] SNAP-PAC-EB2-FM[5] SNAP-PAC-R1[1] SNAP-PAC-R1-FM[5] SNAP-PAC-R2[1] SNAP-PAC-R2-FM[5]	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
				SNAP-PAC-R1-B	B-series rack	All SNAP I/O
				E2 for analog	PB4AH PB8AH PB16AH	G1 (Standard) analog I/O
				G4EB2	G4PB32H PB32HQ	G4 rack: G4 digital I/O[2] PB rack: Quad Pak
				G4D32EB2-UPG	G4D32RS	G4 digital I/O
				SNAP-PAC-R1-B	B-series rack	All SNAP I/O
				SNAP-UP1-ADS[2] SNAP-UP1-D64[2] SNAP-UP1-M64[2] SNAP-B3000-ENET[3] SNAP-ENET-S64[3] SNAP-ENET-D64[3]	Brain-compatible SNAP rack	Brain-compatible SNAP I/O[4]

[1] Obsolete -W models (for example, SNAP-PAC-EB1-W) are also compatible
[2] G4 digital modules must be 5 VDC (for example, G4ODC5, but not G4ODC15 or G4ODC24).
[3] Not recommended for new designs
[4] See the *Legacy and Current Products Comparison and Compatibility Charts* (form 1693).
[5] Obsolete Product, contact Opto 22 Pre-Sales engineers for more information.

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On this page: C++ OptoMMP SDK for SNAP PAC.

If your I/O application requires...	Use this combination of equipment					
	Protocol	Software	Compatibility	Processor	Racks	I/O modules
Ethernet control of multiple discrete and/or analog I/O units No adapter card	OptoMMP	C++ OptoMMP SDK for *groov* EPIC, *groov* RIO, and SNAP PAC (Part #: PAC-DEV-OPTOMMP-CPLUS)	Windows® 11 Professional Windows® 10 Professional (32-bit & 64-bit)	GRV-EPIC-PR1 GRV-EPIC-PR2	All *groov* EPIC chassis	All *groov* I/O
				GRV-R7-MM1001-10 GRV-R7-MM2001-10 GRV-R7-I1VAPM-3	Integral	Integral
				SNAP-PAC-EB1[1] SNAP-PAC-EB1-FM[3] SNAP-PAC-EB2[1] SNAP-PAC-EB2-FM[3] SNAP-PAC-R1[1] SNAP-PAC-R1-FM[3] SNAP-PAC-R2[1] SNAP-PAC-R2-FM[3]	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
				SNAP-PAC-R1-B	B-series rack	All SNAP I/O
				E2 for analog	PB4AH PB8AH PB16AH	G1 (Standard) analog I/O
				G4EB2	G4PB32H PB32HQ	G4 racks: All 5 VDC logic G4 digital I/O PB rack: Quad Pak
				G4D32EB2-UPG	G4D32RS	G4 digital I/O
				SNAP-PAC-R1-B	B-series rack	All SNAP I/O
				SNAP-UP1-ADS[2] SNAP-UP1-D64[2] SNAP-UP1-M64[2] SNAP-B3000-ENET[2] SNAP-ENET-S64[2] SNAP-ENET-D64[2]	Brain-compatible SNAP rack	Brain-compatible SNAP I/O[4]

[1] Not recommended for new designs. The corresponding (obsolete) -W models (for example, SNAP-PAC-EB1-W) are also compatible.
[2] See the *Legacy and Current Products Comparison and Compatibility Charts* (form 1693).
[3] Obsolete Product, contact Opto 22 Pre-Sales engineers for more information.
[4] See the *Legacy and Current Products Comparison and Compatibility Charts* (form 1693).

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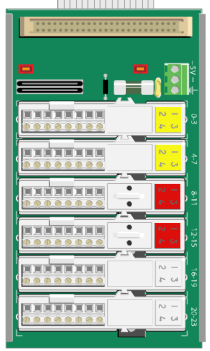
DIRECT CONTROL OF I/O—NO I/O PROCESSOR—SYSTEM EXAMPLE

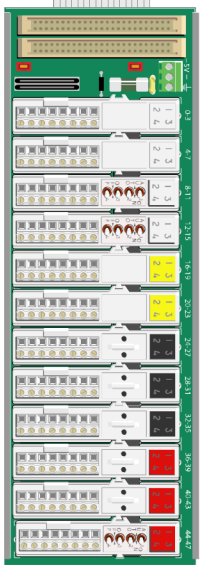
PC with AC5-type adapter card:
- PCIe bus: PCIe-AC5
- PCI bus: PCI-AC5
- ISA bus: AC5 or G4AC5

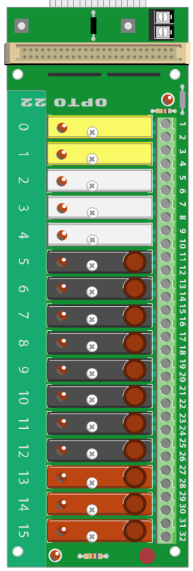
Use the **PC-Based Direct I/O SDK** to create a custom control program.
The control program runs on your PC and directly controls I/O; no brain (I/O processor) is used.

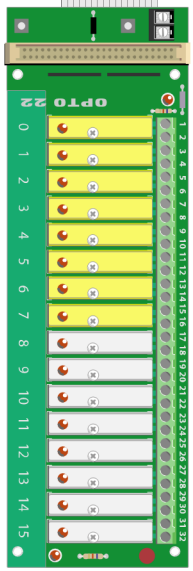
Separate 50-pin ribbon cables

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.

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DIRECT CONTROL OF I/O—NO 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	Processor	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 (Part #: PC-DIRECT-SDK)	Windows® 10 Professional (32-bit & 64-bit) Windows 8.1 Professional (32-bit & 64-bit) Windows 7 Professional (32-bit and 64-bit) Works with .NET platform languages, including C# and VB.NET®	--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				PB8 PB16A PB16C PB24 PB24Q	PB24Q: Quad Pak Other racks: G1 digital I/O
Direct, high-speed control of I/O points (24 or 48 points, depending on the card)	Direct I/O	ISA	G4AC5 AC5	No current SDK support		--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
							PB8 PB16A PB16C PB24 PB24Q	PB24Q: Quad Pak Other racks: G1 digital I/O

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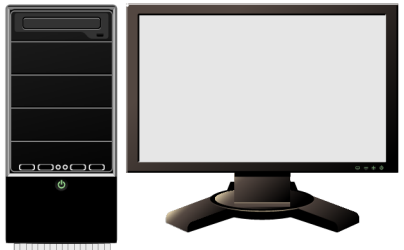
PAMUX: PC-BASED CONTROL VIA BRAIN (I/O PROCESSOR)—SYSTEM EXAMPLE

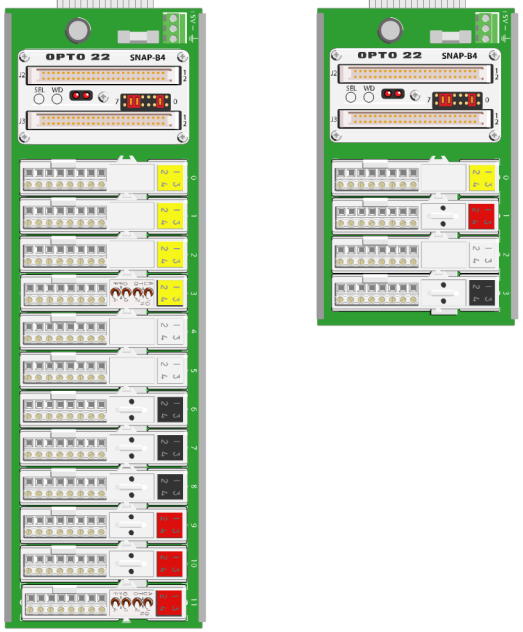
PC with Pamux adapter card:
For PCI bus: **PCI-AC51**
For PCIe bus: **PCIe-AC51**



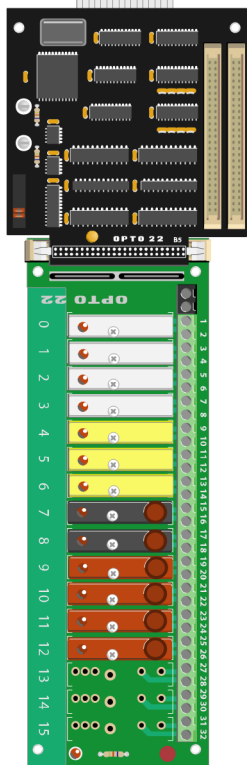
Use the **PAMUX Systems SDK** to create a custom program for PC-based control using the Pamux protocol.

50-pin ribbon cables

SNAP-B4 brains and SNAP digital I/O



B5 brain board and G4 digital I/O



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

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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	Processor	Racks	I/O modules
High-speed control via brain of multiple digital and/or analog I/O points Access to up to 512 I/O points, located up to 500 ft. (150 m.) away, per adapter card	Pamux	PCIe	PCIe-AC51	PAMUX Systems SDK (Part #: PC-PAMUX-SDK)	Windows 10 Professional (32-bit & 64-bit) Windows 8.1 Professional (32-bit & 64-bit) Windows 7 Professional (32-bit and 64-bit) Works with .NET platform languages, including C# and VB.NET.	SNAP-B4 (digital)	SNAP B-series	Brain-compatible SNAP I/O[1]
						B4 (digital)	G4PB32H PB32HQ	G4 rack: All 5 VDC logic 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: All 5 VDC logic digital I/O PB16HQ: Quad Pak PB16J/K/L: Racks with integrated G1 I/O Other PB racks: G1 (Standard) digital I/O
High-speed control via brain of multiple digital and/or analog I/O points Access to up to 512 I/O points, located up to 500 ft. (150 m.) away, per adapter card	Pamux	PCI	PCI-AC51	PAMUX Systems SDK (Part #: PC-PAMUX-SDK)	Windows 10 Professional (32-bit & 64-bit) Windows 8.1 Professional (32-bit & 64-bit) Windows 7 Professional (32-bit and 64-bit) Works with .NET platform languages, including C# and VB.NET.	SNAP-B4 (digital)	SNAP B-series	Brain-compatible SNAP I/O[1]
						B4 (digital)	G4PB32H PB32HQ	G4 rack: All 5 VDC logic 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: All 5 VDC logic digital I/O PB16HQ: Quad Pak PB16J/K/L: Racks with integrated G1 I/O Other PB racks: G1 (Standard) digital I/O

[1] See the *Legacy and Current Products Comparison and Compatibility Charts* (form 1693)
[2] Not recommended for new designs