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Getting Started with *Direct*NET Communications

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— What can I use as a network slave station?
— Choosing a Configuration
— What communications program should I use?
— How can I create a network?

The *Direct*NET Basics

It's an Easy-to-use Data NETwork

DirectNET is an easy-to-use data network for the ***Direct***LOGIC™ family of products. ***Direct***NET is the perfect choice for those applications requiring data to be shared between programmable controllers (PLCs) or, between PLCs and a host computer. This network operates at speeds up to 38.4Kbps and permits you to upload or download virtually any type of system data. Some examples are:

- Timer / Counter Data
- I/O Information
- Variable Memory Information (V memory, registers, etc.)

It has Advantages...

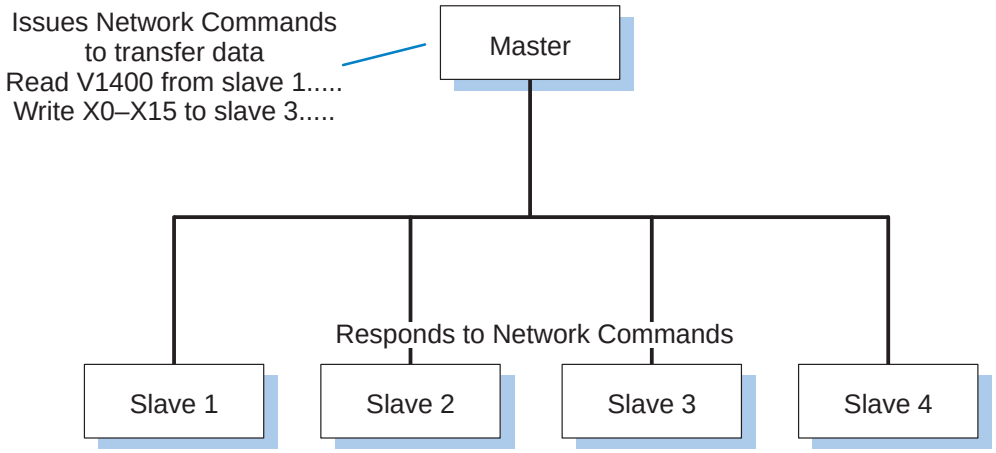
DirectNET is a great choice for sharing small amounts of data between network devices and has many advantages. You can build a data network with a minimal investment in equipment and training because:

- The DL430, DL440, DL340, and DL240 Central Processing Units (CPUs) have built-in ***Direct***NET ports.
- In the most common applications there is no need for complex communications programming. Simple Relay Ladder Logic instructions can be used to manage the communications, so you don't have to be a networking guru to start moving data around.

It has Disadvantages...

DirectNET operates asynchronously at speeds up to 38.4K baud. Therefore, it is not the best choice in an application requiring extremely fast update times and moving large amounts of data.

How Does it Work? The network is controlled by a master station that issues network commands to individual slave stations (you cannot "broadcast" a message to all slaves). The commands may be used to download data to the slave stations, or upload data from the slave stations. The slave stations only respond to requests from the master station and cannot initiate communications.



Network Protocol ***Direct***NET uses the ***Direct***NET communications protocol, but you don't have to understand the protocol to build the most common network configurations. A description of the ***Direct***NET protocol is included in Chapter 6 – ***Direct***NET Communication Programs.

Network Specifications

Maximum Number of Slaves	90 per master (RS422 Amplifier required for over 16 stations)
Configurations	Point-to-point, multi-drop
Interface Type	Serial RS232C / RS422 Half-duplex, Asynchronous operation
Transmission Rate	300 to 38.4K baud
Transmission Distance	3300 Feet (1000 meters)
Protocol	***Direct***NET

What can I use as a network master station?

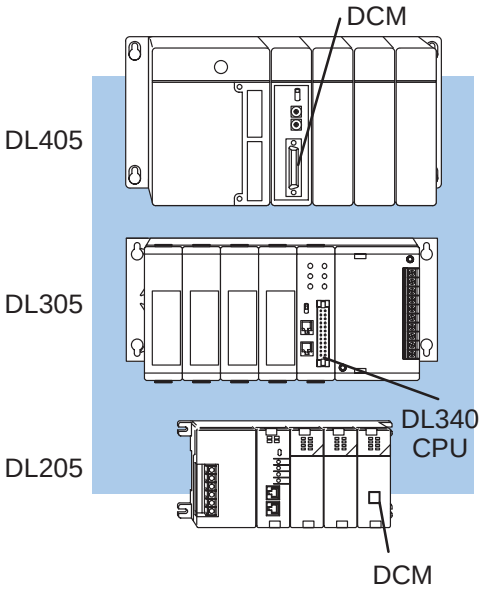
DL405/DL205 PLCs with a DCM or DL340 CPU

The master stations can be any one of the following:

- DL430 or DL440 PLCs with a DCM
- DL340 CPU (using built-in port)
- DL240 PLC with a DCM

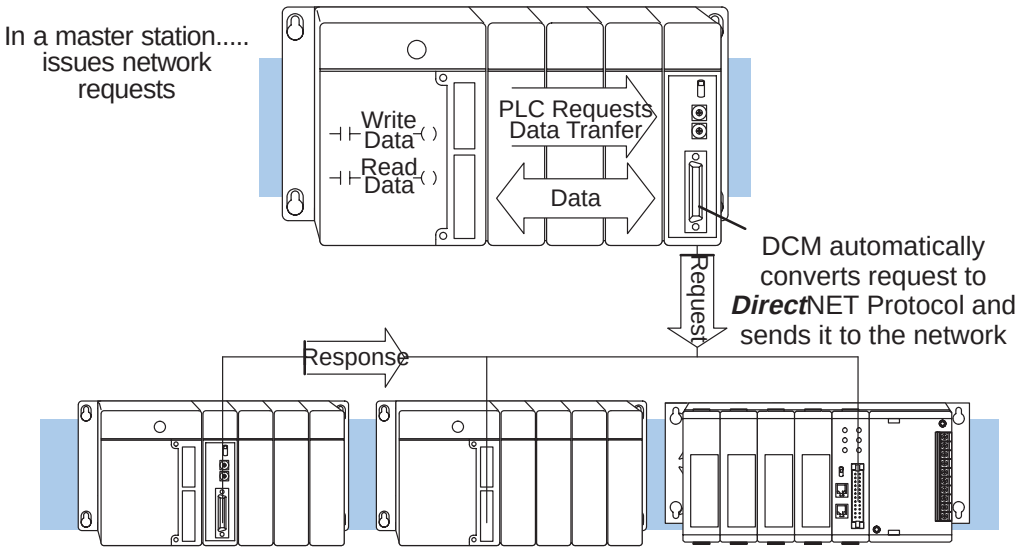
(A DCM is a Data Communication Module.)

These master stations use Relay Ladder Logic Instructions to initiate the communications requests over the network. No complex programming (or knowledge of the ***Direct***NET protocol) is required.



NOTE: The DL205 DCM was not available for shipment at the time of this publication. Availability will be announced at a later date.

The DCM has no internal program and only processes the data transfer requests from the master station CPU. The DCM automatically converts the requests into the appropriate ***Direct***NET commands and issues them to the network.



Operator Interface

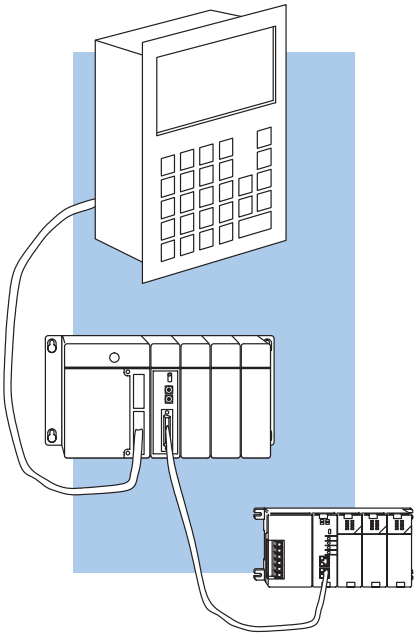
Many operator interfaces can be used as a network master station to communicate with one or more slave stations. An operator interface must have a driver that supports the ***Direct***NET protocol.

Make sure your operator interface uses one of the following protocols or has a driver for the equipment listed.

- ***Direct***NET (DL430, DL440, D4–DCM)
- Hostlink (TI™ or Simatic® TI425, -430, -435, U-01DM)
- CCM2 (GE® Series One™)

Many companies advertise some of their operator interface products will operate with the ***Direct***LOGIC™ family of products. Check with your operator interface supplier to see if they offer versions for use with the ***Direct***LOGIC™ products.

Operator Interface

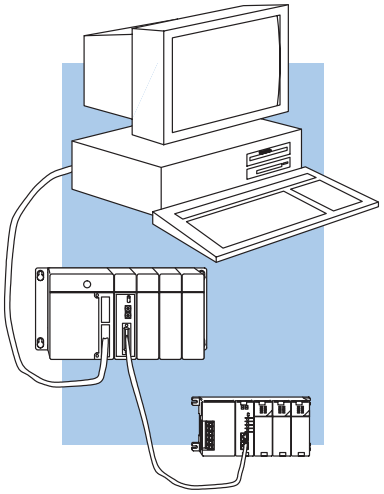


Host Computer

Many applications utilize a computer to act as a central data collection point and to manage the network requests for data transfer. The advantage with this approach is you can perform many different types of operations with the data either before or after a request.

The disadvantage is you may have to write your own communications driver and that can take a considerable amount of time for more complex applications. The communications programming is difficult unless you have a considerable amount of network programming experience. The programs must utilize the ***Direct***NET protocol used by ***Direct***NET.

Host Computer



What can I use as a network slave station?

CPUs with Built-in *Direct*NET Port

One of the benefits of ***Direct***NET is many of the ***Direct***LOGIC™ CPUs already have built-in ***Direct***NET ports that can communicate up to 19.2K baud, (38.4K for the DL340). The following CPUs have this feature.

- DL430, DL440
- DL340
- DL240

Data Communications Modules and Data Communications Units

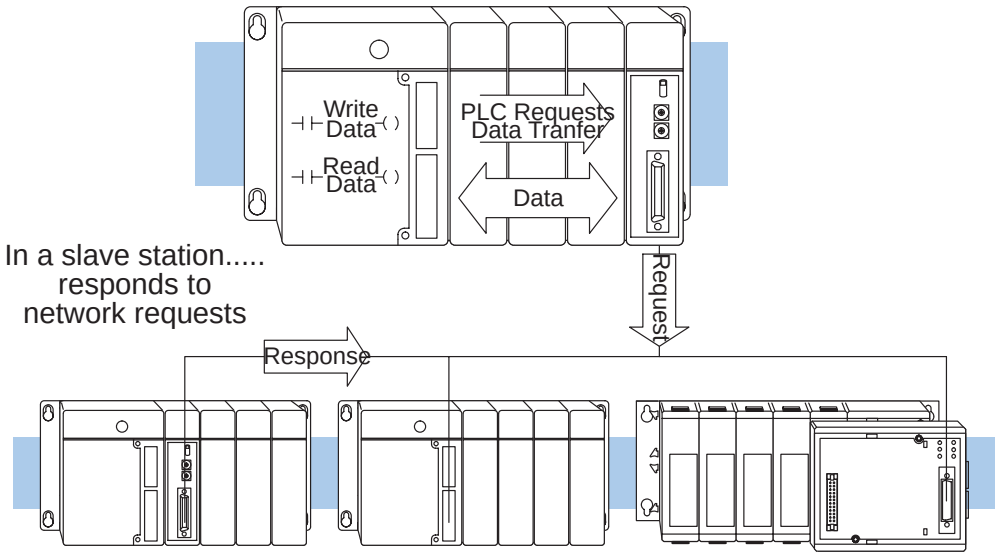
Each ***Direct***LOGIC™ product family has a general purpose communications interface. A DCM for the DL405 and DL205 CPUs and a DCU for the DL305 CPUs. You can use any of the ***Direct***LOGIC™ PLCs with their appropriate communications interface as a slave station. A few reasons to use a communication interface are:

- The communication interfaces (except for the DL305 DCU) allow baud rates of up to 38.4K baud.
- You can leave the CPU built-in port open to attach an operator interface or programming device.

The following communications interfaces are available.

- D4–DCM (with DL405 CPUs)
- D2–DCM (with DL205 CPUs)
- D3–232–DCU and D3–422–DCU (with DL305 CPUs)

In a slave station, the DCM responds to requests from the network master station.



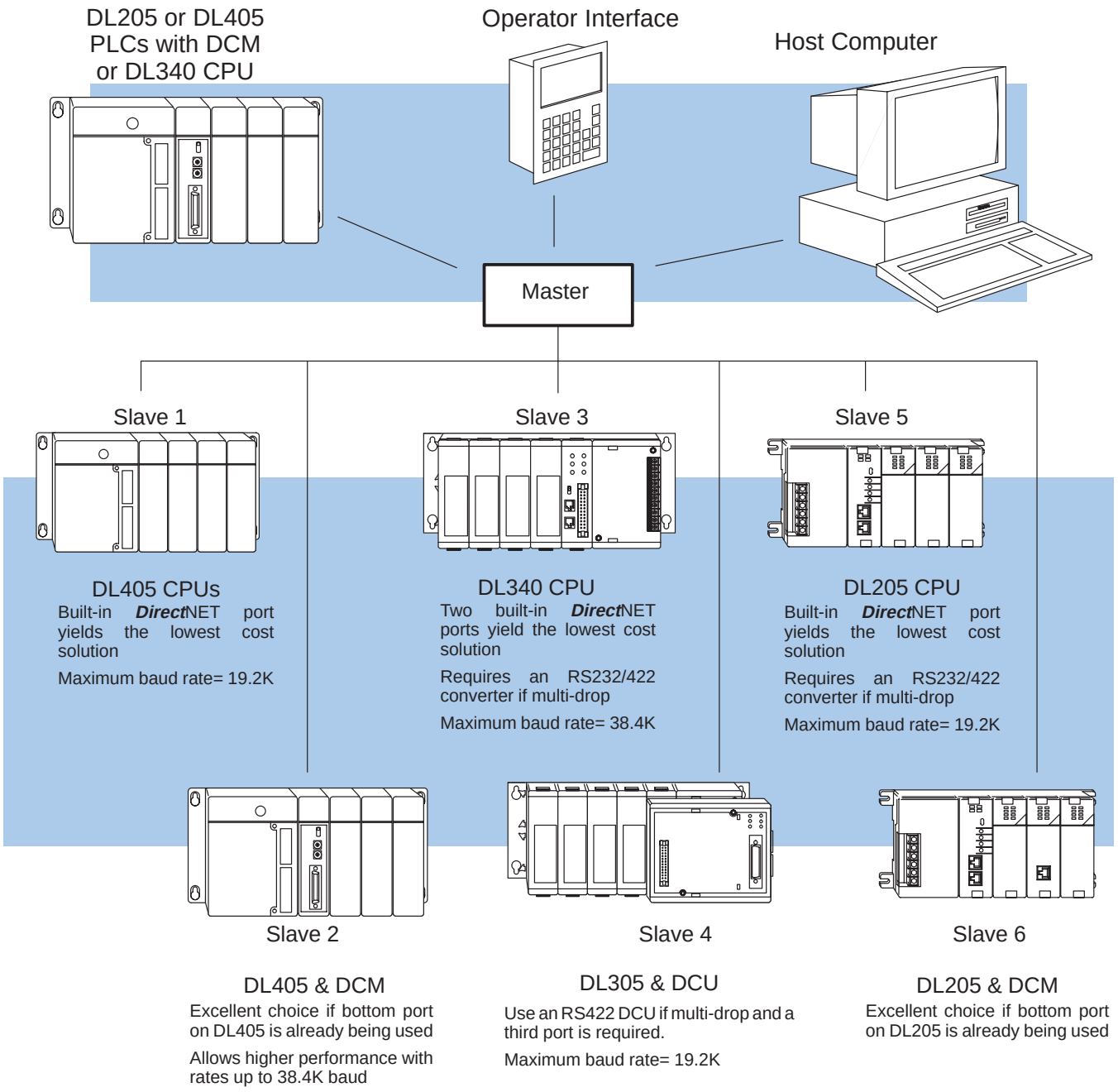
(a DCU may or may not be required depending on the DL305 CPU model chosen.

Compatible Products

There are also many compatible products from the following families that will communicate over ***Direct***NET.

- GE® Series 1®
- Texas Instruments TI305® and TI405®
- Simatic® TI305 and TI405

The following diagram shows the various combinations of master and slave stations available with a ***Direct***NET solution.



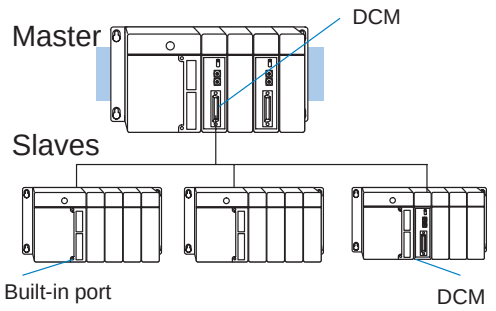
Choosing a Configuration

Three Basic Configurations

The network components can be used to create many different network designs. However, all networks use a mixture of three basic configurations. Any of the three configurations can be grouped together or used independently. The type of configuration determines the types of cables, communication parameters, and communications programming.

PLC as Master

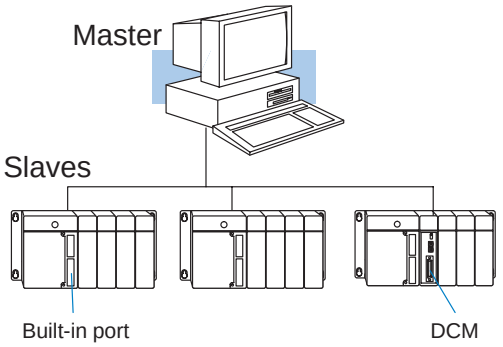
This configuration is very easy to use. A PLC master / slave configuration utilizes a ***Direct***LOGICE PLC as the network master. A small communications program and a communications interface (DCM) is required in the master station. Slave stations can have built-in ***Direct***NET ports, or, they can have communication interfaces.



Host as Master

A host computer, operator interface, or other intelligent device can be connected to one or more slave stations. The master must contain a program (or driver) capable of issuing network requests using the ***Direct***NET protocol.

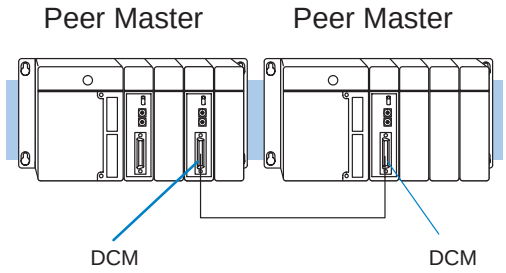
Slave stations can have built-in ***Direct***NET ports, or, they can have communication interfaces (DCMs or DCUs).



Peer as Master

Two DL405 PLCs with DCMs as the network interface can be connected so either station can initiate a request for data. Both stations must contain a communications program to initiate the requests for data.

This configuration can only be achieved by using DCMs. No other stations can be connected in this manner.

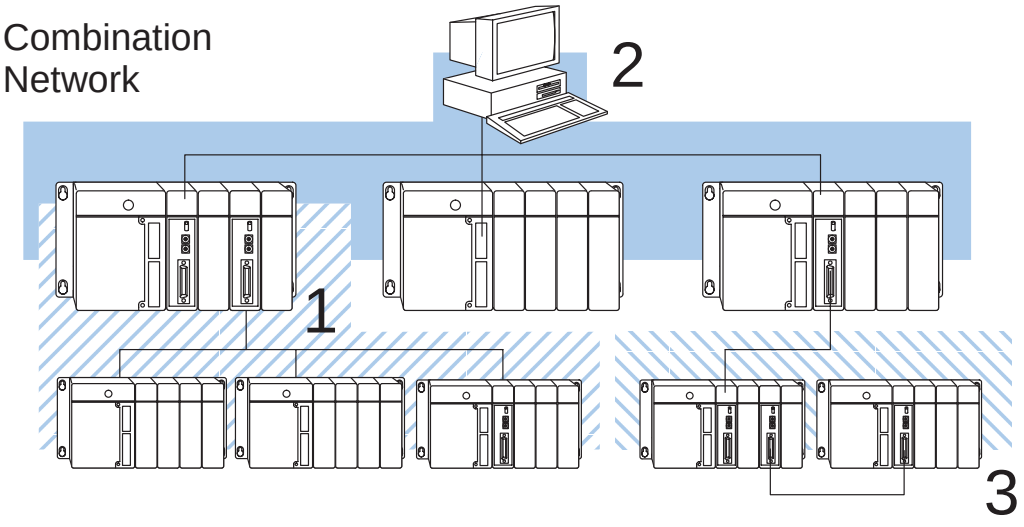


Configuration Limits

- Up to 90 slave stations can be connected to a single master.
- Only one master is allowed for each portion of the network.
- A single base can have multiple masters, with each master communicating to its own slave stations.

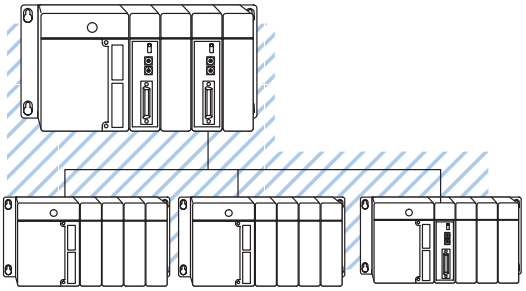
Combination Networks

The three types of networks can be combined to solve many different applications. Even though the configurations can be combined in an application, each network remains independent. The master station from one network cannot request data directly from slave stations on another network. This does not mean you cannot obtain data from these networks, you can. It just requires more than one interface for that slave station. The following diagram shows a simple application using all three types of networks, some with multiple interfaces for each station.



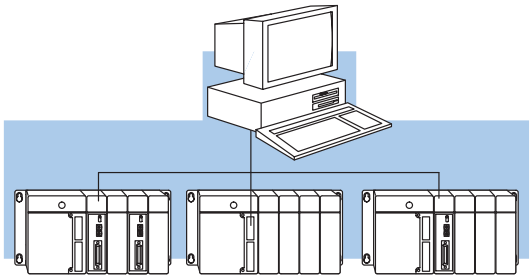
1 – PLC as Master Network

- Master can initiate read or write with any slave station
- PLC with DCM as master
- Full range of slave stations available



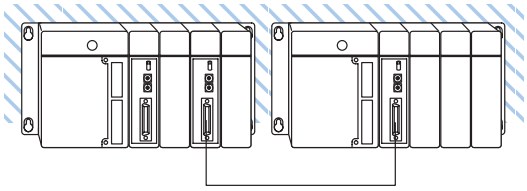
2 – Host as Master Network

- Host computer (or other intelligent device) as master
- Requires ***Direct***NET program in the host
- Full range of slave stations available



3 – Peer as Master Network

- Two stations only
- Only DL405 DCMs
- Either station can initiate a request



What communications program should I use?

Two Options

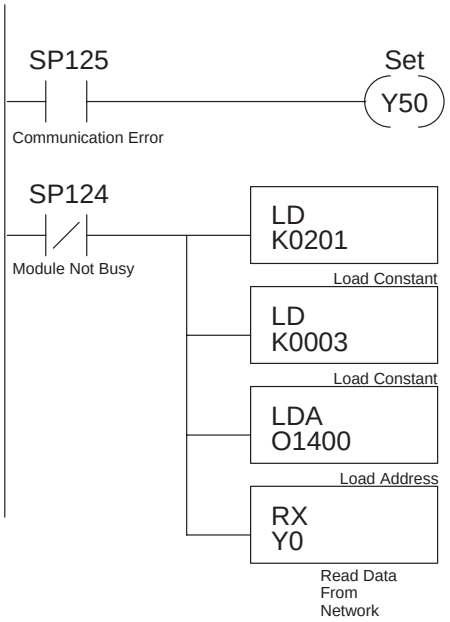
There are two types of communications programs, RLL instructions or ***Direct***NET protocol programs. The network configuration determines the type of communications program required.

- PLC as Master — The PLC master requires instructions in the RLL program to initiate the requests for data.
- Peer as Master — Both peer masters require instructions in the RLL program. Since both stations contain network instructions, either station can initiate a request for data.
- Host as Master — Host computers or operator interfaces must execute communications programs that can issue network commands with the ***Direct***NET protocol. You'll either have to use a DL405 driver, (that hopefully came with your host software package or operator interface), or you'll have to create one.

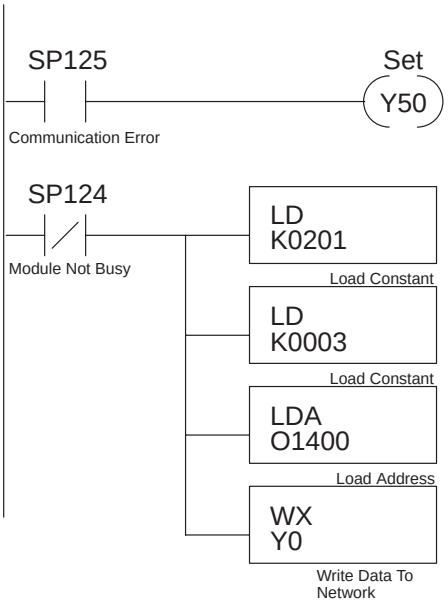
RLL Programs

The RLL instructions are used to describe and initiate the operation the DCM will process. Here's an example of a simple RLL communications program. Chapter 4 provides a detailed description of the instructions.

Read Example



Write Example



*Direct*NET Programs

The communications program used with a hosted network is more complex than the simple RLL instructions used with the other configurations, but the concept is the same. The host is the ***Direct***NET master and must use a ***Direct***NET protocol communications program to initiate all network requests to read or write data. These communication programs can be written in many different languages, such as BASIC, C, etc. and must include the appropriate ***Direct***NET protocol commands.

Here's an example of a simple ***Direct***NET program. Chapter 5 provides a detailed description of the ***Direct***NET protocol.

DirectNET Program in BASIC

```
10    REM Program to read X0–X7 from a DL405 PLC
20    REM
30    REM Define all variables
40    REM
50    REM Change the slave address in HEX at line 60 if required.
60    SLAVEADDRESS=&H1
70    DATATYPE$=CHR$(&H32)
80    DATAADDR$=CHR$(&H30)+CHR$(&H31)+CHR$(&H30)+CHR$(&H31)
90    COMPLETEBLK$=CHR$(&H30)+CHR$(&H30)
100   PARTBLK$=CHR$(&H30)+CHR$(&H32)
110   MASTERADDR$=CHR$(&H30)+CHR$(&H30)
120   NORMAL$=CHR$(&H4E)
130   SLAVEADDR$=HEX$(SLAVEADDRESS)
140   IF LEN(SLAVEADDR$)<2 THEN SLAVEADDR$="0"+SLAVEADDR$
150   OFFSETADDR$=CHR$(&H20+SLAVEADDRESS)
|
|
|
```

How can I create a network?

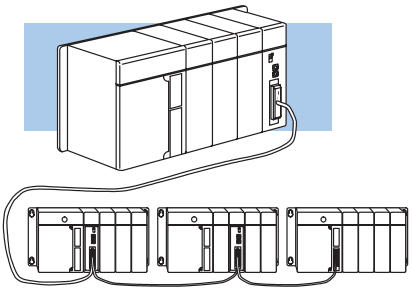
Follow Four Simple Steps

You can easily create a ***Direct***NET network by following four simple steps. The remainder of this manual provides explanations and examples of these steps.

1. Design the network by:
   - Selecting the configuration(s)
   - Building the communication cables.

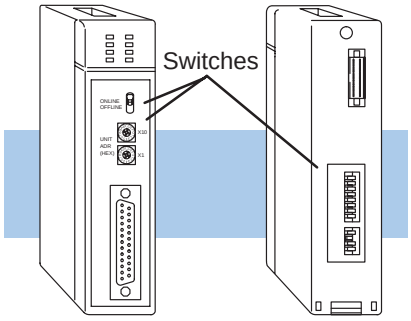
   Don't ignore the importance of this step because it determines the type of switch settings and communications program you should use. Chapter 3 provides the details.

Configuration and Cables



2. Select the communication settings by:
   - Setting the master switches
   - Setting the slave switches

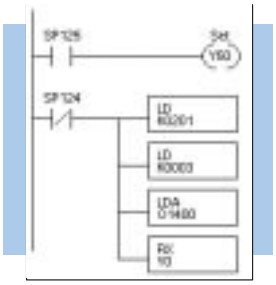
   Chapter 4 provides switch settings.



Write Program

3. Write the communication control program.
   - RLL program with PLC master
     or
   - ***Direct***NET program with host master

   Chapters 5 and 6 provide programming information.



Start Network

4. Start the network operation.

   Chapter 7 provides a description of network operation.