5

DL250/DL350 CPU Setup & Programming

In This Chapter. . . .

- DL250/D350 CPU Bottom Port as Remote Master
- Writing Your Remote I/O Setup for a DL250/DL350 CPU
- Examples for Typical Configurations
- Configuring the bottom port of the DL250/DL350 CPU
- DL250/DL350 Reserved Memory for 2nd port as Remote Master

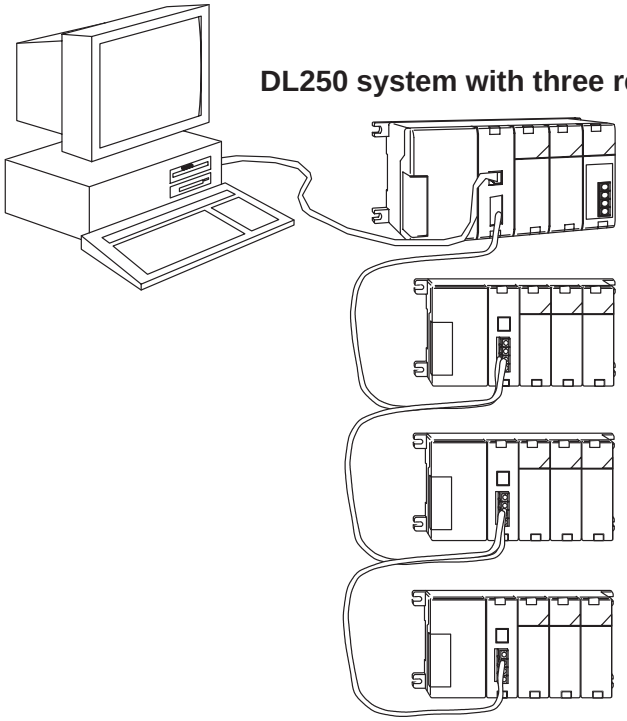
DL250/DL350 CPU Bottom Port as Remote Master

For the D2–250 or D3–350 CPU, the most cost-effective way to add remote I/O is to use the bottom port of the CPU as a remote master. The restriction is that it operates in the RM–NET addressing mode only, which means a maximum of seven slaves at a baud rate of 38.4 kBaud.

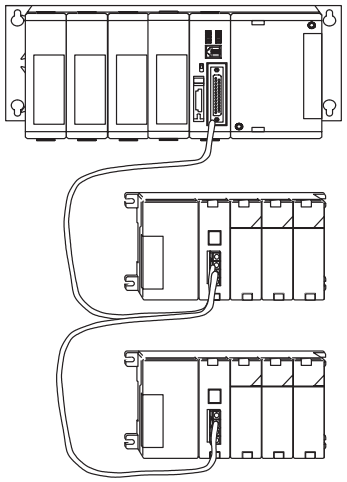
This configuration requires some setup programming for the CPU. You can write your program using either a handheld programmer or PC loaded with software such as ***Direct***SOFT. The examples that follow will show you how to do this using ***Direct***SOFT.

To get started, enter ***Direct***SOFT and carry out the normal ***Direct***SOFT setup procedures for communicating with your DL250 or DL350 CPU. If you do not know how to do this, refer to your ***Direct***SOFT Manual. Your DL205 or DL305 User Manual have very good coverage of the basic commands available and examples of using the commands to write general ladder logic. We will be showing you in this chapter only those commands that pertain to setting up your remote I/O initialization and its successful utilization.

DL250 system with three remote bases



DL350 system with two remote bases

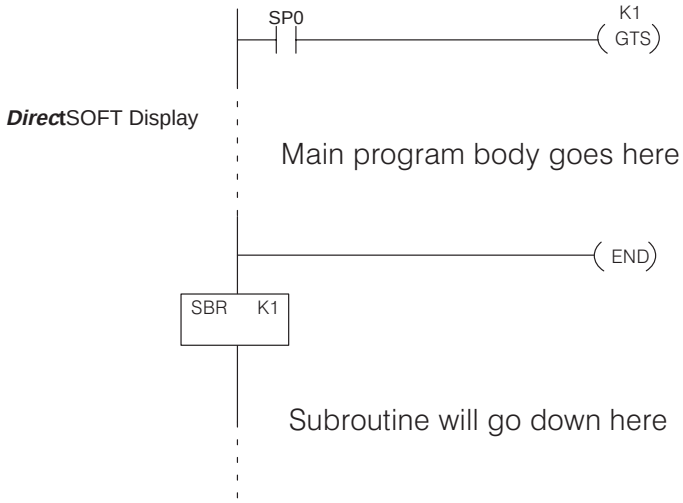


Writing Your Remote I/O Setup for a DL250/DL350 CPU

Step 1: Decide How You Are Going to Call the Program

Your setup logic can be in the main program body or in a subroutine. A subroutine for remote I/O setup has an advantage over writing the code into the program's main body. Some remote I/O setup logic becomes quite lengthy. By putting the setup in a subroutine, you don't have to scroll through extra logic during routine troubleshooting procedures. We advise you to use a subroutine for your remote I/O initialization, by following the example below:

Using the GTS Command for the Setup Logic



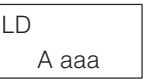
Step 2: Write the Setup Logic for the Channel

The setup program to use the D2–250 or D3–350 bottom port as master is different from the program for the D2–RMSM as master. These are the things you must do for this channel of remote I/O:

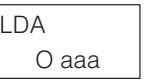
- Tell the CPU the station number of the port (“0” for master), communication V-memory address (start of pointer table), and the baud rate setting.
- Tell the CPU, *for each slave*, the starting V-memory addresses for the inputs and outputs, and the total number of each. You do this with address “pointers” and constant data.
- Tell the CPU that setup is complete.

To write the setup logic, we use the CPU instructions described below. If you are not familiar with these instructions, you may want to refer to the DL205 or DL305 User Manual for more details and examples.

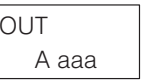
The Load instruction is a 16-bit instruction that loads the value (Aaaa), which is either a V-memory location or a 4-digit constant, into the lower 16 bits of the accumulator. The upper 16 bits of the accumulator are set to 0.



The Load Address instruction is a 16-bit instruction. It converts any octal value or address to the HEX equivalent value and loads the HEX value into the accumulator.



The OUT instruction is a 16-bit instruction that copies the values in the lower 16 bits of the accumulator to a specified V-memory location (Aaaa).



Use your worksheets to assist you in creating the setup logic.

Examples for Typical Configurations

Example 1: Using X and Y addresses as the remote I/O memory types

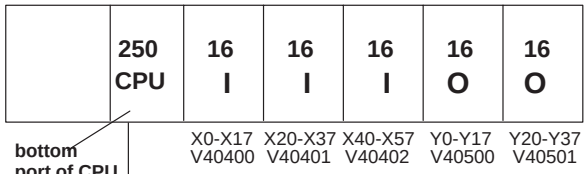
A typical system uses X and Y memory types for the inputs and outputs on the remote I/O channel.

To illustrate the setup program for this configuration, we will use the remote I/O system below, shown with the completed Channel Configuration Worksheet.

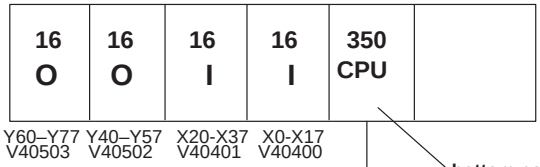
The first block of logic tells the CPU the station number of the port, communication V-memory address, and the baud rate setting. Define the constant value based on these selections (see DL250/DL350 Reserved Memory Table at the end of this chapter), and then write the value to the reserved V-memory address in the CPU. You can also perform this function interactively with ***Direct***SOFT (see "Configuring the Bottom Port of the CPU", later in this chapter).

Write Port Setup Word

DL250 CPU in Main Base



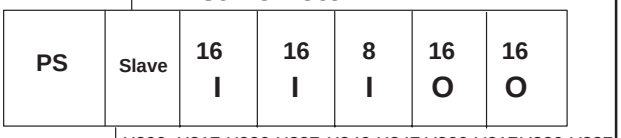
DL350 CPU in Main Base (–1 base addressing)



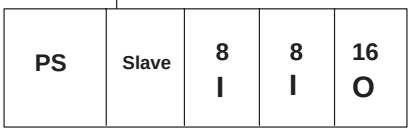
to thoroughly understand addressing conventions and restrictions for the DL350, refer to the DL305 User Manual

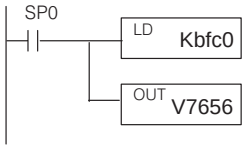
the setup program will be identical for either a DL250 or DL350 CPU

1st Remote



2nd Remote





Constant defines station as master, V-memory table at V37700, and baud rate of 38.4 kBaud

V-memory address of setup word

Channel Configuration Worksheet
DL250/DL350 CPU Bottom Port

Circle one selection or fill in blank for each parameter

Configuration Parameter	SELECTION
Baud Rate (in KBaud), determined by required distance to last slave	19.2 (38.4)
Remote I/O Configuration table Starting address	V 37700 (V37700 is default)

Slave Station	INPUT		OUTPUT	
	Input Address	No. of Inputs	Output Address	No. of Outputs
1	V40410	48	V40510	32
2	V40413	16	V40512	16
3				
4				
5				
6				
7				

To calculate the input and output addresses and ranges, complete the Remote Slave Worksheets and fill in the V-memory addresses *for each slave*, not just the first one. You can transfer this data to the Channel Configuration Worksheet to condense it, or fill in the Channel Worksheet directly if you choose not to use the Remote Slave Worksheets.

Calculate input and output addresses and ranges for each remote base

1st Remote

PS	Slave	16 I	16 I	8 I	16 O	16 O
		X200–X217 V40410	X220-X237 V40411	X240-X247 V40412	Y200-Y217 V40510	Y220-Y237 V40511

2nd Remote

PS	Slave	8 I	8 I	16 O
		X260–X267 V40413	X270–X277	Y240–Y257 V40512

Remote Slave Worksheet

Remote Base Address 1 **(Choose 1–7 for RM–NET or 1–31 for SM–NET)**

Slot Number	Module Name	INPUT		OUTPUT	
		Input Address	No. of Inputs	Output Address	No. of Outputs
0	16ND3-2	X200	16		
1	16ND3-2	X220	16		
2	08ND3	X240	16 (8 used)		
3	16TD1-2			Y200	16
4	16TD1-2			Y220	16
5					
6					
7					

Input Bit Start Address: X200 **V-Memory Address*:V** 40410
Total Input Points 48

Output Bit Start Address: Y200 **V-Memory Address*:V** 40510
Total Output Points 32

D2–RMSM automatically assigns I/O addresses in sequence based on # 1's starting addresses. The DL250/DL350 CPU port setup program es these addresses for each slave.

Channel Configuration Worksheet

DL250/DL350 CPU Bottom Port

Circle one selection or fill in blank for each parameter

Configuration Parameter	SELECTION
Baud Rate (in KBaud), determined by required distance to last slave	19.2 / 38.4
Remote I/O Configuration table Starting address	V **37700** (V37700 is def

Slave Station	INPUT		OUTPUT	
	Input Address	No. of Inputs	Output Address	No. of Outputs
1	**V40410**	**48**	**V40510**	**32**
2	**V40413**	**16**	**V40512**	**16**
3				
4				
5				
6				
7				

Remote Slave Worksheet

Remote Base Address 2 **(Choose 1–7 for RM–net or 1–31 for SM–NET)**

Slot Number	Module Name	INPUT		OUTPUT	
		Input Address	No. of Inputs	Output Address	No. of Outputs
0	08ND3	X260	8		
1	08ND3	X270	8		
2	16TD1–2			Y240	16
3					
4					
5					
6					
7					

Input Bit Start Address: X260 **V-Memory Address*:V** 40413
Total Input Points 16

Output Bit Start Address: Y240 **V-Memory Address*:V** 40512
Total Output Points 16

* The D2–RMSM automatically assigns I/O addresses in sequence based on Slave # 1's starting addresses. The DL250/DL350 CPU port setup program requires these addresses for each slave.

NOTE: Configuring remote I/O for the DL250 or DL350 CPU port requires *both* the starting addresses and the number of input and output points for each slave. The starting addresses for each slave must be on a 16-point boundary. In this example, this means that X250–X257 in Slave # 1 are unused.

The second block of logic tells the CPU, *for each slave*, the starting V-memory addresses for the inputs and outputs, and the total number of each. The CPU has reserved memory locations, called pointers, that accomplish this task. Use the values from the Remote Slave Worksheets or the Channel Configuration Sheet and the pointer addresses from the DL250/DL350 Reserved Memory Table to complete this logic.

Write Input and Output Pointers and Ranges for each remote base

Channel Configuration Worksheet
DL250/DL350 CPU Bottom Port

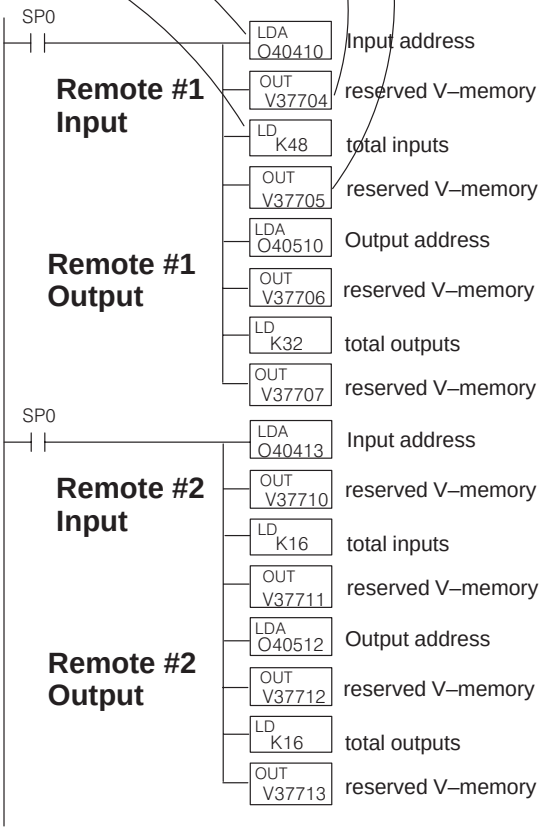
Circle one selection or fill in blank for each parameter

Configuration Parameter	SELECTION
Baud Rate (in KBaud), determined by required distance to last slave	19.2 (38.4)
Remote I/O Configuration table Starting address	V **37700** (V37700 is default)

Slave Station	INPUT		OUTPUT	
	Input Address	No. of Inputs	Output Address	No. of Outputs
1	**V40410**	**48**	**V40510**	**32**
2	**V40413**	**16**	**V40512**	**16**
3				
4				
5				
6				
7				

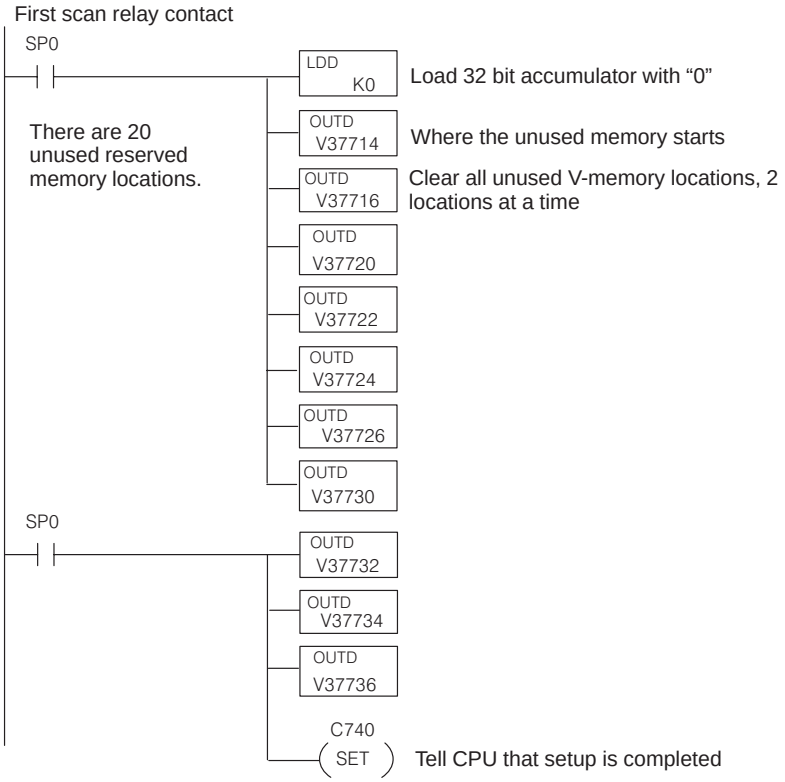
DL250/DL350 Reserved Memory Table

Port Setup Word				V7656
Setup Complete Flag				C740
Slave	Input Address	Number of Input Pts	Output Address	Number of Output Pts
1	V37704	V37705	V37706	V37707
2	V37710	V37711	V37712	V37713
3	V37714	V37715	V37716	V37717
4	V37720	V37721	V37722	V37723
5	V37724	V37725	V37726	V37727
6	V37730	V37731	V37732	V37733
7	V37734	V37735	V37736	V37737

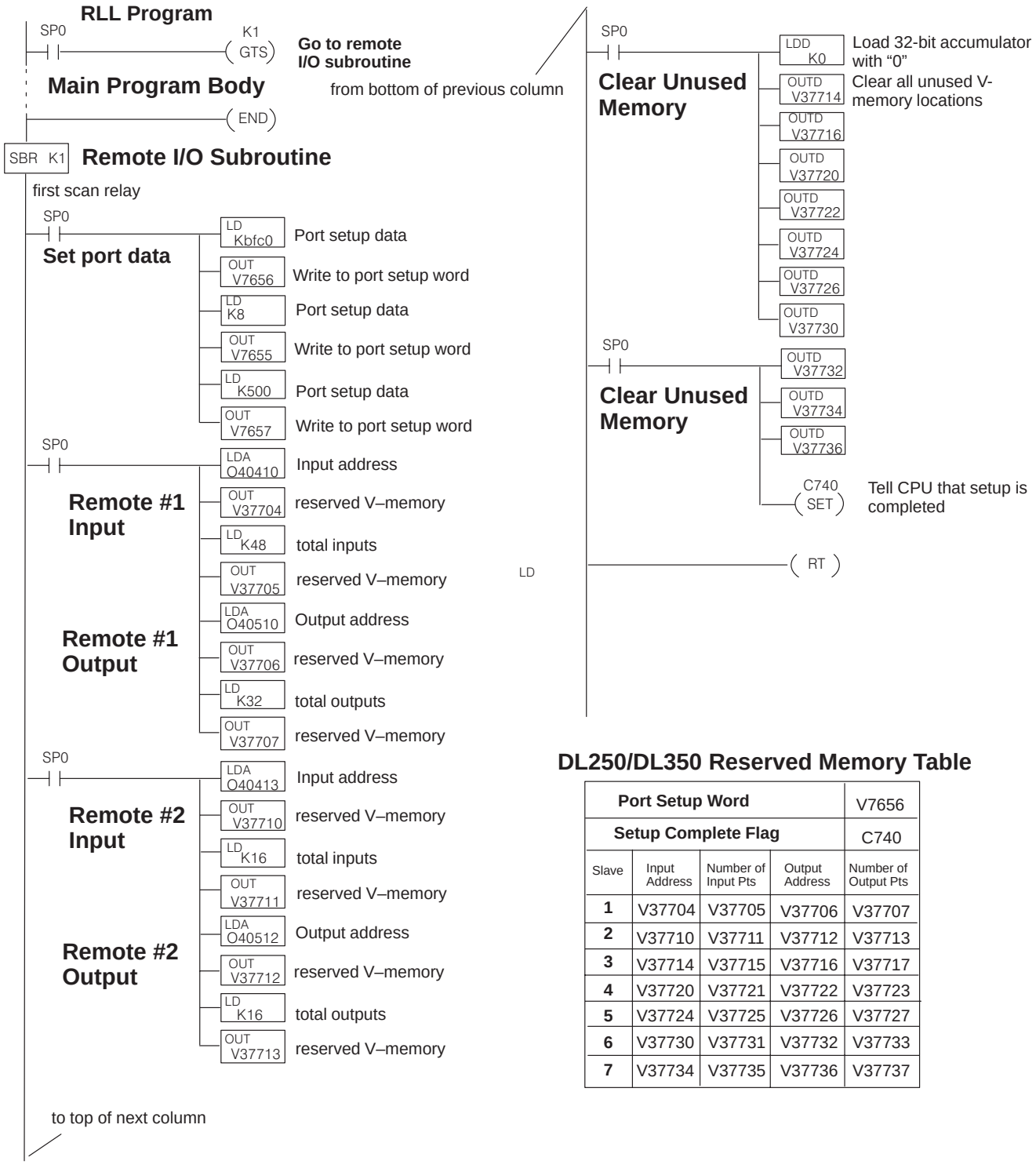


Once you have written all of the logic to map the starting addresses and point totals for each remote base, you have to zero out all of the reserved memory locations you are not going to use and then tell the CPU that you are finished with the setup. If you don't insert zeros in the unused areas, the CPU will assume that every pointer address V37714 through V37736 is pointing to a read or write start address. This could cause problems; you may have garbage in these locations. At the very least, it will take up unnecessary scan time.

The most efficient method for zeroing out the unused memory is to use LDD and OUTD instructions (load and store double) to clear two consecutive memory locations at a time. The following logic shows how to finish the setup program for this example.



Completed Setup Program for DL250/DL350 as Remote Master



DL250/DL350 Reserved Memory Table

Port Setup Word				V7656
Setup Complete Flag				C740
Slave	Input Address	Number of Input Pts	Output Address	Number of Output Pts
1	V37704	V37705	V37706	V37707
2	V37710	V37711	V37712	V37713
3	V37714	V37715	V37716	V37717
4	V37720	V37721	V37722	V37723
5	V37724	V37725	V37726	V37727
6	V37730	V37731	V37732	V37733
7	V37734	V37735	V37736	V37737

Example 2: Using Control Relays as a Remote I/O Memory Type

In certain applications, you may need to address remote I/O as a memory type other than real inputs (X type) and/or real outputs (Y type). To conserve X/Y addresses, use the control relay (C type) memory as the references for inputs, outputs, or both, on a per slave basis.

To illustrate the setup program with this option, we will use the DL250 system from Example 1, except that we have assigned the C memory type to Slave #2's inputs and outputs. To define the input and outputs as control relays, choose the correct V-memory addresses from the Control Relay (C) Addresses table in Appendix B.

DL250 CPU in Main Base

	250 CPU	16 I	16 I	16 I	16 O	16 O
		X0-X17 V40400	X20-X37 V40401	X40-X57 V40402	Y0-Y17 V40500	Y20-Y37 V40501

bottom port of CPU is remote master

1st Remote

PS	Slave	16 I	16 I	8 I	16 O	16 O
		X200–X217 V40410	X220-X237 V40411	X240-X247 V40412	Y200-Y217 V40510	Y220-Y237 V40511

2nd Remote

PS	Slave	8 I	8 I	16 O
		C200–207 V40610	C210–217	C300–317 V40614

Remote Slave Worksheet

Remote Base Address 1 **(Choose 1–7 for RM–NET or 1–31 for SM–NET)**

Slot Number	Module Name	INPUT		OUTPUT	
		Input Address	No. Inputs	Output Address	No.Outputs
0	16ND3-2	X200	16		
1	16ND3-2	X220	16		
2	08ND3	X240	16 (8 used)		
3	16TD1-2			Y200	16
4	16TD1-2			Y220	16
5					
6					
7					

Input Bit Start Address: X200 **V-Memory Address*:V** 40410
Total Input Points 48

Output Bit Start Address: Y200 **V-Memory Address*:V** 40510
Total Output Points 32

* The D2–RMSM automatically assigns I/O addresses in sequence based on Slave # 1's starting addresses. The DL250/DL350 CPU port setup program requires these addresses for each slave.

Channel Configuration Worksheet
DL250/DL350 CPU Bottom Port

Circle one selection or fill in blank for each parameter

Configuration Parameter	SELECTION
Baud Rate (in KBaud), determined by required distance to last slave	19.2 (38.4)
Remote I/O Configuration table Starting address	V 37700 (V37700 is default)

Slave Station	INPUT		OUTPUT	
	Input Address	No. of Inputs	Output Address	No. of Outputs
1	V40410	48	V40510	32
2	V40610	16	V40614	16
3				
4				
5				
6				
7				

Remote Slave Worksheet

ote Base Address 2 **(Choose 1–7 for RM–net or 1–31 for SM–NET)**

	Module Name	INPUT		OUTPUT	
		Input Address	No. Inputs	Output Address	No.Outputs
	08ND3	C200	8		
	08ND3	C210	8		
	16TD1–2			C300	16

Bit Start Address: C200 **V-Memory Address*:V** 40610
Total Input Points 16

Bit Start Address: C300 **V-Memory Address*:V** 40614
Total Output Points 16

2–RMSM automatically assigns I/O addresses in sequence based on 1's starting addresses. The DL250/DL350 CPU port setup program s these addresses for each slave.

The logic to write the port setup word is identical to Example 1, so we will proceed to the second block of logic.

This block of logic tells the CPU, *for each slave*, the starting V-memory addresses for the inputs and outputs, and the total number of each. Use the values from the Remote Slave Worksheets or Channel Configuration Worksheet and the pointer addresses from the DL250/DL350 Reserved Memory Table to complete the logic.

Write Input and Output Pointers and Ranges for each remote base

Channel Configuration Worksheet
DL250/DL350 CPU Bottom Port

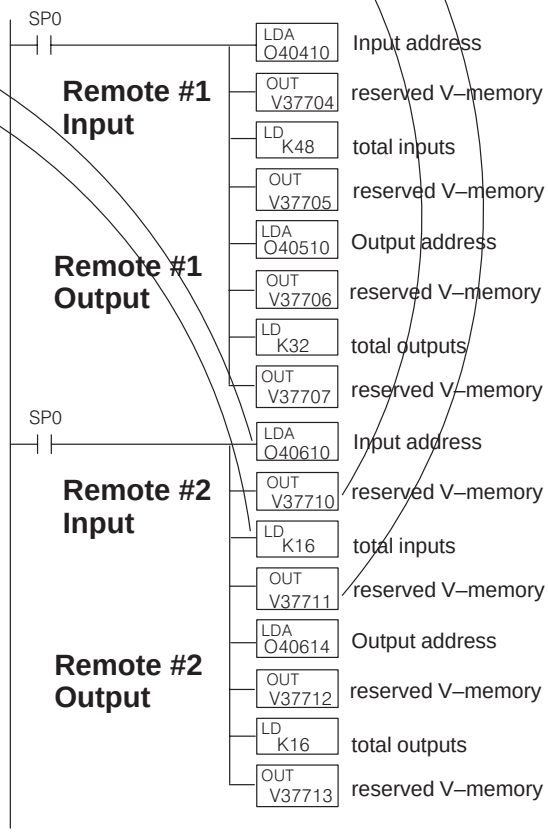
Circle one selection or fill in blank for each parameter

Configuration Parameter	SELECTION
Baud Rate (in KBaud), determined by required distance to last slave	19.2 (38.4)
Remote I/O Configuration table Starting address	V 37700 (V37700 is default)

Slave Station	INPUT		OUTPUT	
	Input Address	No. of Inputs	Output Address	No. of Outputs
1	V40410	48	V40510	32
2	V40610	16	V40614	16
3				
4				
5				
6				
7				

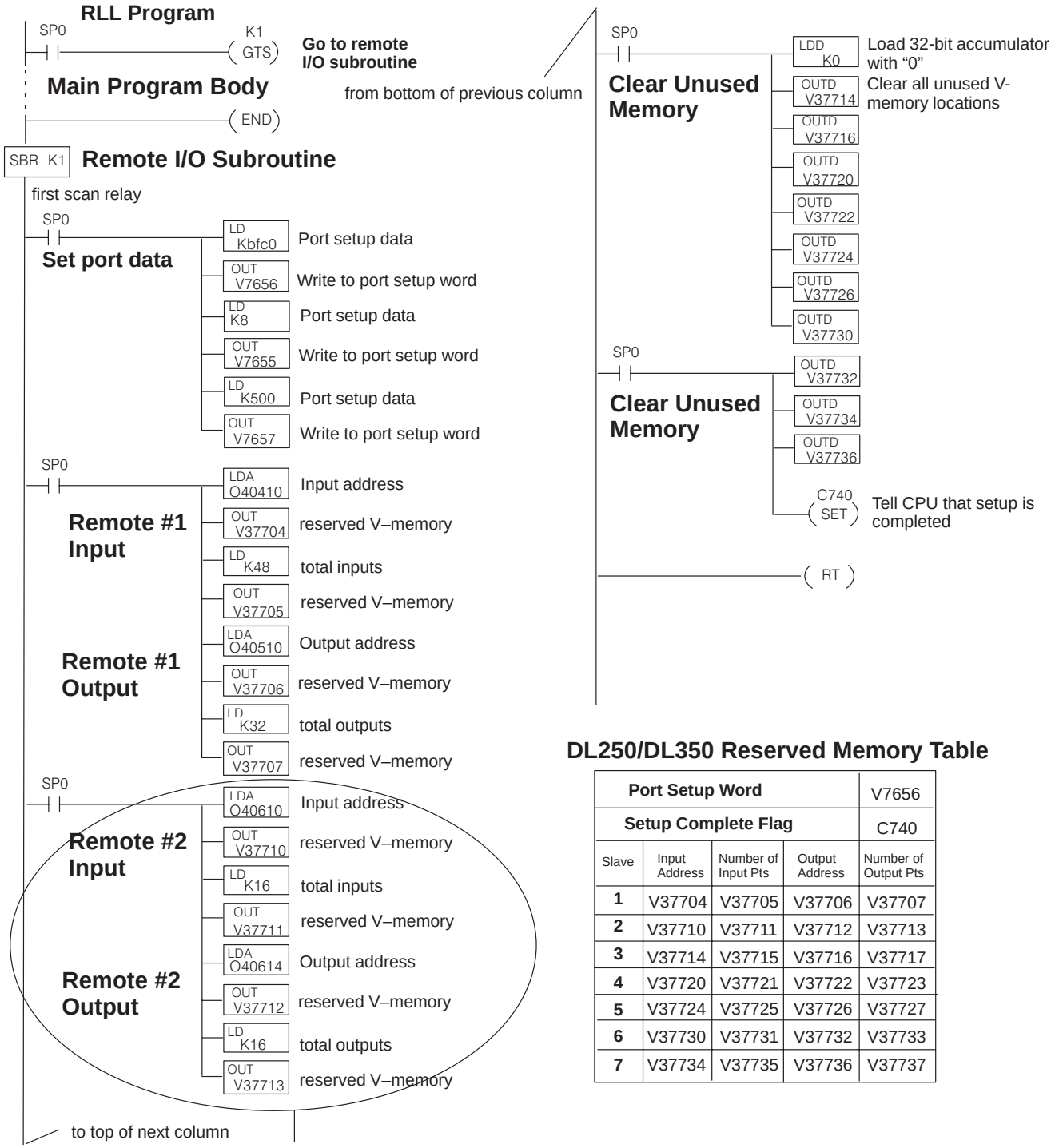
DL250/DL350 Reserved Memory Table

Port Setup Word				V7656
Setup Complete Flag				C740
Slave	Input Address	Number of Input Pts	Output Address	Number of Output Pts
1	V37704	V37705	V37706	V37707
2	V37710	V37711	V37712	V37713
3	V37714	V37715	V37716	V37717
4	V37720	V37721	V37722	V37723
5	V37724	V37725	V37726	V37727
6	V37730	V37731	V37732	V37733
7	V37734	V37735	V37736	V37737



Since the rest of the logic is identical to Example 1, we will now show the completed setup program.

Completed Setup Program for DL250/DL350 as Remote Master using C memory type



Slave #2 uses C memory type as inputs and outputs

DL250/DL350 Reserved Memory Table

Port Setup Word				V7656
Setup Complete Flag				C740
Slave	Input Address	Number of Input Pts	Output Address	Number of Output Pts
1	V37704	V37705	V37706	V37707
2	V37710	V37711	V37712	V37713
3	V37714	V37715	V37716	V37717
4	V37720	V37721	V37722	V37723
5	V37724	V37725	V37726	V37727
6	V37730	V37731	V37732	V37733
7	V37734	V37735	V37736	V37737

Example 3: Using V memory as Remote I/O type

To assign I/O references to other than the X/Y and C addresses, you can use the V-memory as the references for inputs, outputs, or both, on a per slave basis. Note that this option is not available for the D2–RMSM channels.

To illustrate the setup program with this option, we will use our DL250 sample system, except that we have assigned the V-memory type to all slave inputs and outputs. To reference the individual input and output status in the application program, use the "Bit of Word" instructions, detailed in the DL205 or DL305 User Manual.

DL250 CPU in Main Base

	250 CPU	16 I	16 I	16 I	16 O	16 O
		X0-X17 V40400	X20-X37 V40401	X40-X57 V40402	Y0-Y17 V40500	Y20-Y37 V40501

bottom port of CPU is remote master

1st Remote

PS	Slave	16 I	16 I	8 I	16 O	16 O
		V2501 bit 0-15	V2502 bit 0-15	V2503 bit 0-7	V2601 bit 0-15	V2602 bit 0-15

2nd Remote

PS	Slave	8 I	8 I	16 O
		V2504 bit 0-15		V2603 bit 0-15

Remote Slave Worksheet

Remote Base Address 1 **(Choose 1–7 for RM–NET or 1–31 for SM–NET)**

Slot Number	Module Name	INPUT		OUTPUT	
		Input Address	No. of Inputs	Output Address	No. of Outputs
0	16ND3-2	V2501	16		
1	16ND3-2	V2502	16		
2	08ND3	V2503	16 (8 used)		
3	16TD1-2			V2601	16
4	16TD1-2			V2602	16
5					
6					
7					

Input Bit Start Address:_____ **V-Memory Address*:V** 2501

Total Input Points 48

Output Bit Start Address:_____ **V-Memory Address*:V** 2601

Total Output Points 32

Remote Slave Worksheet

Remote Base Address 2 **(Choose 1–7 for RM–net or 1–31 for SM–NET)**

Slot Number	Module Name	INPUT		OUTPUT	
		Input Address	No. of Inputs	Output Address	No. of Outputs
0	08ND3	V2504	8		
1	08ND3	V2504	8		
2	16TD1–2			V2603	16
3					
4					
5					
6					
7					

Input Bit Start Address:_____ **V-Memory Address*:V** 2504

Total Input Points 16

Output Bit Start Address:_____ **V-Memory Address*:V** 2603

Total Output Points 16

* The D2–RMSM automatically assigns I/O addresses in sequence based on Slave # 1's starting addresses. The DL250/DL350 CPU port setup program requires these addresses for each slave.

Channel Configuration Worksheet

DL250/DL350 CPU Bottom Port

ne selection or fill in blank for each parameter

guration Parameter	SELECTION
ate (in KBaud), determined by required e to last slave	19.2 **38.4**
I/O Configuration table Starting address	V **37700** (V37700 is default)

Slave Station	INPUT		OUTPUT	
	Input Address	No. of Inputs	Output Address	No. of Outputs
1	**V2501**	**48**	**V2601**	**32**
2	**V2504**	**16**	**V2603**	**16**
3				
4				
5				
6				
7				

NOTE: Do not use V-memory words reserved for other functions.

The logic to write the port setup word is identical to Example 1, so we will proceed to the second block of logic.

This block of logic tells the CPU, *for each slave*, the starting V-memory addresses for the inputs and outputs, and the total number of each. Use the values from the Remote Slave Worksheets or Channel Configuration Worksheet and the pointer addresses from the DL250/DL350 Reserved Memory Table to complete the logic.

Write Input and Output Pointers and Ranges for each remote base

DL250/DL350 Reserved Memory Table

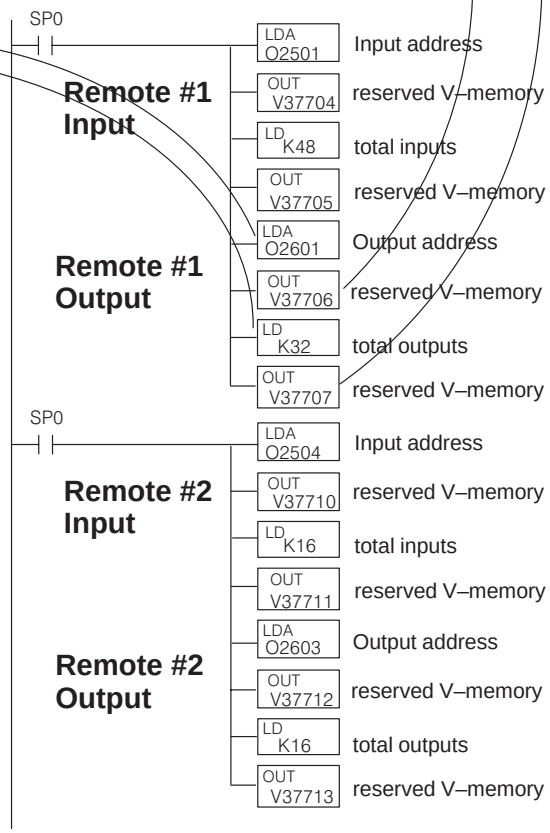
Port Setup Word				V7656
Setup Complete Flag				C740
Slave	Input Address	Number of Input Pts	Output Address	Number of Output Pts
1	V37704	V37705	V37706	V37707
2	V37710	V37711	V37712	V37713
3	V37714	V37715	V37716	V37717
4	V37720	V37721	V37722	V37723
5	V37724	V37725	V37726	V37727
6	V37730	V37731	V37732	V37733
7	V37734	V37735	V37736	V37737

Channel Configuration Worksheet
DL250/DL350 CPU Bottom Port

Circle one selection or fill in blank for each parameter

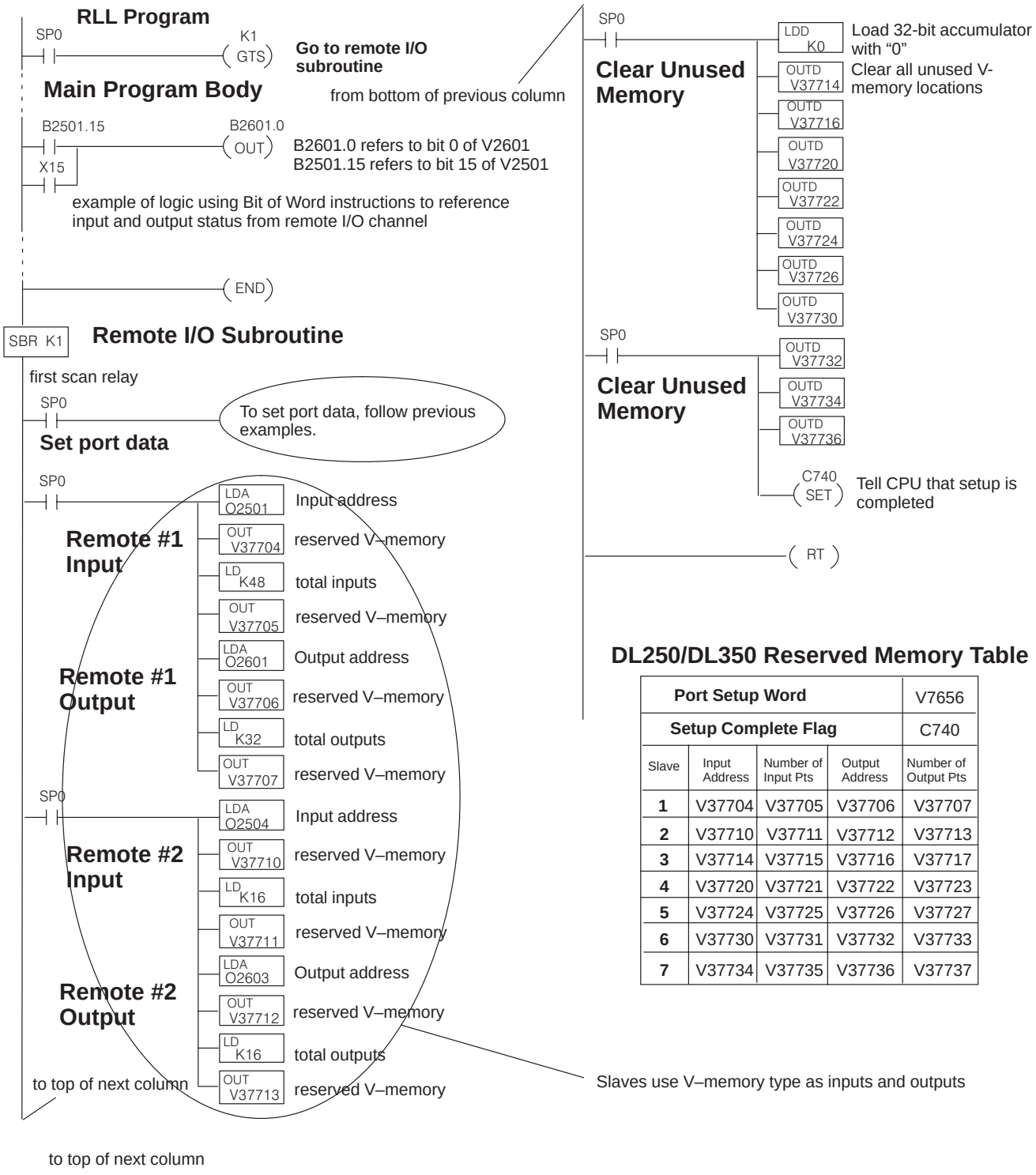
Configuration Parameter	SELECTION
Baud Rate (in KBaud), determined by required distance to last slave	19.2 (38.4)
Remote I/O Configuration table Starting address	V **37700** (V37700 is default)

Slave Station	INPUT		OUTPUT	
	Input Address	No. of Inputs	Output Address	No. of Outputs
1	**V2501**	**48**	**V2601**	**32**
2	**V2504**	**16**	**V2603**	**16**
3				
4				
5				
6				
7				



Since the rest of the logic is identical to Example 1, we will now show the completed setup program.

Completed Setup Program for DL250/DL350 as Remote Master using V memory type



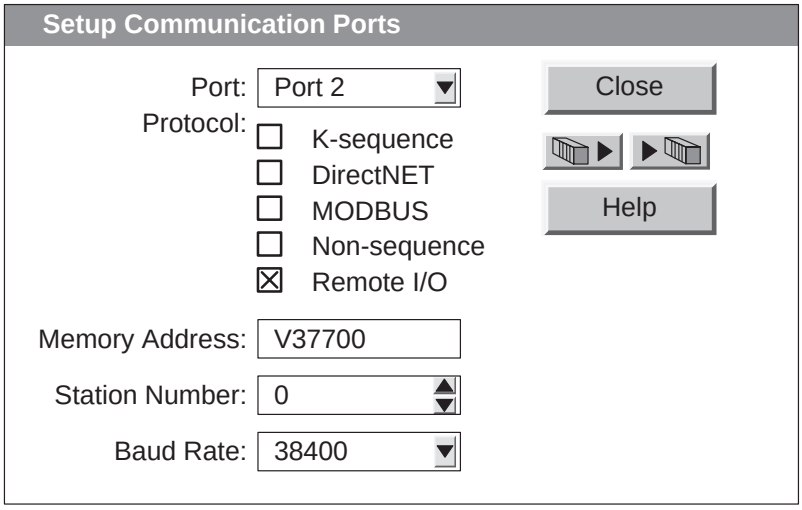
DL250/DL350 Reserved Memory Table

Port Setup Word				V7656
Setup Complete Flag				C740
Slave	Input Address	Number of Input Pts	Output Address	Number of Output Pts
1	V37704	V37705	V37706	V37707
2	V37710	V37711	V37712	V37713
3	V37714	V37715	V37716	V37717
4	V37720	V37721	V37722	V37723
5	V37724	V37725	V37726	V37727
6	V37730	V37731	V37732	V37733
7	V37734	V37735	V37736	V37737

Configuring the bottom port of the DL250 or DL350 CPU

To configure the port using the Handheld Programmer, use AUX 56 and follow the prompts, making the same choices as indicated below on this page. To configure the port in ***Direct***SOFT, choose the PLC menu, then Setup, then Setup Secondary Comm Port...

- **Port:** From the port number list box at the top, choose “Port 2”.
- **Protocol:** Click the check box to the left of “Remote I/O” (called “M–NET” on the HPP), and then you’ll see the dialog box shown below.



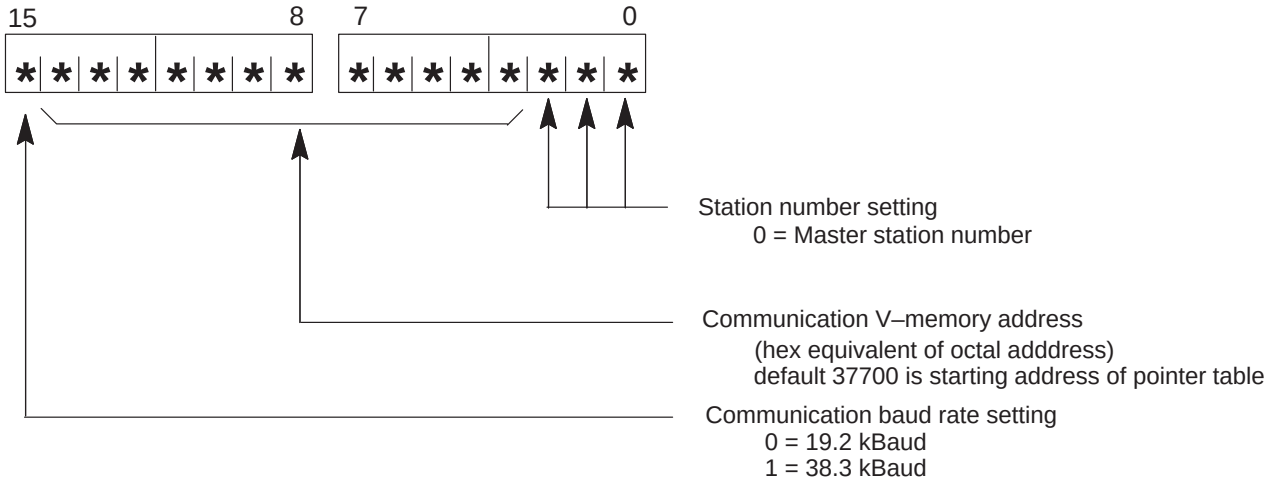
- **Memory Address:** Choose a V-memory address to use as the starting location of a Remote I/O configuration table (V37700 is the default). This table is separate and independent from the table for any Remote Master(s) in the system.
- **Station Number:** Choose “0” as the station number, which makes the DL250 or DL350 the master. Station numbers 1–7 are reserved for remote slaves.
- **Baud Rate:** The baud rates 19200 and 38400 baud are available. Choose 38400 initially as the remote I/O baud rate, and revert to 19200 baud if you experience data errors or noise problems on the link. Important: You must configure the baud rate on the Remote Slaves (via DIP switches) to match the baud rate selection for the CPU’s Port 2.

Then click the button indicated to send the Port 2 configuration to the CPU, and click Close.

DL250/DL350 Reserved Memory for 2nd Port as Remote Master

When you configure the bottom port of the DL250 or DL350 CPU via ***Direct***Soft or the Handheld Programmer, you are actually loading a reserved V-memory adddress (V7656) with configuration data. The following chart defines the meaning of the bits in this register. The examples include logic in the setup program to set these parameters so they are not lost or accidentally changed.

Remote I/O Communication (V7656)



This table provides a listing of the reserved memory addresses in the DL250 or DL350 CPU to program the pointer addresses and ranges for slaves attached to the bottom port of the CPU.

DL250/DL350 Reserved Memory Table

Port Setup Word				V7656
Setup Complete Flag				C740
Slave	Input Address	Number of Input Points	Output Address	Number of Output Points
Reserved	V37700	V37701	V37702	V37703
1	V37704	V37705	V37706	V37707
2	V37710	V37711	V37712	V37713
3	V37714	V37715	V37716	V37717
4	V37720	V37721	V37722	V37723
5	V37724	V37725	V37726	V37727
6	V37730	V37731	V37732	V37733
7	V37734	V37735	V37736	V37737

This table provides a listing of the control relay flags available for the setup and monitoring of remote I/O attached to the bottom port of the DL250 or DL350 CPU.

FLAG ADDRESS	FUNCTION	DETAIL
C740	Setup Complete Flag	Set ON to command CPU to read and check parameters loaded into setup memory
C741	Communications Error Response Flag	This flag determines the CPU's response if there is a communications error. Set ON to hold last state of received inputs; set OFF to clear the status of the received inputs.