

Building the Communication Cable

There are several considerations that help determine the type of cable needed for your D2–DCM application.

1. Will the D2–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?

The next few pages discuss these considerations in detail.



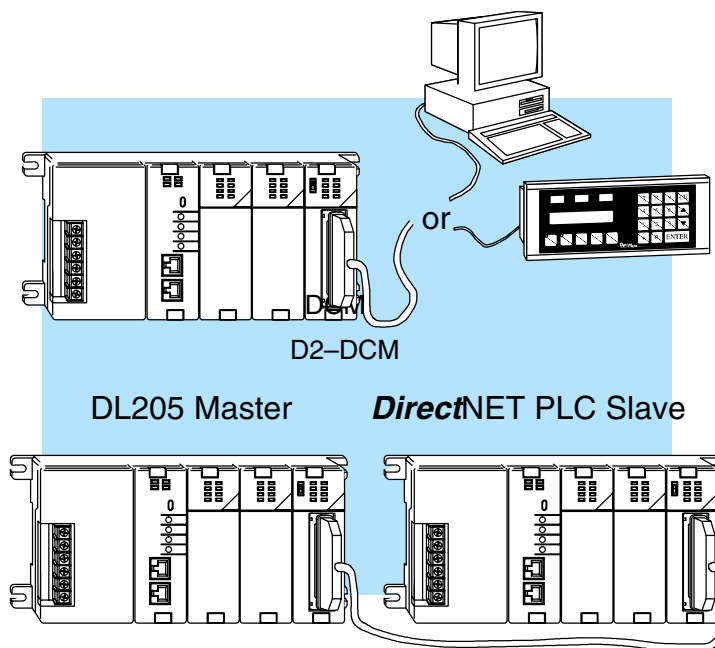
Tip: If you need a quick test cable you may want to try our FA–CABKIT which allows you to quickly build several different types of cables. (See page 15 for more information). If you're fairly comfortable with network or communications cabling requirements, see Appendix A for detailed diagrams.

Consideration 1: Physical Configuration

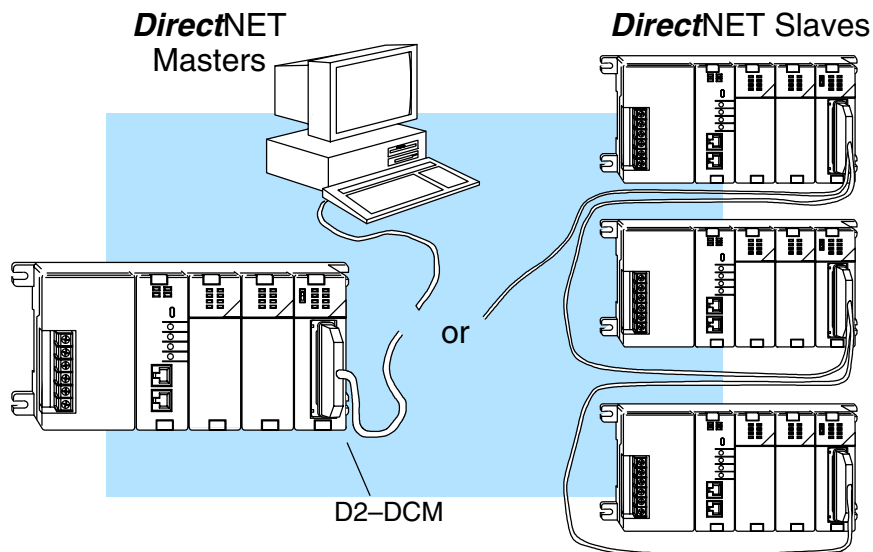
The D2-DCM can be used in either a point-to-point or multi-drop configuration. A point-to-point connection only has two stations, a master and a slave. Use the point-to-point configuration to connect a personal computer, an operator interface, or an intelligent device to a single D2-DCM. You must also 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 D2–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.

Consideration 3: Cable Schematics

Although the network configuration and electrical specification are important, the type of devices being connected to the D2–DCM are just as important. The exact cable schematic needed really depends on a combination of all three things. There are a wide range of possibilities when you consider that all three product families, the DL205, DL305, and DL405 all offer **DirectNET** communication capabilities.

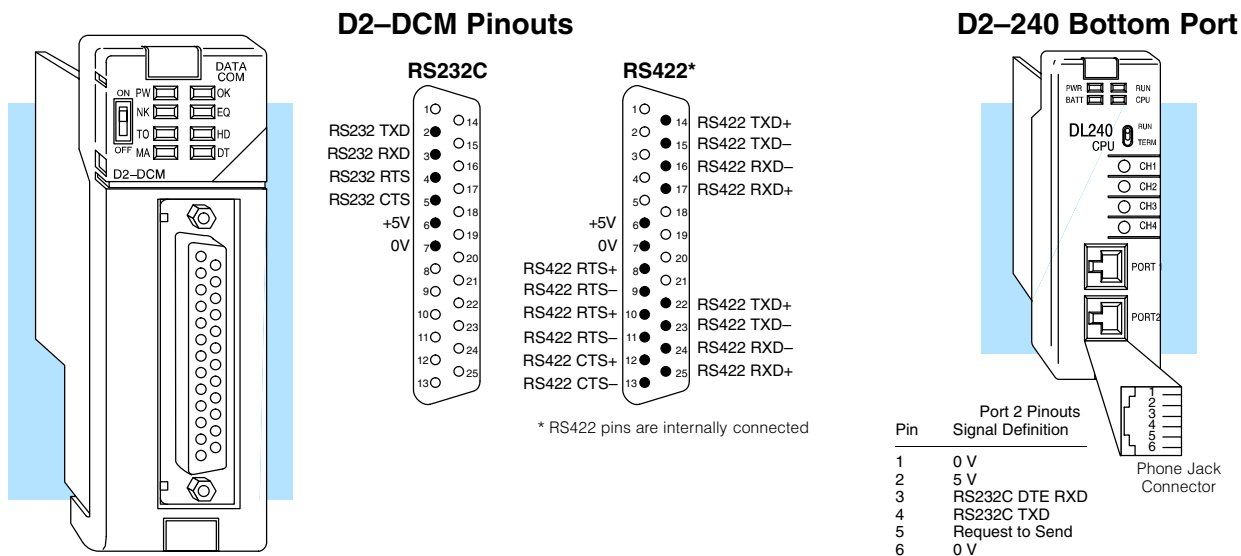


Hint: Look at Appendix A to determine a cable possibility. Some of these examples may need to be combined to design a cable for your application.



NOTE: If you are using the D2–DCM to connect an OptiMation operator interface, you must order our standard pre-made cable, part number OP–4CBL–2. If you are using a DV–1000, you must build a custom cable. See the cable diagram at the end of Appendix A.

The following diagram shows the port pinouts for the D2–DCM and the bottom port of the DL240 CPU. These are the two most likely combinations that you will use. Notice that the D2–DCM has two sets of RS422 pins. These pins are internally connected and can make it easier to wire multidrop connections.



NOTE: The DL205 CPU ports only support RS232C signal levels. If you are going to have more than one slave station, you will have to use RS422 and a FA–UNICON RS232 to RS422 converter for each slave station. See the cable diagrams shown in Appendix A for detailed diagrams.

**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 is 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

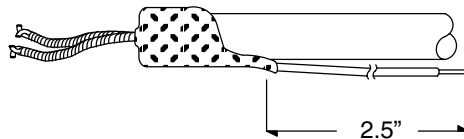
**Consideration 5:
Installation
Guidelines**

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.

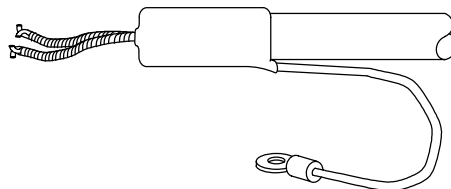
- Don't run cable next to larger motors, high current switches, or transformers. This may cause noise problems.
- Route the cable through an approved cable housing to minimize the risk of accidental cable damage. Check local and national codes to choose the correct method for your application.
- Consider 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.

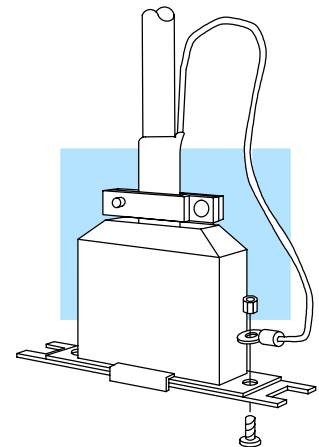
Step 1: Strip back about 2.5" of the shield.



Step 2: Crimp a ring connector onto the shield.



Step 3: Secure the shield to the connector shell.

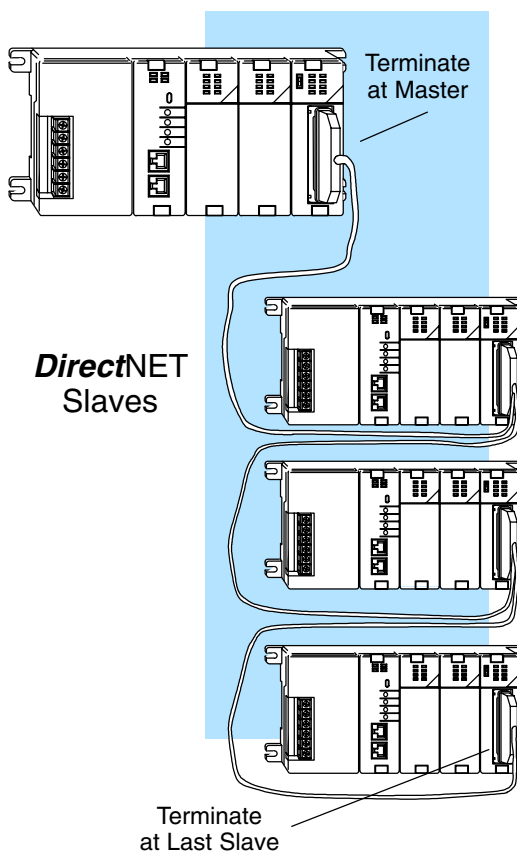


Multi-drop Termination Resistors — It is important you add termination resistors at each end of the RS422 line. This helps reduce data errors during data transmission. You must select resistors that match the cable impedance. For example, a typical 22 AWG solid conductor cable with 4.5 twists per foot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

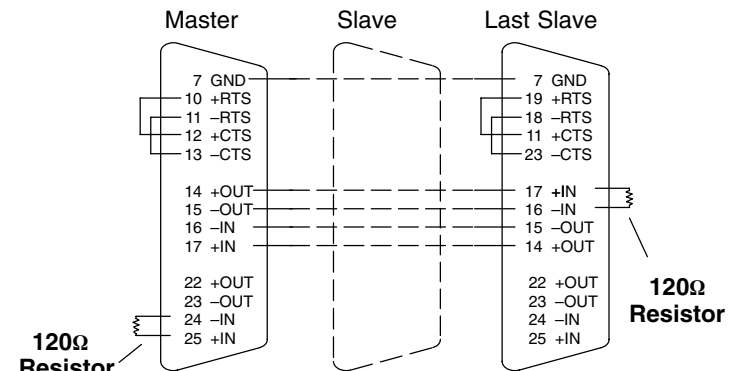
There are two ways to actually connect the resistors.

- **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.

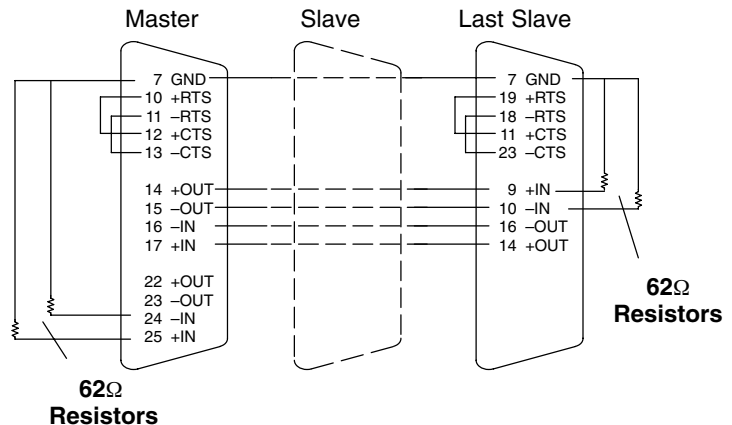
The following diagram illustrates the two options.



Line-to-Line Termination for the D2-DCM

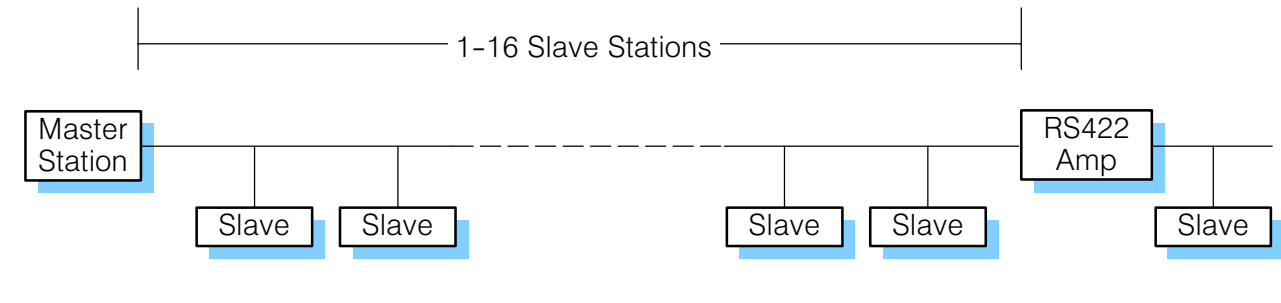


Line-to-Ground Termination for the D2-DCM

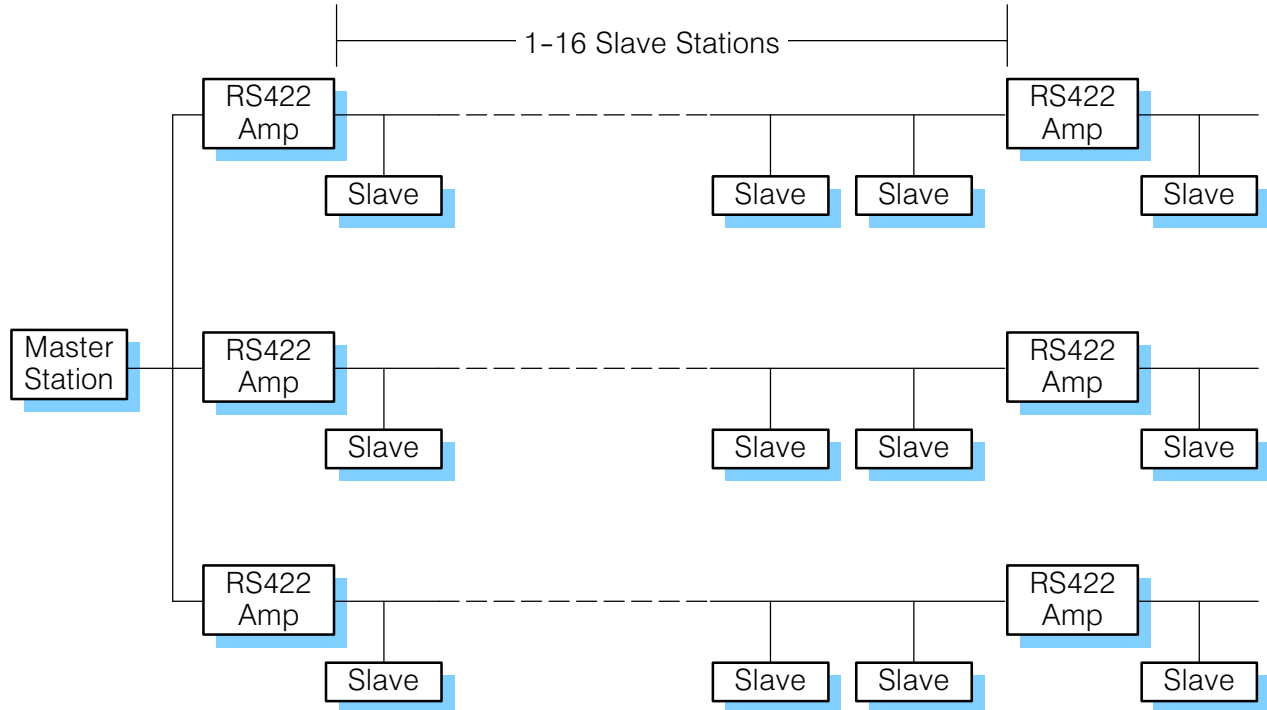


Network Amplifiers — If you have more than 16 slave stations, you must use an RS422 amplifier to maintain the signal levels. The best amplifiers are regenerative, that is, they try to improve signal quality by reducing any noise signals that are present. (They amplify the signal and not the noise if possible.) Some amplifiers are not regenerative and amplify the noise as well as the signal. You can purchase amplifiers from several sources. The Black Box catalog is one of many good places to start; they sell direct. Call 1-800-555-1212 and ask the 800 directory assistance operator for their phone number. You can also look for a amplifier supplier on the internet. One web site to look at is www.idealsolution.com, or search for other RS422 amplifier web sites. The following diagram illustrates some instances where an amplifier is necessary.

Serial Slave Connection



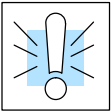
Parallel Slave Connection



A Quick Test Cable

AutomationDirect offers a Universal Cable Kit (part number FA-CABKIT). This cable kit allows you to connect various types of **DirectLOGIC** products with an RS232C cable. 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 connect products from the different **DirectLOGIC** family of products. To use the kit with the D2-DCM, just follow these steps.

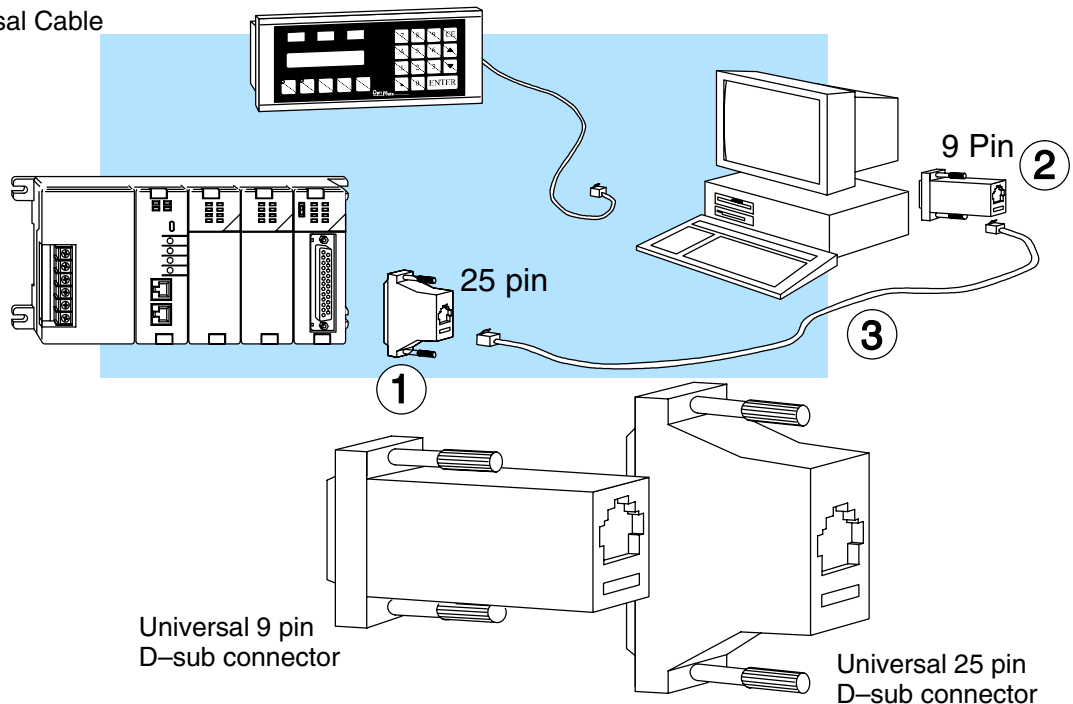
1. Plug the appropriate D-sub connector onto the D2-DCM.
2. Plug the appropriate D-sub connector onto the other device you are connecting to the D2-DCM.
3. Connect the cable to the two D-sub connectors.



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 D2-DCM
2. Attach another Universal Cable Adapter to the Device which will connect to the D2-DCM
3. Attach the Universal Cable

**Cable Kit Contains one (1) each of:**