Considerations for Choosing a Programmable Automation Controller (PAC)

Perhaps you've been reading about programmable automation controllers (PACs) and how they combine the capabilities of several traditional control and monitoring systems. (See "Comparing PACs to Other Technologies" on page 3.) As industrial applications become more complex—requiring the integration of multiple systems; incorporating process, discrete, and motion control; providing realtime data to company databases—perhaps you're thinking PACs could be useful in your application.

Many automation manufacturers are offering PACs now, and the capabilities of these controllers vary. When you're choosing programmable automation controllers for your application, here are some considerations to keep in mind.

New System

For a new system, a PAC offers monitoring, control, and data acquisition capabilities plus Ethernet connections with company computers. Full analog and digital control, motion control, the ability to interface with serial devices, and remote monitoring should all be PAC capabilities. You may not need them all now, but needs have a way of expanding.

Also, look for PAC features that can reduce network hardware expenditures, such as extra built-in network interfaces.

The PAC shown at right, for example, includes two independent Ethernet network interfaces plus four serial ports configurable for RS-232 or RS-485/422.

A PAC with multiple network interfaces reduces hardware costs.

Existing System

For an existing installation, a PAC can consolidate separate systems and link them with company computers, so that control, production, and monitoring data can be exchanged as needed.

Verify that new PACs are compatible with all legacy systems, including all networks and protocols.

Location and Extent of System

Is your system distributed over a broad area? Do you need to monitor assets in remote locations? Because PACs combine distributed control with remote communication options, they can efficiently handle extensive systems with remote installations.

PACs efficiently handle extensive systems, because they combine distributed control and remote communication options.

Choose the PAC to suit the size of your system. For example, a PAC that mounts on the I/O rack is probably more suited to cell control, RTU-type installations, or smaller systems. A more powerful, standalone PAC may be needed for more extensive systems.

For the most efficient PAC-based system, choose one that utilizes distributed *intelligence*, not just a distributed *architecture*. Distributed intelligence offloads many control functions to remote processors co-located with distributed I/O. Distributed intelligence shortens wiring runs, reduces network traffic, maintains critical control should communications fail, and frees the central controller for supervisory tasks.

Networks and Communications

Choose a PAC that has all the networking and communication options you need—and anticipate needing—built in.

Networks may include Ethernet (either wired or wireless), serial, or others.

Communication options might include OPC, Modbus® or Modbus/TCP, Profibus®, Allen-Bradley DF1, and other standards on the control side. For communication with computer networks, you may also need protocols such as TCP/IP, SMTP for email, SNMP for network management, and FTP for file transfer.

Environment

In contrast to a personal computer (PC), PACs are industrially hardened and built to withstand normal industrial use. Check the PAC's specs for temperature and humidity tolerances.

If your application involves extreme temperatures, vibration, dampness, dust, electrical noise, or other exceptional conditions, provide necessary enclosures and protection just as you would for a traditional control system.

Types of Sensors, Actuators, and Devices

Signal requirements for inputs and outputs vary widely. Look for PAC-based systems offering reliable I/O with the signals you need. These may include temperature, rate, RMS, pH/ORP, load cell, and others in addition to voltage and current. The PAC should be able to communicate with all signal types natively, rather than requiring signal conditioners.

Where cabinet space is limited, high-density I/O is a good choice. Software-configurable I/O—for example, an input module configurable as any of several thermocouple types—offers flexibility and reduces the number of spares you need to have on hand.

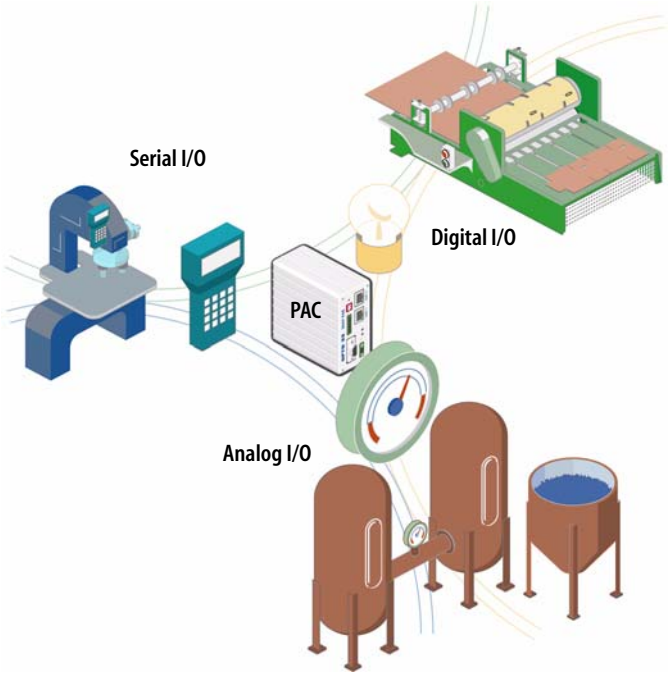
Advanced Control Capabilities

PAC-based systems have advanced control capabilities built in. Make sure that your requirements for high-speed digital control, motion control, PID loop control, and mathematically complex logic, for instance, can be satisfied without expensive add-ons.

Advanced Programming

Because a PAC is similar to a PC, the integrated software that comes with it includes advanced programming features such as subroutines, string handling, complex conditions, and floating-point math. In addition, a PAC can often be programmed in C or other standard programming languages.

While it may seem easier to continue using programming tools you're familiar with (such as ladder logic for a PLC), you may find that software designed for the PAC is more efficient for your expanding needs. It's a good idea to explore any software suite designed for the



A PAC can simultaneously monitor and control digital, analog, and serial I/O signals from sensors, actuators, and devices.

PAC. Such software will likely save development time and effort, and it may be easier to learn than you think. For more on PAC software, see the white paper *Software for Programmable Automation Controllers* (Opto 22 form #1736).

Data Acquisition and Database Connectivity

For data acquisition applications, choose a PAC system with two strengths: first, substantial memory for acquiring and storing data; and second, the ability to share data directly with corporate databases over an Ethernet network.

If control networks and computer networks need to be separated, consider how you'll accomplish this. One way is to segment networks using independent Ethernet network interfaces on the PAC itself.

Operator Interface

Check out the PAC-based system's human-machine interface (HMI) options. The integrated software development environment should use a single tagname database, so that once you define variables and I/O in the control software, you can immediately use them in the HMI software.

A PAC should also offer communication with third-party HMIs using OPC. And other options, such as a touchscreen terminal, may be available as well.

Future Expansion

Finally, plan for the future. When your needs change, additional distributed I/O should be handled by the same PAC—as should process, discrete, and motion control.

All of these types of control should be programmable in the same software as part of the same system, and most changes should require no middleware or add-ons.

Comparing PACs to Other Technologies

It's easier to understand and evaluate a new technology if you can see how its capabilities compare with technologies you already know. The following chart compares features of a PAC with common features of PCs, PLCs, DCSs, and RTUs.

Which features will your application require? Make sure the PAC you choose has all the features you anticipate needing, both now and in the future.

Feature	PCs	PLCs	RTUs	DCSs	PACs
Industrially hardened hardware		●	●	●	●
Discrete control/sequential control		●	●		●
Process control (batch and continuous)	●	●		●	●
Remote monitoring & control, SCADA		●	●		●
Motion control	●				●
Multi-domain capabilities (One controller performs logic, process control, discrete control, motion control, monitoring, and data acquisition.)	●				●
Distributed control functions to reduce load on central controller (for example, PID loop control, pulse generation, latching, events and alarms)				●	●
Critical local operations continue in the event of a communication failure.				●	●
Multifunction (Meet complex requirements without add-ons or middleware.)					●
Multitasking	●				●
Efficient processing and I/O scanning (PACs scan only when logic requires it, thus reducing data polling and network traffic.)	●			●	●
Data-intensive applications such as recipe or batch processes; recipe switching	●	●		●	●
Floating-point math	●	●		●	●
Compact, high-density system		●			●
Flexible, modular architecture (Use same hardware in small or large system; easily expand system with additional modules.)					●
Extensive communication options	●		●		●
Open languages and standard protocols	●	●			●
Open, standard network interfaces	●				●
Easy support for multiple vendors' hardware and software	●				●
Integrated hardware and software				●	●
Integrated development environment for all applications (Discrete, analog, serial, motion, etc. Reduces programming effort/time.)					●
Common tagname database (No retyping or cross-reference lists)		●			●
Long, plain-language tagnames					●

For more information on PACs, visit the Opto 22 website, www.opto22.com.
Click the Learn tab for videos, product comparison charts, and white papers.

More About Opto 22

Products

Opto 22 develops and manufactures reliable, flexible, easy-to-use hardware and software products for industrial automation, remote monitoring, and data acquisition applications.

SNAP PAC System

Designed to simplify the typically complex process of understanding, selecting, buying, and applying an automation system, the SNAP PAC System consists of four integrated components:

- SNAP PAC controllers
- PAC Project™ Software Suite
- SNAP PAC brains
- SNAP I/O™

SNAP PAC Controllers

Programmable automation controllers (PACs) are multifunctional, multidomain, modular controllers based on open standards and providing an integrated development environment.

Opto 22 has been manufacturing PACs for many years. The latest models include the standalone SNAP PAC S-series and the rack-mounted SNAP PAC R-series. Both handle a wide range of digital, analog, and serial functions and are equally suited to data collection, remote monitoring, process control, and discrete and hybrid manufacturing.

SNAP PACs are based on open Ethernet and Internet Protocol (IP) standards, so you can build or extend a system without the expense and limitations of proprietary networks and protocols.

PAC Project Software Suite

Opto 22's PAC Project Software Suite provides full-featured and cost-effective control programming, HMI (human machine interface) development and runtime, OPC server, and database connectivity software to power your SNAP PAC System.

These fully integrated software applications share a single tagname database, so the data points you configure in PAC Control™ are immediately available for use in PAC Display™, OptoOPCServer™, and OptoDataLink™. Commands are in plain English; variables and I/O point names are fully descriptive.

PAC Project Basic offers control and HMI tools and is free for download on our website, www.opto22.com. PAC Project Professional, available for separate purchase, adds OptoOPCServer, OptoDataLink, options for Ethernet link redundancy or segmented networking, and support for legacy Opto 22 serial *mistic*™ I/O units.

SNAP PAC Brains

While SNAP PAC controllers provide central control and data distribution, SNAP PAC brains provide distributed intelligence for I/O processing and communications. Brains offer analog, digital, and serial functions, including thermocouple linearization; PID loop control; and optional high-speed digital counting (up to 20 kHz), quadrature counting, TPO, and pulse generation and measurement.

SNAP I/O

I/O provides the local connection to sensors and equipment. Opto 22 SNAP I/O offers 1 to 32 points of reliable I/O per module, depending on the type of module and your needs. Analog, digital, serial, and special-purpose modules are all mixed on the same mounting rack and controlled by the same processor (SNAP PAC brain or rack-mounted controller).

Quality

Founded in 1974 and with over 85 million devices sold, Opto 22 has established a worldwide reputation for high-quality products. All are made in the U.S.A. at our manufacturing facility in Temecula, California. Because we do no statistical testing and each part is tested twice before leaving our factory, we can guarantee most solid-state relays and optically isolated I/O modules for life.

Free Product Support

Opto 22's Product Support Group offers free, comprehensive technical support for Opto 22 products. Our staff of support engineers represents decades of training and experience. Product support is available in English and Spanish, by phone or email, Monday through Friday, 7 a.m. to 5 p.m. PST.

Free Customer Training

Hands-on training classes for the SNAP PAC System are offered at our headquarters in Temecula, California. Each student has his or her own learning station; classes are limited to nine students. Registration for the free training class is on a first-come, first-served basis. See our website, www.opto22.com, for more information or email training@opto22.com.

Purchasing Opto 22 Products

Opto 22 products are sold directly and through a worldwide network of distributors, partners, and system integrators. For more information, contact Opto 22 headquarters at 800-321-6786 or 951-695-3000, or visit our website at www.opto22.com.

www.opto22.com

www.opto22.com • Opto 22 • 43044 Business Park Drive • Temecula, CA 92590-3614 • Form 1335-070717
SALES 800-321-6786 • 951-695-3000 • FAX 951-695-3095 • sales@opto22.com • **SUPPORT** 800-835-6786 • 951-695-3080 • FAX 951-695-3017 • support@opto22.com