

Building the Communication Cable

There are several considerations that help determine the type of cable needed for your DCM application.

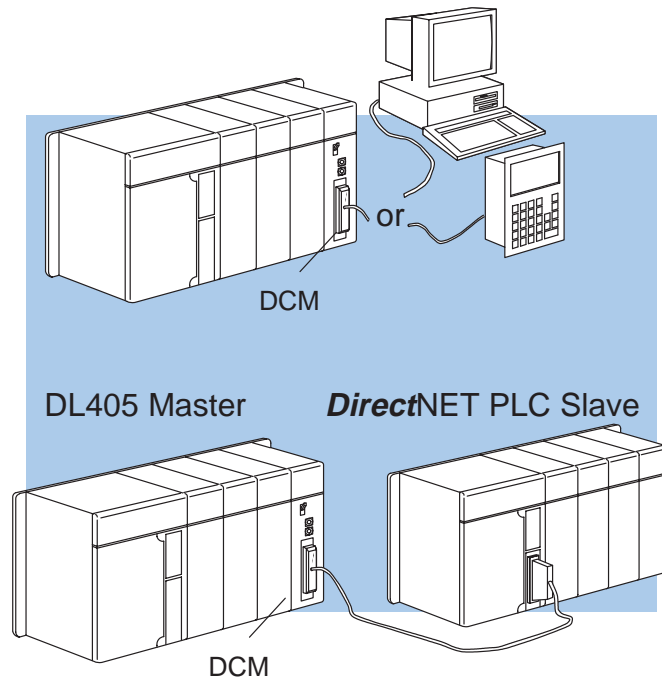
1. Will the DCM be physically connected in a point-to-point configuration or multi-drop configuration?
2. What electrical specification is best for your application? RS232C or RS422?
3. What is the cable schematic?
4. What are the relevant cable specifications?
5. What installation guidelines are necessary?
6. Do you just need a quick test cable?

The next few pages discuss these considerations in detail. If you already know the type of cable needed, the cable schematics are included on pages 8 and 9.

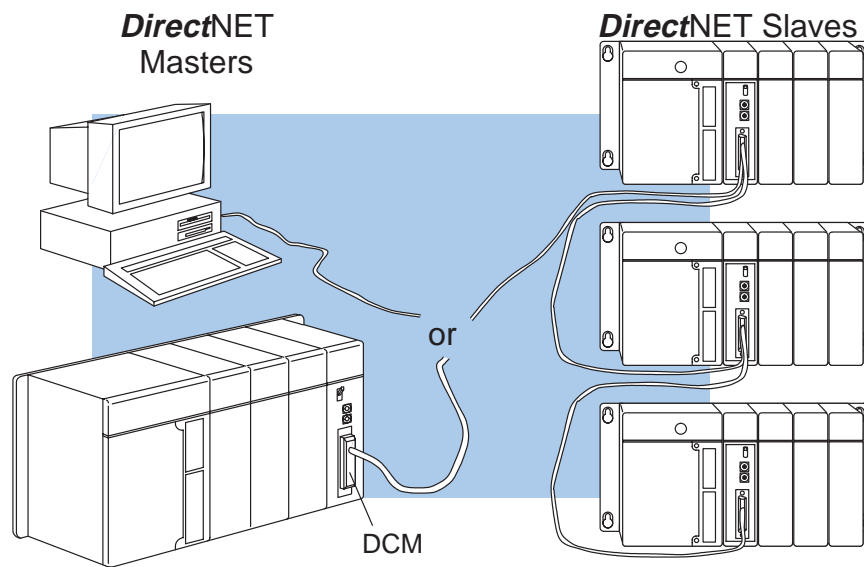
**Consideration 1:
Physical
Configuration**

The DCM can be used in either a point-to-point or multi-drop configuration. A point-to-point connection only has two stations, a master and a slave. Use the point-to-point configuration to connect a personal computer, an operator interface, or an intelligent device to a single DCM. You must also use this configuration when you want to connect a **DirectNET** master station to a single **DirectNET** slave station. Use the multi-drop configuration to connect one master to two or more slaves (90 slave maximum).

Point to Point



Multi-drop



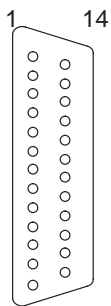
**Consideration 2:
Electrical
Specification
RS232C or RS422**

The DCM can support RS232C or RS422 communication. Your application and configuration choice will help determine which electrical specification is best for you. If you are using multi-drop, you must use RS422. If you are using point-to-point, you may have a choice between RS232C and RS422.

You can use RS232C if the cable length is less than 50 feet and if the cable will not be subjected to induced electrical noise that is commonly found near welders, large motors, or other devices that create large magnetic fields.

You must use RS422 for all other applications. RS422 allows longer cable distances (up to 3300 feet) and provides higher noise immunity.

The following diagram shows the port pinouts for the DCM and the DL405 CPUs. These are the pinouts you'll need to be familiar with most often.



DL405 DCM Port Pinouts

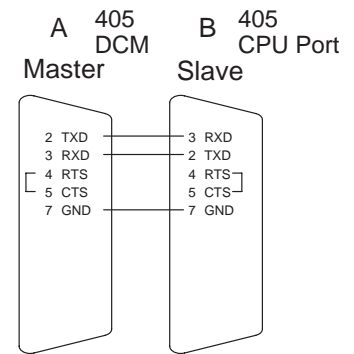
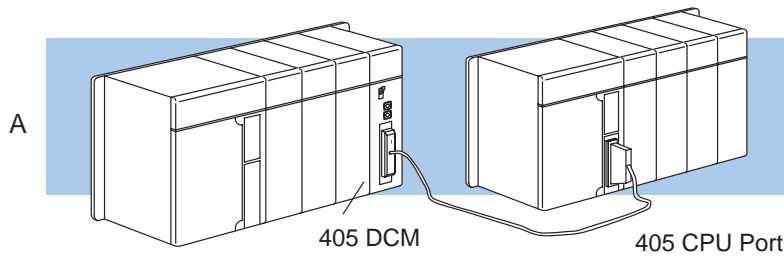
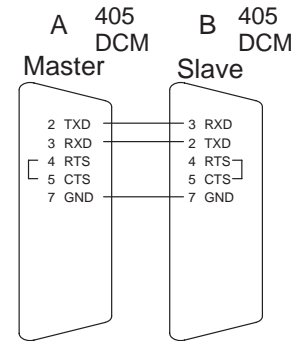
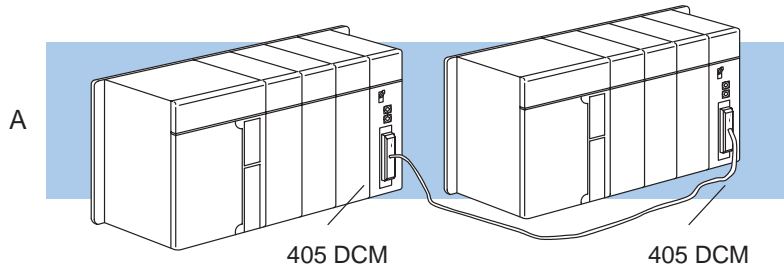
Pin	Signal Definition	Pin	Signal Definition
1	Not connected	14	RS422 data out +
2	RS232C data out	15	RS422 data out -
3	RS232C data in	16	RS422 data in -
4	RS232C RTS	17	RS422 data in +
5	RS232C CTS	18	Not connected
6	Internal Circuit 5V	19	Not connected
7	Internal Circuit 0V	20	Not connected
8	RS422 RTS +	21	Not connected
9	RS422 RTS -	22	RS422 data out +
10	RS422 RTS +	23	RS422 data out -
11	RS422 RTS -	24	RS422 data in -
12	RS422 CTS +	25	RS422 data in +
13	RS422 CTS -		

DL405 CPU Port Pinouts

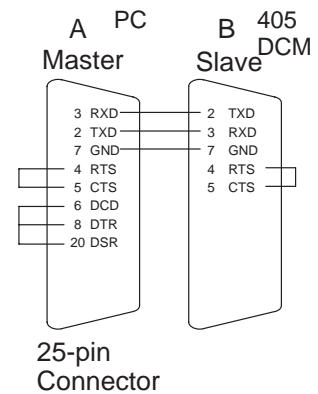
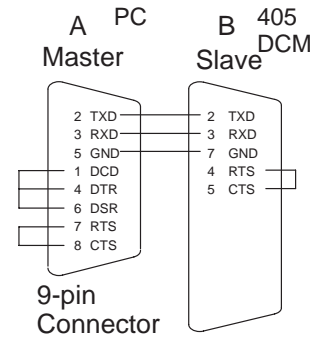
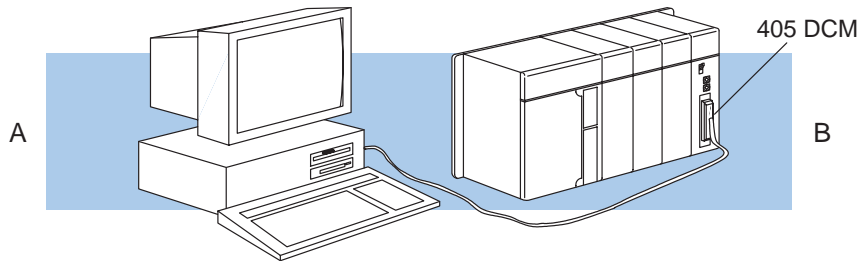
Pin	Signal Definition	Pin	Signal Definition
1	Not connected	14	RS422 data out +
2	RS232C data out	15	Not connected
3	RS232C data in	16	RS422 data out -
4	RS232C RTS	17	Not connected
5	RS232C CTS	18	RS422 RTS -
6	Not connected	19	RS422 RTS +
7	Signal ground	20	Not connected
8	Not connected	21	Not connected
9	RS422 data in +	22	Not connected
10	RS422 data in -	23	RS422 CTS -
11	RS422 CTS +	24	Not connected
12	Not connected	25	Not connected
13	Not connected		

Consideration 3: Cable Schematics The following cable schematics are appropriate for most applications. You may have to combine some of these examples to design a cable that meets your exact application requirements.

DCM to DCM or PLC Slave (RS232C)

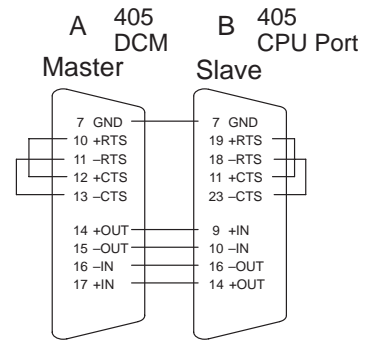
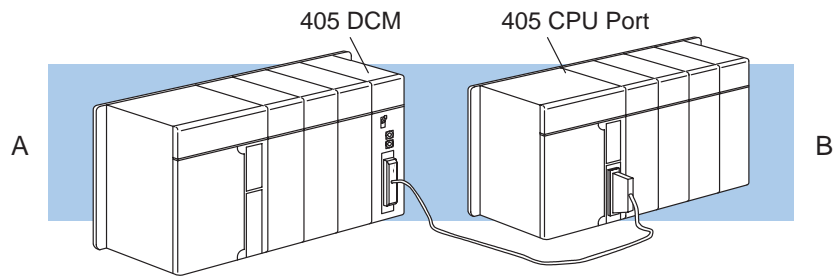
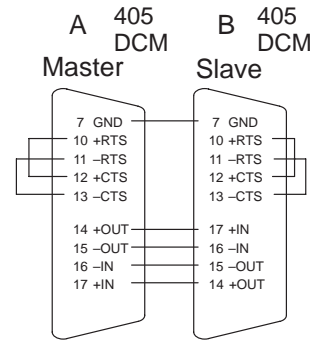
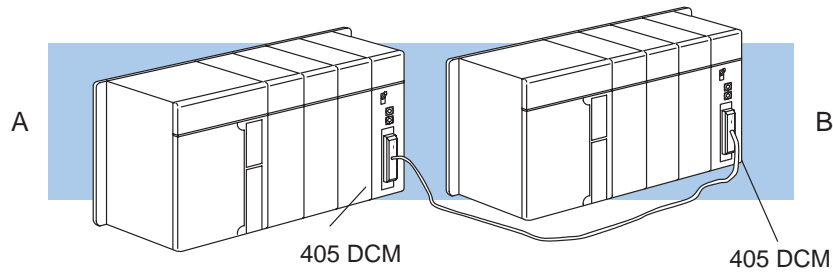


Personal Computer to DCM (RS232C)



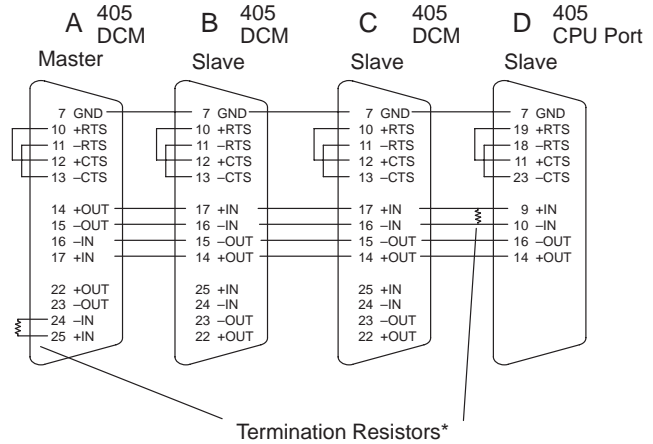
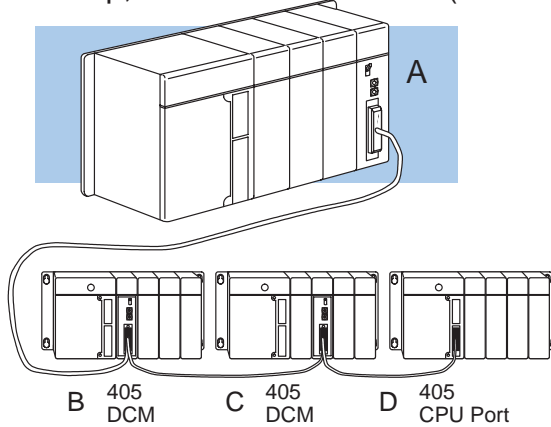
Pin labeling conforms to the IBM DTE and DCE standards.

DCM to DCM or PLC Slave (RS422)

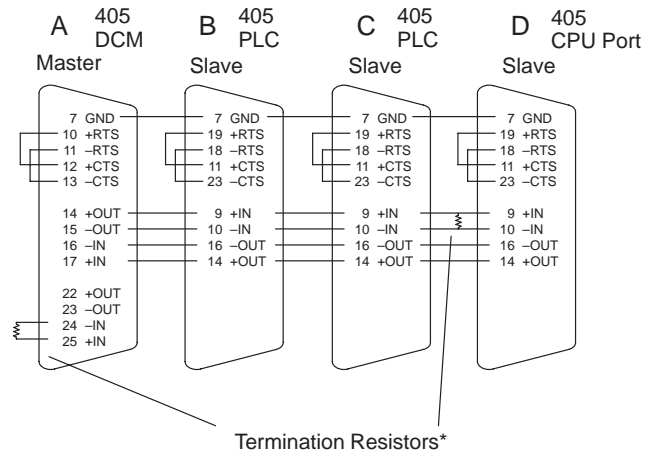
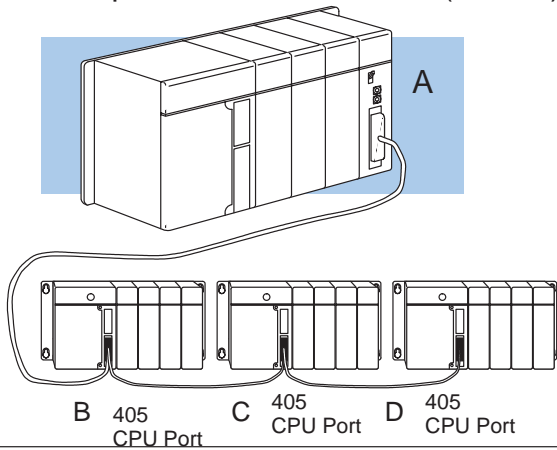


Pin labeling conforms to the IBM DTE and DCE standards.

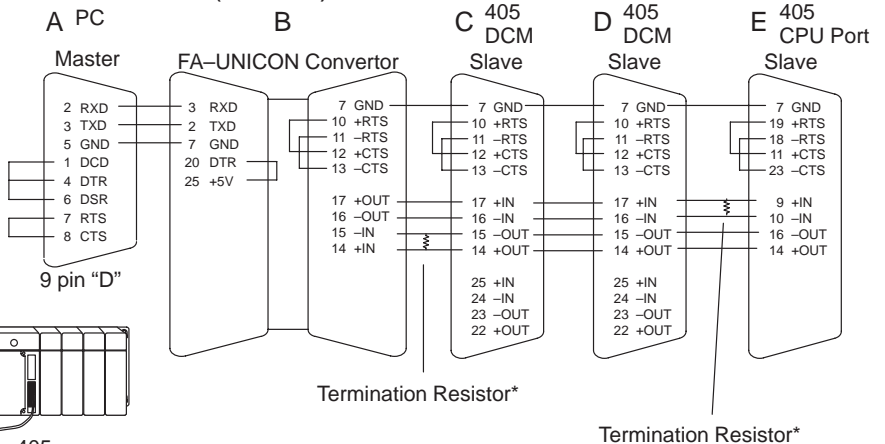
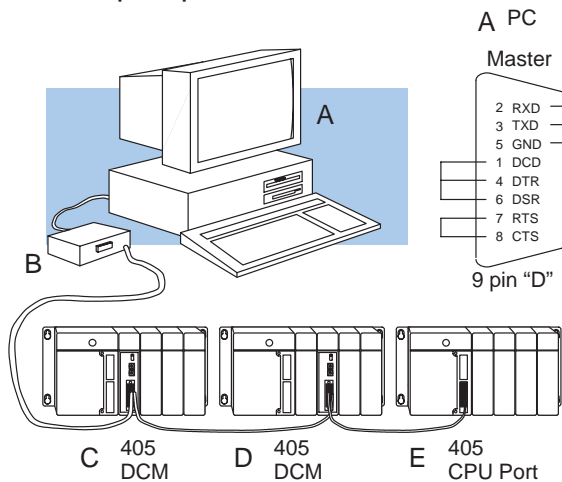
Multi-drop, DCM to DCM Slaves (RS422)



Multi-drop, DCM to PLC Slaves (RS422)



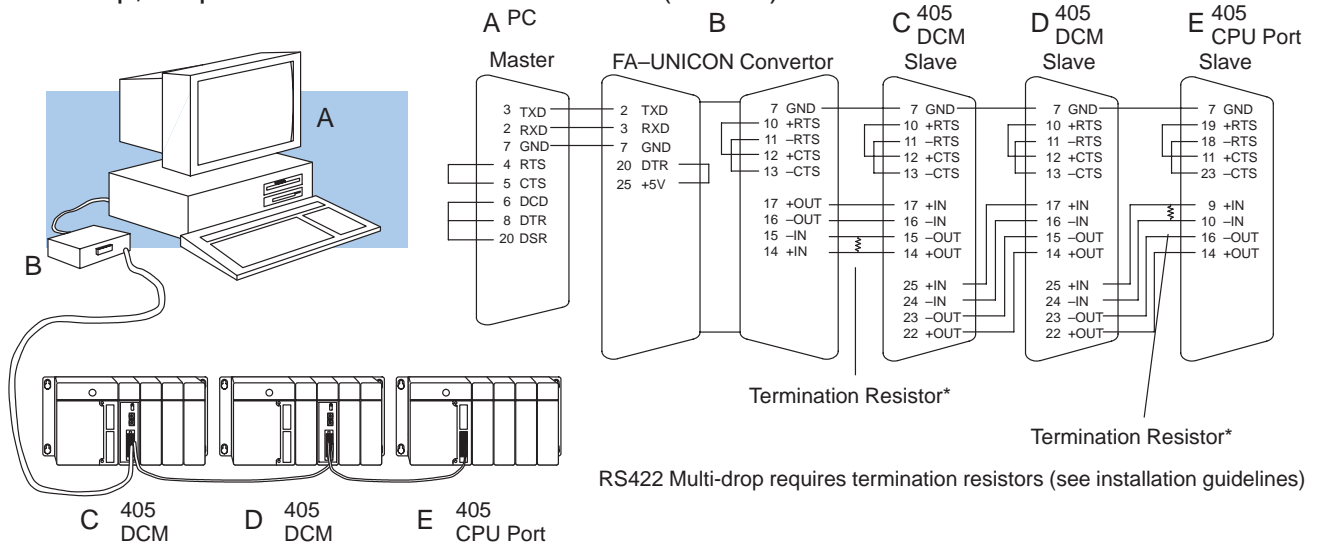
Multi-drop, 9-pin PC to DCM and PLC Slaves (RS422)



RS422 Multi-drop requires termination resistors (see installation guidelines)

Pin labeling conforms to the IBM DTE and DCE standards.

Multi-drop, 25-pin PC to DCM and PLC Slaves (RS422)



Pin labeling conforms to the IBM DTE and DCE standards.

Consideration 4: Cable Specifications

Although many types of cables may work for your application, we recommend you use a cable that is constructed to offer a high degree of noise immunity. A cable constructed equivalent to Belden 9855 will be sufficient. The following specifications are to be used as a guideline.

Structure	Shielded, twisted-pair (RS232C only uses two wires and a ground)
Conductor size	24 AWG or larger
Insulation	Polyethylene
Shield	Copper braid or aluminum foil
Impedance	100 Ω @ 1MHz
Capacitance	60pf / meter or less

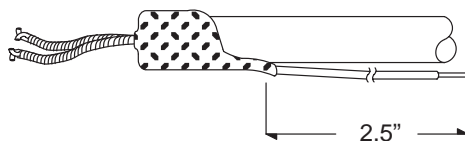
Consideration 5: Installation Guidelines

Your company may have guidelines for cable installation. If so, you must check those before you begin the installation. Here are some general things to consider.

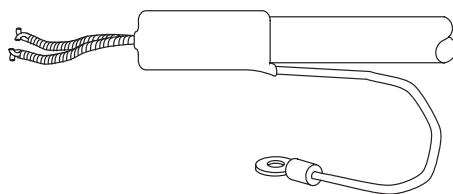
- Don't run cable next to larger motors, high current switches, or transformers. This may cause noise problems.
- Route the cable through an approved cable housing to minimize the risk of accidental cable damage. Check local and national codes to choose the correct method for your application.
- Consider redundant cabling if the application data is critical. This allows you to quickly reconnect all stations while the primary cable is being repaired.

Cable Shield Grounding — It is important to ground the cable shield to minimize the possibility of noise. The preferred method is to connect one end of the cable shield to the connector housing. If noise problems are still present and you have a good earth ground for the cabinet, you must connect one end of the shield to the cabinet earth ground. *Don't* ground both ends of the shield because this will create induced noise on the cable.

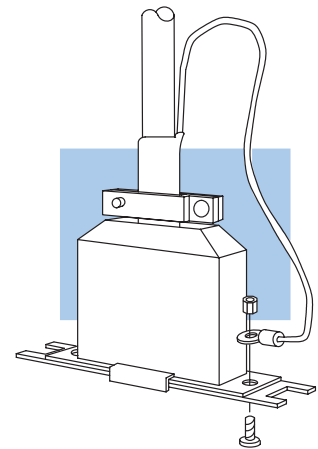
Step 1: Strip back about 2.5" of the shield.



Step 2: Crimp a ring connector onto the shield.



Step 3: Secure the shield to the connector shell.

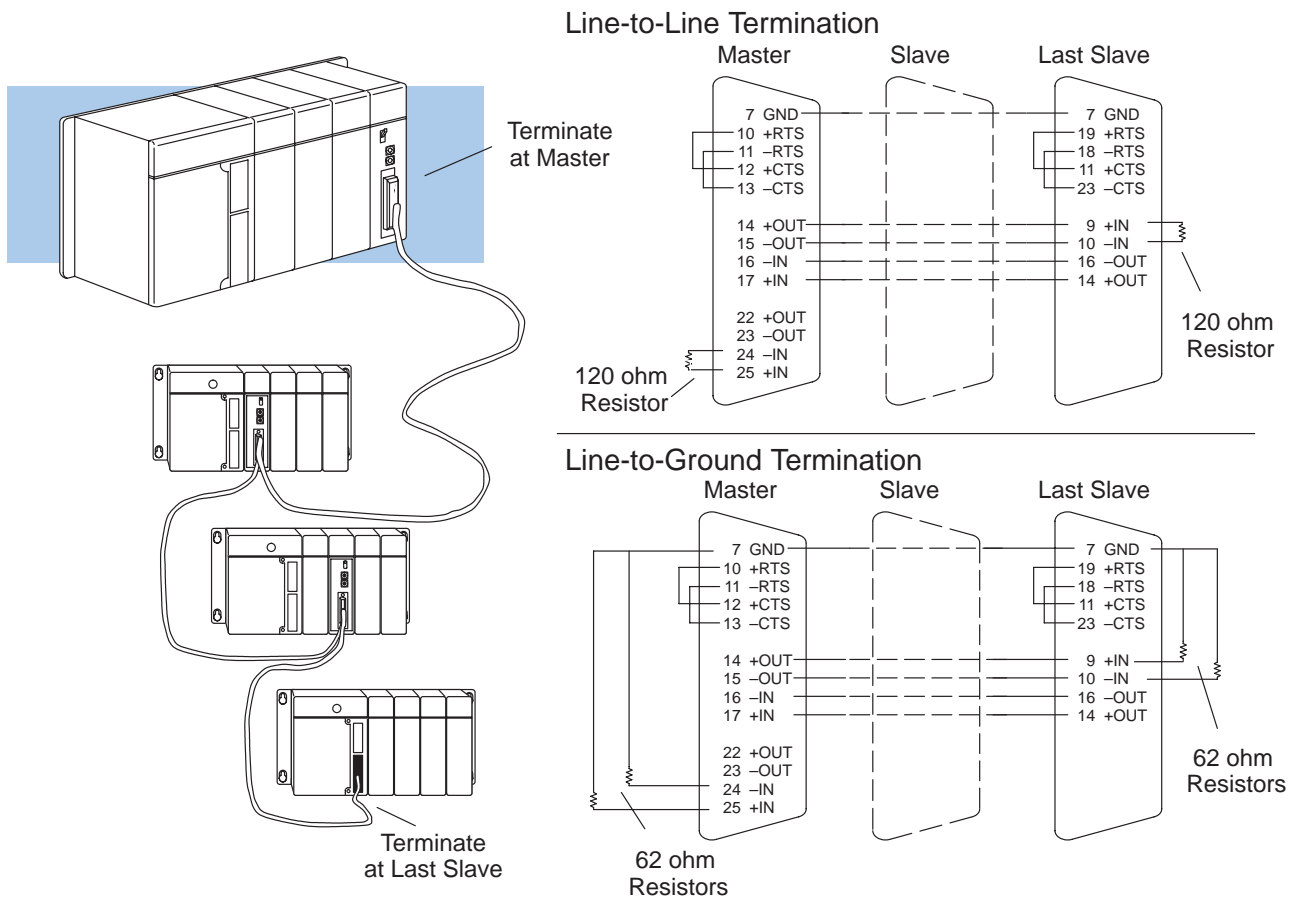


Multi-drop Termination Resistors — It is important you add termination resistors at each end of the RS422 line. This helps reduce data errors during data transmission. You must select resistors that match the cable impedance. For example, a typical 22 AWG solid conductor cable with 4.5 twists per foot has a typical impedance of about 120Ω.

There are two ways to actually connect the resistors.

- **Line-to-Line** — this method balances the receive data lines (IN+ and IN-) and requires one resistor at each end of the line. (The cable diagrams we've provided show this method, but you can use either).
- **Line-to-Ground** — this method also balances the receive data lines, but common mode noise rejection is improved significantly. This method requires two resistors at each end of the line. Also, since there are two resistors, the sum total of both resistors must match the cable impedance.

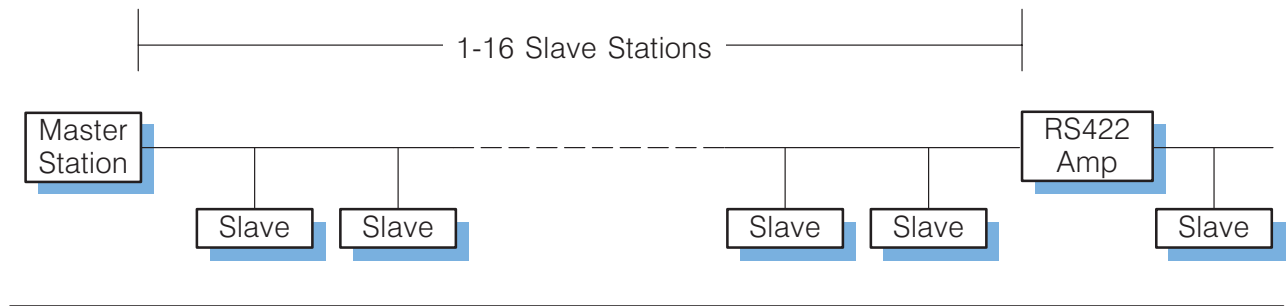
The following diagram illustrates the two options.



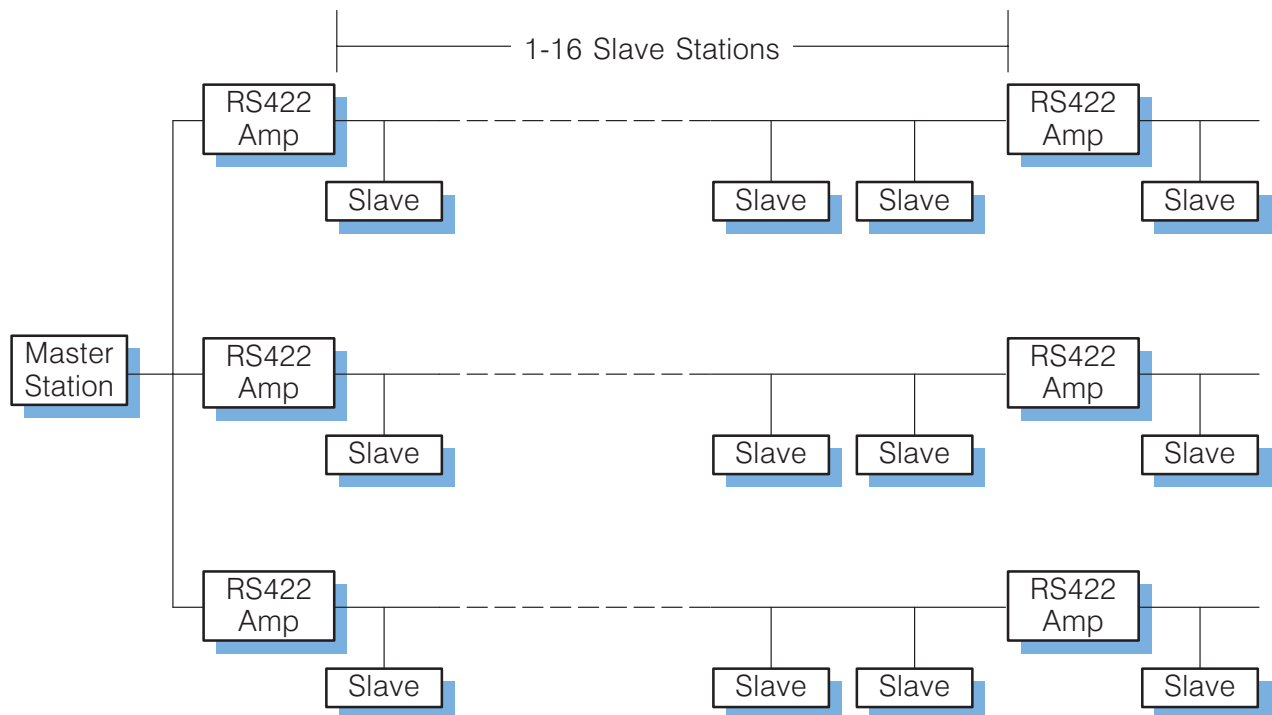
Pin labeling conforms to the IBM DTE and DCE standards.

Network Amplifiers — If you have more than 16 slave stations, you must use an RS422 amplifier to maintain the signal levels. The best amplifiers are regenerative, that is, they recover the signal and try to reduce any noise signals that are present. Some amplifiers are not regenerative and amplify the noise as well as the signal. (You can get amplifiers from several sources. The Black Box catalog is one of many good places to start). The following diagram shows some instances where an amplifier is necessary.

Serial Slave Connection



Parallel Slave Connection



**Consideration 6:
A Quick Test Cable**

PLC*Direct*™ offers a Universal Cable Kit (part number FA-CABKIT). This cable kit allows you to connect various types of *Direct*LOGIC™ products with an RS232C cable in a matter of minutes. (Check your DL405 Parts List for part number). The kit consists of cable (phone cable with male plugs already attached) and several specially wired connectors. The special connectors are a D-sub style with built-in female phone jacks. The kit includes a wide variety of the special connectors so you can use one kit to easily connect products from the different *Direct*LOGIC™ family of products. To use the kit with the DCM, just follow these steps.

1. Plug the appropriate D-sub connector onto the DCM.
2. Plug the appropriate D-sub connector onto the other device you are connecting to the DCM.
3. Connect the cable to the two D-sub connectors.

WARNING: This cable is suitable for quick testing situations and must not be used in actual applications. This cable is not shielded and is highly susceptible to electrical noise. Electrical noise can cause unpredictable operation that may result in a risk of personal injury or damage to equipment. Use the cable specifications described earlier in this manual to select a cable suitable for actual applications.

Build A Test Cable In 30 Seconds

1. Attach Universal Cable Adapter to the DCM
2. Attach another Universal Cable Adapter to the Device which will connect to the DCM
3. Attach the Universal Cable

