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Using the DCM with Modems

Introduction

There are some applications that require a remote connection to the PLC. These remote connections require you to use a modem to communicate between the Personal Computer and the PLC system. Although this manual tends to focus on using the DCM in networking applications, there are a tremendous number of people who simply use the DCM as an extra communications port. The DCM provides additional flexibility in configuration and baud rates compared to the built-in port on the CPU, so it's a logical choice for use with a modem.

It is not hard to establish remote communications with a PLC system via a modem. This appendix provides some guidelines to help you setup the communications link.

System Components

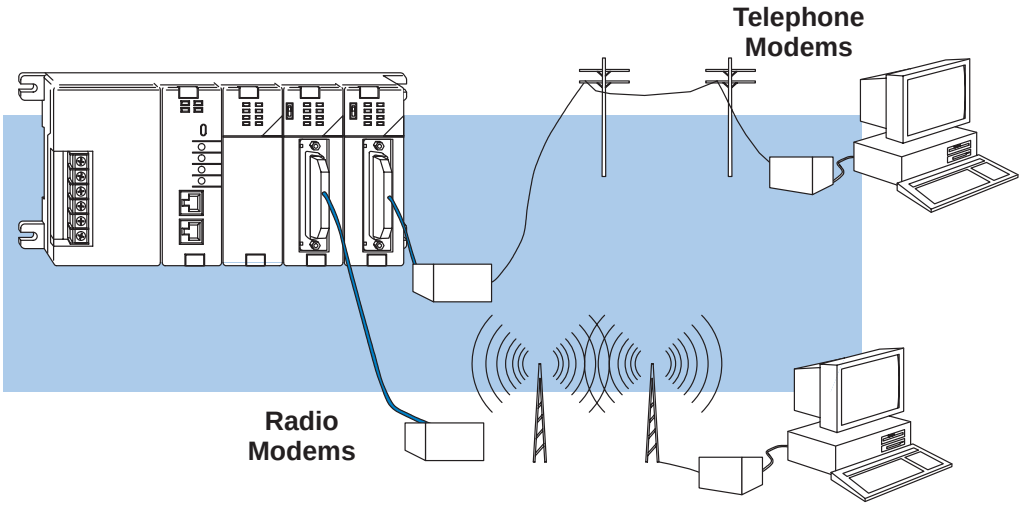
There are typically two types of communication paths for modem applications.

- Telephone modems
- Radio modems

Both serve the same basic function, which is to enable data communications over a long distance. However, your choice really depends on your particular application. Radio modems are typically more expensive and can be more difficult to use in some situations. But if you don't have phone lines or dedicated cabling in the area, your choice may be restricted to radio modems anyway.

For the DL205 family of products, any system that is designed to handle modem communications usually contains components from the following list.

- PLC System with DCM
- PLC System with DL240 CPU bottom port
- Personal Computer
- 2 modems (one on each end)



Possible Configurations

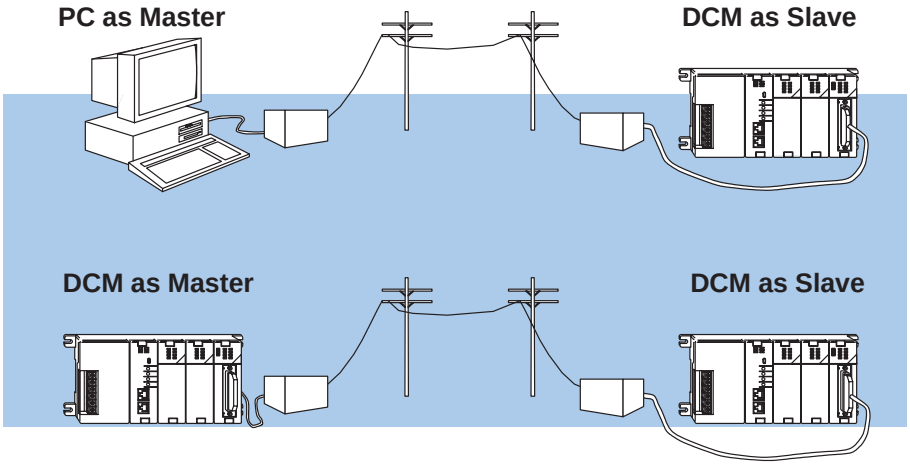
Even though most all systems have one or more of the system components, there are a couple of ways that they can be used.

PC Master — Some people need to use modems between a personal computer and the PLC system so that they can do remote programming and/or data monitoring with PC-based software, such as ***Direct***SOFT or WonderWare. In this case, the personal computer is the master and the PLC system is the remote slave station.

DCM Master — In other situations, you may be using a DCM as the remote communications master instead of a personal computer. If you are considering this, you **must** have one of the following situations.

- **You have a Leased-line** — You can have a leased (dedicated) phone line if telephone modems are used. A dedicated line is necessary because the DCM cannot issue the dial-up commands, so the carrier must be active at all times.
- **You have a Radio Link** — You also have the option of using radio modems. This is useful when it is not feasible to have hard-wired communications cabling between the remote stations.

In either case, the cabling and setup requirements share many similarities, which are covered later in this Appendix.



Choosing a Modem

With today's prices, it is possible to buy a high quality modem for a reasonable price. We recommend that you buy a modem not mainly because it is inexpensive, but because it has a good reputation. This will save you money (and time) over the long run. We also suggest that you spend a few extra bucks to get an external modem if possible. The internal versions typically do not have status indicator lights and are much harder to debug when things don't work correctly.

We have established communications between a personal computer and our PLCs while using the following brands of modems:

- US Robotics Sportster (*not* the Sportster Si)
- MultiTech
- Hayes Optima
- Supra

We use the US Robotics Sportster modems here in our office and they work quite well. We also think the MultiTech modems are great, but they are more expensive. There are also some modems that we have encountered problems with when used with our equipment. Because of this, we *do not* recommend BOCA modems.

Step 1: Set the DCM Switches

For the most part, we suggest that you follow the setup instructions shown earlier in this manual. That is, choose the protocol you're using, set the station address, etc. However, there are a couple of important differences which are discussed here.

Baud Rate & Parity

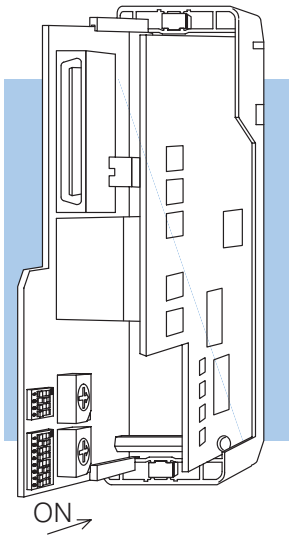
It is important that you select the following communications parameters when you use the DCM for remote communications.

- 9600 baud
- NO parity

The important part is the parity setting. Most popular modems cannot transmit an odd number of bits per character. If parity is enabled, each character would consist of 1 start bit, 8 data bits, 1 parity bit and 1 stop bit, making a total of 11 bits per character. Since this is an odd number, the modem would not work properly. You can experiment with the baud rate settings, but make sure all components are set to the same baud rate.

Delay Time

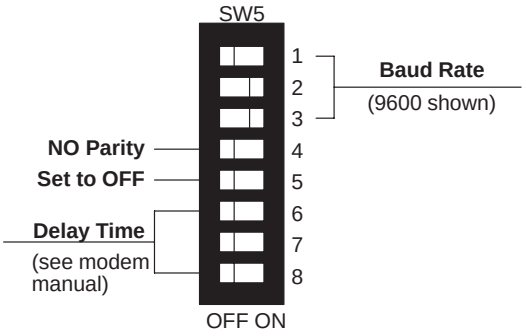
If you're using a radio modem, you may have to set a delay time for the communications. This time is necessary to allow time for the radio to "key-up" before the data is transmitted. You must match the settings required by your modem.



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

Delay Time Considerations for Networks with DL240 Slaves

You may recall that we mentioned a couple of scenarios where you may be using a DCM connected to a modem as the master station and a DL240 CPU connected to a modem as the slave station. If you have such a situation, there are a couple of things that you may have to take into consideration.

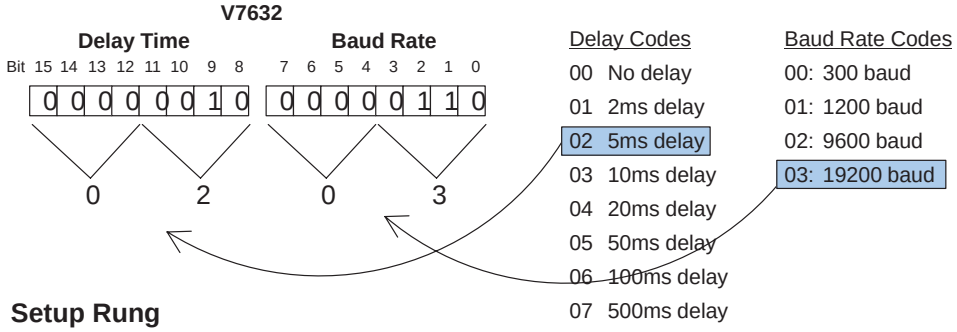
If you are using a radio modem connected to the bottom port of a DL240, you will probably have to set a delay time for the CPU port. You can do this by loading a BCD value into V7632. This is a special V-memory location that can define the baud rate and/or time delay for the bottom port. We recommend that you do this on the first scan within your ladder program. The following diagram provides a table of the settings and an example of some simple setup logic that could be included in your RLL program.

V7632

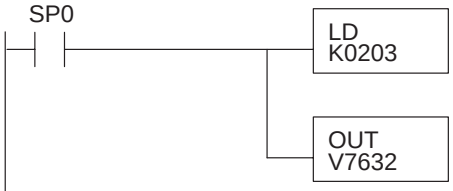
MSB		LSB	
X	X	X	X

Delay Codes	Baud Rate Codes
00 No delay	00: 300 baud
01 2ms delay	01: 1200 baud
02 5ms delay	02: 9600 baud
03 10ms delay	03: 19200 baud
04 20ms delay	
05 50ms delay	
06 100ms delay	
07 500ms delay	

Example:
First Scan Only, Load Delay Time of 5ms & Baud Rate of 19200 for Bottom Port



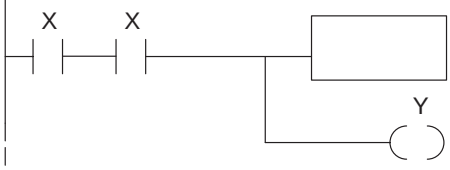
Setup Rung



Use the LD (Load) instruction to load the BCD codes for each parameter into the accumulator. The number 0203 is just the code used for our particular example, which is a 5ms delay, 19.2K baud.

Place the value in memory location V7632

Main Ladder Program Begins



After the parameter setup rung(s) above, we begin the normal ladder program. Use your actual program for this and the following rungs.

Step 2: Choose the Proper Cables

The exact cables needed really depend on your particular application. In any case, you will probably use one or more of the following connections.

- Personal Computer to modem connection
- Modem to DCM connection
- Modem to DL240 connection

Connecting a Modem to your Personal Computer

Your choice of cable for connecting the modem to your personal computer depends on whether you have a 9-pin port or a 25-pin port on your COM card. In either case, it's usually easier to buy a cable rather than make one. We suggest you check your modem documentation to see what they recommend. If your documentation does not recommend a cable, you could try the following sources.

- Radio Shack
- Black Box Catalog

Some of you techno-wizards will want to build your own cable. Here are the pinouts that are usually required. Again, check your modem documentation for the exact requirements.

NOTE: The 9-pin diagram has confused many techno–wizards over the years because it shows TXD – TXD and RXD – RXD connections. Believe it or not this is actually correct. Why? Because the 9-pin connector conforms to the IBM standard for DTE and the 25-pin side conforms to the standard for DCE. This results in the slight confusion over the terminology used to label the TXD and RXD pins.

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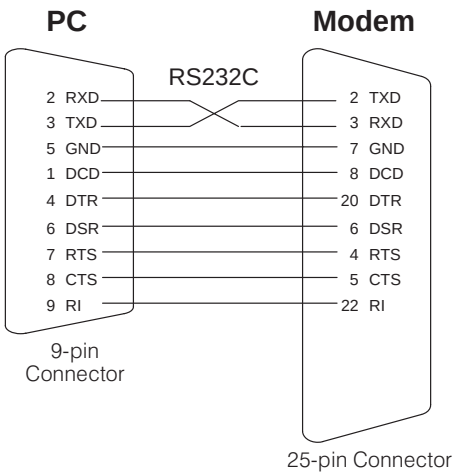
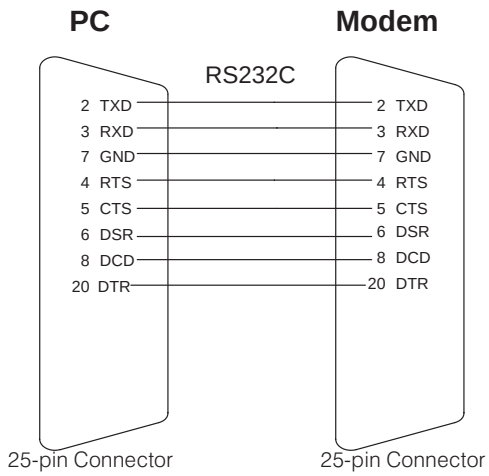
9 to 25 Pin Cable



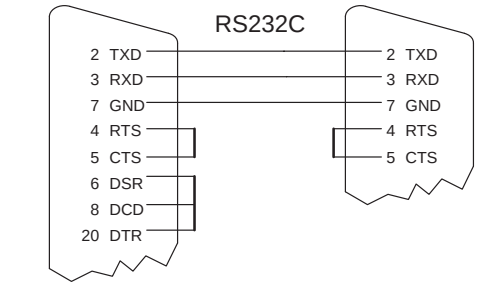
25 to 25 Pin Cable



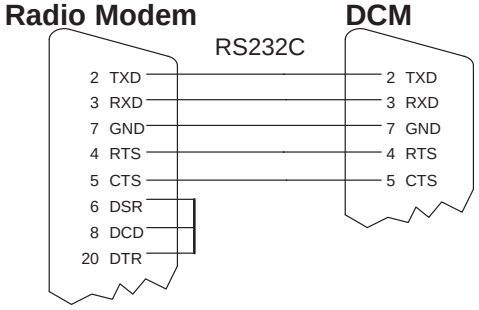
Connecting a Modem to the DCM

The PLC lies on the other end of the remote communication link and will typically have a DCM as the communications interface. Just as you needed a cable to connect your personal computer to the modem, you'll also need a cable between the PLC system (DCM) and the receiving modem. Since the DCM and the modem have 25-pin connectors, use the straight-through 25-pin to 25-pin cable diagram shown here.

25–pin to 25-pin Cable

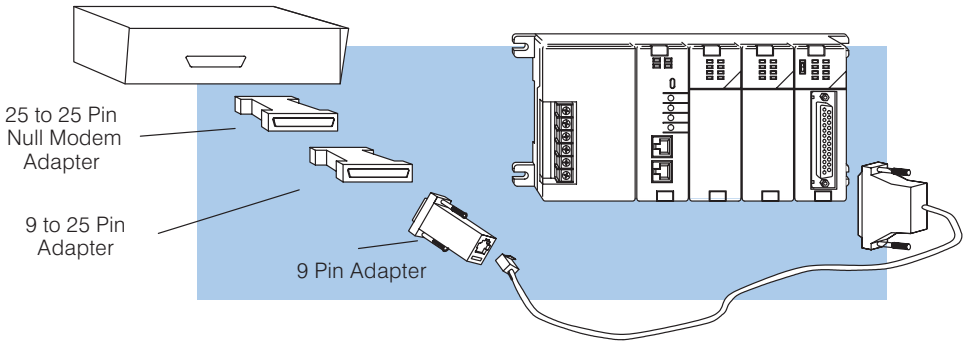


25–pin to 25-pin Cable



You can use our D3–DSCBL–2 with a null modem adapter to quickly build a cable that can connect the modem to the D2–DCM. You'll need the following parts, which can be obtained at most any electronics store. Since there seems to be a Radio Shack on every corner, we've included their part numbers.

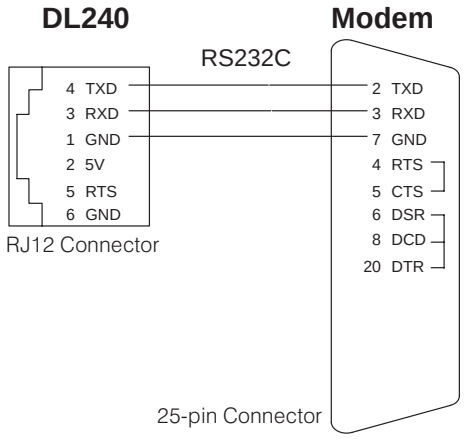
- **D3–DSCBL–2** — PLC***Direct*** DL305 Programming Cable
- **26–1496** — Radio Shack DB25 Null Modem Adapter
- **26–1388** — Radio Shack DB25 Male to DB9 Male Adapter



Connecting a Modem to the DL240

Use the cable diagram shown here to connect a modem to the bottom port of a DL240 CPU.

25–pin to 25-pin Cable



Step 3: Setting up the Modems

Use a Terminal Program

You must use a terminal program of some kind, such as the Windows Terminal application, to configure the modems. Once again, make sure you select the same communications parameters for all system components. (Around our office we usually use 9600 baud, 8 data bits, No parity, 1 stop bit, and hardware handshaking with good results.) Check your Windows documentation for information on how to use the Terminal program.

Choose a COM Port

First, you'll need to choose the personal computer COM port that you want to use. We suggest that you choose the same COM port that you normally would use with your ***Direct***SOFT Programming Software. If you have a mouse, it usually occupies COM 1, so start by trying COM 2.

Configure the Modems

A modem will allow you to select certain operating characteristics by sending it special modem commands. The settings usually differ slightly between the local modem (at the master) and the remote modem (at the slave). For the remote modem, make sure you use the modem documentation to determine the setup commands to:

- Use auto answer (for the remote modem)
- Use baud rate adjustment (or select a fixed serial port baud rate of 9600)
- Turn off any data compression
- Use error correction

Write these settings to the modem's non-volatile RAM. By saving it in non-volatile RAM, you don't have to worry about a power cycle wiping out your setup routine. Here are the setup strings for several popular brands of modems.

- **Hayes Optima 9600**
  Remote: AT&F N0 S37=9 S46=136 &C1 &K0 &Q5 &R1 &Y0 S0=1 &W0
  Local: AT&F N0 S37=9 S46=136 &C1 &K0 &Q5 &R1 &Y0 &W0
- **MultiTech MT932EAB**
  Remote: Start with the default DIP switch settings, but then set switch 1 to force DTR ON and set switch 5 to select Auto Answer mode.
  AT&W1&F1
  ATQ0$BA0$MB9600$SB9600
  AT&E3&E7&E12&E14&W0
  Local: (Uses the same settings except uses Q1 instead of Q0)
  AT&W1&F1
  ATQ1$BA0$MB9600$SB9600
  AT&E3&E7&E12&E14&W0
- **Supra FaxModem 14.4k V.32**
  Remote: AT&F0 N0 S37=9 %C0 \N3 &C1 &K0 &Q5 &R1 &Y0 S0=1 &W0
  Local: AT&F0 N0 S37=9 %C0 \N3 &C1 &K0 &Q5 &R1 &Y0 &W0
- **USRobotics Sportster**
  Remote: Start with the default DIP switch settings, but then set switch 1 to force DTR ON and set switch 5 to select Auto Answer
  AT&F1&B0&N6&D0&H1&R1&I0&K0&W0

  Local: Use default switch settings
  AT&F1&D0&W0

Step 4: Connect the Modems

If You are Using a Personal Computer as Master

To dial the remote modem, you need to use the Windows Terminal program (or other package). You must dial the modem by sending the following command:

AT &D0 DT *telephone number*

The "&D0" command is very important and tells the modem not to hang up the line when the DTR signal is dropped. Since we will have to exit the terminal program, the communications port is reset and the DTR signal is dropped. If the modem disconnected at this point, we wouldn't be able to connect to the remote PLC system with our software package.

NOTE: Assuming you have used the above command to connect to the remote site, you will have to exit the terminal program ***completely*. This is extremely important.** You will have to exit the terminal program completely. Otherwise, your software package, such as ***Direct***Soft, will not be able to get control of the communications port and you will not be able to go online with the PLC.

If You are Using a DCM as Master

If you are using the DCM as a master connected directly to a modem, then you must be using one of two types of modems. In either case, there are no special procedures that are required.

- **Leased-line Modem** — If you have a leased line modem, it tries to establish communications with the remote modem as soon as the power is turned on. The carrier stays active as long as the power is on. (That's why they call them "dedicated" lines.) After they are connected, the RX or WX instruction in the RLL program controls the data transmission between the stations. That is, when the RX or WX is executed, it automatically causes the DCM's Request to Send line to go high. The modem responds with a Clear to Send and the communications begins.
- **Radio Modems** — If you have a radio modem, the RX or WX instruction in the RLL program controls the data transmission between the stations. That is, when the RX or WX is executed, it automatically causes the DCM's Request to Send line to go high. The modem responds with a Clear to Send and the communications begins. The radio modem broadcasts the request and (hopefully) the remote station will receive it and respond accordingly.

Step 5: Start *Direct*SOFT

It's really easy to use our Windows-based ***Direct***SOFT programming software (and many other software packages) over a modem. There are a few simple steps to follow that will simplify the process.

1. First, make sure you have exited your terminal program that you used to setup the modems. This is very important. If you fail to do this, the terminal program will still "hold" the PC's COM port and you will not be able to communicate with the PLC system.
2. Next, start ***Direct***SOFT as you normally would.
3. Create a new ***Direct***SOFT communications link and use the PC COM port that you used to connect your modem.
4. You will now be able to communicate with your PLC just like it were connected to your computer. Follow the normal procedures for opening a program, connecting to a PLC, etc.

NOTE: When you are done with the connection, you will have to exit ***Direct***SOFT, restart the terminal program, and disconnect the modem using the +++ (wait for OK response) and ATH <CR>command sequence.
