

Getting Started

In This Chapter. . . .

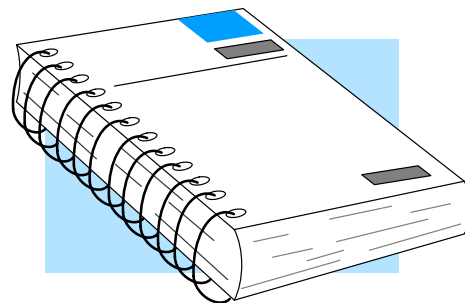
- Introduction
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 - DL205 System Components
 - Programming Methods
 - **Direct**LOGIC™ Part Numbering System
 - Quick Start for PLC Validation and Programming
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Introduction

The Purpose of this Manual

Thank you for purchasing our DL205 family of products. This manual shows you how to install, program, and maintain the equipment. It also helps you understand how to interface them to other devices in a control system.

This manual contains important information for personnel who will install DL205 PLCs and components, and for the PLC programmer. If you understand PLC systems, our manuals will provide all the information you need to start and keep your system up and running.



Where to Begin

If you already understand PLCs please read Chapter 2, “Installation, Wiring, and Specifications”, and proceed on to other chapters as needed. Keep this manual handy for reference when you have questions. If you are a new DL205 customer, we suggest you read this manual completely to understand the wide variety of features in the DL205 family of products. We believe you will be pleasantly surprised with how much you can accomplish with our products.

Supplemental Manuals

If you have purchased operator interfaces or *DirectSOFT32*, you will need to supplement this manual with the manuals that are written for these products.

Technical Support

We realize that even though we strive to be the best, the information may be arranged in such a way you cannot find what you are looking for. First, check these resources for help in locating the information:

- **Table of Contents** – chapter and section listing of contents, in the front of this manual
- **Appendices** – reference material for key topics, near the end of this manual
- **Index** – alphabetical listing of key words, at the end of this manual

You can also check our online resources for the latest product support information:

- **Internet** – Our address is <http://www.automationdirect.com>

If you still need assistance, please call us at 770-844-4200. Our technical support group is glad to work with you in answering your questions. They are available Monday through Friday from 9:00 A.M. to 6:00 P.M. Eastern Standard Time. If you have a comment or question about any of our products, services, or manuals, please fill out and return the ‘Suggestions’ card that was shipped with this manual.

Conventions Used



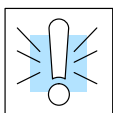
When you see the “light bulb” icon in the left-hand margin, the paragraph to its immediate right will give you a **special tip**.

The word **TIP:** in boldface will mark the beginning of the text.



When you see the “notepad” icon in the left-hand margin, the paragraph to its immediate right will be a **special note**.

The word **NOTE:** in boldface will mark the beginning of the text.

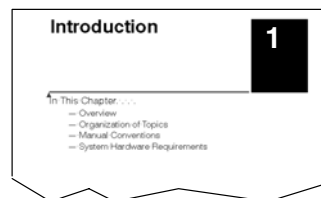


When you see the “exclamation mark” icon in the left-hand margin, the paragraph to its immediate right will be a **warning**. This information could prevent injury, loss of property, or even death (in extreme cases).

The word **WARNING:** in boldface will mark the beginning of the text.

Key Topics for Each Chapter

The beginning of each chapter will list the key topics that can be found in that chapter.



DL205 System Components

The DL205 family is a versatile product line that provides a wide variety of features in an extremely compact package. The CPUs are small, but offer many instructions normally only found in larger, more expensive systems. The modular design also offers more flexibility in the fast moving industry of control systems. The following is a summary of the major DL205 system components.

CPUs

There are four feature enhanced CPUs in this product line, the DL230, DL240, DL250-1 and DL260. All CPUs include built-in communication ports. Each CPU offers a large amount of program memory, a substantial instruction set and advanced diagnostics. The DL250-1 features drum timers, floating-point math, 4 built in PID loops with automatic tuning and 2 bases of local expansion capability. The DL260 features ASCII IN/OUT and extended MODBUS communications, table and trigonometric instructions, 16 PID loops with autotuning and up to 4 bases of local expansion. Details of these CPU features and more are covered in Chapter 3, CPU Specifications and Operation.

Bases

Four base sizes are available: 3, 4, 6 and 9 slot. The (-1) bases (with a connector for local expansion on the right side) can serve in local, local expansion and remote I/O configurations. All bases include a built-in power supply. The (-1) bases can replace existing non (-1) bases if necessary.

I/O Configuration

The DL230 and DL240 CPUs can support up to 256 local I/O points. The DL250-1 can support up to 768 local I/O points with up to two expansion bases. The DL260 can support up to 1280 local I/O points with up to four expansion bases. These points can be assigned as input or output points. The DL240, DL250-1 and DL260 systems can also be expanded by adding remote I/O points. The DL250-1 and DL260 provide a built-in master for remote I/O networks. The I/O configurations are explained in Chapter 4, System Design and Configuration.

I/O Modules

The DL205 has some of the most powerful modules in the industry. A complete range of discrete modules which support 24 VDC, 110/220 VAC and up to 10A relay outputs (subject to derating) are offered. The analog modules provide 12 and 16 bit resolution and several selections of input and output signal ranges (including bipolar). Several specialty and communications modules are also available.

Programming Methods

There are two programming methods available to the DL205 CPUs, RLL (Relay Ladder Logic) and RLL^{PLUS} (Stage Programming). Both the **DirectSOFT32** programming package and the handheld programmer support RLL and Stage.

DirectSOFT32 Programming for Windows™

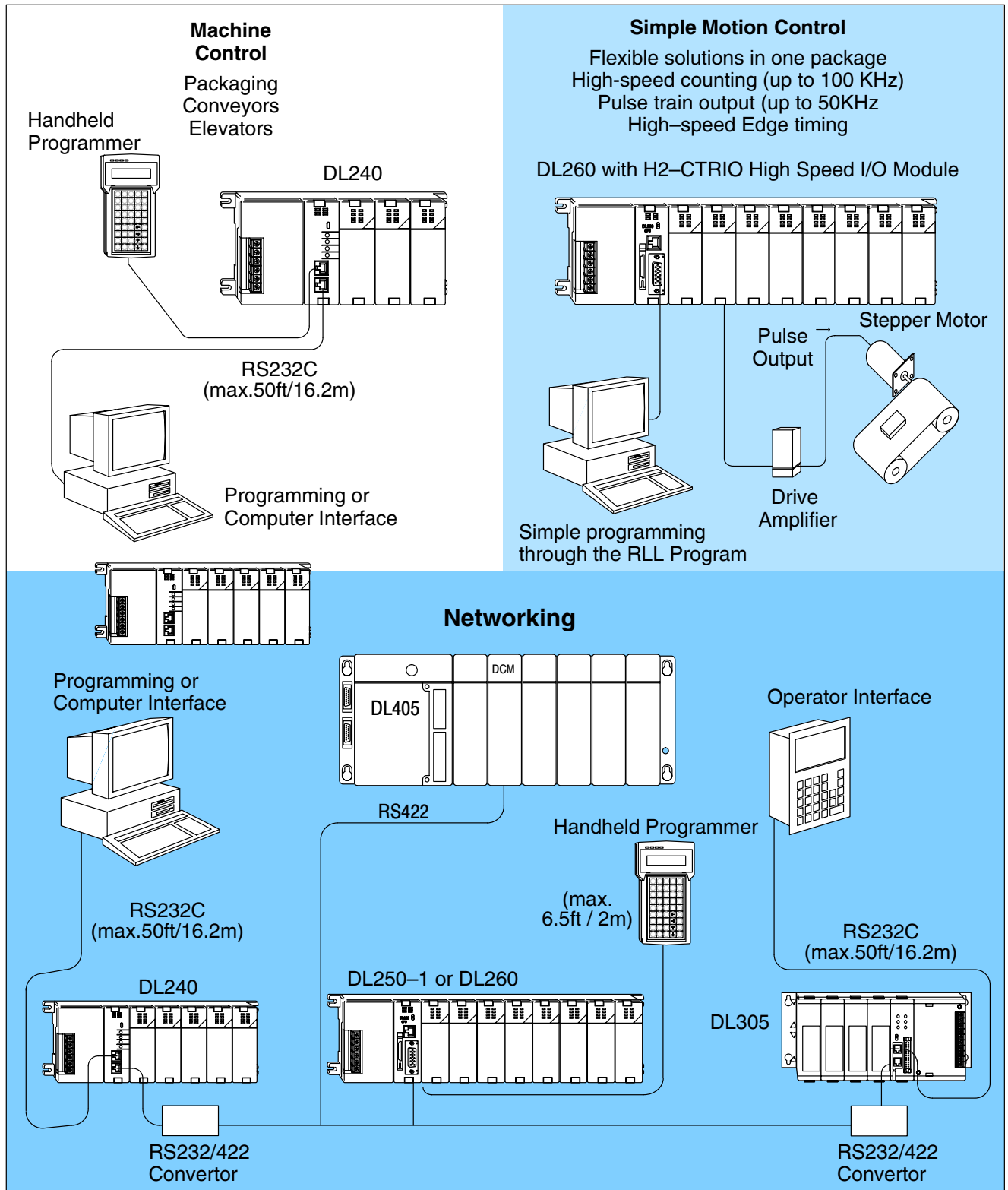
The DL205 can be programmed with one of the most advanced programming packages in the industry — **DirectSOFT32**. **DirectSOFT32** is a Windows-based software package that supports many Windows-features you already know, such as cut and paste between applications, point and click editing, viewing and editing multiple application programs at the same time, etc. **DirectSOFT32** universally supports the **DirectLOGIC™** CPU families. This means you can use the *same* **DirectSOFT32** package to program DL05, DL06, DL105, DL205, DL305, DL405 or any new CPUs we may add to our product line. There is a separate manual that discusses the **DirectSOFT32** programming software.

Handheld Programmer

All DL205 CPUs have a built-in programming port for use with the handheld programmer (D2-HPP). The handheld programmer can be used to create, modify and debug your application program. A separate manual that discusses the DL205 Handheld Programmer is available.

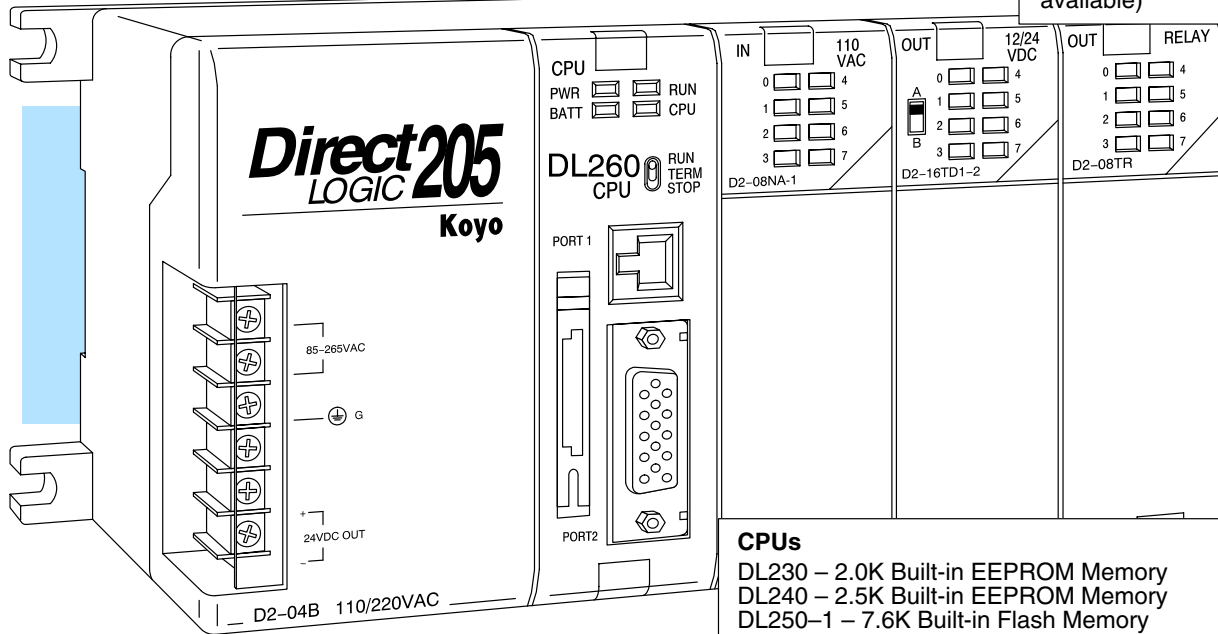
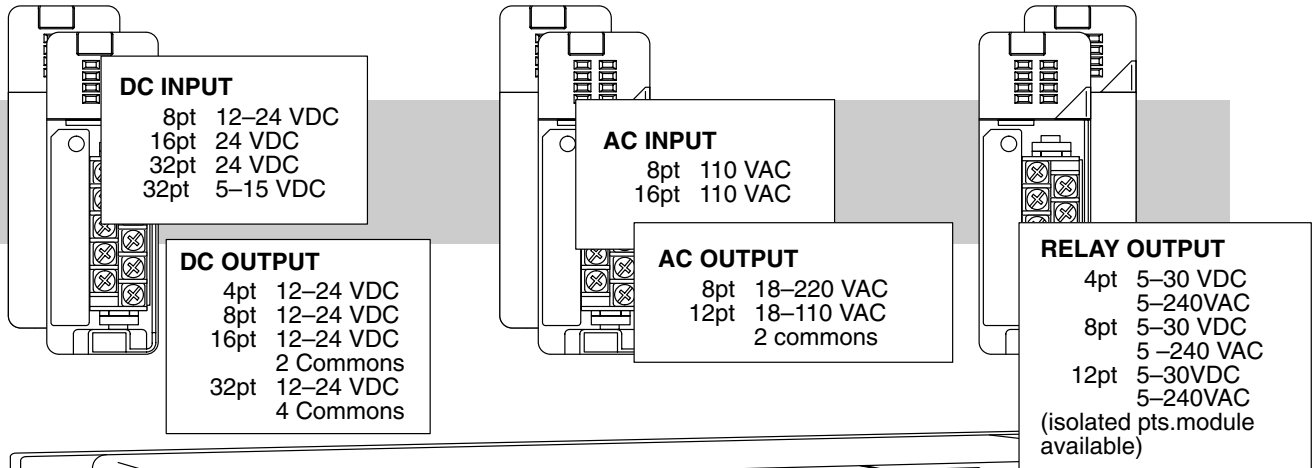
DL205 System Diagrams

The diagram below shows the major components and configurations of the DL205 system. The next two pages show specific components for building your system.

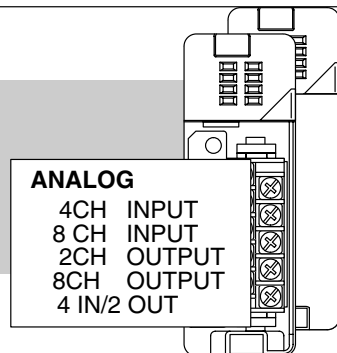
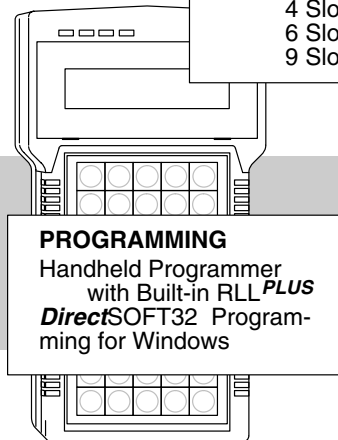
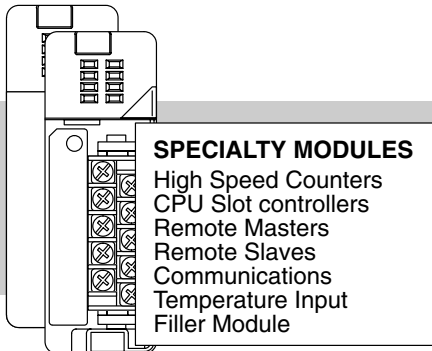


DirectLOGIC DL205 Family

Getting Started



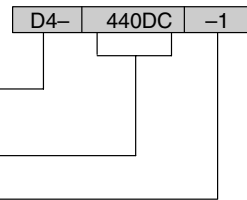
- CPU's**
 DL230 - 2.0K Built-in EEPROM Memory
 DL240 - 2.5K Built-in EEPROM Memory
 DL250-1 - 7.6K Built-in Flash Memory
 DL260 - 15.8K Built-in Flash Memory
- BASES**
 3 Slot Base, 110/220VAC, 24VDC
 4 Slot Base, 110/220VAC, 24VDC
 6 Slot Base, 110/220VAC, 24VDC, 125 VDC
 9 Slot Base, 110/220VAC, 24VDC, 125 VDC



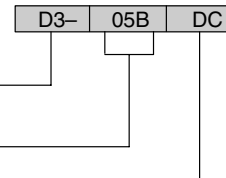
DirectLOGIC™ Part Numbering System

As you examine this manual, you will notice there are many different products available. Sometimes it is difficult to remember the specifications for any given product. However, if you take a few minutes to understand the numbering system, it may save you some time and confusion. The charts below show how the part numbering systems work for each product category. Part numbers for accessory items such as cables, batteries, memory cartridges, etc. are typically an abbreviation of the description for the item.

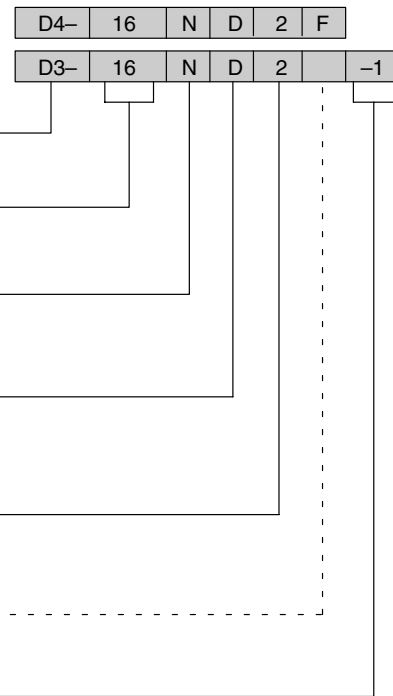
CPUs	
Specialty CPUs	
Product family	D0/F0 D1/F1 D2/F2 D3/F3 D4/F4
Class of CPU / Abbreviation	230...,330...,430...
Denotes a differentiation between Similar modules	-1, -2, -3, -4



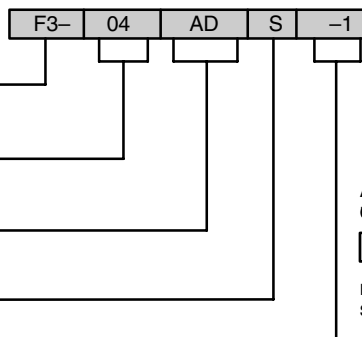
Bases	
Product family	D2/F2 D3/F3 D4/F4
Number of slots	##B
Type of Base	DC or empty



Discrete I/O	
DL05/06 Product Family	D0/F0
DL205 Product family	D2/F2
DL305 Product family	D3/F3
DL405 Product family	D4/F4
Number of points	04/08/12/16/32
Input	N
Output	T
Combination	C
AC	A
DC	D
Either	E
Relay	R
Current Sinking	1
Current Sourcing	2
Current Sinking/Sourcing	3
High Current	H
Isolation	S
Fast I/O	F
Denotes a differentiation between Similar modules	-1, -2, -3, -4



Analog I/O	
DL05/06	D0/F0
DL205 Product family	D2/F2
DL305 Product family	D3/F3
DL405 Product family	D4/F4
Number of channels	02/04/08/16
Input (Analog to Digital)	AD
Output (Digital to Analog)	DA
Combination	AND
Isolated	S
Denotes a differentiation between Similar modules	-1, -2, -3, -4

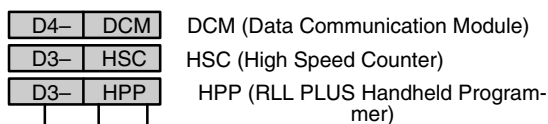


Alternate example of Analog I/O using abbreviations

F3- 08 THM -n

note: -n indicates thermocouple type such as: J, K, T, R, S or E

Communication and Networking Special I/O and Devices Programming	
DL205 Product family	D2/F2
DL305 Product family	D3/F3
DL405 Product family	D4/F4
Name Abbreviation	see example

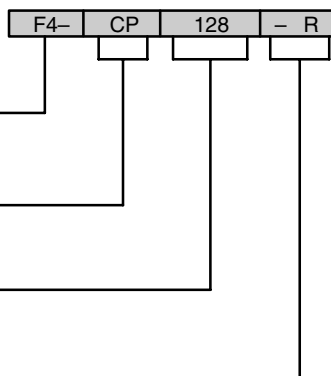


DCM (Data Communication Module)

HSC (High Speed Counter)

HPP (RLL PLUS Handheld Programmer)

CoProcessors and ASCII BASIC Modules	
DL205 Product family	D2/F2
DL305 Product family	D3/F3
DL405 Product family	D4/F4
CoProcessor	CP
ASCII BASIC	AB
64K memory	64
128K memory	128
512K memory	512
Radio modem	R
Telephone modem	T



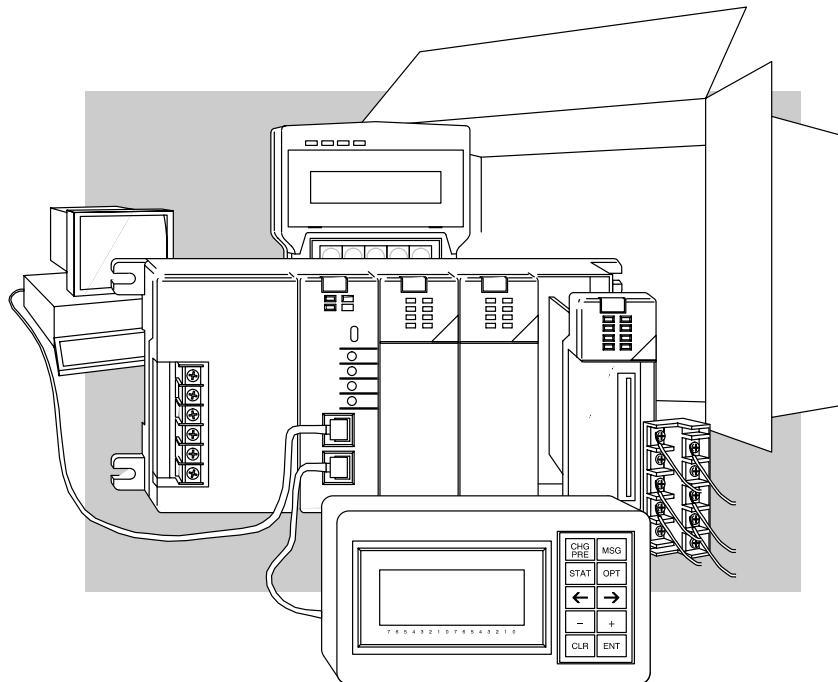
Quick Start for PLC Validation and Programming

If you have experience with PLCs, or want to setup a quick example, this section is what you want to use. This example is not intended to explain everything needed to start-up your system. It is only intended to provide a general picture of what is needed to get your system powered-up.

Step 1: Unpack the DL205 Equipment

Unpack the DL205 equipment and verify you have the parts necessary to build this demonstration system. The minimum parts needed are as follows:

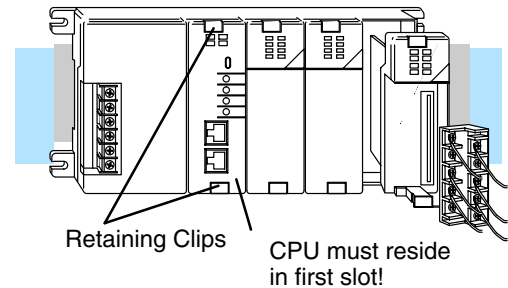
- Base
 - CPU
 - D2-16ND3-2 DC input module or a F2-08SIM input simulator module
 - D2-16TD1-2 DC output module
 - *Power cord
 - *Hook up wire
 - *A 24 VDC toggle switch (if not using the input simulator module)
 - *A screwdriver, regular or Phillips type
- * These items are not supplied with your PLC.
- You will need at least one of the following programming options:
- **DirectSOFT32** Programming Software, **DirectSOFT32 Manual**, and a programming cable (connects the CPU to a personal computer), or
 - D2-HPP Handheld Programmer and the Handheld Programmer Manual



Step 2: Install the CPU and I/O Modules

Insert the CPU and I/O into the base. The CPU must go into the first slot of the base (adjacent to the power supply).

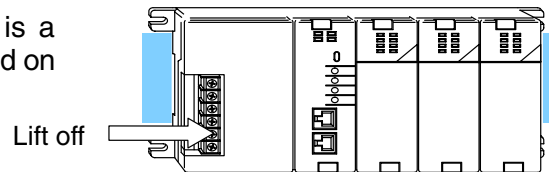
- Each unit has a plastic retaining clip at the top and bottom. Slide the retainer clips to the out position before installing the module.
- With the unit square to the base, slide it in using the upper and lower guides.
- Gently push the unit back until it is firmly seated in the backplane.
- Secure the unit to the base by pushing in the retainer clips.



Placement of discrete, analog and relay modules are not critical and may go in any slot in any base, however for this example, install the output module in the slot next to the CPU and the input module in the next. Limiting factors for other types of modules are discussed in Chapter 4, System Design and Configuration. You must also make sure you do not exceed the power budget for each base in your system configuration. Power budgeting is also discussed in Chapter 4.

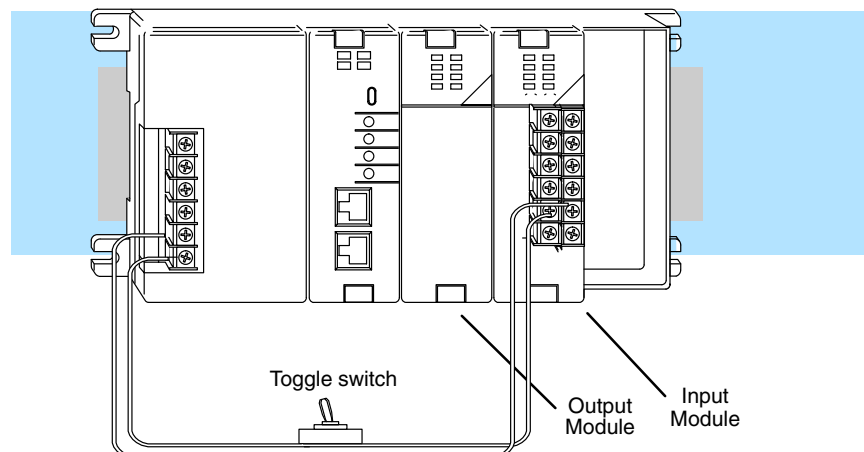
Step 3: Remove Terminal Strip Access Cover

Remove the terminal strip cover. It is a small strip of clear plastic that is located on the base power supply.



Step 4: Add I/O Simulation

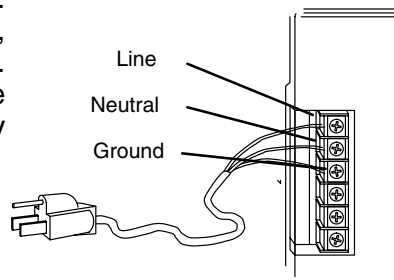
To finish this quick start exercise or study other examples in this manual, you will need to install an input simulator module (or wire an input switch as shown below), and add an output module. Using an input simulator is the quickest way to get physical inputs for checking out the system or a new program. To monitor output status, any discrete output module will work.



Wire the switches or other field devices prior to applying power to the system to ensure a point is not accidentally turned on during the wiring operation. Wire the input module (X0) to the toggle switch and 24VDC auxiliary power supply on the CPU terminal strip as shown. Chapter 2, Installation, Wiring, and Specifications provides a list of I/O wiring guidelines.

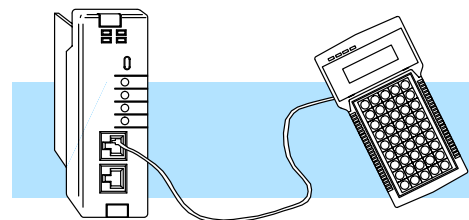
Step 5: Connect the Power Wiring

Connect the wires as shown. Observe all precautions stated earlier in this manual. For details on wiring see Chapter 2, Installation, Wiring, and Specifications. When the wiring is complete, replace the CPU and module covers. Do not apply power at this time.



Step 6: Connect the Handheld Programmer

Connect the D2-HPP to the top port (RJ style phone jack) of the CPU using the appropriate cable.



Step 7: Switch On the System Power

Apply power to the system and ensure the PWR indicator on the CPU is on. If not, remove power from the system and check all wiring and refer to the troubleshooting section in Chapter 9 for assistance.

Step 8: Enter the Program

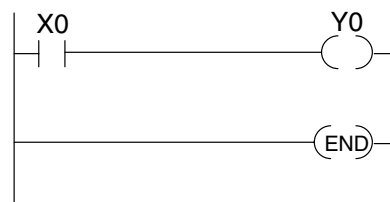
Slide the switch on the CPU to the STOP position (250-1 / 260 only) and then back to the TERM position. This puts the CPU in the program mode and allows access to the CPU program. The PGM indicator should be illuminated on the HPP. Enter the following keystrokes on the HPP:



NOTE: It is not necessary for you to configure the I/O for this system since the DL205 CPUs automatically examine any installed modules and establishes the correct configuration.

Handheld Programmer Keystrokes

\$ STR	→	B 1	ENT
GX OUT	→	C 2	ENT



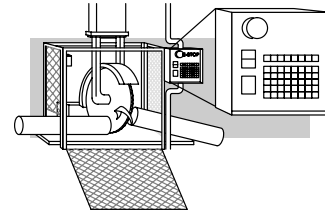
After entering the simple example program slide the switch from the TERM position to the RUN position and back to TERM. The RUN indicator on the CPU will come on indicating the CPU has entered the run mode. If not repeat Step 8 insuring the program is entered properly or refer to the troubleshooting guide in chapter 9.

During Run mode operation, the output status indicator "0" on the output module should reflect the switch status. When the switch is on the output should be on.

Steps to Designing a Successful System

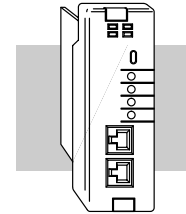
Step 1: Review the Installation Guidelines

Always make safety your first priority in any system application. Chapter 2 provides several guidelines that will help provide a safer, more reliable system. This chapter also includes wiring guidelines for the various system components.



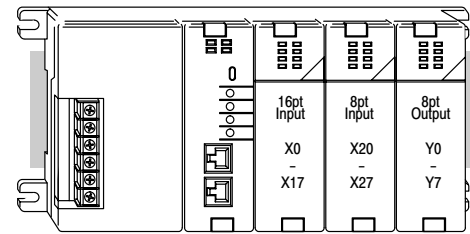
Step 2: Understand the CPU Setup Procedures

The CPU is the heart of your automation system. Make sure you take time to understand the various features and setup requirements.



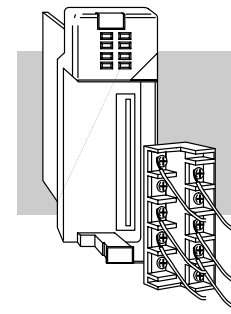
Step 3: Understand the I/O System Configurations

It is important to understand how your local I/O system can be configured. It is also important to understand how the system Power Budget is calculated. This can affect your I/O placement and/or configuration options.



Step 4: Determine the I/O Module Specifications and Wiring Characteristics

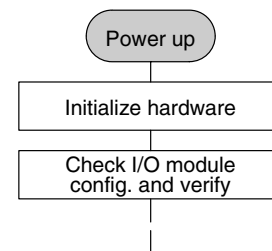
There are many different I/O modules available with the DL205 system. Chapter 2 provides the specifications and wiring diagrams for the discrete I/O modules.



NOTE: Specialty modules have their own manuals and are not included in this manual.

Step 5: Understand the System Operation

Before you begin to enter a program, it is very helpful to understand how the DL205 system processes information. This involves not only program execution steps, but also involves the various modes of operation and memory layout characteristics. See Chapter 3 for more information.

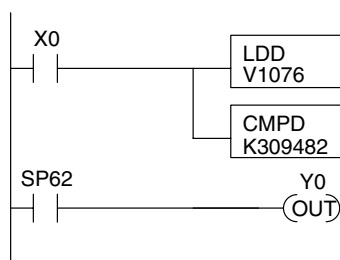


**Step 6:
Review the
Programming
Concepts**

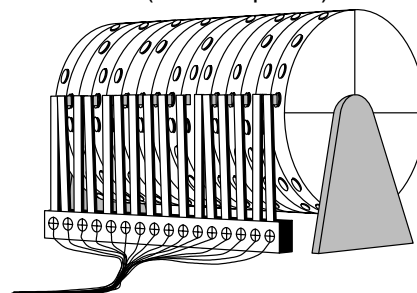
The DL205 provides four main approaches to solving the application program, including the PID loop task depicted in the next figure.

- RLL diagram-style programming is the best tool for solving boolean logic and general CPU register/accumulator manipulation. It includes dozens of instructions, which will augment drums, stages, and loops.
- The DL250-1 and DL260 have four timer/event drum types, each with up to 16 steps. They offer both time and/or event-based step transitions. Drums are best for a repetitive process based on a single series of steps.
- Stage programming (also called RLL *Plus*) is based on state-transition diagrams. Stages divide the ladder program into sections which correspond to the states in a flow chart of your process.
- The DL260 PID Loop Operation uses setup tables to configure 16 loops. The DL250-1 PID Loop Operation uses setup tables to configure 4 loops. Features include; auto tuning, alarms, SP ramp/soak generation, and more.

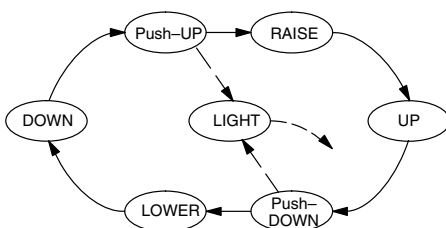
Standard RLL Programming
(see Chapter 5)



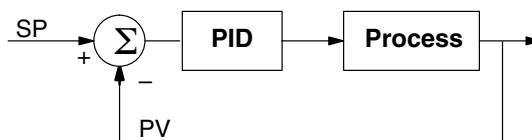
Timer/Event Drum Sequencer
(see Chapter 6)



Stage Programming
(see Chapter 7)

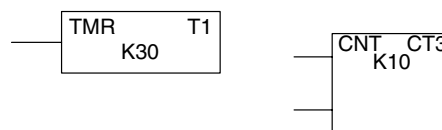


PID Loop Operation
(see Chapter 8)



**Step 7:
Choose the
Instructions**

Once you have installed the system and understand the theory of operation, you can choose from one of the most powerful instruction sets available.



**Step 8:
Understand the
Maintenance and
Troubleshooting
Procedures**

Equipment failures can occur at any time. Switches fail, batteries need to be replaced, etc. In most cases, the majority of the troubleshooting and maintenance time is spent trying to locate the problem. The DL205 system has many built-in features that help you quickly identify problems. Refer to Chapter 9 for diagnostics and troubleshooting tips.

