Getting Started

In This Chapter. . . .

— Introduction
— DL305 System Components
— *Direct*LOGIC™ Part Numbering System
— A Few Steps to a Successful System

D3-330 CPU has been retired as of 8/26/2021. Please consider D3-340 or D3-350 CPU as a replacement.

Handheld Programmer D3-HP & D3-HPP have been retired as of 03/2021 & 01/2018 respectively. Please consider Productivity, BRX, or CLICK series PLC systems as upgrades.

Introduction

The Purpose of this Manual
Thank you for purchasing our DL305 family of automation products. This manual shows you how to install the equipment, and it also helps you understand the system operation characteristics.
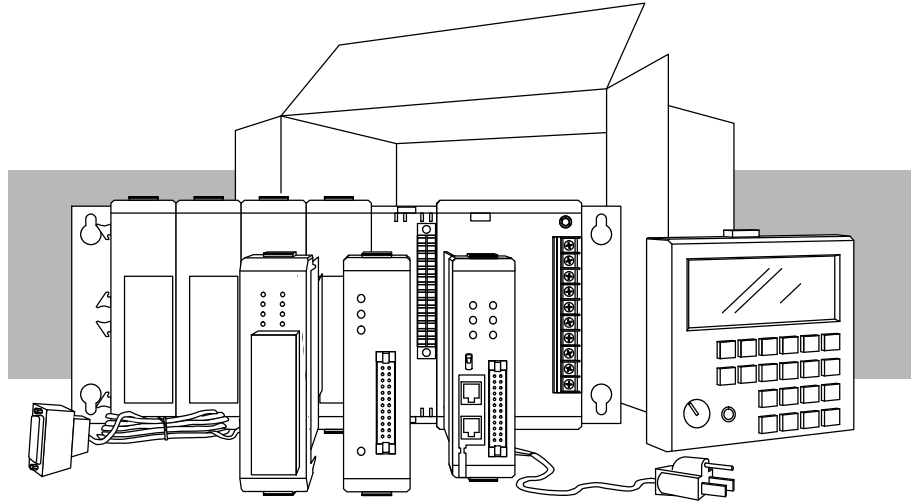
Since we constantly try to improve our product line, we occasionally issue addenda that document new features and changes to the products. If an addendum is included with this manual, please read it to see which areas of the manual or product have changed.

Who Should Read this Manual
If you understand PLC systems our manuals will provide all the information you need to get and keep your system up and running. We will use examples and explanations to clarify our meaning and perhaps help you brush up on specific features used in the DL305 system. This manual is not intended to be a generic PLC training manual, but rather a user reference manual for the DL305 system.

Where to Begin
If you are in a hurry and already understand the DL305 system please read Chapter 2, Installation and Safety Guidelines, and proceed on to the chapter pertaining to your needs. Be sure to keep this manual handy for reference when you run into questions. If you are a new DL305 customer, we suggest you read this manual completely so you can understand the wide variety of products, configurations, and procedures used with the DL305 family of products. We believe you will be pleasantly surprised with how much you can accomplish with *AutomationDirect* products.

If you're really in a hurry, check out Appendix A. This appendix has a quick start that will show you how to quickly connect and program a very simple system.

Supplemental Manuals
Depending on the products you have purchased, there may be other manuals that are necessary for your application. If you have purchased analog I/O, specialty modules, or *Direct*SOFT, or you will be using remote I/O or networking, you will want to supplement this manual with the manuals written for these products.

How this Manual is Organized

Ch 1: Getting Started – provides an overview of all the components that can be used to make up one or many DL305 systems. This chapter shows the basic concepts of how the pieces fit together. It also explains the DL305 part numbering system, which will help you quickly identify the various types of modules.

Ch 2: Installation and Safety Guidelines – shows you how to prepare for system installation, and gives you guidelines for providing a safe environment for your personnel and process. Be sure to read this chapter so potential safety problems can be avoided. In this chapter you will find topics you must consider when installing a system, the environmental specifications, component dimensions, safety guidelines, installation guidelines, etc.

Ch 3: DL330/DL330P/DL340 CPU Specifications – provides details of each of the DL305 CPUs. This chapter contains the operating specifications for the CPUs, detailed information on the different types of program storage media available, and some basic procedures needed to get the CPU ready for programming.

Ch 4: System Configuration, Bases and Expansion Bases – provides selection and installation criteria for Local I/O and Local Expansion I/O. This chapter also discusses the system power budget, which is an important part of the planning and installation process.

Ch 5: I/O Module Selection Criteria – contains specific considerations which affect I/O selection such as sinking, sourcing, and temperature derating characteristics.

Ch 6: Discrete Input Modules – explains each term you will find on our specification sheets, provides specifications, wiring diagrams and derating curves (where applicable) for the DL305 Discrete Input Modules.

Ch 7: Discrete Output Modules – explains each term you will find on our specification sheets, provides specifications, wiring diagrams and derating curves (where applicable) for the DL305 Discrete Output Modules.

Ch 8: System Operation – explains how the DL305 CPUs control the system operation. This includes information on I/O updates, application program execution and memory structure.

Ch 9 : RLL Programming Concepts – explains the basic concepts used in RLL programming.

Ch 10: RLL^{PLUS} Programming Concepts – explains the basic concepts used in the RLL^{PLUS} programming. This programming method greatly reduces program design time and simplifies machine startup and troubleshooting.

Ch 11: Instruction Set – explains how each individual instruction operates.

Ch 12: RLL^{PLUS} Instruction Set – explains the instructions used with the DL330P CPU. It also shows some instructions that operate differently with this CPU.

Ch 13: Maintenance and Troubleshooting – is a guide designed to aid you in diagnosing, repairing and avoiding system problems.

Appendices A – D – there are several appendices referred to throughout the manual. These include things such as a quick start, error code listing, instruction execution times, etc.

Technical Assistance

We realize even though we strive to be the best, we may have arranged our information in such a way you cannot find what you are looking for. If you need assistance, please, call us at 1–800–633–0405. Our technical support group is glad to work with you in answering your questions. They are available weekdays from 8:00 a.m. to 6:00 p.m. eastern standard time. If you find a problem with any of our products, services or manuals, please fill out and return the Suggestions card included with this manual.
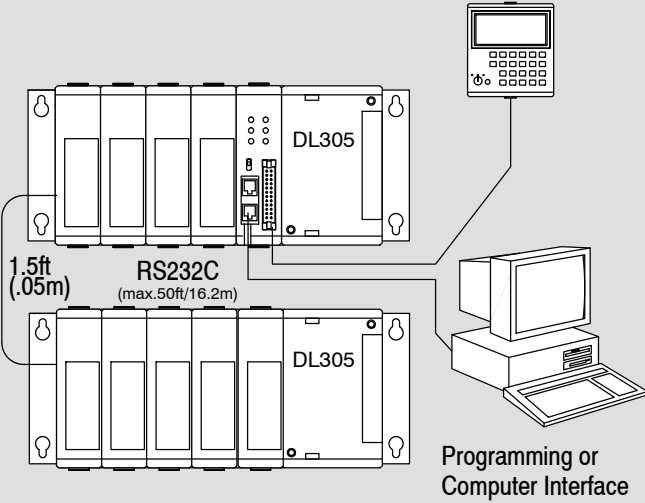
DL305 System Components

The DL305 product family is one of the most versatile and widely accepted PLCs used for small control applications. These CPUs are small yet powerful. Their modular design and expansion capability blend well with todays fast moving industry. The following is a summary of the major DL305 system components.

CPUs

There are three CPUs in this product line, the DL330, the DL330P and the *new* DL340. Details of these CPU are covered in Chapter 3, DL330/DL330P/DL340 CPU Specifications.

Bases

Three base sizes are available in the system: 5 slot, 8 slot and 10 slot.

I/O Configuration

The DL330 and DL330P CPUs support up to 128 local I/O and 176 local expansion I/O. The DL340 supports 136 local I/O and 184 local expansion I/O. Each of these I/O configurations is explained in Chapter 4, Bases and Expansion Bases and I/O Configuration.

I/O Modules

The DL305 has one of the most diverse I/O module selections in the industry. A complete range of discrete modules which support 24 VDC, 125 VDC, 110/220 VAC and up to 10A relay outputs are offered. The analog modules provide 12 bit resolution and several selections of input and output signal ranges (including bipolar). The specialty modules include 10KHz high speed input, thermocouple, general purpose communication, and more.

Programming Methods

There are two programming methods available, RLL (Relay Ladder Logic) and RLL^{PLUS}. RLL^{PLUS} combines the added feature of flow chart programming (stages) to the standard RLL language. RLL^{PLUS} is only available for the DL330P CPU. All of the DL305 CPUs support RLL programming. *Direct*SOFT supports both RLL and RLL^{PLUS} programming. Two handheld programmers are available, the D3–HPP which supports RLL^{PLUS} and the D3–HP which only supports RLL programming. The key pads for each handheld programmer differ, so it is recommended the handheld programmer that directly supports your CPU be used for programming.

***Direct*SOFT Programming for Windows™**

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

Handheld Programmer

All DL305 CPUs have a built-in programming port for use with the handheld programmers (D3–HPP and D3–HP). Handheld programmers can be used to create, modify and store programs to cassette tape, as well as debug your application program. There is also a separate manual that discusses the DL305 Handheld Programmers.

DL305 System Diagrams

The next page shows a generic example highlighting the major components and configurations of the DL305 system. The following two pages highlight the specific components which can be used to build your system.
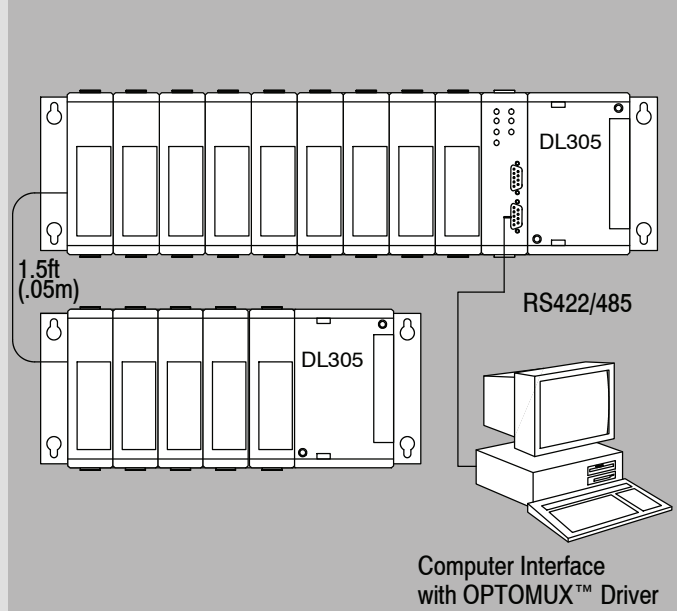
Getting Started

Machine Control
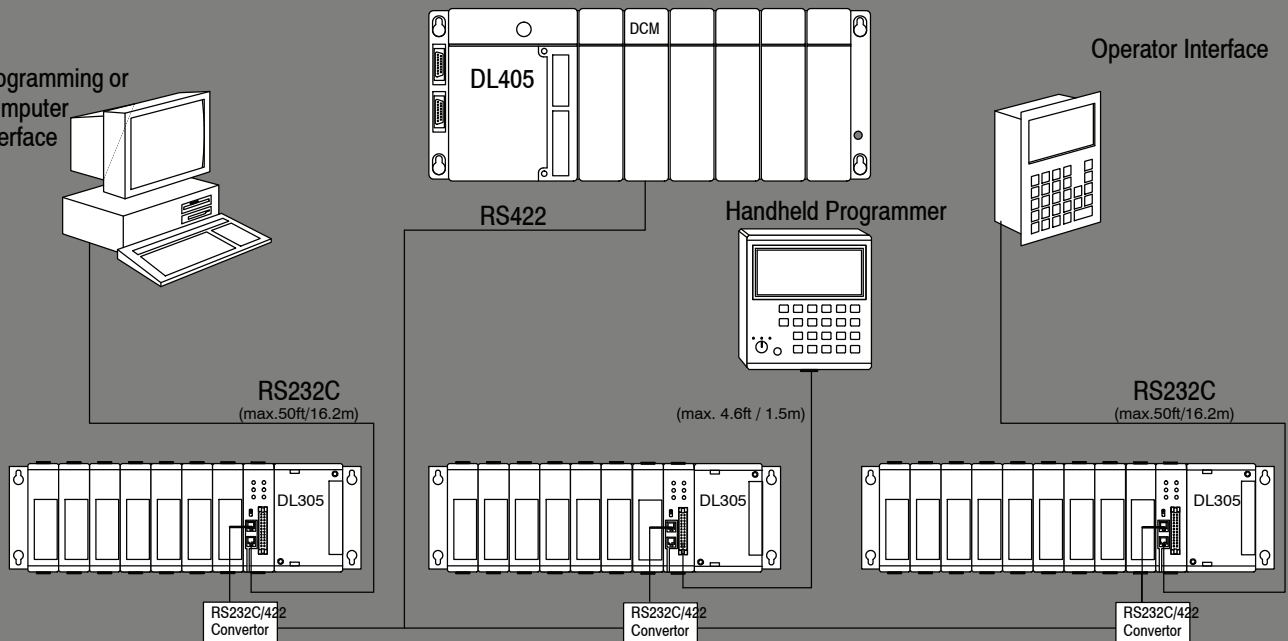
Packaging
Conveyors
Elevators

Handheld Programmer

DL305

1.5ft
(.05m)

RS232C
(max.50ft/16.2m)

DL305

Programming or
Computer Interface

Computer Controlled I/O

Industry Standard Computer I/O Protocol
OPTOMUX™ (Serial RS422/485)
PAMUX™ (Parallel)

DL305

1.5ft
(.05m)

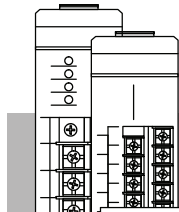RS422/485

DL305

Computer Interface
with OPTOMUX™ Driver

Networking

Programming or
Computer
Interface

DL405

DCM

Operator Interface

RS422

Handheld Programmer

RS232C
(max.50ft/16.2m)

(max. 4.6ft / 1.5m)

RS232C
(max.50ft/16.2m)

DL305

RS232C/422
Convertor

DL305

RS232C/422
Convertor

DL305

RS232C/422
Convertor

*Direct*LOGIC   DL305 Family
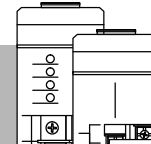
DC INPUT

  8pt   24 VDC
  16pt 24 VDC
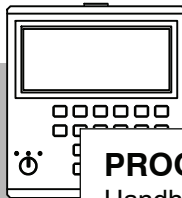 16pt 5-24 VDC
  16pt 12-24 VDC
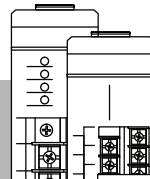
AC INPUT

  8pt   110 VAC
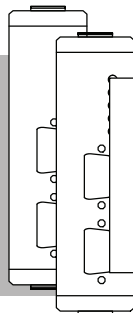 16pt 110 VAC

AC/DC INPUT
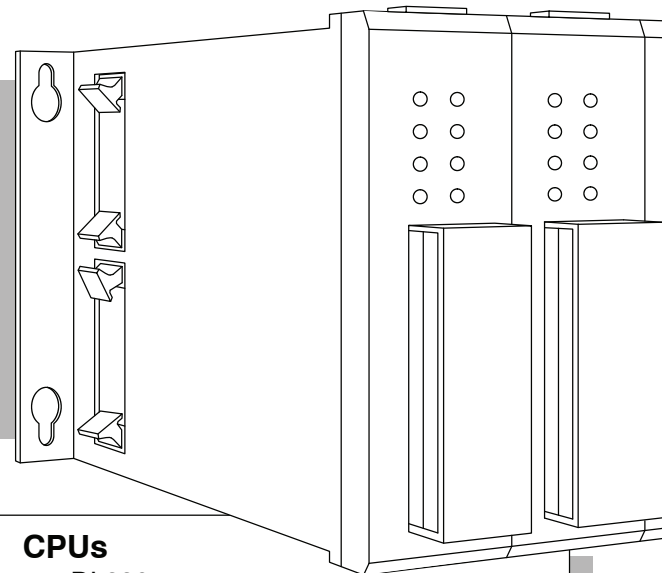
  8pt   24 VAC/DC
  16pt 24 VAC/DC

PROGRAMMING

Handheld Programmer for RLL CPUs
Handheld Programmer for RLL*PLUS* CPUs

***Direct*SOFT** Programming for Windows™

ASCII BASIC Modules

RS232C / RS422 / RS485
Built-in Radio Modem
Built-in Telephone Modem
Program Memory 64K/128K

CPUs

DL330
  3.7K RAM RLL Programming
DL330P
  3.7K RAM RLL*PLUS* Programming
DL340
  3.7K RAM RLL Programming
  and 2 Built-in RS232C Ports
DL330/DL330P/DL340 EPROM
  Memory Chips

BASES

  5 Slot Base w/Expansion Capability,
    110/220 VAC P/S
  5 Slot Base w/Expansion Capability,
    24 VDC Supply
  8 Slot Base w/Expansion Capability,
    110/220 VAC P/S
  10 Slot Base w/Expansion Capability,
    110/220 VAC P/S

DC OUTPUT

8pt   5–24 VDC
16pt 5–24 VDC

AC OUTPUT

4 pt   110–220 VAC
8pt   110–220 VAC
16pt 12–220VAC
16pt 15–220VAC

RELAY OUTPUT

8pt   4A/pt
8pt   5A/pt
8pt   10A/pt
16pt 2A/pt

ANALOG

4ch   INPUT
8ch   INPUT
16ch INPUT
2ch   OUTPUT
4ch   OUTPUT
8ch   TEMPERATURE
      TRANSDUCER INPUT
8ch   THERMOCOUPLE
      INPUT

SPECIALTY CPUs

Bridge CPU to connect
        to host w/OPTOMUX™ Driver
Bridge CPU w/FACTS
        Extended Basic Programming
Bridge CPU to connect to
        High-speed PAMUX™
        compatible host

NETWORKING

RS232C Data Communication Unit
RS422 Data Communication Unit
MODBUS® Slave Module
MODBUS® Slave Module
 w/Radio Modem

Universal connector:
        RS232C / RS422/485 Convertor

SPECIALTY MODULES / UNITS

8pt INPUT Simulator
1pt High Speed Counter
PROM Writer Unit
Filler Module

*Direct*LOGIC Part Numbering System

As you examine this manual, you'll 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	D2/F2
	D3/F3
	D4/F4
Class of CPU / Abbreviation	230...,330...,430...
Denotes a differentiation between Similar modules	−1, −2, −3, −4

D4− | 440DC | −1
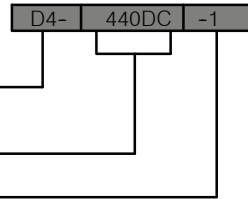
Bases	
Product family	D2/F2
	D3/F3
	D4/F4
Number of slots	##B
Type of Base	DC or empty

D3− | 05B | DC

D4− | 16 | N | D | 2 | F
D3− | 16 | N | D | 2 | | −1
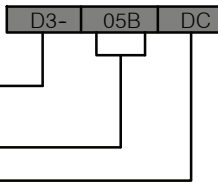
Discrete I/O	
DL205 Product family	D2/F2
DL305 Product family	D3/F3
DL405 Product family	D4/F4
Number of points	04/08/12/16/32
Input	N
Output	T
Combination	C
AC	A
DC	D
Either	E
Relay	R
Current Sinking	1
Current Sourcing	2
Current Sinking/Sourcing	3
High Current	H
Isolation	S
Fast I/O	F
Denotes a differentiation between Similar modules	−1, −2, −3, −4
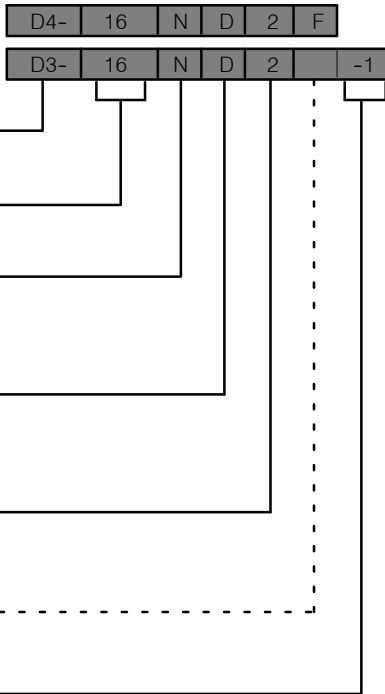
*Direct*LOGIC Part Numbering System (cont.)

Analog I/O	
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

F3-	04	AD	S	-1
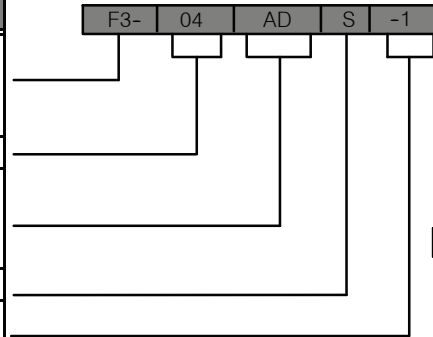
Alternate example of Analog I/O using abbreviations

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

D4-	DCM
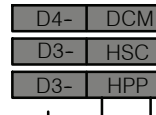
DCM (Data Communication Module)

D3-	HSC

HSC (High Speed Counter)

D3-	HPP

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

F4-	CP	128	- R

Getting Started
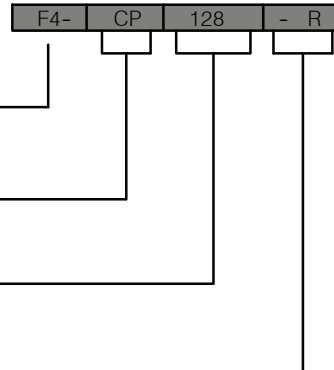
# A Few Steps to a Successful System

Step 1:
Review the
Installation
Guidelines

You should 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.
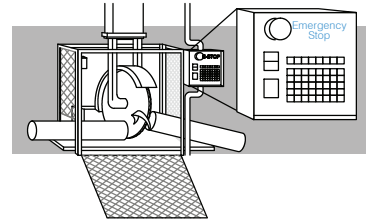
Step 2:
Understand the
CPU Setup
Procedures

The CPU is the heart of your automation system. Make sure you take the time to understand the various features and setup requirements.
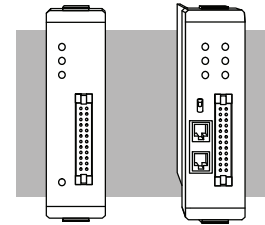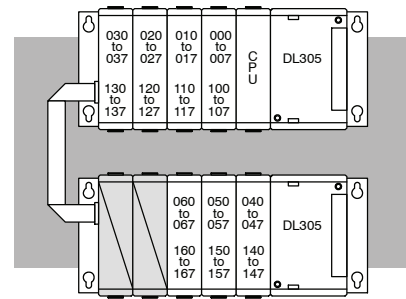
Step 3:
Understand the
I/O System
Configurations

It is important to understand how the I/O system can be configured. You have two different types of systems.

- Local System
- Local Expansion System

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:
Review the I/O
Selection Criteria

There are many considerations involved when you select your I/O modules. Take time to understand how the various types of electrical connections can affect your choice of I/O modules.
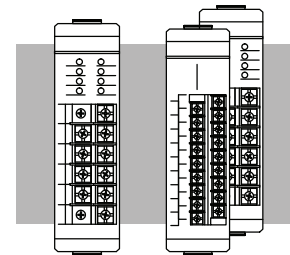
Step 5:
Determine the I/O
Module
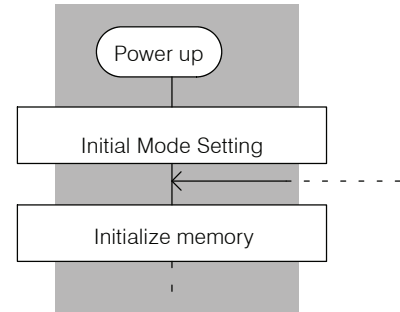**Specifications and**
Wiring
Characteristics

There are many different I/O modules available with the DL305 system. Chapters 6 and 7 provide 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
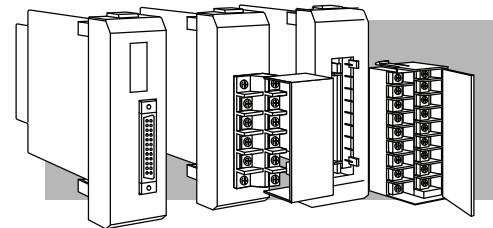
Step 6:
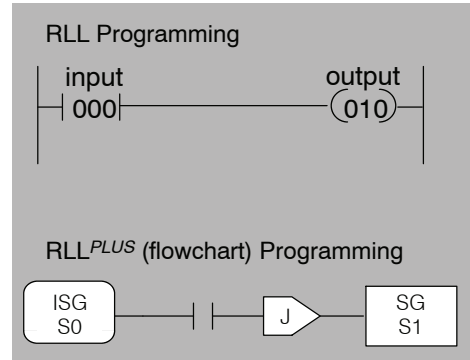**Understand the**
System Operation

Before you begin to enter a program, it is very helpful to understand how the DL305 system processes information. This involves not only program execution steps, but also involves the various modes of operation and memory layout characteristics.

```
        ( Power up )
            │
   ┌──────────────────┐
   │ Initial Mode Setting │ ← ─ ─ ─ ─ ─
   └──────────────────┘
            │
   ┌──────────────────┐
   │  Initialize memory  │
   └──────────────────┘
            ┆
```

Step 7:
Review the
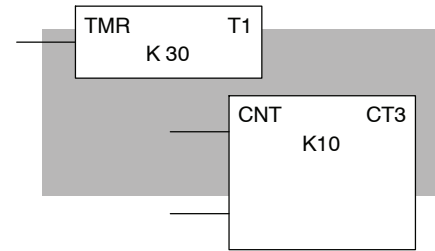**Programming**
Concepts

All control systems differ in some areas. The DL305 CPUs offer two different types of programming. RLL programming available for all the DL305 CPUs, uses conventional ladder diagram type solutions for many application problems.

RLL*PLUS* is available for the DL330P CPU. This method of programming greatly reduces the program design time and makes program troubleshooting and machine startup considerably easier.

RLL Programming

```
 input                    output
─┤ 000├─                  ─(010)─
```

RLL*PLUS* (flowchart) Programming

```
┌─────┐                        ┌─────┐
│ ISG │───┤ ├───▷ J ───▷       │ SG  │
│ S0  │                        │ S1  │
└─────┘                        └─────┘
```

Step 8:
Choose the
Instructions

Once you have installed the system and understand the theory of operation, you can choose from a diverse instruction set to implement your application.

```
┌──────────────┐
│ TMR      T1  │
│      K 30    │
└──────────────┘
          ┌──────────────┐
          │ CNT     CT3  │
          │      K10     │
          └──────────────┘
```

Step 9:
Understand the
Maintenance and
Troubleshooting
Procedures

Many things can happen on the factory floor. 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. Chapter 13 provides some information that will help you quickly identify problems, so you can look like a hero if you take time to understand them.