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.
# ETHERNET: PC-BASED CONTROL USING SOFTPAC—DETAILS

<table>
<thead>
<tr>
<th>If your I/O application requires...</th>
<th>Use this combination of equipment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protocol</td>
<td>Software</td>
</tr>
<tr>
<td>Ethernet control of multiple discrete and/or analog I/O units</td>
<td>SoftPAC software-based programmable automation controller (programmed with PAC Control)</td>
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</tr>
</tbody>
</table>

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)
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.
### 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.

<table>
<thead>
<tr>
<th>If your I/O application requires...</th>
<th>Use this combination of equipment</th>
<th>Processor</th>
<th>Racks</th>
<th>I/O modules</th>
</tr>
</thead>
<tbody>
<tr>
<td>No adapter card</td>
<td>E1 for digital</td>
<td>G4PB8H G4PB16H G4PB16HC G4PB16/K/L PB4H PB8H PB16H PB16HC PB16HQ PB16K/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</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>G4PB32H G4PB32HQ</td>
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<td></td>
<td>G4D32RS</td>
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</tr>
<tr>
<td></td>
<td>SNAP-PAC-R1-B B-series rack</td>
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<tr>
<td></td>
<td>B-series rack</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>SNAP-PAC-R1-B B-series rack</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>SNAP-UP1-ADS SNAP-UP1-D64 SNAP-UP1-M64 SNAP-B3000-ENET SNAP-ENET-S64 SNAP-ENET-D64</td>
<td>Brain-compatible SNAP rack</td>
<td></td>
<td>Brain-compatible SNAP I/O</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>If your I/O application requires...</th>
<th>Protocol</th>
<th>Software</th>
<th>Use this combination of equipment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethernet control of multiple</td>
<td>OptoMMP</td>
<td>C++ OptoMMP SDK for</td>
<td>Use this combination of equipment for Ethernet control of multiple discrete and/or analog I/O units</td>
</tr>
<tr>
<td>No adapter card</td>
<td></td>
<td>groov EPIC, groov RIO,</td>
<td>GRV-EPIC-PR1, GRV-EPIC-PR2, OptoMMP C++ OptoMMP SDK for groov EPIC, groov RIO, and SNAP PAC (Part #:&lt;br&gt;PAC-DEV-OPTOMMP-CPLUS)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SNAP PAC (Part #: PAC-DEV-OPTOMMP-CPLUS)</td>
<td>Windows® 10 Professional (32-bit &amp; 64-bit)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Processor: All groov EPIC chassis, Racks: All groov I/O, I/O modules: All SNAP I/O</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>GRV-R7-MM1001-10, GRV-R7-MM2001-10, GRV-R7-11VAPM-3, SNAP-PAC-EB1, SNAP-PAC-EB1-FM, SNAP-PAC-EB2, SNAP-PAC-EB2-FM, SNAP-PAC-R1, SNAP-PAC-R1-FM, SNAP-PAC-R2, SNAP-PAC-R2-FM</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>G4PB32H, G4PB32HQ, G4D32EB2-UPG, G4D32RS, G4 racks: All 5 VDC logic, G4 digital I/O, PB rack: Quad Pak</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>SNAP-PAC-R1, SNAP-PAC-R1-FM, SNAP-PAC-R2, SNAP-PAC-R2-FM, B-series rack: All SNAP I/O</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>SNAP-UP1-ADS, SNAP-UP1-D64, SNAP-UP1-M64, SNAP-B3000-ENET, SNAP-ENET-S64, SNAP-ENET-D64, Brain-compatible SNAP rack, Brain-compatible SNAP I/O</td>
</tr>
</tbody>
</table>

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

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.

See the table on the following page for all supported I/O.
## DIRECT CONTROL OF I/O—NO I/O PROCESSOR—DETAILS

<table>
<thead>
<tr>
<th>If your I/O application requires...</th>
<th>Use this combination of equipment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct, high-speed control of I/O points (24 or 48 points, depending on the card)</td>
<td><strong>Product Line or Protocol</strong>&lt;br&gt;Direct I/O</td>
</tr>
<tr>
<td>Direct I/O ISA</td>
<td><strong>PC Bus</strong>&lt;br&gt;ISA</td>
</tr>
</tbody>
</table>
SERIAL: PC-BASED CONTROL VIA I/O PROCESSOR—SYSTEM EXAMPLE

For mistic protocol, use the OptoDriver Toolkit to create your custom control program. The program runs on your PC and controls all mistic I/O units.

For Optomux protocol, use Optomux Driver Protocols & Utilities to create your custom control program. The program runs on your PC and controls all Optomux I/O units. (Some older systems may use OptoDriver Toolkit instead; see descriptions on our website.)

See the tables on the following two pages for all supported brains, I/O, and adapter cards.
### SERIAL: PC-BASED CONTROL VIA I/O PROCESSOR—DETAILS

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

<table>
<thead>
<tr>
<th>If your I/O application requires...</th>
<th>Use this combination of equipment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Product Line or Protocol</strong></td>
<td><strong>PC Bus</strong></td>
</tr>
<tr>
<td>serial control of multiple digital and/or analog brains</td>
<td>mistic</td>
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</tr>
</tbody>
</table>

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1. The B3000 brain board is obsolete; it has been replaced by the B3000-B.
2. See the Legacy and Current Products Comparison and Compatibility Charts (form 1693)
3. B1 and B2 brain boards are obsolete; they have been replaced by E1 and E2 brain boards, respectively.
The table on this page covers PCs with an ISA bus; see the following page if your PC has no available PCI slot.

<table>
<thead>
<tr>
<th>If your I/O application requires...</th>
<th>Product Line or Protocol</th>
<th>PC Bus</th>
<th>Adapter Card</th>
<th>Software Developer Toolkit</th>
<th>Compatibility</th>
<th>Processor</th>
<th>Racks</th>
<th>I/O modules</th>
</tr>
</thead>
<tbody>
<tr>
<td>Serial control of multiple digital and/or analog brains</td>
<td>mistic</td>
<td>ISA</td>
<td>AC37</td>
<td>OptoDriver Toolkit</td>
<td>Windows® 2000 B3000-B (analog/digital)</td>
<td>SNAP B-series</td>
<td>B3000-B (analog/digital)</td>
<td>Compatible analog &amp; digital SNAP I/O²</td>
</tr>
<tr>
<td>Support for 31 devices without using a repeater. With repeaters, 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</td>
<td></td>
<td></td>
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<td>Windows XP B3000-1 (analog/digital)</td>
<td>SNAP-B8M (digital)</td>
<td>SNAP-B8M SNAP-B8MC SNAP-B8MC-P</td>
<td>SNAP 4-channel digital I/O</td>
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<td>Windows 95 SNAP-BRS (digital)</td>
<td>G4D16R brick (integrated brain, rack, and G4 digital I/O)</td>
<td>G4 digital racks: All 5 VDC logic digital I/O</td>
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<td></td>
<td>Windows 98 SNAP-B8M</td>
<td>G4D32RS brick (integrated brain, rack, and G4 digital I/O)</td>
<td>PB digital racks: All G1 (Standard) digital I/O</td>
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<td>Windows ME SNAP-B8MC</td>
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<td>Microsoft Visual C++ SNAP-B8MC-P</td>
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<td></td>
<td>Microsoft Visual Basic (using Microsoft Visual Studio 6)</td>
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</tbody>
</table>

1 The B3000 brain board is obsolete; it has been replaced by the B3000-B.
2 See the Legacy and Current Products Comparison and Compatibility Charts (form 1693)
3 B1 and B2 brain boards are obsolete; they have been replaced by E1 and E2 brain boards, respectively.
The table on this page covers PCs that have no available PCI slot.

<table>
<thead>
<tr>
<th>Product Line or Protocol</th>
<th>PC Bus</th>
<th>Adapter card</th>
<th>Software Developer Toolkit</th>
<th>Compatibility</th>
<th>Processor</th>
<th>Racks</th>
<th>I/O modules</th>
</tr>
</thead>
</table>

1 The B3000 brain board is obsolete; it has been replaced by the B3000-B.
2 See the Legacy and Current Products Comparison and Compatibility Charts (form 1693).
3 B1 and B2 brain boards are obsolete; they have been replaced by E1 and E2 brain boards, respectively.
PAMUX: PC-BASED CONTROL VIA BRAIN (I/O PROCESSOR) – SYSTEM EXAMPLE

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

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

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

50-pin ribbon cables

SNAP-B4 brains and SNAP digital I/O

BS5 brain board and G4 digital I/O

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.
## PAMUX: PC-BASED CONTROL VIA BRAIN (I/O PROCESSOR)—DETAILS

<table>
<thead>
<tr>
<th>If your I/O application requires...</th>
<th>Product Line or Protocol</th>
<th>PC Bus</th>
<th>Adapter Card</th>
<th>Software Developer Toolkit</th>
<th>Compatibility</th>
<th>Processor</th>
<th>Racks</th>
<th>I/O modules</th>
</tr>
</thead>
<tbody>
<tr>
<td>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</td>
<td>Pamux PCIe PCIe-AC51</td>
<td>Pamux PCIe PCIe-AC51</td>
<td>PAMUX Systems SDK (Part #: PC-PAMUX-SDK)</td>
<td>Windows 10 Professional (32-bit &amp; 64-bit) Windows 8.1 Professional (32-bit &amp; 64-bit) Windows 7 Professional (32-bit and 64-bit)</td>
<td>Works with .NET platform languages, including C# and VB.NET.</td>
<td>SNAP-B4 (digital)</td>
<td>SNAP B-series</td>
<td>Brain-compatible SNAP I/O(^1)</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>B4 (digital)</td>
<td>G4PB32H PB32HQ</td>
<td>G4 rack: All 5 VDC logic digital I/O PB32HQ: Quad Pak</td>
</tr>
<tr>
<td>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</td>
<td>Pamux PCI PCI-AC51</td>
<td>Pamux PCI PCI-AC51</td>
<td>PAMUX Systems SDK (Part #: PC-PAMUX-SDK)</td>
<td>Windows 10 Professional (32-bit &amp; 64-bit) Windows 8.1 Professional (32-bit &amp; 64-bit) Windows 7 Professional (32-bit and 64-bit)</td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td>B4 (digital)</td>
<td>G4PB32H PB32HQ</td>
<td>G4 rack: All 5 VDC logic digital I/O PB32HQ: Quad Pak</td>
</tr>
</tbody>
</table>

\(^1\) See the Legacy and Current Products Comparison and Compatibility Charts (form 1693)

\(^2\) Not recommended for new designs

(Continued next page)
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<tr>
<th>If your I/O application requires...</th>
<th>Product Line or Protocol</th>
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<th>I/O modules</th>
</tr>
</thead>
<tbody>
<tr>
<td>Access to up to 512 I/O points, located up to 500 ft. (150 m.) away, per adapter card</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>B4 (digital)</td>
<td>G4PB16J/K/L: Racks with integrated G1 I/O</td>
<td>G4PB16J/K/L: Racks with integrated G1 I/O</td>
<td>G4P8H PB8H PB16H PB16HC PB16HQ PB16J/K/L</td>
</tr>
</tbody>
</table>

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