What is a Programmable Controller?

What are programmable controllers and how do they work?

Programmable controllers are often defined as miniature industrial computers that contain hardware and software used to perform control functions. A controller consists of two basic sections: the central processing unit (CPU) and the input/output interface system. The CPU, which controls all system activity, can further be broken down into the processor and memory system. The input/output system is physically connected to field devices (e.g., switches, sensors, etc.) and provides the interface between the CPU and the information providers (inputs) and controllable devices (outputs).

To operate, the CPU "reads" input data from connected field devices through the use of its input interfaces, and then "executes" or performs the control program that has been stored in its memory system. Programs are typically created in ladder logic, a language that closely resembles a relay-based wiring schematic, and are entered into the CPU's memory prior to operation. Finally, based on the program, the PLC "writes" or updates output devices via the output interfaces. This process, also known as scanning, typically continues in the same sequence without interruption, and changes only when a change is made to the control program.

Discrete applications

Programmable controllers are often used to control machines or processes that are sequential in nature, using "discrete" inputs and outputs that have defined states. For example, if a limit switch detects the presence of an object, it provides an "ON" signal to the PLC; if no object is detected, it provides an "OFF" signal. The machine or device typically performs actions based on time or events in a pre-defined order. The expected sequence is typically interrupted only when an abnormal condition occurs.

Process control applications

Programmable controllers can also control continuous processes that use analog I/O. For example, a temperature sensor may provide a variable signal, such as 0-10 volts, based on the measurement of an actual temperature. The controller program monitors the sensed values continuously and operates devices that may also be analog in nature. This could include setting the position of a valve between 0-100% open, or controlling the speed of a motor. Continuous applications are so called because they typically have no defined start or end once they are initiated; they maintain a process in a "steady" operating state.

Today's controllers

Initially, devices that exhibited the attributes discussed here were known as Programmable Logic Controllers (PLCs). This tended to emphasize that the main functionality of these systems was LOGIC operations. As technology has advanced, so have programming languages and communications capabilities, along with many other important features. These developments seemed to demand the definition of a new class of controller, the Programmable Automation Controller (PAC), which combines features of traditional PLCs with those of personal computers.

In the past, size was typically used to categorize controllers, and was often an indication of the features and types of applications it would accommodate. Small, non-modular PLCs (also known as fixed I/O PLCs) generally have less memory and accommodate a small number of inputs and outputs in fixed configurations. Modular PLCs have bases or racks that allow installation of multiple I/O modules, and will accommodate more complex applications. With the emergence of PACs, functionality is the determining factor in categorizing controllers.

Which programmable controller is right for you?

Choosing the most effective controller for your application depends on a number of factors. To begin the selection process, a drawing of the machine or process is a good start. This can help identify field devices and physical requirements for hardware locations. From the drawing, you can determine how many analog and/or discrete devices you will have.

Once the field device requirements and hardware locations are defined, you can review controllers that will meet your requirements. See the Controller Selection Worksheet in this section that will help you work through the considerations for determining the type of controller you will need, regardless of which manufacturers you are evaluating.

Programmable Controller — POWER SUPPLY — CPU, MEMORY, COMMUNICATIONS — Switches, Sensors, Smart Devices → INPUT SECTION → OUTPUT SECTION → Motor Starters, Lights, Valves, Smart Devices
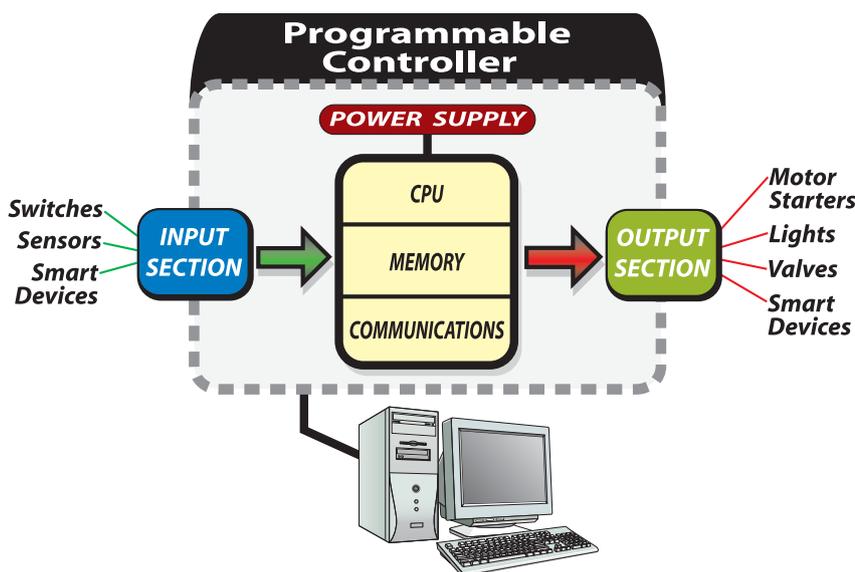
PLC vs. PAC vs. PC-based Control

The most common control systems today are the Programmable Logic Controller (PLC), PC-based control, and the most recent addition, the Programmable Automation Controller (PAC). While they each share a few attributes with the others, their differences lie mainly in form factor and functionality.

Programmable Logic Controller

The Farlex Dictionary defines a PLC as follows: "A programmable microprocessor-based device that is used in discrete manufacturing to control assembly lines and machinery on the shop floor as well as many other types of mechanical, electrical and electronic equipment in a plant. Typically RISC based and programmed in a specific-purpose programming language, a PLC is designed for realtime use in rugged, industrial environments. Connected to sensors and actuators, PLCs are categorized by the number and type of I/O ports they provide and by their I/O scan rate."

PLCs excel at sequential logic and basic analog control. Their modularity and ruggedness make them suitable for a wide variety of automation applications.

PC-based Control

With Personal Computer technology booming in the 1980s and 1990s, there was a natural progression to consider using the processing power in these units to solve more complicated applications that extended well beyond the realm of digital and analog I/O manipulation. These more advanced capabilities could be performed far more efficiently by hardware and software native to the commercial personal computer. Examples of these requirements include:

- The need for a Human Machine Interface (HMI) as well as control
- Advanced data manipulation and advanced math functions
- Data exchange with business applications (spreadsheets, ERP systems)
- One or more third-party PC cards, such as those for motion control or vision systems
- Communication with serial or networked field devices
- Storage or access to large amounts of data
- Large number of PID loops (64 or more)
- Open architecture for C/C++ or VisualBasic systems
- Online productivity tools to analyze and improve performance of the process

In a PC-based control system, a standard operating system such as Windows NT supports HMI and control software running on a PC platform, either a readily available commerical model or an industrially hardened unit. PC architecture allows the system to seamlessly support a variety of third-party I/O, specialty motion and vision systems, and field networks.

Programmable Automation Controller

A programmable automation controller is a compact controller that combines the features and capabilities of a PC-based control system with that of a typical programmable logic controller (PLC).

This hybrid arose not only to solve complex applications with the speed and processing power of a PC-based system, but to do it on a platform capable of withstanding the environmental pounding that PLCs have been subjected to for many years.

Ideally, a PAC encompasses the following features:

PLC Feel

- Modular footprint
- Industrial reliability
- Wide array of I/O modules and system configurations

PC Power

- Large memory and fast processing
- High-level data handling and enterprise connectivity
- Extensive communications capability, multiple protocols and field networks

PACs are most often used for advanced machine control, process control, data acquisition and equipment monitoring.

Although each PAC vendor uses their own development environment (IDE) and programming language, PAC networking is typically based on IP and Ethernet.

This class of controller provides more memory capacity and processing power which allows for better data processing capabilities, and connectivity to enterprise business systems from the plant floor.

Additionally, PACs offer the benefit of easy integration for multi-domain systems comprising Human Machine Interface (HMI), discrete control and process control.

Company Information
Systems Overview
Programmable Controllers
Field I/O
Software
C-more & other HMI
Drives
Soft Starters
Motors & Gearbox
Steppers/ Servos
Motor Controls
Proximity Sensors
Photo Sensors
Limit Switches
Encoders
Current Sensors
Pressure Sensors
Temperature Sensors
Pushbuttons/ Lights
Process
Relays/ Timers
Comm.
Terminal Blocks & Wiring
Power
Circuit Protection
Enclosures
Tools
Pneumatics
Appendix
Product Index
Part # Index

Considerations for Choosing a Controller

Use the worksheet on the following pages as a checklist of the things to consider when determining programmable controller requirements. It lists the most important areas to consider when choosing a system, and provides space for recording determinations of your system needs.

Consideration	Information to Record		Why this is important
1. Proposed System	_____ New system	_____ Existing system	Determine whether your system is new or existing: Will your system be installed from scratch or are there existing products already installed? The rest of your system will need to be compatible with new components. *Why this is important:* Certain controller products may not be compatible with others. Making sure your existing products are compatible with any new products you are researching will save you time and money. Check appropriate entry.
2. Environmental Issues	_____ Codes/environmental issues to consider	_____ No codes or environmental issues to consider	Consider any environmental issues that will affect your application (temperature, dust, vibration, codes specific to your facility, etc.). *Why this is important:* Certain environments may affect the operation of a controller. For example, typical controllers have an operating temperature of 0-55 degrees Celsius (32-130 degrees F). If your application will include any extreme environmental conditions, or you have specific codes at your facility that must be met, you will need to either research products that meet those specifications or design the installation to meet requirements. Check appropriate entry.
3. Discrete Devices	_____ Total inputs: _____ AC _____ DC	_____ Total outputs: _____ AC _____ DC	Determine how many discrete devices your system will have. Which types (AC, DC, etc.) are needed? *Why this is important:* The number and type of devices your system will include is directly linked to the amount of I/O that will be necessary for your system. You will need to choose a controller that supports your I/O count requirements and has modules that support your signal types. Enter quantities and type based on corresponding field devices.
4. Analog Devices	_____ Total inputs: _____ Voltage _____ Current _____ Thermo _____ RTD	_____ Total outputs: _____ Voltage _____ Current	Determine how many analog devices your system will have. Which types (voltage, current, temperature, etc.) are needed? *Why this is important:* The number and type of devices your system will include is directly linked to the amount of I/O that will be necessary for your system. You will need to choose a controller that supports your I/O count requirements and has modules that support your signal types. Enter quantities and type based on corresponding field devices.
5. Specialty Modules or Features (application-specific)	_____ High speed counter _____ Positioning _____ Servo/stepper _____ BASIC programming _____ Real-time clock _____ Others (list)		Determine whether your system will require any specialty features: Will your application require high-speed counting or positioning? What about a real-time clock or other specialty feature? *Why this is important:* Specialty functions are not necessarily available in a controller CPU or in standard I/O modules. Understanding the special functions your system may perform will help you determine whether or not you will need to purchase additional specialty modules. Check all features required.

Table continued on the following page

Considerations for Choosing a Controller

Company Information

Systems Overview

Programmable Controllers

Field I/O

Software

C-more & other HMI

Drives

Soft Starters

Motors & Gearbox

Steppers/ Servos

Motor Controls

Proximity Sensors

Photo Sensors

Limit Switches

Encoders

Current Sensors

Pressure Sensors

Temperature Sensors

Pushbuttons/ Lights

Process

Relays/ Timers

Comm.

Terminal Blocks & Wiring

Power

Circuit Protection

Enclosures

Tools

Pneumatics

Appendix

Product Index

Part # Index

Consideration	Information to Record		Why this is important
6. CPU Required	**Hardware requirements:** _____ K program memory required (estimated) _____ K data memory required (estimated) _____ Fast scan time required? _____ Battery backup required? **Software/special function requirements:** ____ PID ____ Floating Point Math Others (see Programming section below)		Determine the type of CPU you will need: How much memory will your system require? How many devices will your system have (determines data memory)? How large is your program, and what types of instructions will your program include (determines program memory)? How fast a scan time do you need? *Why this is important:* Data memory refers to the amount of memory needed for dynamic data manipulation and storage in the system. For example, counter and timer instructions typically use data memory to store setpoints, current values, and other internal flags. If the application requires historical data retention, such as measured device values over a long period of time, the size of the data tables required may determine the CPU model you choose. Program memory is the amount of memory needed to store the sequence of program instructions that have been selected to perform the application. Each type of instruction requires a specific amount of program memory, typically defined in a programming manual. Applications that are basically sequential in nature can rely on the I/O device rule of thumb to estimate program memory (five words of memory for each I/O device); complex applications will be more difficult to judge. If scan time is important in your application, consider the CPU processor speed as well as instruction execution speed. Some CPUs are faster at boolean logic but slower with data handling instructions. If special functions such as PID are required, the CPU you select may make those functions easier to perform. For program memory required, follow this rule of thumb: 5 words of program memory for each discrete device and 25 words for each analog device. Check or calculate all requirements that apply.
7. I/O Locations	_____ Local . . . only	_____ Remote Locations Specific remote I/O protocol required? Which one? _____	Determine where your I/O will be located: Will your system require only local I/O, or both local and remote I/O locations? *Why this is important:* If subsystems will be needed at long distances from the CPU, you will need a controller that supports remote I/O. You will also have to determine if the remote distances and speeds supported will be adequate for your application. Serial and Ethernet-based I/O hardware are two typical choices available for most systems. This I/O may also be referred to as distributed I/O, and may require a particular protocol, such as Modbus. Enter number of physical locations needed, and if/what specific protocol may be required.
8. Commuications	_____ Ethernet _____ PLC to PLC _____ Modbus RTU _____ ASCII (interface to serial devices) _____ Other		Determine your communication requirements: Will your system be communicating to other networks, systems or field devices? *Why this is important:* Communication ports (other than the programming port) are not always included with a controller. Knowing your system communication requirements will help you choose a CPU that supports your communication requirements, or additional communication modules if necessary. Check any/all communications functions required.
9. Programming	_____ Floating point math _____ Drum sequencer	_____ PID loops _____ number of loops needed _____ Subroutines _____ Direct interrupts _____ Others (list)	Determine your programming requirements: Does your application require only traditional programming instructions, or are special instructions necessary? *Why this is important:* Certain controllers may not support every type of instruction. You will need to choose a model that supports all instructions that you may need for a specific application. For example, built-in PID functions are much easier to use than writing your own code to perform closed-loop process control. Typical instructions such as timers, counters, etc. are available in most controllers; note any other special instructions required here. Check any/all programming functions required.

Programmable Controller Summary

Those making the buying decisions for Programmable Controller applications can have very different needs. Our goal is to offer a selection of controller families that best fit your specific application needs. Regardless if you are a newcomer to programmable controllers or if you are a seasoned veteran; whether you need simple discrete control or if you need to calculate complex algorithms lightning fast, we have a controller family that is perfect for you.

CLICK
Our best value PLC

The CLICK PLC is rapidly becoming one of the industry's favorite control systems in the 142 I/O or less category.

Get standard PLC features (discrete and analog) in a compact yet expandable design. The FREE software offers an extremely easy to use programming experience with powerful features commonly found in programs costing several hundred dollars.

- Select from a variety of Stand-alone CPU combinations with AC / DC / Relay & Analog I/O available
- Built-in communications ports (two in the Basic CPUs, three in the Analog CPUs)
- Eleven stackable, discrete I/O modules
- 21 Intuitive and easy to use instructions
- 8000 step program memory
- Store your program and ladder documentation in the CPU
- PLCs start at $69.00 (stand-alone, DC powered CPU with 8DC in & 6DC out)

FREE SOFTWARE

DirectLOGIC
The most practical PLCs

DirectLOGIC PLCs (nano fixed I/O to modular units) are industry workhorses, time-tested in some of the toughest industrial settings. Installed in thousands of applications, their wide range of I/O and communication options ensure you've got the tools you need to do the job.

From simple machine sequencing to process control, you will find a quality programmable controller to suit your application at a fraction of the price you'd normally expect to pay.

- 6 PLC platforms to chose from within the DirectLOGIC family
- **DL05** stand-alone brick PLC with one available option slot (30 I/O max)
- **DL06** stand-alone brick PLC with 4 available option slots (100 I/O max)
- **DL105** stand-alone brick PLC with high amp relays (18 I/O max)
- **DL205** powerful modular PLC with the most available option modules (up to 16,384 I/O max)
- **DL305** time tested, legacy control platform (up to 368 I/O max)
- **DL405** time tested, legacy control platform (up to 16,384 I/O max)

FREE SOFTWARE*

Productivity3000
PAC features for a PLC price

The Productivity 3000 shatters the price per feature paradigm in every category.

Once again, AutomationDirect challenges the status quo to remain the #1 Value in Automation, with prices that can't be beat and a two-year warranty on all modules.

- Auto discovery of hardware, including remote I/O bases & GSDrives when connected to the Ethernet remote I/O network
- Tag name database programming
- Task management
- Advanced "fill-in-the-blank" instructions
- Seamless Corporate Database connectivity
- Run-time Editing and project transfer
- Project file, tag database and ladder documentation stored in the CPU
- Much more

FREE SOFTWARE

100 word limited version. Full version cost is $395.00

Application Briefs

DL06 PLC puts heaters to the test

Pyromatics Automation Systems of Crystal Lake, Il. was contracted by a customer to develop a Life Cycle Test Station for its electric heating elements.

This test station needed a user-friendly graphical interface to give operators the ability to select multiple ramp/soak parameters, output voltages, temperature sensor types, amperage ratings and total cycle counts on tests for the cast-in electric heater platens. The system also needed to record temperature, volts, and current draw throughout the test for use in quality reports. Also, a failure of the heater required a safe shutdown of the test while alerting the quality department of the alarm condition.

Pyromatics selected the cost-effective DirectLOGIC® DL06 PLC as the heart of the system because of its ability to control up to eight PID loops and the multiple expansion slots available for thermocouple cards and analog input modules. It also controls two heaters, two chillers and an array of panel indicators, buttons, switches and relays.

A C-more 10-inch TFT touch-screen operator interface was used to provide operators with the necessary interface to operate and monitor the tests.

The completed system allows users to quickly connect the heater to be tested, enter test parameters, and run the test. Trend charts on the C-more panel track test parameters and quickly identify potential issues such as sudden drops in current or temperature.

Alarm reporting and history are also automatically recorded, allowing the operator to determine causes of failure. Data from the test can be easily uploaded to a USB thumb drive from the C-more panel. The data can then be imported into the user's choice of word processor or spreadsheet.

Semi cab sheeting production improved

ITS, a design build firm in Columbus, Ohio specializes in industrial automation. The company was contacted by a division of International Harvester responsible for the manufacturing of semi cabs. International Harvester uses automated machines to place aluminum rivets on sheeting that is attached to the frame of the semi cabs. The original CNC machines were becoming antiquated and needed to be upgraded.

ITS chose a DL205 PLC as the new controller for the machines, along with discrete I/O and an H2-CTRIO high-speed counter module that drives a dual axis servo. An H2-ECOM Ethernet Communications card links the machines back to an office for data acquisition. ITS also added a 15-inch touch screen for diagnostics.

In the new system, an operator stamps sheets of aluminum to welded framework with a handful of hand rivets and then places the product onto a dual axis servo table. After the operator selects one of five different parts programs, the machine will navigate the panel under the head assembly, which is responsible for the drilling and riveting, with a tolerance of 1/10 of a millimeter. The panel is drilled and a rivet is installed and squeezed to approximately 1200 PSI, producing a rivet consistency within .003 in. After completion of the panel (between 64 and 138 rivet locations), the machine will return to its home position and await the next product.

The solution increased productivity by approximately 30% and provides an easy way to run and maintain the machines.

Cost-effective I/O simplifies hydroelectric plant controls upgrade

Lockhart Power Company owns and operates a hydroelectric plant located on the Broad River in upstate South Carolina.

The plant includes an 8-gate dam feeding a canal that channels the water flow to the powerhouse. The powerhouse contains five turbine generators with a combined power capacity of over 17 MW. The dam and turbine control system receives data from power, flow, and level sensing devices to perform monitoring and control of the dam, generators, and associated equipment.

Lockhart Power contracted North Fork Electric in Crumpler, NC, to lend their expertise to a renovation of the control system.

The system consists of seven DirectLOGIC DL205 micro-modular PLCs with built in PID functionality. Each of the five systems for generator control includes discrete and analog I/O, and an Ethernet communications module. The remaining two PLCs are configured in a master/slave arrangement and control the dam gates, located upriver from the powerhouse, via radio modems. Operator interfaces include two 6-inch color touch screen panels and a Windows NT-based PC running the LookoutDirect SCADA/HMI software package.

In the automatic mode, the PLC can start, stop, and operate the generator, and control startup and synchronization of the turbine. Changing the generator gate position varies the flow of water to the turbine.

The dam control system controls the eight canal gates located at the dam, which regulate the flow of water downstream to the turbines.

Programmable Controller Overview

CLICK: **Brick PLC with expandable I/O and easy-to-use instructions**

The CLICK series is a fixed I/O PLC with eight inputs and six outputs, with up to eight expansion I/O modules, and features you won't find in most bricks — seven combinations of AC, DC, relay and analog I/O, and advanced programming functions such as drum sequencing.

- 8 discrete inputs and 6 discrete outputs for discrete units
- 4 discrete inputs / 4 discrete outputs / 2 analog inputs / 2 analog outputs for analog units

- 8 K program / 8 K data memory
- Two built-in communication ports
- 21 instructions
- Removable terminal block
- 24 VDC powered

DL05: **Offers incredible features with an expansion slot**

The DL05 series is a fixed I/O PLC with eight inputs and six outputs with one option card slot, and features you won't find in most bricks — six I/O combinations of AC, DC and relay I/O, and advanced programming functions such as PID.

- Eight inputs and six outputs
- 2 K program memory
- 4 K data memory
- Two built-in communication ports
- Over 250 instructions, including four PID loops
- Removable terminal block
- 12/24 VDC powered versions
- Discrete and analog I/O modules

- Thermocouple and RTD modules
- Ethernet and serial communications modules
- 1-channel high-speed input/pulse output module
- Memory cartridge/real-time clock module
- DeviceNet™ / Profibus slave modules
- Basic CoProcessor module

DL06: **Mighty micro PLC with 36 I/O and four expansion slots**

The DL06 series combines its fixed I/O of 20 inputs and 16 outputs with four option card slots for expansion all in the same package. With the DL06, you can use the same PLC panel layout for all applications from 36 to 100 I/O.

- 20 inputs and 16 outputs
- 7.5 K program memory
- 7.3 K data memory
- Two built-in communication ports - one RS232 and one RS232/422/485 port
- Over 275 instructions, including eight PID loops and ASCII
- Removable terminal blocks
- Built-in 300 mA 24 VDC auxiliary power supply

- 12/24 VDC powered versions
- Built-in real-time clock/calendar
- Discrete and analog I/O modules
- Thermocouple and RTD modules
- Ethernet and serial communications modules
- High speed input/pulse output module
- DeviceNet™ and Profibus slave modules
- Basic CoProcessor module
- Optional plug-in LCD display

DL105: **Fixed-I/O Micro PLC**

The DL105 series is a fixed-I/O micro PLC with 10 inputs and eight outputs. Eight configurations are available in combinations of AC, DC and relay I/O.

- 10 inputs and eight outputs
- 2 K program memory
- 384 words data memory
- 110/220 VAC or 24 VDC power supply versions
- Built-in 0.5A, 24 VDC auxiliary power supply

- One RS-232 communication port
- Heavy-duty seven amp relays with built-in surge suppression on models with relay outputs

Programmable Controller Overview

DL205: The most practical micro-modular PLC with a wide range of I/O and communications modules

If your application requires the flexibility of a modular system, a DL205 PLC is a low cost, yet extremely versatile solution.

- Four CPUs, up to 30.4K memory and 16,384 I/O
- Four base sizes available
- 16 built-in PID loops using D2-260 CPU
- AC/DC input/output modules
- Up to 10 A relay outputs
- 12-bit and 16-bit analog I/O modules
- Thermocouple and RTD input modules
- Ethernet and serial communications modules

- Ethernet and serial remote I/O
- High-speed counter/pulse output module
- Counter input/pulse output module
- Basic CoProcessor module
- Ethernet, DeviceNet™ and Profibus slave controller modules
- Triple port serial module for WinPLCs and EBCs

DL305: We've still got it!

The DL305 series is a small modular PLC that has been marketed by various name brand PLC manufacturers for over 27 years. This Koyo design revolutionized the small PLC market, and you can keep your DL305 system operating with these compatible components.

- Three CPUs, including the D3-350 with PID control and two communication ports
- Five, eight and 10 slot bases
- 110/220 VAC or 24 VDC power supply

- AC, DC inputs
- AC, DC and relay outputs
- Analog input/output

DL405: Specialty modules for complex applications

The DL405 PLC product line has a wide choice of specialty I/O modules, including high-speed counting, temperature controller, and magnetic pulse input.

- Three CPUs, up to 30.8K memory and 16,384 I/O
- Three base sizes with built-in power supply
- 16 built-in PID loops (D4-450 CPU), up to 96 loops using PID modules
- AC/DC input/output modules

- 10 A relay outputs
- 12-bit and 16-bit analog I/O modules
- Thermocouple and RTD input modules
- Ethernet and serial communications modules
- Ethernet and serial remote I/O master and slave modules

Productivity3000 PAC:
PAC features at a PLC price

Productivity3000 is a compact controller that combines the features and capabilities of a PC-based control system with that of a typical programmable logic controller (PLC).

- **High-performance** CPU with 50Mb memory, fast scan time, and USB & Ethernet programming ports for quick and easy connectivity
- **Modular** rack-based footprint with 36 discrete and analog I/O option modules, up to 115,000 I/O
- **Hot-Swappable** I/O for advanced troubleshooting and system repair

- Unmatched **built-in communications** capabilities, including local and remote I/O ports and networking
- Integrated **drive communications** over Ethernet
- System hardware Auto Discovery
- Tag name database programming
- Advanced "fill-in-the-blank" instructions

Control Systems Overview

Company Information

Systems Overview

Programmable Controllers

Field I/O

Software

C-more & other HMI

Drives

Soft Starters

Motors & Gearbox

Steppers/ Servos

Motor Controls

Proximity Sensors

Photo Sensors

Limit Switches

Encoders

Current Sensors

Pressure Sensors

Temperature Sensors

Pushbuttons/ Lights

Process

Relays/ Timers

Comm.

Terminal Blocks & Wiring

Power

Circuit Protection

Enclosures

Tools

Pneumatics

Appendix

Product Index

Part # Index

Programmable Controller Selection Guide

Selection Criteria		I/O Capacity				Basic Machine Control		Process Control		Test & Data Acquisition	CPU Communications						
Controller Family	Series / CPU	AC, DC, Relay I/O (Built-In I/O)	Analog In & Out (Built-In I/O)	Local I/O (with Expansion)	Total Possible I/O	Digital I/O & Simple Logic Requirements	Stage Programming (State Machine Control)	Analog I/O, limited PID, Simple Math and data manipulation	>16 PID loops, Complex Math formulas & Array Manipulation	Sub-millisecond Scan, Data Logging & Corporate database connectivity	Built-In Ethernet & USB	Built-In Local I/O Expansion Ports	Built-In Remote I/O	Built-In RS-232 Serial port	Built-In RS-485 Multi-drop port	Modbus TCP Ethernet Protocol	Modbus RTU Salve
Click PLC Basic CPU	Basic CPU	8 In/6 Out		142	142	✔								✔			✔
	Analog CPU	4 In/4 Out	2 In/2 Out	140	140	✔		✔						✔	✔		✔
DirectLogic — DL05	All CPUs	8 In/6 Out		30	30	✔	✔	✔						✔			✔
DL06	All CPUs	20 In/16 Out		100	100	✔	✔	✔						✔	✔		✔
DL105	All CPUs	10 In/8 Out		n/a	18	✔	✔							✔			
DL205	D2-230			256	256	✔	✔							✔			
	D2-240			256	896	✔	✔							✔			
	D2-250-1			768	16,384*	✔	✔	✔					✔	✔	✔		✔
	D2-260			1280	16,384*	✔	✔	✔					✔	✔	✔		✔
DL305	D3-330			176	176	✔						✔					
	D3-340			184	184	✔						✔		✔			✔
	D3-350			368	368	✔	✔	✔				✔	✔	✔	✔		✔
DL405	D4-430			640	1664	✔	✔					✔		✔			
	D4-440			640	2688	✔	✔					✔		✔			
	D4-450			2048	16,384*	✔	✔	✔				✔	✔	✔	✔		✔
Productivity 3000	P3-550 CPU			3520	116,160	✔		✔	✔	✔①	✔	✔	✔	✔	✔	✔	✔

* 16384 (fully expanded H4-EBC slave bases, using V-memory & bit of word instructions)
① Scan time is based on type and amount of ladder logic instructions and total system I/O
② Scan times may vary during Run-Time Transfers
③ DeviceNet & ProfiBus Slave modules for the DL205 series are installed in place of the CPU in the CPU slot
④ High Speed inputs available on DC input models / Pulse output available on DC output models

Programmable Controller Selection Guide

Company Information

Systems Overview

Programmable Controllers

Field I/O

Software

C-more & other HMI

Drives

Soft Starters

Motors & Gearbox

Steppers/Servos

Motor Controls

Proximity Sensors

Photo Sensors

Limit Switches

Encoders

Current Sensors

Pressure Sensors

Temperature Sensors

Pushbuttons/Lights

Process

Relays/Timers

Comm.

Terminal Blocks & Wiring

Power

Circuit Protection

Enclosures

Tools

Pneumatics

Appendix

Product Index

Part # Index

Ports & Protocols						Communications and Specialty Modes								Programmability									
Modbus RTU Master	K-Sequence Slave	DirectNet Slave	DirectNet Master	ASCII Out	ASCII IN	Ethernet (10/100 Mb)	Serial RS-232 & RS-485	Basic Coprocessor	Ethernet Remote I/O	Serial Remote I/O	DeviceNet Slave	Profibus Slave	Total Memory	Battery Backed Memory Clock / Calendar	Stage Programming	Run Mode Edits (Outputs pause during transfer)	Run-Time Transfer (Scan updates during transfer)	Built-in High Speed Counter & Pulse Output	Floating point Math	Freeform Expressions in Math	Drum Sequencer	Email Instruction	Sub-Divided Program Tasks
✔				✔	✔								8k steps						✔	✔	✔		✔
✔				✔	✔								8k steps	✔					✔	✔	✔		✔
✔	✔	✔	✔	✔		✔	✔	✔			✔	✔	6.0k		✔	✔		✔④		✔	✔	✔	
✔	✔	✔	✔	✔	✔	✔	✔	✔			✔	✔	14.8k	✔	✔	✔		✔④	✔	✔	✔	✔	
	✔												2.4k		✔	✔		✔④			✔		
	✔										✔③	✔③	2.4k		✔	✔							
	✔	✔				✔	✔	✔	✔	✔	✔③	✔③	3.8k	✔	✔	✔							
✔	✔	✔	✔	✔		✔	✔	✔	✔	✔	✔③	✔③	14.8k	✔	✔	✔			✔	✔	✔		
✔	✔	✔	✔	✔		✔	✔	✔	✔	✔	✔③	✔③	30.4k	✔	✔	✔			✔	✔	✔		
	✔	✔											3.8k										
	✔												3.9k										
✔	✔	✔	✔	✔			✔						14.8k	✔	✔	✔			✔		✔		
	✔	✔				✔	✔	✔	✔	✔			6.5k	✔	✔	✔							
	✔	✔				✔	✔	✔	✔	✔			22.5k	✔	✔	✔					✔		
✔	✔	✔	✔	✔		✔	✔	✔	✔	✔			30.8k	✔	✔	✔			✔	✔	✔	✔	
✔				✔	✔				✔				50Mb	✔			✔②		✔	✔	✔	✔	✔

Get The Training You Need, When And Where You Need It

Doug Bell and InterConnecting Automation, Inc.

Interested in a PLC or drives training course focused entirely on AUTOMATIONDIRECT's products, taught by someone who has used most of our products in real-world applications? Would it be extra convenient if the training was held in a city near you? We thought so! Doug's offering includes:

- Basic PLC training course (three days) covering basic PLC theory of operation including CPU, bases, discrete I/O, analog I/O, and communications
- Advanced PLC training course (three days) covering advanced programming and debugging, with remote I/O, networking, modems and more
- PID training course (two days) covering PID loop setup, tuning and troubleshooting, as well as shortcuts and tools the experts use

Check Appendix for a complete schedule of classes for 2010-11 in cities across the U.S.

Training sets

Available on DVD and in Spanish

Want to learn how to program our PLCs in the comfort of your own office? Doug Bell has created two hands-on training kits, one based on his world-famous basic PLC training class, the other focusing on PLC analog principles. The basic PLC training kit includes two videotapes or one DVD, a pre-wired trainer containing a DL05 PLC, and the DL05 User Manual.

The analog training kit includes two videotapes or one DVD, a pre-wired trainer with potentiometers and meters, a DL05 analog input/output module, I/O cable and 24 VDC power supply. Each kit can be ordered directly from ICA.

(*Direct*SOFT *programming software must be purchased separately*.)

Online training

If you can't travel and can't justify a training kit, how about inexpensive online training? Check out Doug's online training videos for PLCs and HMI.

Interconnecting Automation
1-414-425-8348
www.interconnectingautomation.com

"Introduction to PLC Logic and Principles" video or DVD and training kit

Get the most important lessons from the three-day basic PLC seminar in a step-by-step two-video or DVD set.

"PLC analog I/O" training video or DVD and hardware

Learn the ins and outs of using analog I/O with PLCs in this step-by-step training set.

Check the Appendix for complete descriptions of the training kits and course contents.

Online training at www.interconnectingautomation.com

View the complete list of videos in each "library" as well as watch sample videos; when ready to purchase, register and pay for your selected libraries on a monthly basis. Get unlimited access anytime during the 30 days; videos can be viewed as many times as needed. Most libraries range from $29.95 - $39.95 per month. Typical libraries include:

- Introduction to PLC Principles (for the novice non-user with limited controls knowledge)
- CLICK series PLC Training (includes Introduction to PLCs library)
- Productivity3000 series Controller Training

Libraries will be added on a continuing basis.

An Automationdirect.com Federation Company

INTERCONNECTING AUTOMATION INC.
Training for PLC Based Control Systems