3

Installation & Field Wiring Guidelines

In This Chapter. . . .

Introduction

4 Easy Steps: There are four easy steps to install either a D2-RMSM or D2-RSSS module:

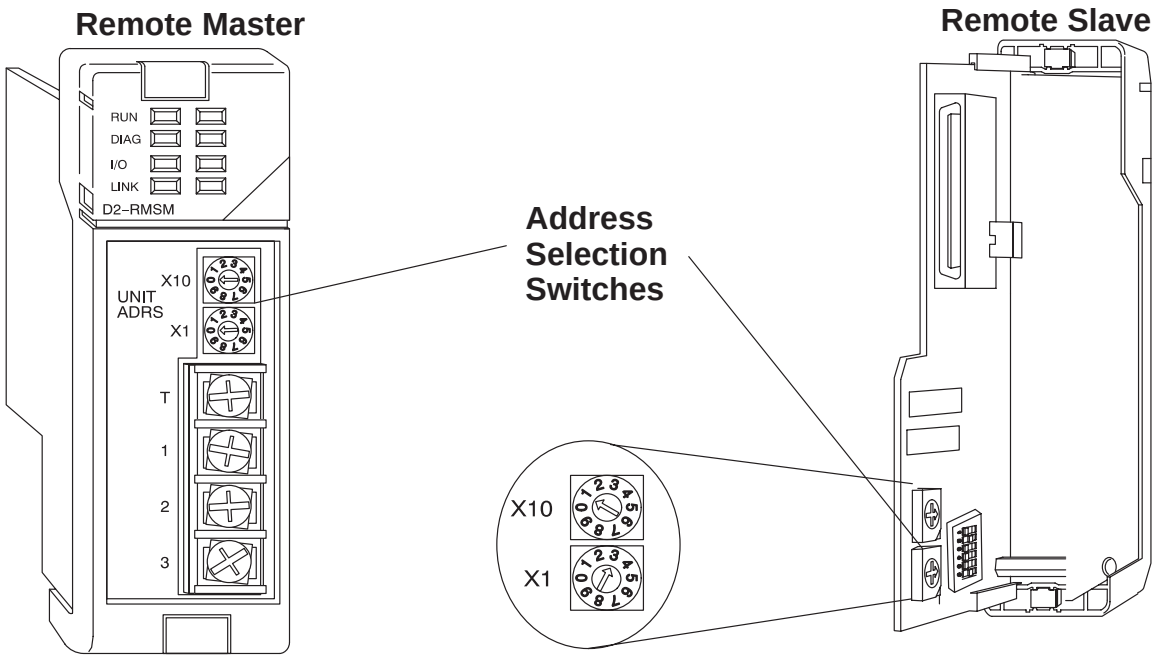
1. Set the address on the front or rear rotary switches.
2. Set the protocol mode, baud rate, and output default on the rear DIP switch.
3. With no power applied, insert the module into the base.
4. With no power applied, connect the wiring.

The text that follows will cover each of these steps in detail.

NOTE: We advise you to read the previous chapter on "Defining Your I/O System " before you install your remote master and slave units. The decision-making process explained in that chapter will help you understand the rotary switches and dip switches covered in this chapter. It will also help you with writing your ladder logic in the next chapter.

Step One: Setting the Rotary Switches

Both the remote master and slave have two small rotary switches to set the unit address. On the remote master (D2–RMSM), they are on the face of the module, with the label “UNIT ADRS” beside it. On the remote slave (D2–RSSS), they are on the printed circuit board of the module, and are labeled “SW2” and “SW3”. Adjust the switches by rotating them with a small flathead screwdriver.



One switch is marked X1 and the other X10. Don’t confuse these with the conventional data type labeling – *these do not refer to inputs* X1 and X10. Instead, these set the address in decimal for each unit. X1 is the “one’s” position and X10 is the “ten’s” position. For example, set address 13 by turning the X10 switch to 1 and the X1 switch to 3 (10+3=13).

Align the arrows on the switches to 0 to use the module as a **master** (D2–RMSM only). Set them to any number (1–7 for RM–NET mode or 1–31 for SM–NET mode) if it will be a **slave** (D2-RSSS). Two slaves cannot have the same number if they are linked to the same master. **Always use consecutive numbers for slaves, starting with Address 1—don’t skip numbers**.

Step Two: Setting the Rear DIP Switches

Toward the rear of each module you will find a DIP switch mounted on the circuit board. The remote master (D2–RMSM) has an 8-position switch labeled “SW3”, while the remote slave (D2–RSSS) has a 6-position switch labeled “SW1”. Set these switches to configure the protocol mode, the baud rate, and the output response on communication failure.

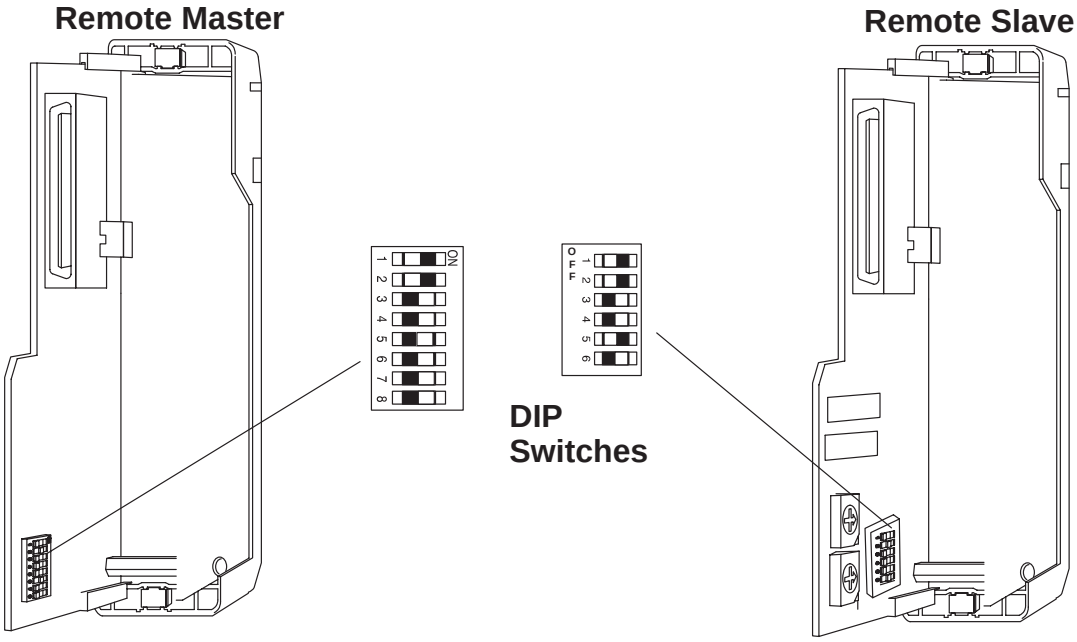


Chart for DIP Switch Settings

Module	DIP Position					
	1	2,3,4	5	6	7	8
Master (RMSM)	**Mode** OFF=SM–NET ON=RM–NET	**Baud Rate** Switch Position Baud Rate 2 3 4 19.2K O O O 38.4K X O O 153.6K O X O 307.2K X X O 614.4K O O X where X=ON, O=OFF- Note: Baud rates above 38.4K for SM–NET only	Always OFF	Always OFF	Always OFF	**Diagnostics** OFF=Normal ON=Diagnostic
Slave (RSSS)	**Mode** Same as Master	**Baud Rate** Same as Master	**Output Default** OFF=Clear ON=Hold	**Diagnostics** OFF=Normal ON=Diagnostic	N/A	N/A

For the D2-RMSM, the word “ON” is visible on the switch beside Position 1 to indicate which side is the ON position. For the D2-RSSS, the word “OFF” is visible on the switch beside Position 1 to indicate which side is the “OFF” position.

Mode: DIP switch Position 1 on both the master and slave unit selects the protocol mode for the remote I/O link. The DL205 remote I/O can use one of two protocols, **RM–NET** or **SM–NET.** Chapters 1 and 2 discussed the features of these protocols and the considerations for using each. Position 1 of the master and all slaves linked to it must be set to the same setting in order to communicate. If there are multiple masters in the system, each can use a different protocol if necessary.

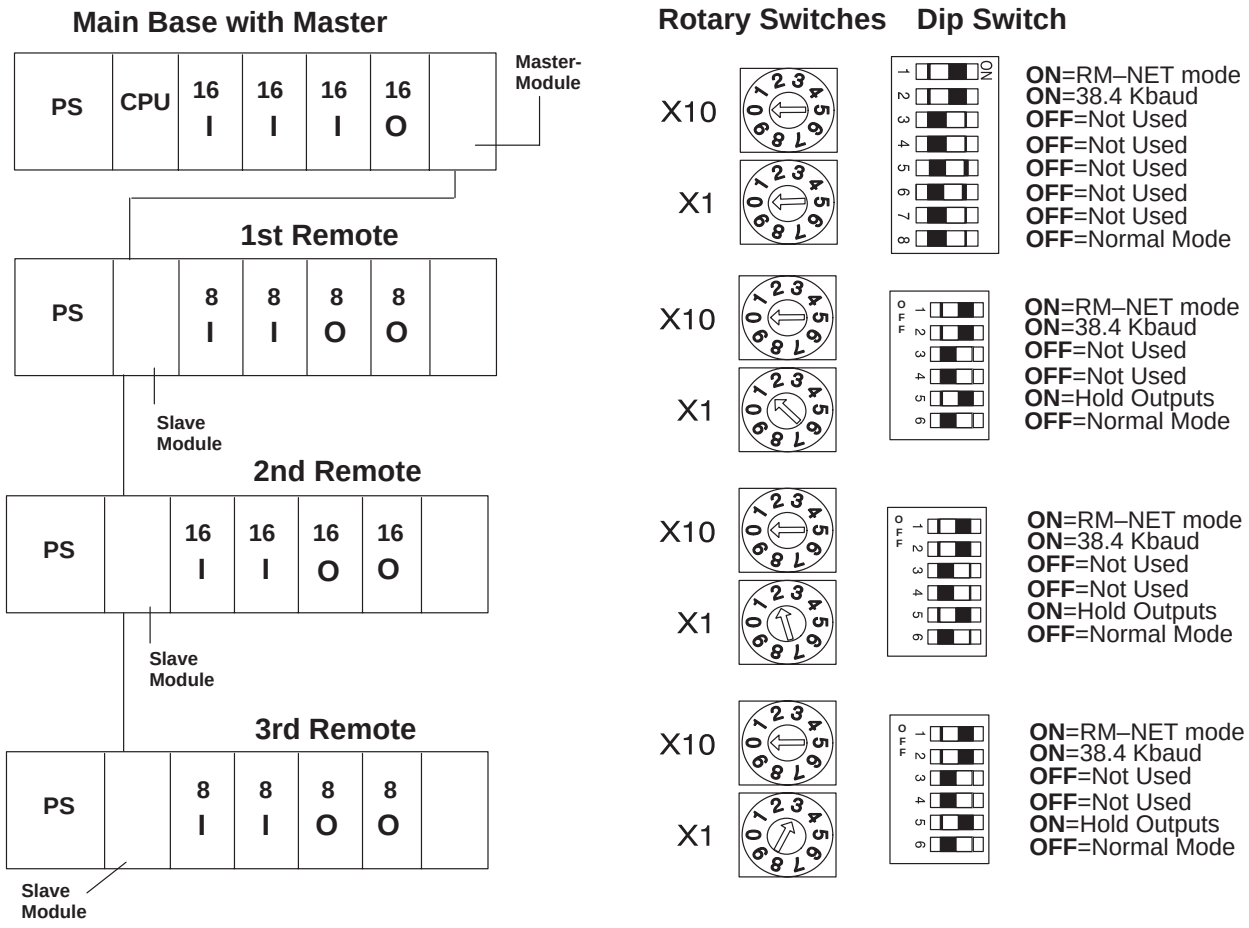
Baud Rate: DIP switch Positions 2,3, and 4 on both the master and slave unit select the baud rate for the remote I/O link. If you have selected the **RM–NET** protocol mode, only Switch 2 selects the baud rate,either 19.2K or 38.4K baud. In this mode, be sure to set switches 3 and 4 OFF. If you have selected the **SM–NET** protocol mode, you set switches 2,3, and 4 to select among five baud rates ranging from 19.2K to 614.4K baud. The higher the baud rate, the less distance is allowed between the master and the end slave. See the Functional Specifications in Chapter 1 for the allowable distance at each baud rate. All stations on a remote I/O link must have the same baud rate before the communications will operate properly. If there are multiple masters in the system, each can use a different baud rate if necessary.

Output Default: DIP switch Position 5 on the slave determines the outputs' response to a communications failure. If DIP switch 5 is ON, the outputs in that slave unit will hold their last state upon a communication error. If OFF, the outputs in that slave unit will turn off in response to an error.

Diagnostics: DIP switch Position 8 on the master and Position 6 on the slave select the factory diagnostic mode, and should always be OFF. If the diagnostic mode is active, the module will not operate correctly.

Example Showing Proper Setting of Switches

Here's the way Steps 1 and 2 would be carried out for the system shown below, if we decided to operate **RM–NET** at 38.4 kBaud, and holding outputs upon a communication error:



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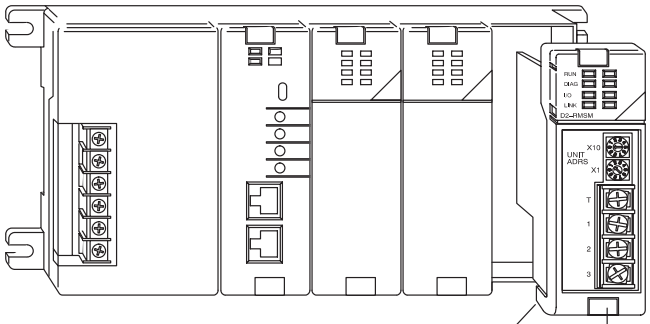
Step Three: Inserting the Module in the Base

The D2-RMSM can occupy any slot in the CPU base, except the slot adjacent to the CPU (that slot accomodates the counter interface module and its memory). The D2-RSSS must reside in the CPU slot of the remote base(s).

NOTE: Don't forget to check your total **power budget** and make sure the total current drawn by the remote modules and other I/O modules does not exceed the total amount allowable for the CPU you are using. See Chapter 2 of this manual or your DL205 User Manual for instructions on how to compute the power budget.

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.

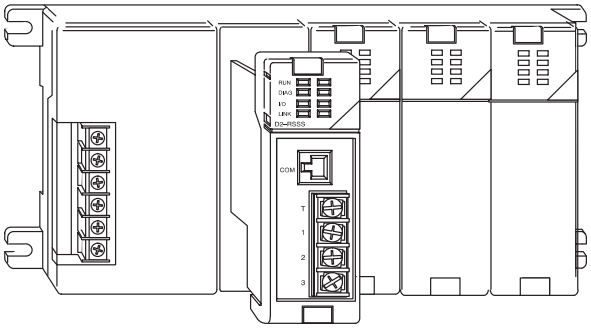
To insert the module into the base, align the circuit board with the grooves on the top and bottom of the base. Push the module straight into the base until it is firmly seated in the backplane connector. Once the module is inserted into the base, push in the retaining clips (located at the top and bottom of the module) to firmly secure the module to the base.



D2-RMSM can go into any slot in the local base except the slot adjacent to the CPU

Align module to slots in base and slide inward

Once the module is seated in the base push the retaining clips in to secure the module to the DL205 base



D2-RSSS must be in the CPU slot of the remote base.

Step Four: Connecting the Wiring

General Wiring Guidelines

Consider the following wiring guidelines when wiring the communication cabling in your system:

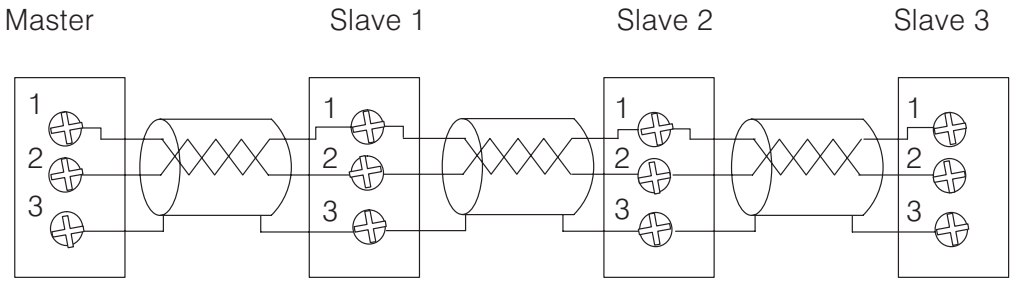
1. Always use a continuous length of cable. Do not combine cables to attain a needed length.
2. Use the shortest possible cable length.
3. Where possible, use conduit for cable routing.
4. Avoid running cable near high energy wiring.
5. Where possible, avoid running communications cabling in close proximity to AC wiring.
6. Avoid creating sharp bends in the cables.
7. Label all wires.

Cable Recommendation

The recommended cable for connecting the master and slaves is a single twisted pair cable, Belden 9841 or equivalent. This cable meets the RS-485 standard for communications. Its impedance specification is 120 ohms per thousand feet.

Cabling Between the D2–RMSM Master and Slaves

The diagram shown below depicts the cabling between the D2-RMSM master and its slaves. The two inner wires are connected to terminals 1 and 2 of each module. The shield wire is connected to terminal 3. *Make sure the the connections between master and all slaves are always 1 to 1, 2 to 2 and 3 to 3*.

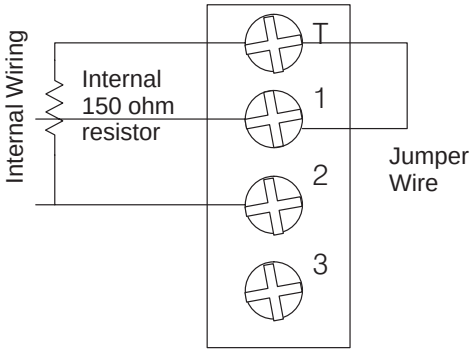


Termination Resistors

At each end of a master/slave system, it is necessary to have a *termination resistor* to prevent signal reflections from interfering with the communications. Although the modules have a 150 ohm resistor built in for this purpose, there are three options to consider:

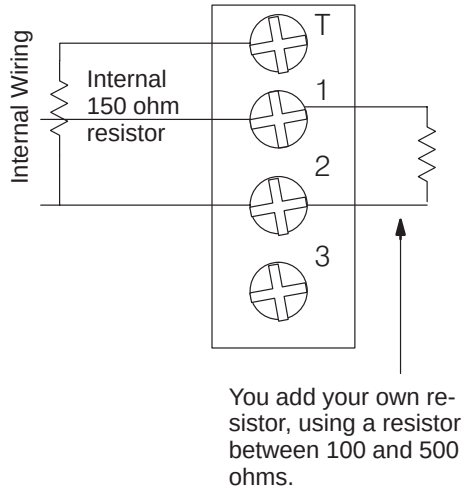
Option 1:
Use Internal Resistor Only

With this configuration, you use the internal resistor of the module to provide all the terminating resistance necessary. Place a jumper wire between the terminating terminal and terminal 1.



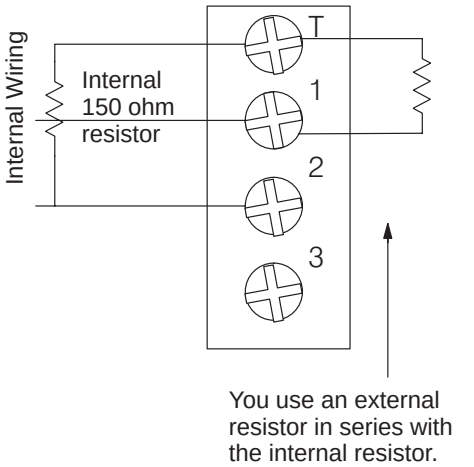
Option 2:
Use Internal Resistor and Balance Resistor

To better match the impedance of the cabling, you can elect not use the internal resistor; and instead, use a resistor of your choice externally. Connect this resistor between terminals 1 and 2. You do not use the jumper wire in this case.



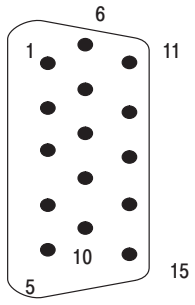
Option 3:
External Resistor in Series

With this option, you use an external resisor in series with the internal resistor. The sum resistance should match the cabling impedance.



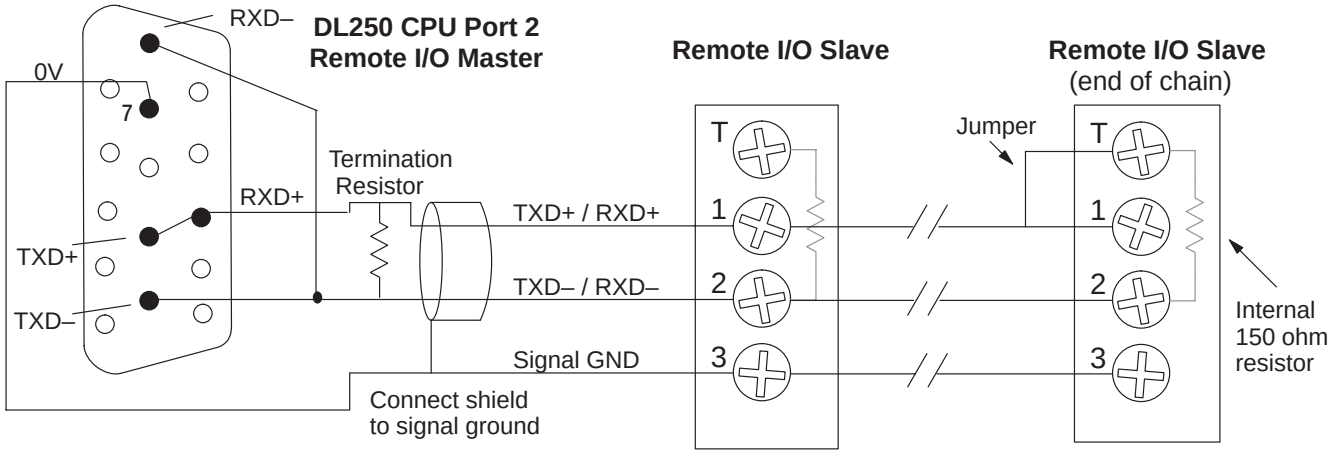
Cabling Between the D2–250 CPU bottom port and slaves

The standard remote I/O link is a 3-wire, half-duplex type. Since Port 2 of the DL250 CPU is a 5-wire full duplex-capable port, we must jumper its transmit and receive lines together as shown below (converts it to 3-wire, half-duplex). The diagram also depicts the port pinout for the D2–250 CPU bottom port.



15-pin Female
D Connector

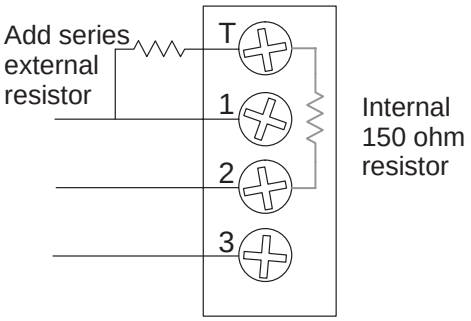
Port 2 Pin Descriptions (DL250 CPU)		
1	5V	5 VDC
2	TXD	Transmit Data (RS232C)
3	RXD	Receive Data (RS232C)
4	RTS	Ready to Send (RS–232C)
5	CTS	Clear to Send (RS–232C)
6	RXD2–	Receive Data – (RS–422)
7	0V	Logic Ground
8	0V	Logic Ground
9	TXD2+	Transmit Data + (RS–422)
10	TXD2 –	Transmit Data – (RS–422)
11	RTS2 +	Request to Send + (RS–422)
12	RTS2 –	Request to Send – (RS–422)
13	RXD2 +	Receive Data + (RS–422)
14	CTS2 +	Clear to Send + (RS422)
15	CTS2 –	Clear to Send – (RS–422)



The twisted/shielded pair connects to the DL250's Port 2 as shown. Be sure to connect the cable shield wire to the signal ground connection. A termination resistor must be added externally to the CPU, as close as possible to the connector pins. Its purpose is to minimize electrical reflections that occur over long cables. Be sure to add the jumper at the last slave to connect the required internal termination resistor.

Ideally, the two termination resistors at the cable's opposite ends and the cable's rated impedance will all three match. For cable impedances greater than 150 ohms, add a series resistor at the last slave as shown to the right. If less than 150 ohms, parallel a matching resistance across the slave's pins 1 and 2 instead.

Remember to size the termination resistor at Port 2 to match the cable's rated impedance. *The resistance values should be between 100 and 500 ohms.*

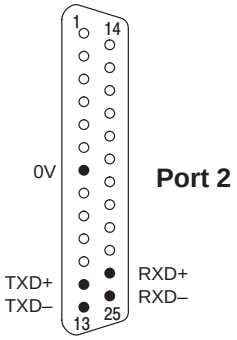


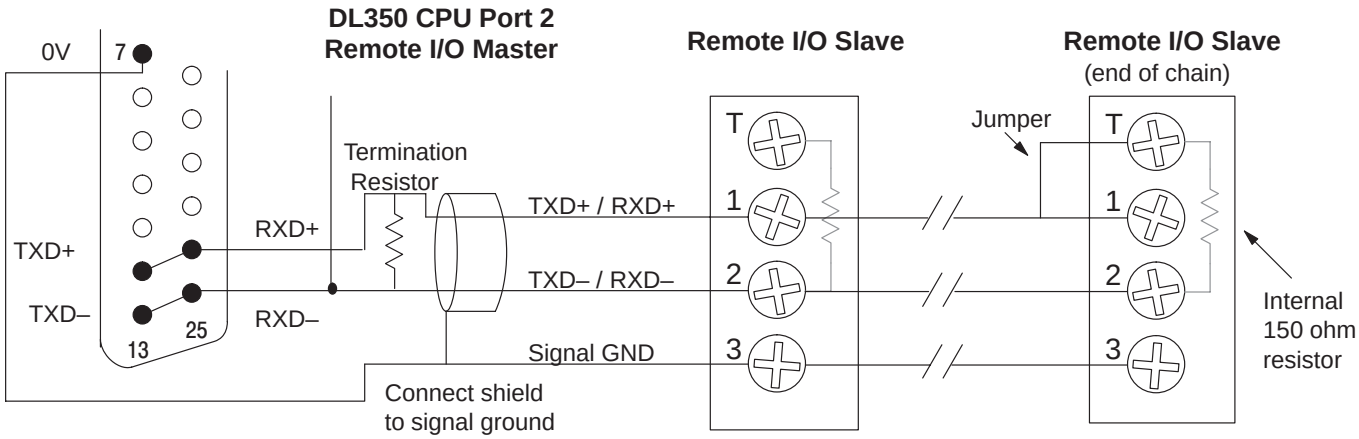
Cabling Between the D3–350 CPU bottom port and Slaves

The remote I/O link is a 3-wire, half-duplex type. Since Port 2 of the DL350 CPU is a 5-wire full duplex-capable port, we must jumper its transmit and receive lines together as shown below (converts it to 3-wire, half-duplex). The diagram depicts the port pinout for the D3–350 CPU bottom port.

The location of Port 2 on the DL350 is on the 25-pin connector , as pictured to the right.

- Pin 7 Signal GND
- Pin 12 TXD+
- Pin 13 TXD–
- Pin 24 RXD+
- Pin 25 RXD–





The twisted/shielded pair connects to the DL350's Port 2 as shown. Be sure to connect the cable shield wire to the signal ground connection. A termination resistor must be added externally to the CPU, as close as possible to the connector pins. Its purpose is to minimize electrical reflections that occur over long cables. Be sure to add the jumper at the last slave to connect the required internal termination resistor.

Ideally, the two termination resistors at the cable's opposite ends and the cable's rated impedance will all three match. For cable impedances greater than 150 ohms, add a series resistor at the last slave as shown to the right. If less than 150 ohms, parallel a matching resistance across the slave's pins 1 and 2 instead.

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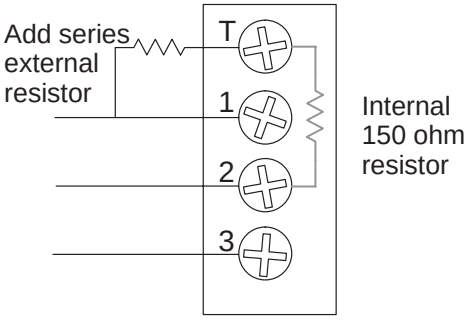
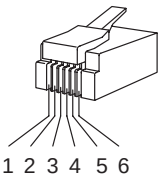


Using the Slave Unit Communications Port

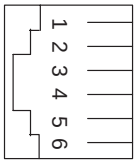
Port Specifications Each D2–RSSS slave module has an RJ–12 phone plug type communications port. It operates at 9600 baud, 8 data bits, one stop bit, and odd parity. It is active only when the channel is configured for SM–NET protocol. You can program or monitor the CPU through this port with ***Direct***SOFT or the handheld programmer. You can also connect the DV–1000 Operator Interface to this port. (Note, if you are using the handheld programmer or the DV–1000, remember to add the power requirement for the device when you calculate your power budget.) You may use multiple slave communication ports simultaneously on one channel.

Port Pinout The port pinout is shown below:

RJ12 plug on cable



RJ12 socket on D2–RSSS



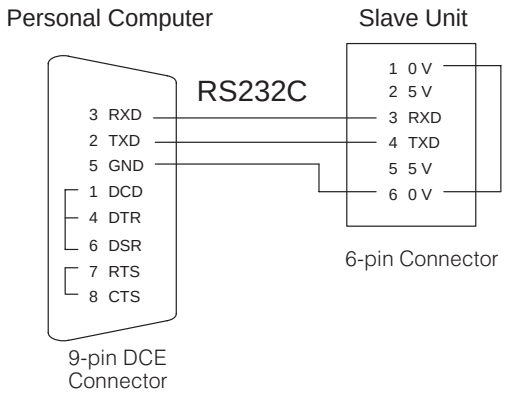
Port Pinout

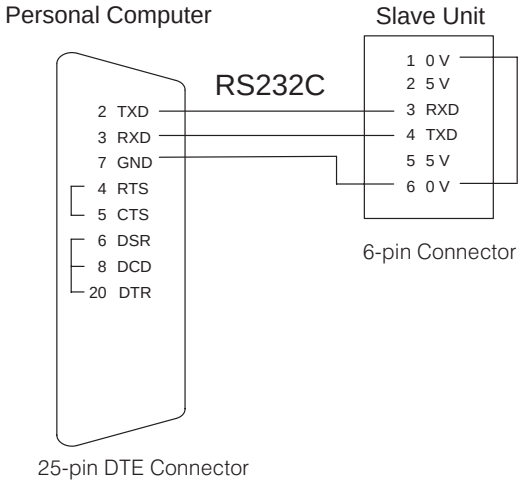
Pin	Signal Definition
1	0 V
2	5 V
3	RS232C Data In
4	RS232C Data Out
5	5 V
6	0 V

Port Cabling Since the handheld programmer and the DV–1000 obtain their operating power from the Slave unit, we strongly suggest you use the standard cables for these devices. You can order the necessary cables with the following part numbers:

- D2–DSCBL – ***Direct***SOFT Programming cable for the DL205 CPUs
- DV–1000CBL – 2m cable to connect DV–1000 Operator Interface

However, there may be an occasion where you need to quickly make your own programming cable for use with your laptop or personal computer. In this case, use the following cable pinout diagrams:





Pin labeling conforms to the IBM DTE and DCE standards.