

# Using the D2–DCM with Modems

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## 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 D2-DCM in networking applications, there are a tremendous number of people who simply use the D2-DCM as an extra communications port. The D2-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.

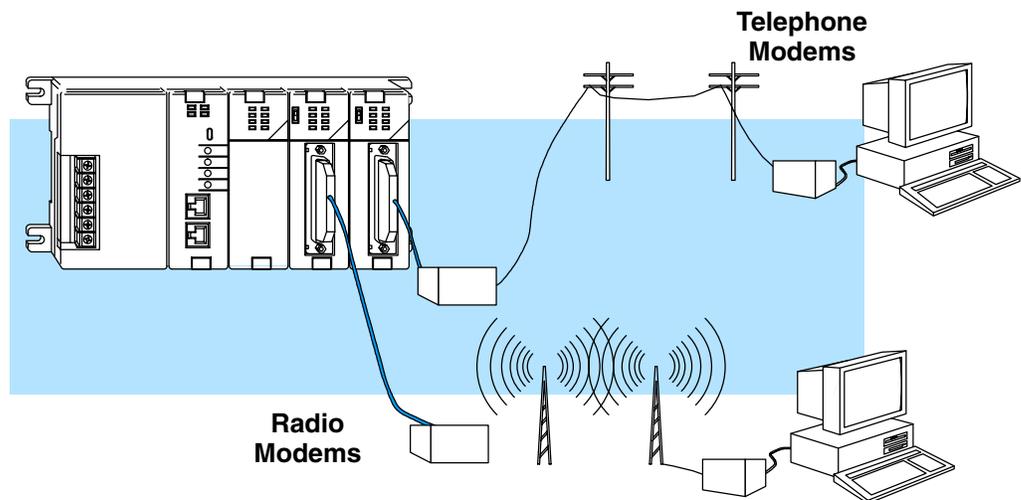
**System Components** There are typically two types of communication paths for modem applications.

- 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.

- DL240 PLC System with D2-DCM
- PLC System with DL250-1/260 CPU bottom port
- Personal Computer
- 2 modems (one on each end)



### Possible Configurations

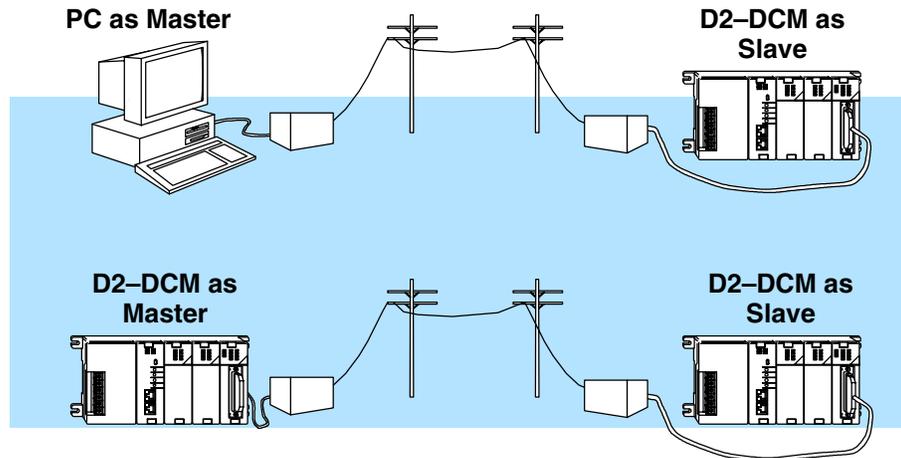
Even though most all systems have one or more of the system components, there are a couple of ways that they can be used.

**PC Master** — Some people need to use modems between a personal computer and the PLC system so that they can perform remote programming and/or data monitoring tasks with PC-based software, such as *DirectSOFT32* or a SCADA system. In this case, the personal computer is the master and the PLC system is the remote slave station.

**D2-DCM Master** — In other situations, you may be using a D2-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 modems are used. A dedicated line is necessary because the D2-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.
- **You have a MDM-TEL** — It has the capability of on contact initiated dialing.

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. It is recommended that you purchase a modem not because it is inexpensive, but because it has a good reputation. This will save you money (and time) over the long run. It is also suggested that you spend a few extra dollars to get an external modem if possible. The internal versions typically do not have status indicator lights and are much harder to debug during setup, or modem communication failure.

We recommend using **AutomationDirect's MDM-TEL**, Industrial Telephone Modem. It is an external modem which is DIN-rail mounted. This is a rugged industrial telephone modem which has been designed for operation in electrical enclosures which are installed in harsh environments. This MDM-TEL supports all standard Hayes AT commands, Fax Class 1 and Class 2 commands and S-registers, therefore it can be setup as an external modem on any PC. This industrial modem is compatible with any telecommunications or dial-up networking software. The MDM-TEL is also fully supported by **AutomationDirect's** technical support team. More detailed information can be located at [www.automationdirect.com](http://www.automationdirect.com).

# Set the D2-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

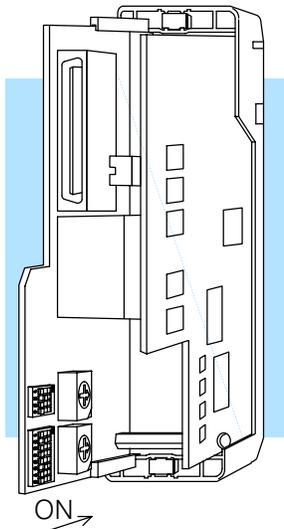
It is important that you select the following communications parameters when you use the D2-DCM for remote communications.

- 9600 baud
- NO parity

The parity setting is most important. 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.

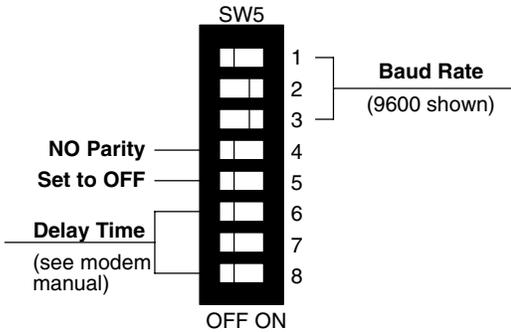
## Delay Time

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	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



Baud	Switch Positions		
	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

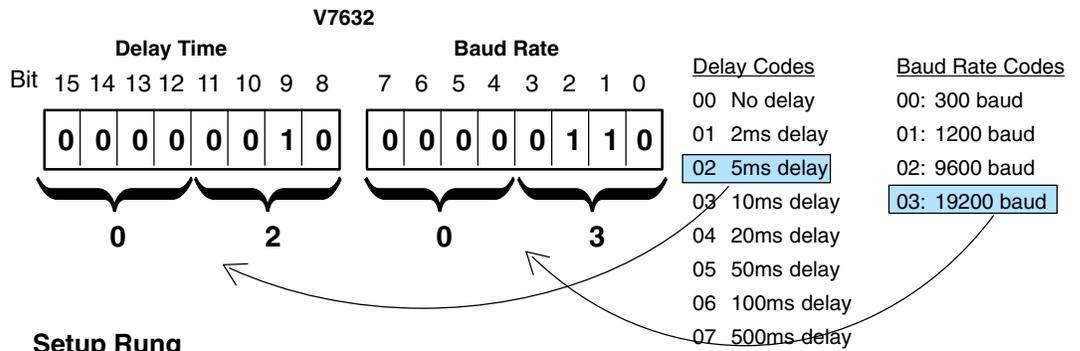
**Delay Time Considerations for Networks with DL240 Slaves**

A couple of scenarios have been mentioned where you may be using a D2-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.

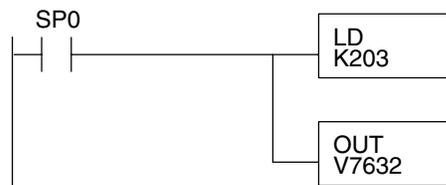
If you are using a radio modem connected to the bottom port of a DL240, you will probably have to set a delay time for the CPU port. You can do this by loading a BCD value into V7632. This is a special V-memory location which defines the baud rate and/or time delay for the bottom port. It is recommended 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																		
<table border="0"> <tr> <td><u>Delay Codes</u></td> <td><u>Baud Rate Codes</u></td> </tr> <tr> <td>00 No delay</td> <td>00: 300 baud</td> </tr> <tr> <td>01 2ms delay</td> <td>01: 1200 baud</td> </tr> <tr> <td>02 5ms delay</td> <td>02: 9600 baud</td> </tr> <tr> <td>03 10ms delay</td> <td>03: 19200 baud</td> </tr> <tr> <td>04 20ms delay</td> <td></td> </tr> <tr> <td>05 50ms delay</td> <td></td> </tr> <tr> <td>06 100ms delay</td> <td></td> </tr> <tr> <td>07 500ms delay</td> <td></td> </tr> </table>		<u>Delay Codes</u>	<u>Baud Rate Codes</u>	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	
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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**



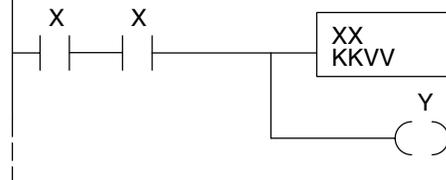
**Setup Rung**



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.

## 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 D2-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. It is suggested that you check your modem documentation to see what the manufacturer recommends. If your documentation does not recommend a cable, you could try the following sources.

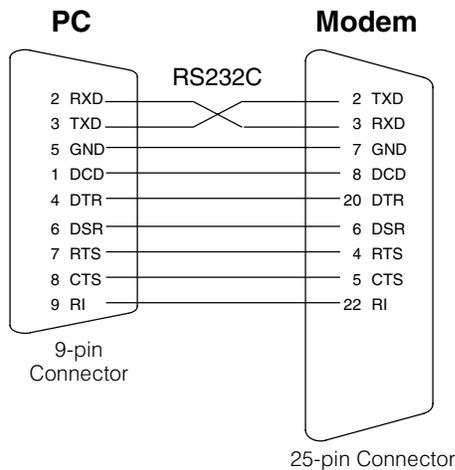
- Radio Shack
- Black Box Catalog

Some users prefer to build their own cable. Here are the pinouts that are usually required. Again, check your modem documentation for the exact requirements.

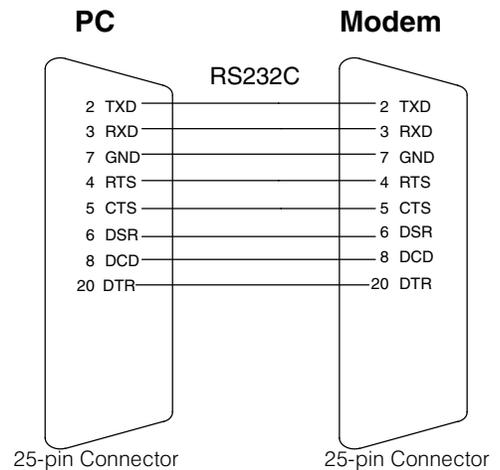


**NOTE:** The 9-pin diagram can be confusing because it shows TXD – TXD and RXD – RXD connections. This is actually correct because the 9-pin connector conforms to the IBM standard for DTE and the 25-pin side conforms to the standard for DCE. This results in the slight confusion over the terminology used to label the TXD and RXD pins.

**9 to 25 Pin Cable**

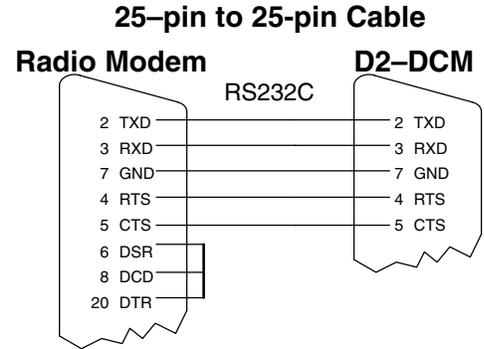
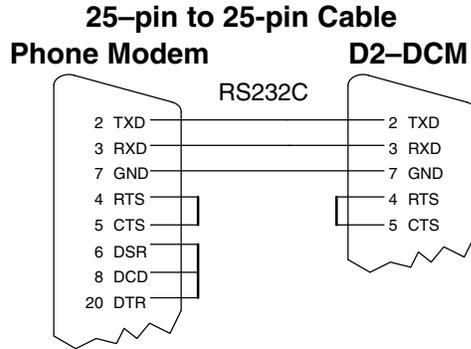


**25 to 25 Pin Cable**



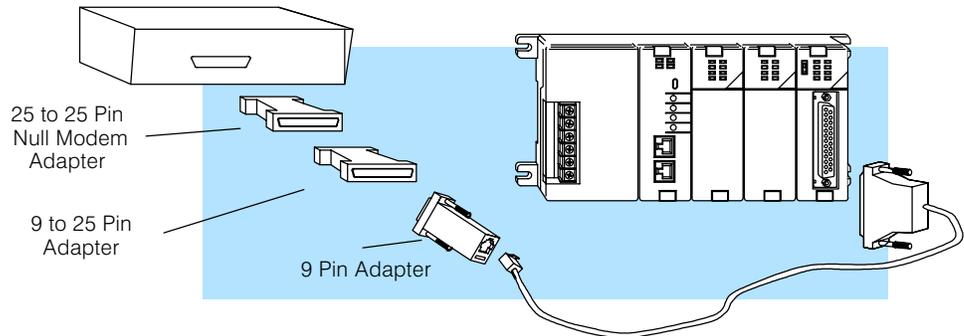
**Connecting a Modem to the D2-DCM**

The PLC is on the other end of the remote communication link and will typically have a D2-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 (D2-DCM) and the receiving modem. Since the D2-DCM and the modem have 25-pin connectors, use the straight-through 25-pin to 25-pin cable diagram shown here.



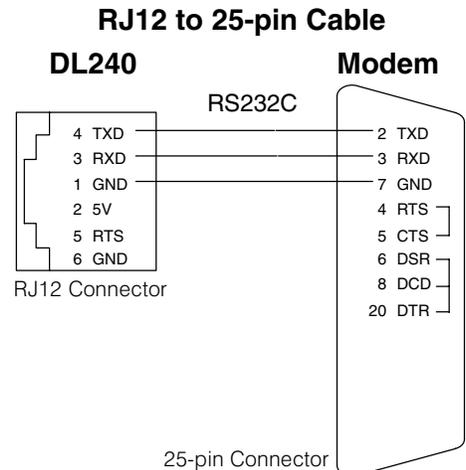
**Tip:** You can use our D3-DSCBL-2 with a null modem adapter to quickly build a cable which can connect the modem to the D2-DCM (also used with the MDM-TEL modem). You'll need the following parts, which can be obtained at most any electronics store. Since there seems to be a Radio Shack on every corner,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

- **D3-DSCBL-2** — Automationdirect 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.



## Using the MDM-TEL

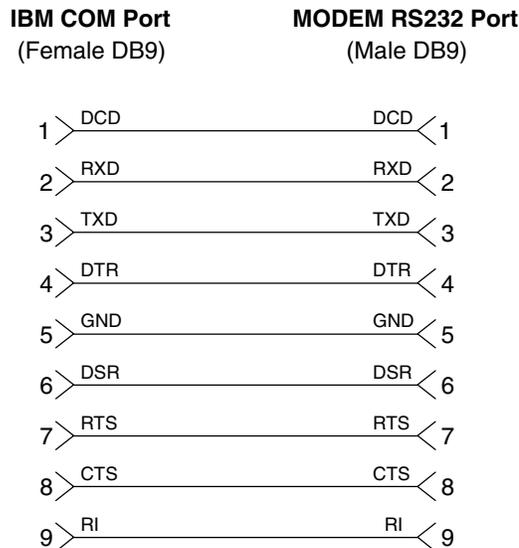
The MDM-TEL industrial modem, which is fully supported by **AutomationDirect**, is a sensible choice for your application. The MDM-TEL User Manual, which can be downloaded from the **AutomationDirect** website, will provide more detailed information.

### RS232 Connections

Use a straight-through or equivalent serial cable to connect the modem's RS232 female port (DB9 cable male end) to the RS232 male port on a PC or other "Data Terminal Equipment" (DTE) device (DB9 cable female end). The diagram below details the pin-out of a straight-through serial communications cable suitable for connecting a DCE device (MDM-TEL) to a DTE device (PC, PLC or other device). A suitable DB9 RS-232 cable is provided with the MDM-TEL.

### MODEM RS232 Connections

#### Cable for MODEM to IBM COM Port



### MODEM CABLE WIRING

(Standard DB9 Cable)

To simplify the connection between the D2-DCM and the MDM-TEL modem purchase a D3-DSCBL-2 cable available from **AutomationDirect**. The null modem adapter supplied with the modem is required when using this cable.



### The MDM-TEL Setup Wizard

A modem setup utility is provided on the MDM-TEL CD to help you quickly configure the modem. In most applications, no knowledge of modem AT commands or S register contents is necessary. Pre-configured profiles, for common situations, are provided for convenience.

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## D2-DCM as Master

### If You are Using a D2-DCM as Master

If you are using the D2-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 D2-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 D2-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.
- **MDM-TEL** — If you have a MDM-TEL modem, you can have the modem dial a preconfigured phone number by applying +24VDC to the "From PLC" terminal on the modem. When the modem connects to another modem and establishes communications, the modem will then apply +24VDC to the "to PLC" terminal. This input to the PLC is used to initiate RX or WX commands from the RLL program. If you do not have either a sourcing DC output or a sinking DC input, you will need to add a D2-08CDR module to your system in order to control the signals to/from the modem.

## Using *DirectSOFT32*

### Creating a Modem Link

*DirectSOFT32* uses Telephony Application Programming Interface (TAPI) for modem configurations. The TAPI protocol allows applications to control modems or other telephony devices for operations such as dialing, answering, or disconnecting a connection. With the TAPI protocol, all of the modem support is centralized by the Windows operating system.

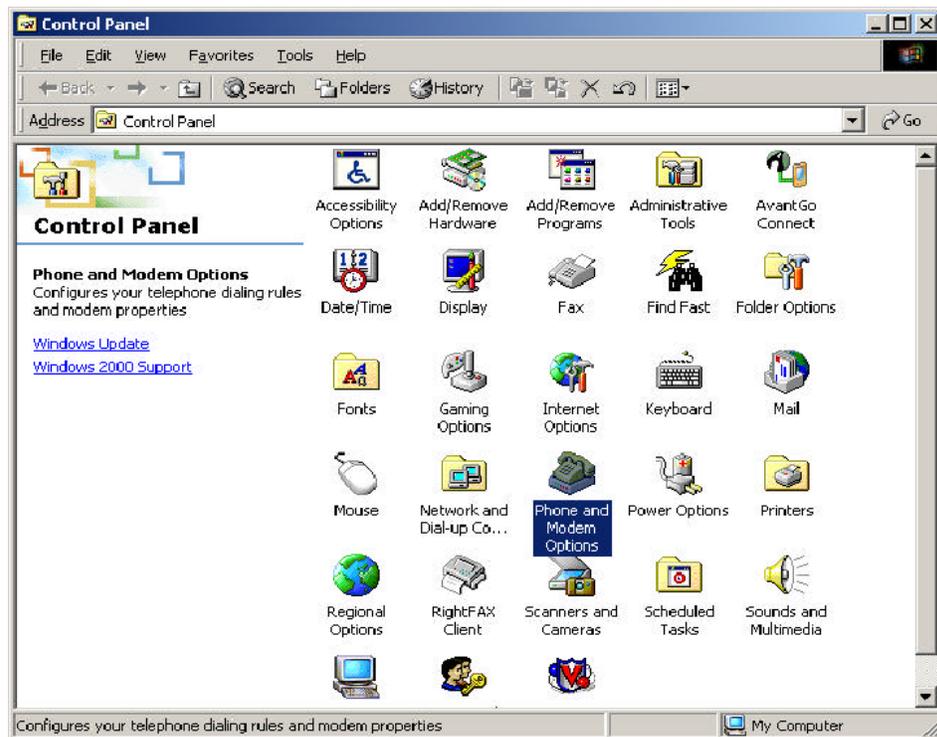
By using the TAPI interface, you will use the Windows modem setup utilities to configure the modem. Configuring the modem in this manner should simplify the setup process and allow you to select the most recent drivers for your modem.

If there is an existing modem connected to your PC for Internet or fax use, the modem setup will have to be changed. Some of the features will have to be disabled in order to communicate to the PLCs. To avoid making any changes to the existing modem configuration, you will need to install the same modem a second time. Windows will change the name by adding a number to the end i.e., “*modemname#2*” each time you add the same modem to your PC. Refer to your PC and/or modems installation manual for additional information on setting up your modem.

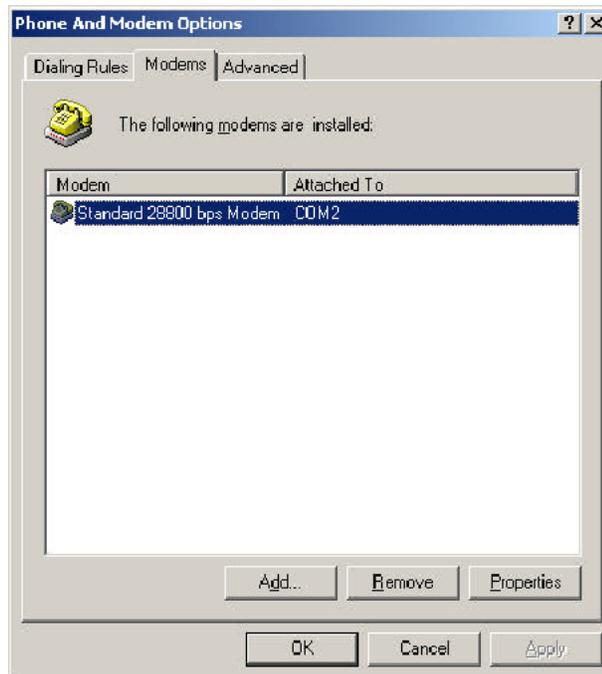
### Modem Setup

The first series of examples were performed in Windows 2000 and will illustrate how to configure the modem connected to your PC. The examples may differ depending on your Windows operating system.

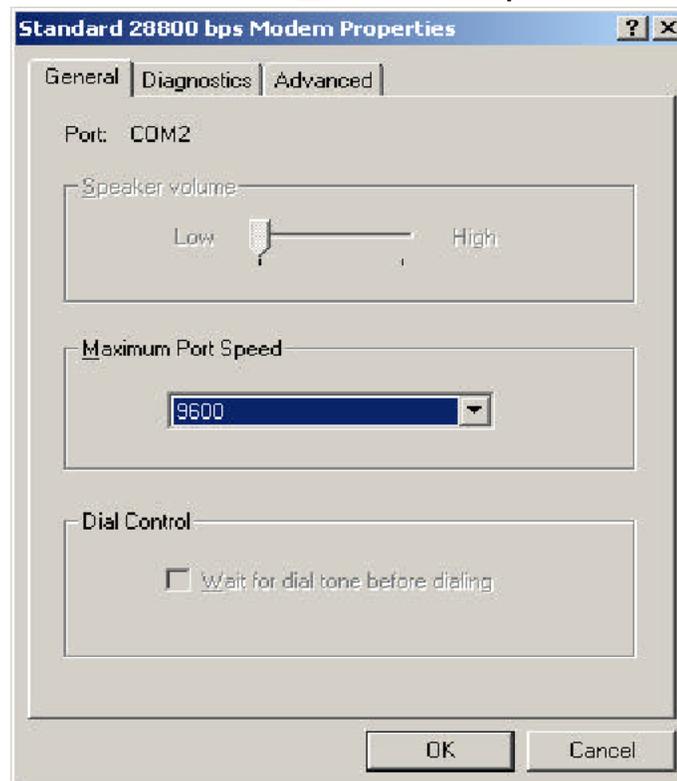
1. Install the modem if not already installed. Refer to the modem’s documentation for installation information. If the modem is to be used for other devices you will need to install it a second time.
2. Once you have successfully installed the modem, you will need to edit its properties. In the Windows **Start** field, select **Settings > Control Panel**.



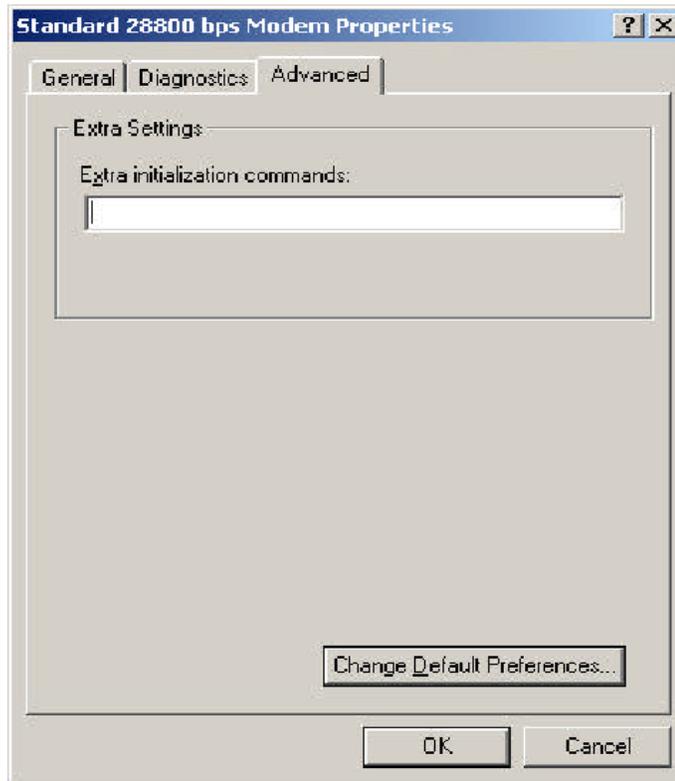
3. Select the **Phone and Modem Options** icon. A dialog box with all available modems installed will appear.
4. Choose the **Modems** tab, then click on **Properties** at the bottom.



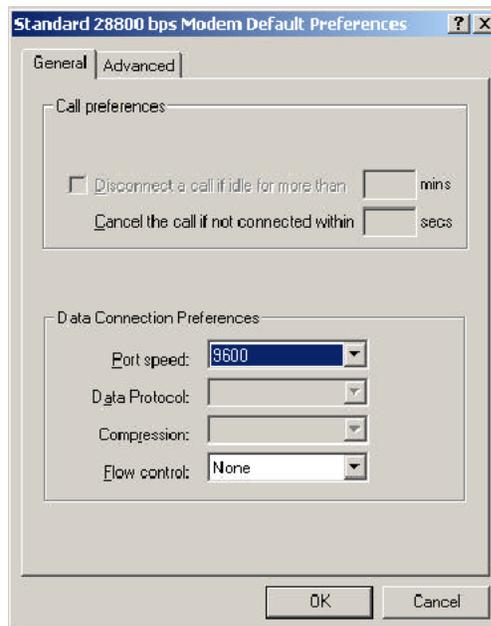
5. Choose 9600 as the **Maximum Port Speed**.



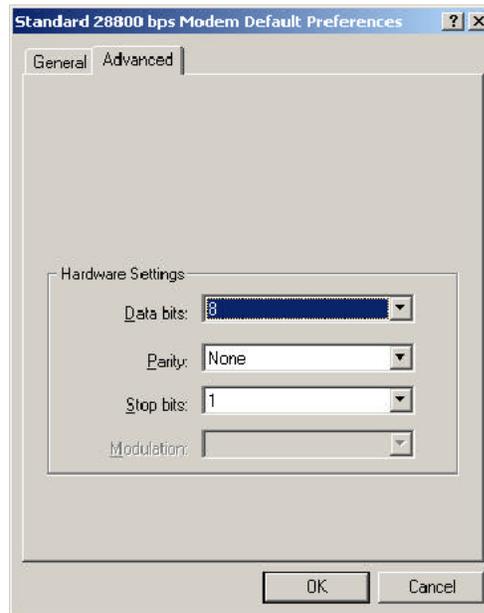
6. Select the **Advanced** tab and click on **Change Default Preferences**.



7. Make **Port speed** 9600, and choose None for **Flow control**.



- Click on the **Advanced** tab and choose 8 **Data bits**, None **Parity** and 1 **Stop bits**.



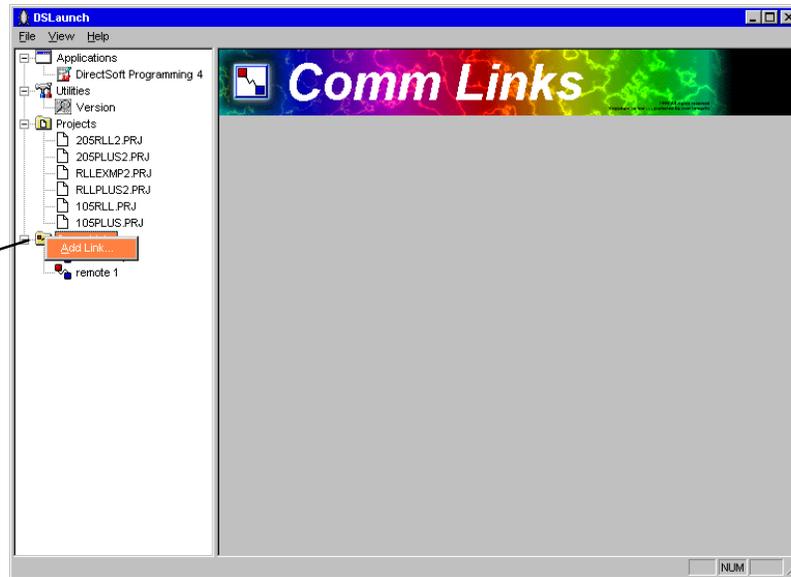
- Click **OK** until all dialog boxes are closed. This will setup your Windows driver so **DirectSOFT32** can use the Windows TAPI control when accessing the modem.

## Configuring the Link

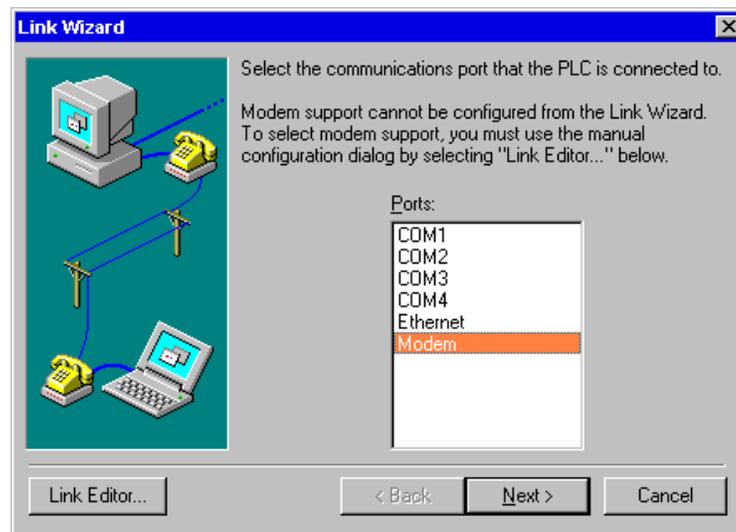
With the modem configured correctly, the link to the PLC can now be established. The next series of steps will provide the information necessary for configuring the link using *DirectSOFT32*.

1. The LinkWizard can automatically determine the majority of the communication settings; however, you will need to manually setup the modem specific information (modem type, phone number, etc.). To activate the Link Wizard in the Launch Window, right click on the **Comm Links** icon in the **DSLlaunch** tree and select **Add Link**.

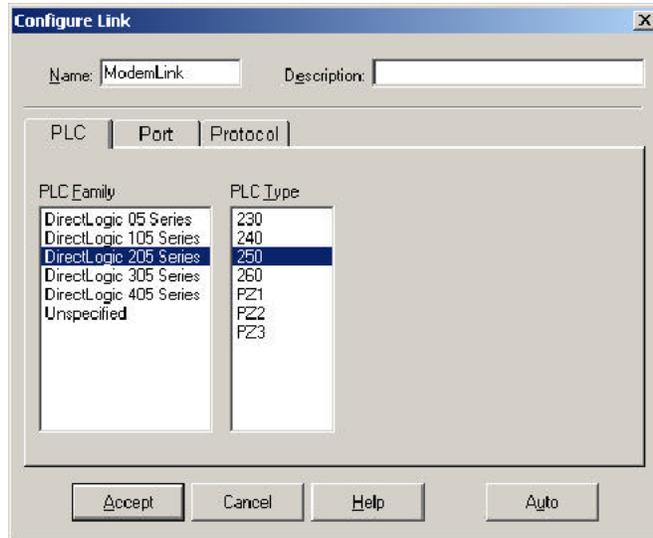
Right Click to  
select Add Link



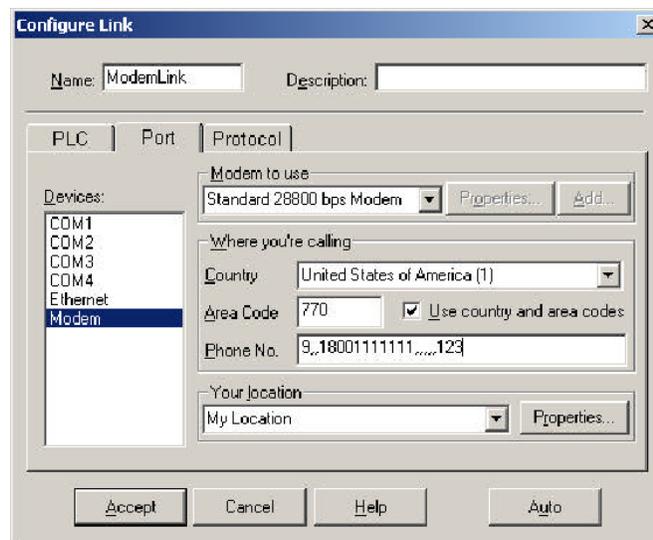
2. Select **Modem** as the device and click the **Next** button.



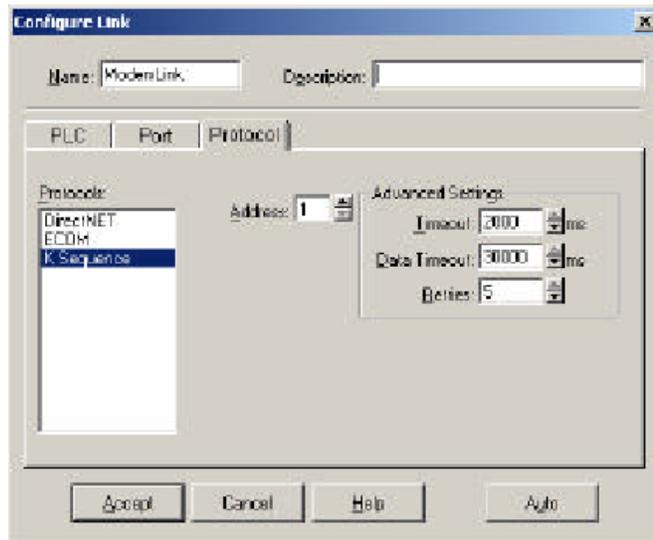
- The Configure Link dialog box should now be present. First, choose the PLC family and the PLC CPU Type. Click once on the appropriate item in the **PLC Family** and a list of available CPUs for that family will appear to the right. Click once to select the appropriate **PLC Type**. Also give the link a name and description.



- Click the **Port** tab of the dialog to display the port configuration dialog. This dialog allows you to setup up the port to match your modem's configuration. Follow the steps below:
  - Select **Modem** in the **Devices** column.
  - Select the modem type that you configured earlier in this procedure. You can verify or modify the settings by clicking on the **Properties** button or you can create a new modem by clicking on the **Add** button.
  - Enter the dialing information for your modem.



- Click the **Protocol** tab to display the communication protocol dialog box. This dialog allows you to further define the communication parameters.



- Select the communication protocol to use. Refer to the chart in Appendix A for a breakdown of the various CPUs, and which protocols are supported on which ports.
  - If the PLC has been given a node **Address** other than 1, enter the new address now.
  - You can adjust the time-outs and retries on this dialog, however, the default values should work for you.
- Click the **Accept** button to save this link configuration. The following dialog will appear. If you click **Yes**, **DirectSOFT32** will dial the modem and attempt to verify that it can communicate with the PLC connected to the other modem using the parameters defined in the link. **DirectSOFT32** will hang-up once the connection is made. If you click **No**, the link configuration will simply be saved to disk.



7. After successfully creating a link, the Launch Window will have an entry for the link that you have created. The name that you assigned to the link should appear in the menu tree under the **Comm Links** icon. If the link is highlighted, the main launch window screen will change with all of the links information displayed.

