A

PLC Master / Slave Example

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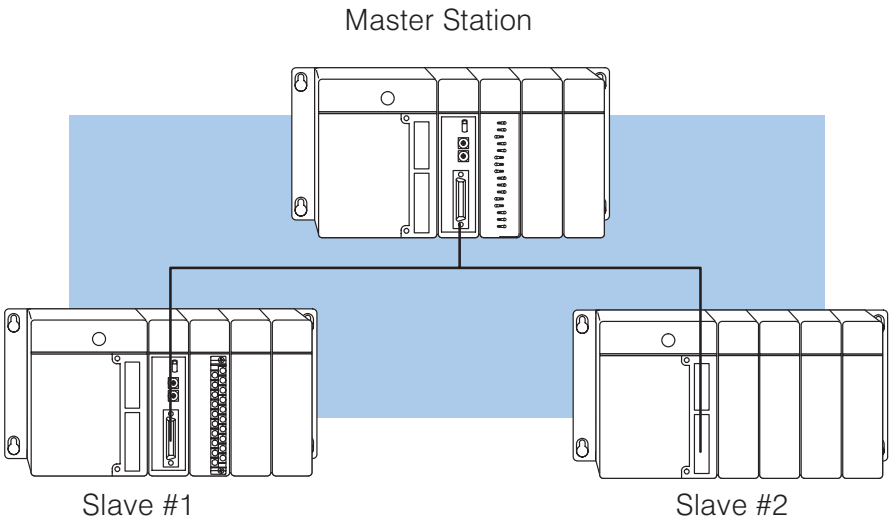
The Example

This chapter provides an example of a PLC master / slave network and is designed for the experienced user. This chapter does not provide detailed descriptions of network concepts and communications parameters. If you're unfamiliar with networking concepts, or if you want to know more detailed information about ***Direct***NET, you may want to read Chapters 2 – 5 before setting up the example network.

Example Equipment

A PLC master with a DCM interface connected to one or more PLC or DCM slaves is the most popular type of network. The PLC is the network master and uses the DCM to initiate all communication requests. The DCM or PLC slave stations respond to the master station requests for data.

This chapter provides an example that allows you to quickly and easily set up a small master / slave network.



Master Station

The following equipment is needed in the master station.

- DL405 Base (4, 6, or 8 slot)
- DL430 or DL440 CPU
- D4–DCM Data Communications Module
- I/O modules, including at least one I/O simulator

Slave Station #1

The following equipment is needed in slave station #1.

- DL405 Base (4, 6, or 8 slot)
- DL430 or DL440 CPU
- I/O modules, including at least one output module

Slave Station #2

The following equipment is needed in slave station #2.

- DL405 Base (4, 6, or 8 slot)
- DL430 or DL440 CPU

Install the Equipment

Normally, you can install the modules in any manner. However, we'd like to keep our examples consistent between the different configurations. Install the equipment in the following order.

WARNING: To minimize the risk of electrical shock, personal injury, or equipment damage, always disconnect the system power before installing or removing any system component.

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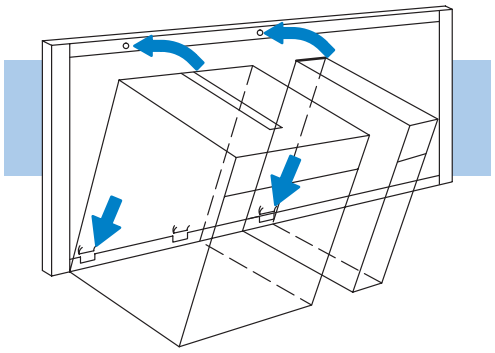
1. Install the CPU in the far left side of the base in the position marked "CPU/Power Supply". When inserting components into the base, tilt the component slightly forward sliding the tab on the bottom of the component into the slot in the base. Push the top of the component into the base until it is seated firmly, then tighten the securing screw at the top of the module/unit.

   Each unit has a plastic tab at the bottom and a screw at the top.

   With the unit tilted slightly forward, hook the module's plastic tab on the base.

   Gently push the top of the unit back until it is firmly installed in the base.

   Secure the unit to the base by tightening the top screw.

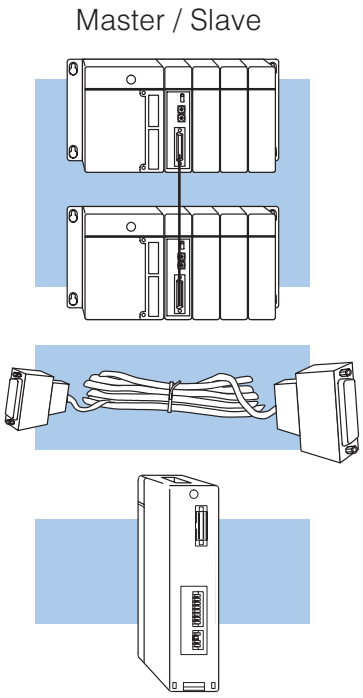
   You can connect the power wiring now (if it's not already connected), but don't connect the source power yet.

2. For the master station and slave stations #1 and #2, reserve slot 0 for the DCM. (Slot 0 is the slot next to the CPU.) Set the DCMs aside for now. (You need to set the dipswitches and station addresses first.)
3. Install the I/O Simulator in slot 1, next to the DCM slot.

Remember these Four Steps!

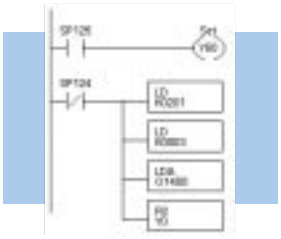
Use these steps to build your example network. The remainder of this chapter provides detailed explanations and examples of these steps.

1. Design the network by:
   - Selecting the configuration (this is a master / slave configuration)
   - Building the communication cables

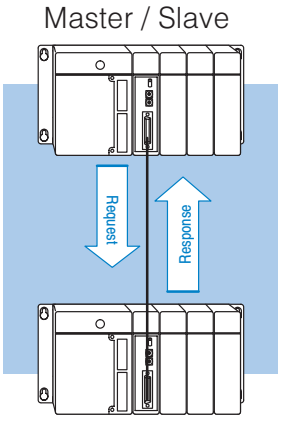


2. Select the communication settings by:
   - Setting the master switches
   - Setting the slave switches

3. Write the communication control program.
   - RLL program is used with PLC master



4. Start the network operation.



Step 1: Design the Network

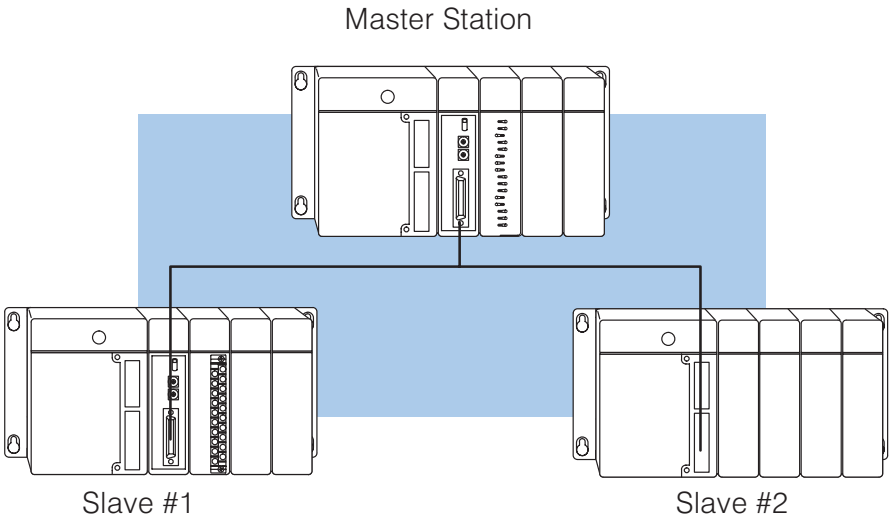
The Example Configuration

In this chapter we'll use the following example configuration to create a simple master slave network.

WARNING: These examples are for illustration purposes only and are not intended for use in actual applications. This is because there may be many aspects of your system safety precautions that are not addressed in the examples. If you use these examples in actual applications, you are increasing the risk of personal injury and/or property damage.

Goal:

1. Write a bit pattern from an input module (X0 – X7) to Slave #1
2. Read 1 V memory location from Slave #2.



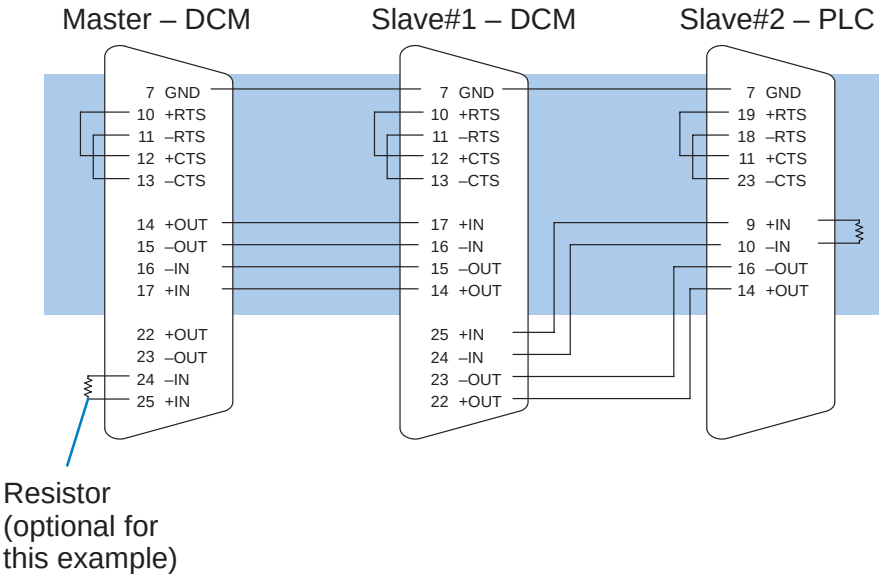
The Example Cable

In our example configuration we have:

- A PLC with a DCM as the master station
- A PLC with a DCM as slave station #1.
- A DL440 PLC with a built-in ***Direct***NET port as slave station #2

We'll have to use the pinout diagrams for those slaves. Also, since we have more than one slave station we'll use the RS422 multi-drop cable.

DCM to DCM to PLC port cable pinout



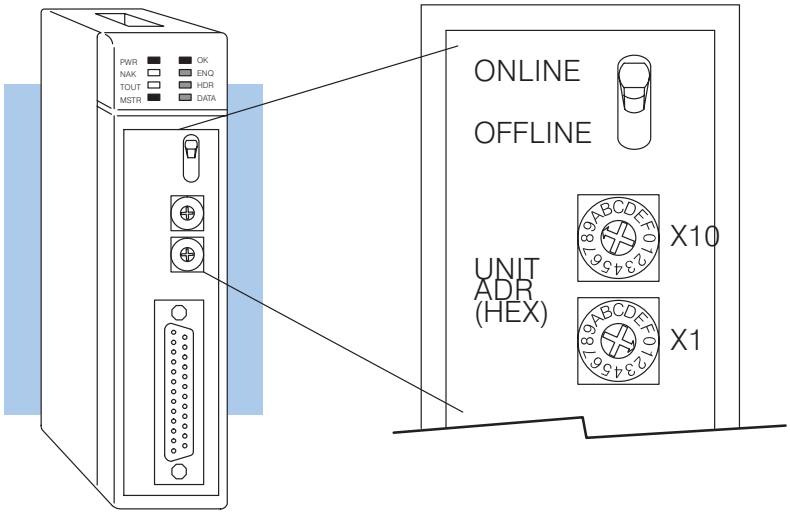
Resistor
(optional for
this example)

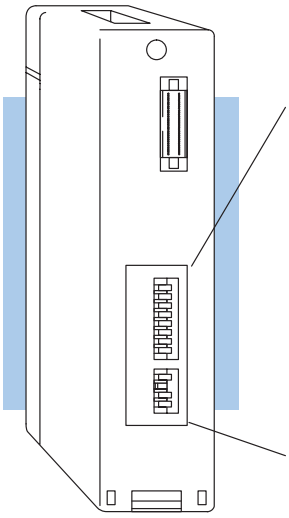
Step 2: Select the Communication Settings

Set the DCM Switches for the Master Station

The next step is to set the master station DCM communication parameters. We will use the following settings in our example.

- On-line / Off-line — On-line position
- Address — 0 (hexadecimal)
- Baud Rate — 19.2K
- Parity — None
- Response Delay Time — 0
- Network Protocol — ***Direct***NET Master
- Mode — HEX



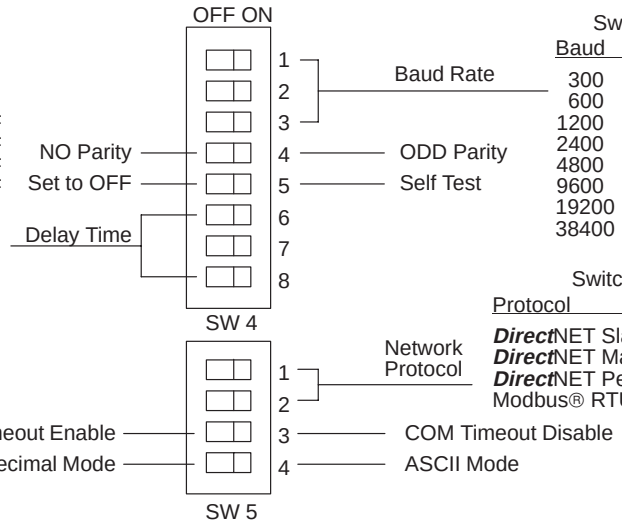


DCM Rear View

Switch Positions

Time*	6	7	8
0	OFF	OFF	OFF
2	ON	OFF	OFF
5	OFF	ON	OFF
10	ON	ON	OFF
20	OFF	OFF	ON
50	ON	OFF	ON
100	OFF	ON	ON
500	ON	ON	ON

*Delay time in milliseconds



Switch Positions

Baud	1	2	3
300	ON	OFF	OFF
600	OFF	ON	OFF
1200	ON	ON	OFF
2400	OFF	OFF	ON
4800	ON	OFF	ON
9600	OFF	ON	ON
19200	ON	ON	ON
38400	OFF	OFF	OFF

Switch Positions

Protocol	1	2
DirectNET Slave	OFF	OFF
DirectNET Master	OFF	ON
DirectNET Peer	ON	OFF
Modbus® RTU Slave	ON	ON

Set the DCM Switches for Slave #1

Slave station #1 is a DL405 PLC with a DCM as the network interface. Set the DCM address to 1. Set the communication parameters to match the master station.

- Address — 1 (hexadecimal)
- On-line / Off-line — On-line position
- Baud Rate — 19.2K
- Parity — None
- Response Delay Time — 0
- Network Protocol — ***Direct***NET Slave
- Mode — HEX

Install the DCM and Connect the Cables

Install the DCMs in the slots next to the CPU for the master station and slave station #2. Connect the communication cables to the appropriate units.

NOTE: Remember that the pinout diagrams are different for the DCMs and the bottom CPU port. Make sure the cables are connected to the proper device.

Set the PLC Switches for the Slave #2

Slave station #2 is a DL405 PLC. If you look at the back of the DL405 CPU you will notice a small bank of switches. Switches 2, 3, and 4 are used to set the communication parameters for the bottom communication port.

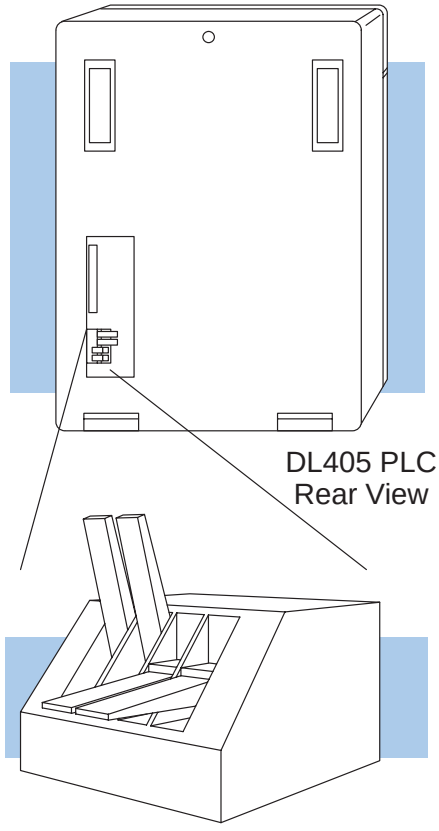
Switch 2 — This switch selects the CPU slave address. If this switch is On, then an address of 1 is used. If the switch is Off, then you can use a programming device to set the address.

Switch 3 & 4 — These switches select the baud rate for the bottom port.

Baud	3	4
300	OFF	OFF
1200	OFF	ON
9600	ON	OFF
19200	ON	ON

Set switch 2 to OFF – Address 1.
Set switch 3 ON and 4 OFF – 9600 Baud

Switch 1 does not apply to the networking example. It is used to select the battery low indictor operation.

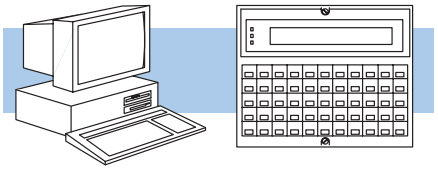


DL405 PLC
Rear View

Set the Station Address for Slave #2

With ***Direct***SOFT, use AUX 56 from the Auxiliary functions menu to set the port parameters.

With the DL405 handheld programmer, use AUX 56 to set the port parameters. The following example shows how to use the handheld programmer to set the address.



DirectSOFT DL405 Handheld Programmer

NOTE: The PLC port address is set in decimal, not hexadecimal.

Select AUX 56

CLR CLR AUX 5 6 ENT ENT

```
AUX 5* CPU CFG
AUX 56 CPU N/W ADDRESS
```

Enter the Address (in decimal)

0 2 ENT

```
AUX 56 CPU N/W ADDRESS
N/W  #  02
```

Set Address to 2 (decimal)

Select HEX or ASCII

To change the mode press .... →

then press enter. ENT

```
AUX 56 CPU N/W ADDRESS
HEX / ASCII
```

Select HEX mode for data transfer.

Select the Parity Option

To change the parity press .... →

then press enter. ENT

```
AUX 56 CPU N/W ADDRESS
NONE / ODD
```

Set Parity to none.

Clear the Display

To clear the display press.... CLR

```
OK
```

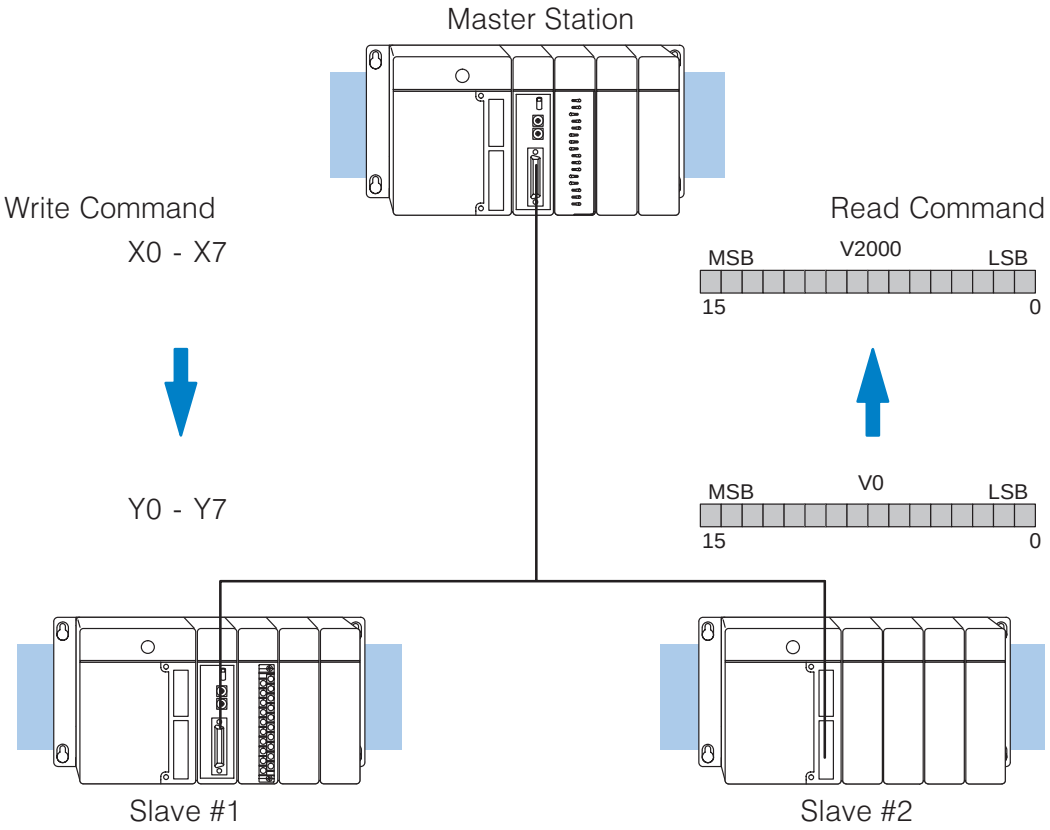
Step 3: Create the Communications Program.

Program Description

In the example network, we'll use 8 switches on the input simulator in the master system to set a bit pattern that will be written to an output module on the slave station #1. Also, we'll read the current value of a timer from slave station #2. Our example requires a program in both the master and slave stations.

Goal:

1. Write a bit pattern from an input module (X0 – X7) to Slave #1
2. Read one V-memory location (V0000 – two bytes) from Slave #2, store in V2000.



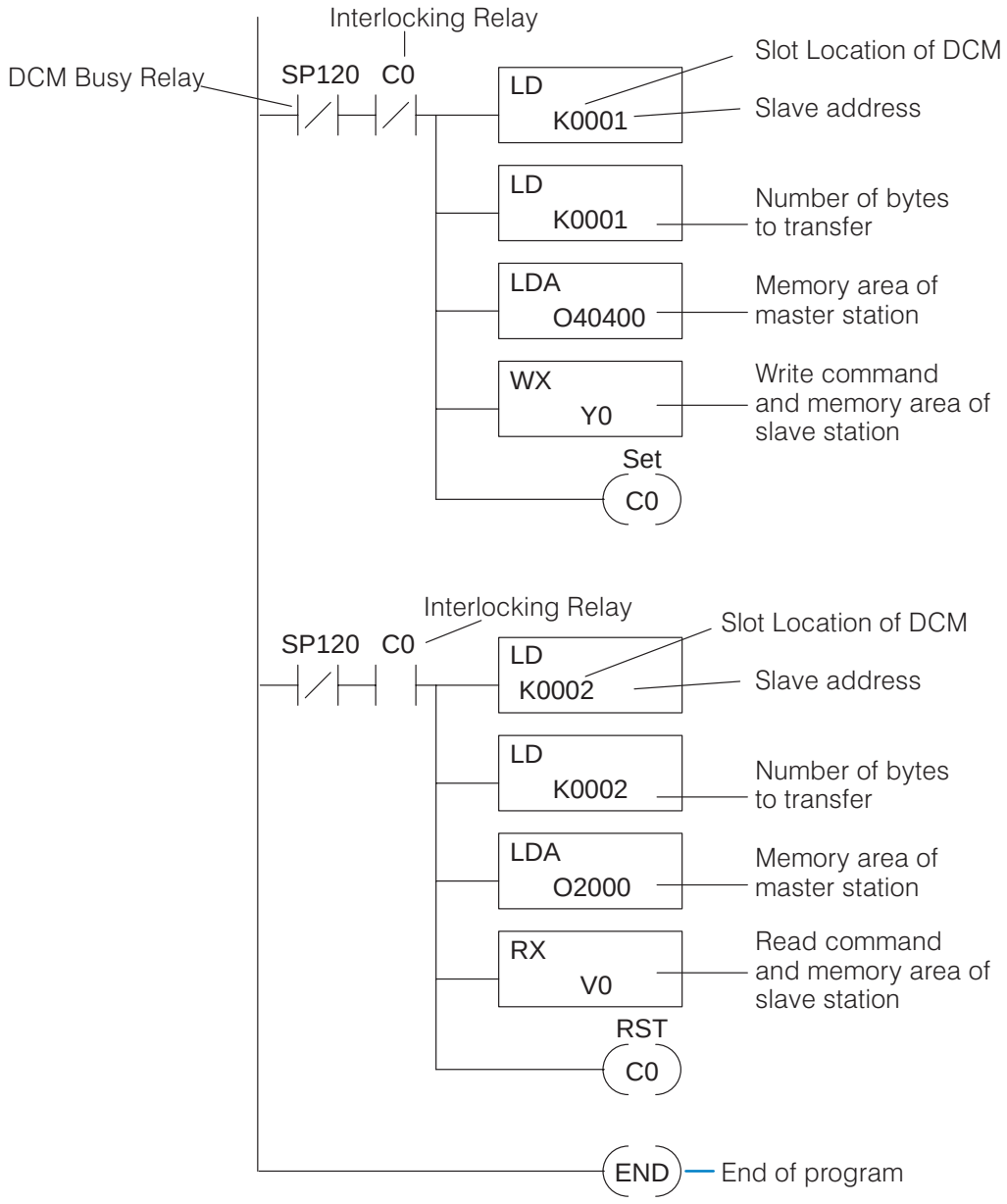
Connect the Programing Device

The example provides the instructions needed for the ***Direct***SOFT programming package and for the DL405 Handheld Programmer. In either case, you should connect the programming device to the top port on the DL405 CPU. We assume you understand how to use the ***Direct***SOFT Programming Package and/or the Handheld Programmer. If you aren't familiar with these, you should probably review those product manuals prior to trying to enter these programs.

The program examples on the following pages show both RLL and RLL*PLUS* examples. The RLL*PLUS* approach eliminates the need for the interlocking relays and is generally a much more straightforward programming method.

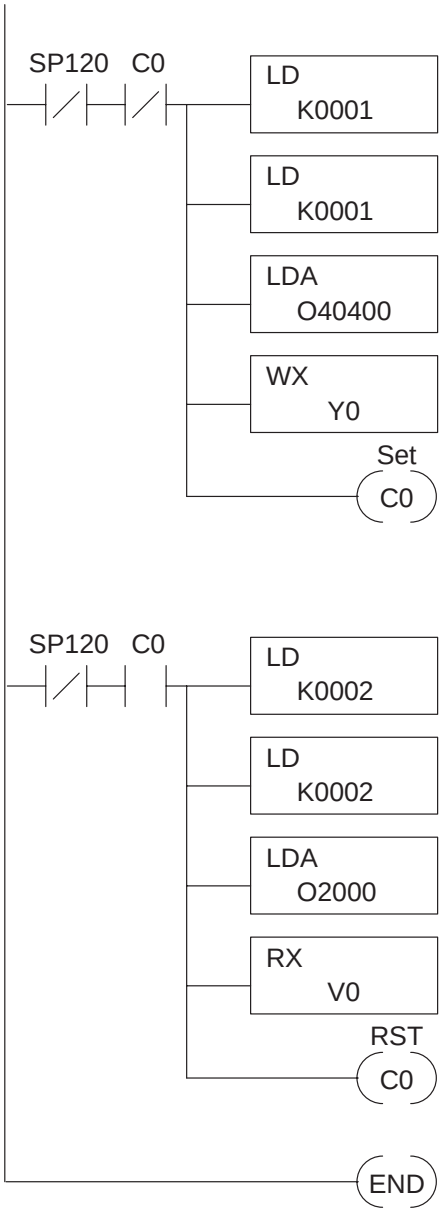
RLL Instructions

The following diagram shows the RLL instructions used in the communications program. Chapter 5 provides detailed descriptions of the instructions. You should always use the interlocking relays to ensure that the DCM has adequate time to finish a communication task.



Master Program
RLL Example

DirectSOFT

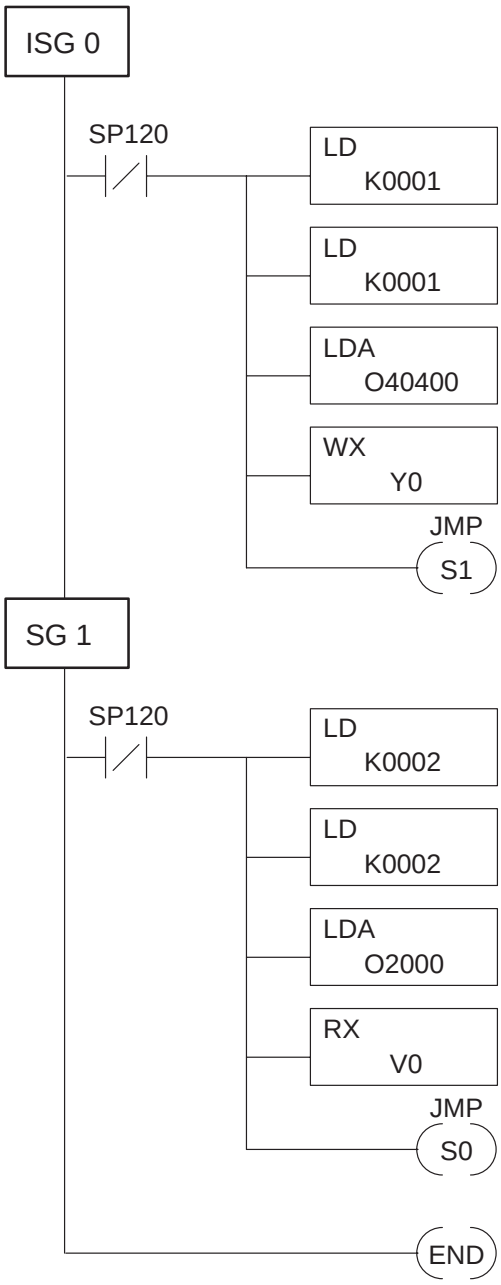


DL405 HP Mnemonics

```
$0
STRN SP120
$1
ANDN C0
$2
LD K0001
$3
LD K0001
$4
LDA O40400
$5
WX Y0
$6
SET C0
$8
STRN SP120
$9
AND C0
$10
LD K0002
$11
LD K0002
$12
LDA O2000
$13
RX V0
$15
RST C0
$16
END
```

Master Program
RLL*PLUS* Example

***Direct*SOFT**



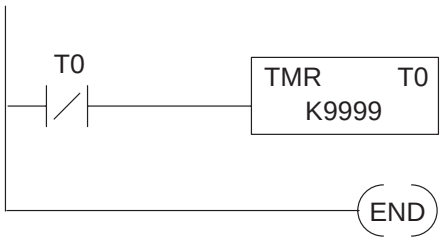
DL405 HP Mnemonics

```
$0
ISG S0
$1
STRN SP120
$2
LD K0001
$3
LD K0001
$4
LDA O40400
$5
WX Y0
$6
JMP S1
$8
SG S001
$9
STRN SP120
$10
LD K0002
$11
LD K0002
$12
LDA O2000
$13
RX V0
$15
JMP S0
$16
END
```

Slave Station #2 Program RLL Example

Our example requires a program in slave station #2. The slave station program is much easier because the master station program controls the communication. In the slave station, we're just using a self-resetting timer to provide a data value.

DirectSOFT

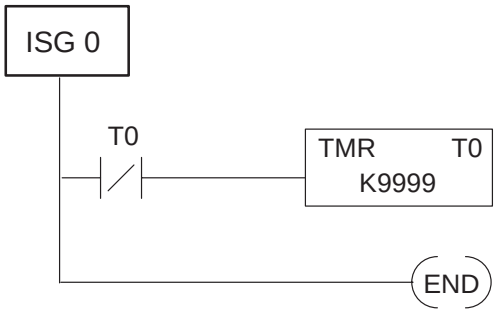


DL405 HP Mnemonics

```
$0
STRN T0
$1
TMR 0
$2
K9999
$3
END
```

Slave Station #2 Program RLL*PLUS* Example

DirectSOFT



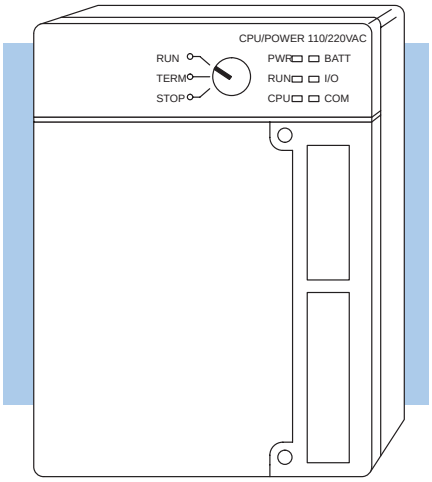
DL405 HP Mnemonics

```
$0
ISG S0
$1
STRN T0
$2
TMR 0
$3
K9999
$4
END
```

Step 4: Start the Network

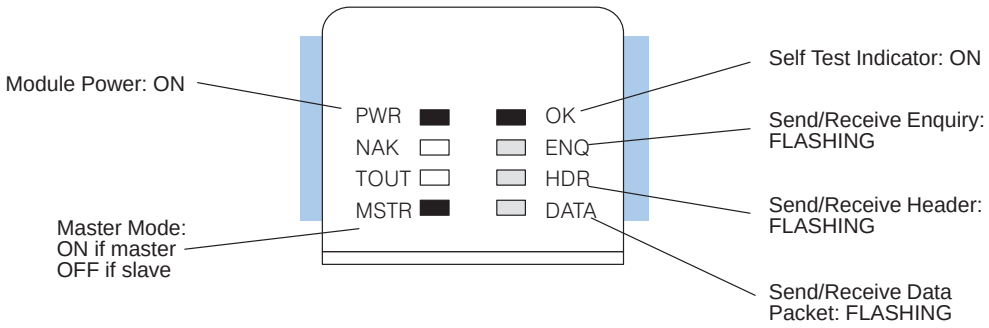
Switch the PLCs to Run Mode

Only the master station needs to be in Run mode to execute the communications program. However, for this example to work correctly all CPUs should be in Run mode. You can use the programming devices to place them in Run mode,or you just turn the keyswitch to the RUN position.



Verify the Network

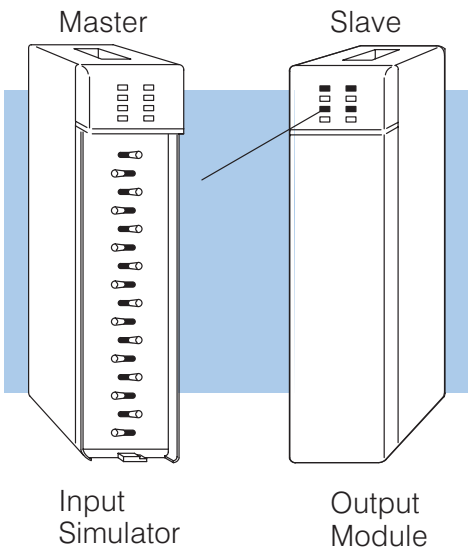
Check the DCM indicators to verify that the network is operating correctly. shows the proper indicator conditions. The ENQ, HDR, and DATA indicators should be flashing.



Verify the Write Command

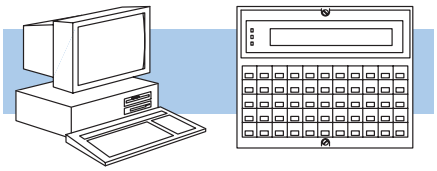
Now you can change the I/O simulator switch settings and verify the communications.

1. Set every other switch to the ON position
2. Look at the first slave station output module. The indicators should match the I/O simulator switch settings.
3. Change the I/O simulator switch settings at random and notice how the output module indicators change.



Verify the Read Command

You'll need to use the programming device to verify the read requests. Connect the programming device and complete the following steps.



DirectSOFT

DL405 Handheld Programmer

Monitor a V Location

CLR CLR V 0 WD ST ENT

ENT

```
        V    1   V    0
V MON  0000      XXXX
```

What should I do if it isn't working correctly?

Troubleshooting Steps

If the network does not seem to be working correctly, check the following items.

1. Cable and connections. Incorrectly wired cables and loose connectors cause the majority of problems. Verify that you've selected the proper cable configuration and check that the cable is wired correctly.
2. Dipswitch settings. Make sure you've set the switches to allow the same communication settings for both stations.
3. Communications program. Verify that the program has been entered as shown in the example.
4. If the network still doesn't work correctly go to Chapter 7, Network Operation and Troubleshooting, and use the troubleshooting charts.