3

D2–RMSM Setup Programming and Troubleshooting

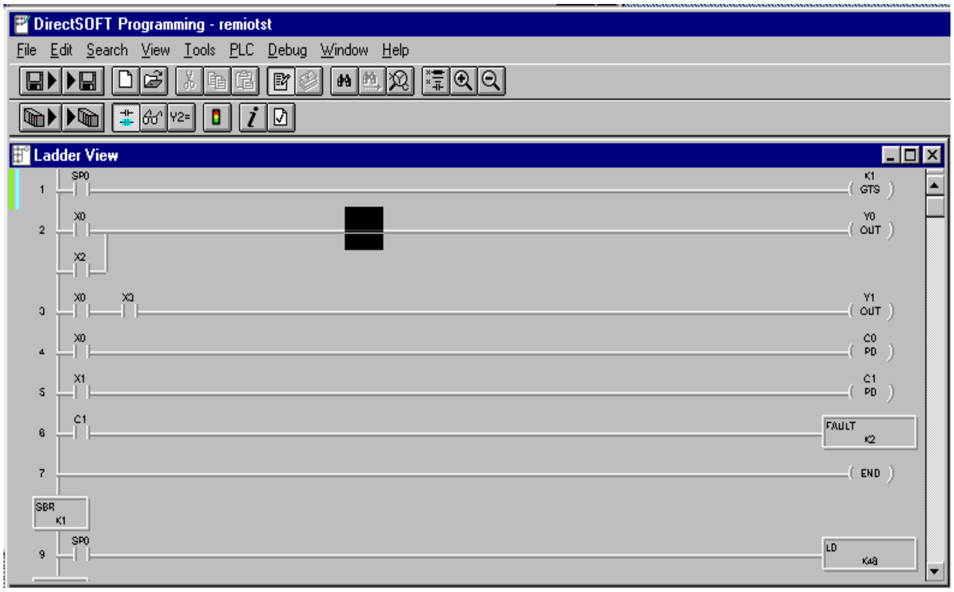
In This Chapter. . . .

Getting Started with the Programming

You can write your program using either a handheld programmer or a PC loaded with software such as ***Direct***SOFT. The examples that follow will show you how to do it using ***Direct***SOFT.

To get started, enter ***Direct***SOFT and carry out the normal ***Direct***SOFT setup procedures for communicating with your DL205 CPU. If you do not know how to do this, refer to your ***Direct***SOFT Manual. Your DL205 User's Manual has a 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.

First open ***Direct***SOFT from Windows and establish a link with your CPU. Then enter the Edit Mode for programming. You should now be looking at a screen similar to the one shown below:



The ***Direct***SOFT window shown above depicts a program that has already been written. Your window, of course, will be empty when you first enter it. The pages that follow will show you how to write each part of your initialization program.

Writing the Remote I/O Setup

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

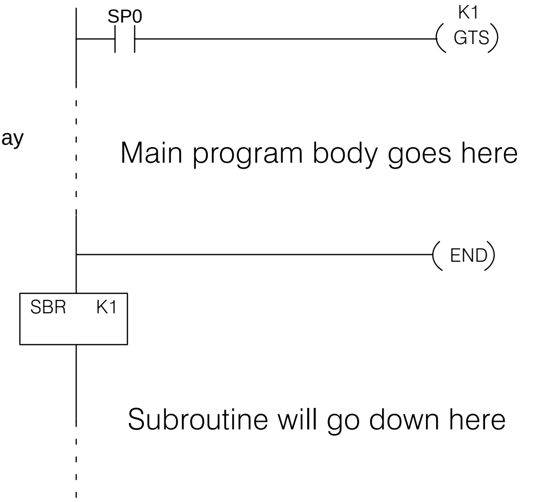
Is your setup logic going to be in the main program body or is it going to be in a subroutine?

A subroutine for your 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. Here's how:

Using the GTS Command for the Setup Logic

Note: SP0 is a special relay contact which energizes only on the first scan of the program

***Direct*SOFT Display**



Step 2: Write the Setup Logic for Each Channel

Whether you choose to write the remote I/O setup program as a subroutine or as a part of the main program, the procedure is still the same. You have several things you must do for each channel of remote I/O:

- Tell the remote master to initiate setup, and define the auto return to network option.
- Tell the remote master the starting V-memory address for inputs and outputs, and the total number of each for the channel. You do this with address *pointers* and constant data.
- Tell the remote master how many input and output points are located in each base.
- Tell the remote master to save the parameters in EEPROM (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 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.

LD
A aaa

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.

LDA
O aaa

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).

OUT
A aaa

The WT instruction writes a block of data (1–128 bytes max.) to an intelligent I/O module from a block of V-memory in the CPU. The function parameters (module base/slot address, number of bytes, and the intelligent I/O module memory address) are loaded into the first and second level of the accumulator stack, and the accumulator by three additional instructions. In the WT instruction, Aaaa specifies the starting V-memory address where the data will be written from in the CPU.

WT
A aaa

You use these instructions to set up the configuration data in a block of V-memory which serves as a buffer. Use WT instructions to store the data to various shared memory locations in the Remote Master module. Use your worksheets to assist you in creating the setup logic.

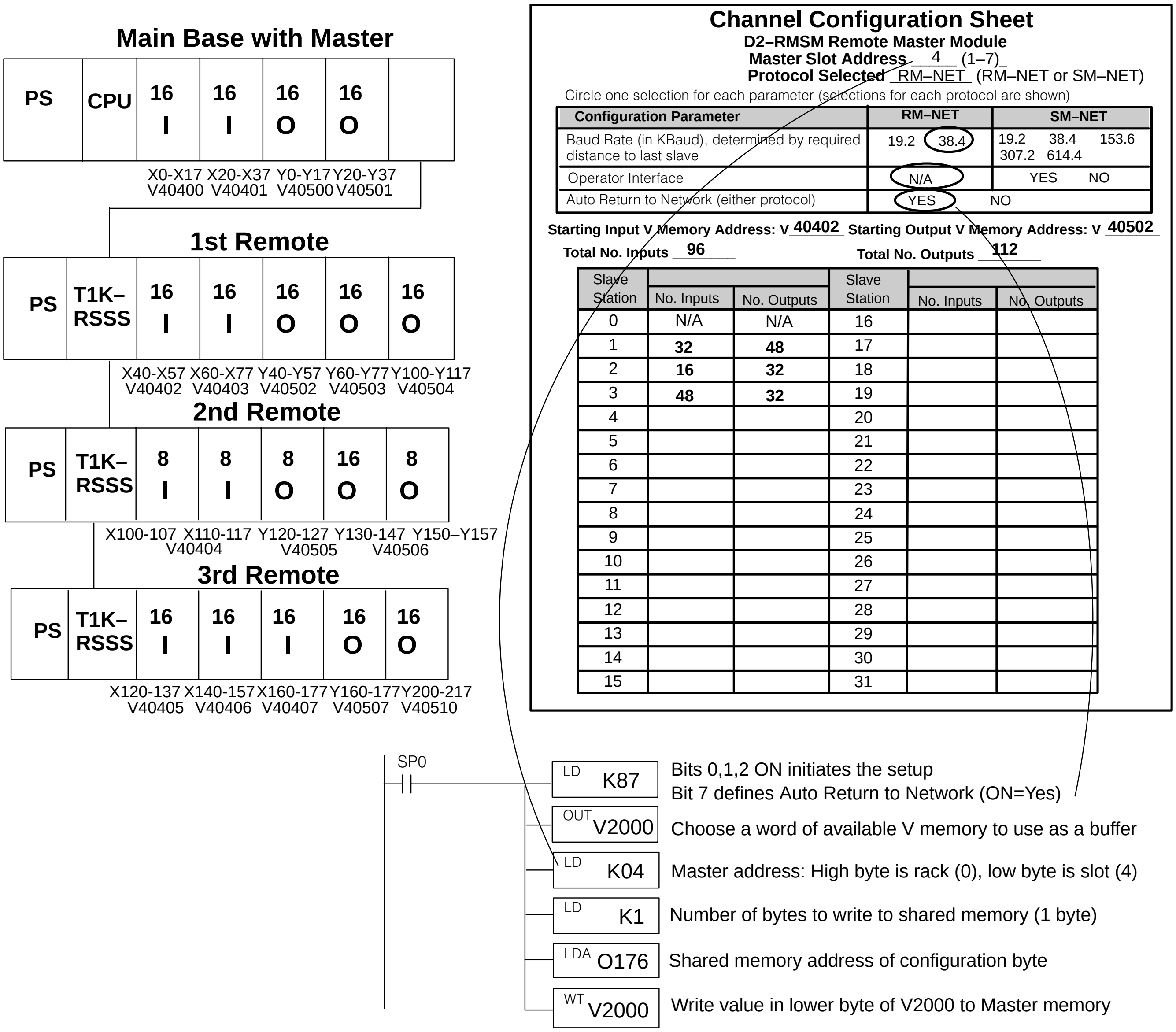
Example Program Using Discrete I/O Modules

Example 1: Addressing using X and Y Memory

To illustrate the setup program for a system using X's as remote inputs and Y's as remote outputs, we will use the example system from Chapter 2, shown here with a completed Channel Configuration Worksheet.

The first block of logic tells the remote master to initiate the setup, and to enable the Auto Return to Network option. To find the D2–RMSM shared memory addresses used in the setup program, refer to the Shared Memory Table at the end of this chapter.

Write Configuration Byte



Channel Configuration Sheet

D2–RMSM Remote Master Module

Master Slot Address 4 (1–7)

Protocol Selected RM–NET (RM–NET or SM–NET)

Circle one selection for each parameter (selections for each protocol are shown)

Configuration Parameter	RM–NET	SM–NET
Baud Rate (in KBaud), determined by required distance to last slave	19.2 [✓ 38.4]	19.2 38.4 153.6 307.2 614.4
Operator Interface	[✓ N/A]	YES NO
Auto Return to Network (either protocol)	[✓ YES] NO	

Starting Input V Memory Address: V 40402 **Starting Output V Memory Address:** V 40502

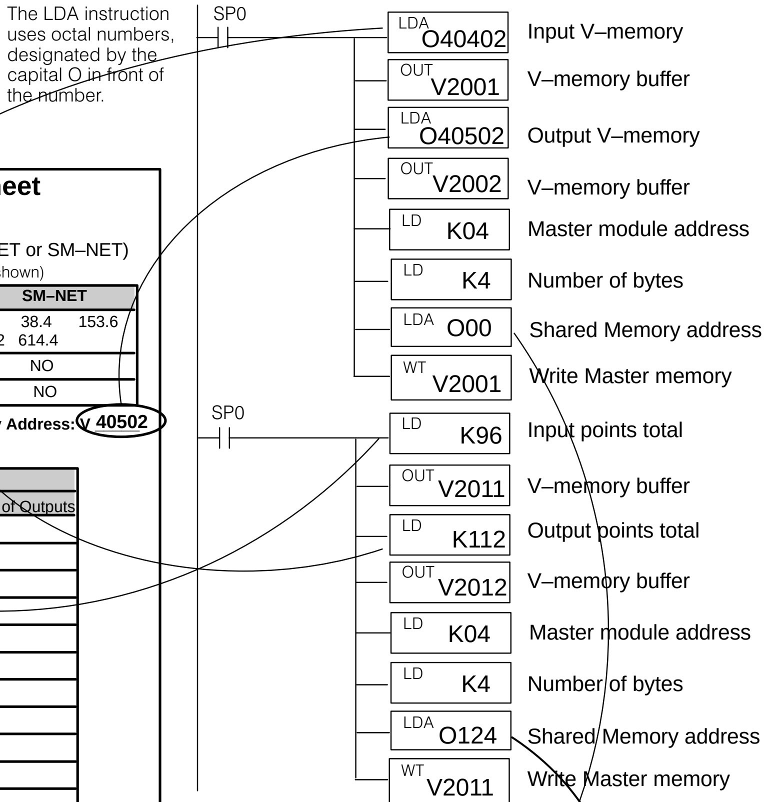
Total No. Inputs 96 **Total No. Outputs** 112

Slave Station	No. Inputs	No. Outputs	Slave Station	No. Inputs	No. Outputs
0	N/A	N/A	16		
1	32	48	17		
2	16	32	18		
3	48	32	19		
4			20		
5			21		
6			22		
7			23		
8			24		
9			25		
10			26		
11			27		
12			28		
13			29		
14			30		
15			31		

LD K87	Bits 0,1,2 ON initiates the setup Bit 7 defines Auto Return to Network (ON=Yes)
OUT V2000	Choose a word of available V memory to use as a buffer
LD K04	Master address: High byte is rack (0), low byte is slot (4)
LD K1	Number of bytes to write to shared memory (1 byte)
LDA O176	Shared memory address of configuration byte
WT V2000	Write value in lower byte of V2000 to Master memory

This block of logic tells the remote master the starting V-memory addresses for the inputs and outputs, and the total number of each for the channel. Use the LD, LDA, and OUT commands to load the starting addresses and point totals into temporary memory, then write the values to the master's shared memory. The Quick Reference Table shows the correct shared memory addresses in octal.

Write Input and Output Pointers, and Input and Output Ranges for Channel



The LDA instruction uses octal numbers, designated by the capital O in front of the number.

Channel Configuration Worksheet

D2–RMSM Remote Master Module

Master Slot Address 4 (1–7)

Protocol Selected RM–NET (RM–NET or SM–NET)

Circle one selection for each parameter (selections for each protocol are shown)

Configuration Parameter	RM–NET	SM–NET
Baud Rate (in KBaud), determined by required distance to last slave	19.2 [✓ 38.4]	19.2 38.4 153.6 307.2 614.4
Operator Interface	[✓ N/A]	YES NO
Auto Return to Network (either protocol)	[✓ YES] NO	YES NO

Starting Input V Memory Address: V 40402 **Starting Output V Memory Address:** V 40502

Total Inputs 96 **Total Outputs** 112

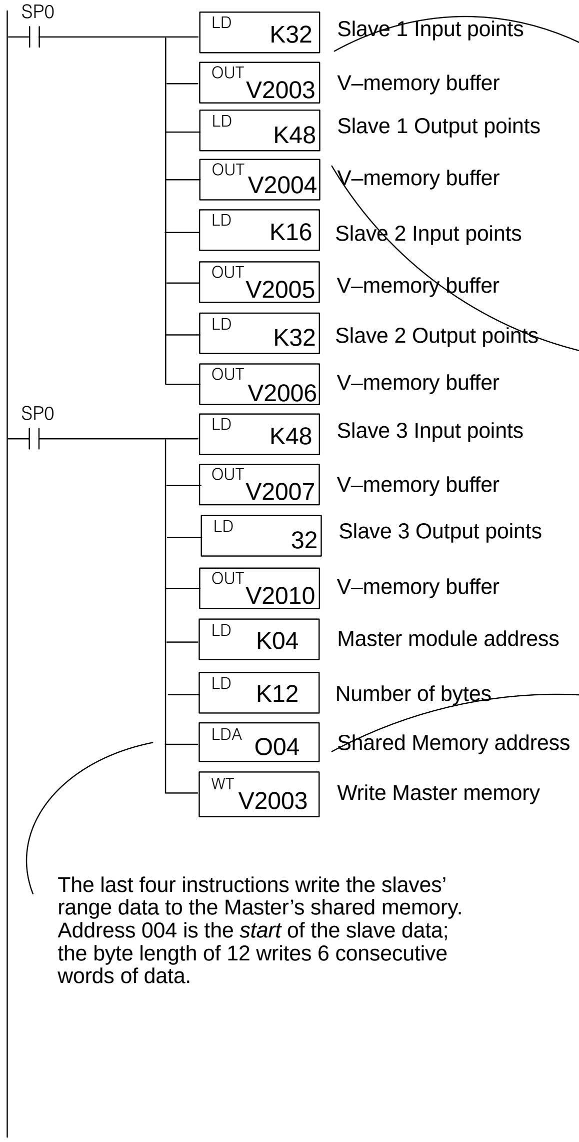
Slave Station	No. of Inputs	No. of Outputs	Slave Station	No. of Inputs	No. of Outputs
0	N/A	N/A	16		
1	**32**	**48**	17		
2	**16**	**32**	18		
3	**48**	**32**	19		
4			20		
5			21		
6			22		
7			23		
8			24		
9			25		
10			26		
11			27		
12			28		
13			29		
14			30		
15			31		

Quick Reference Table of Shared Memory Addresses

D2–RMSM				
Setup Initiation Byte				176
Setup Complete Byte				177
Slave	Input Address	Output Address	Number of Input Pts	Number of Output Pts
ALL	000	002	124	126
1	N/A	N/A	004	006
2	N/A	N/A	010	012
3	N/A	N/A	014	016
4	N/A	N/A	020	022
5	N/A	N/A	024	026
6	N/A	N/A	030	032
7	N/A	N/A	034	036

This block of logic tells the remote master how many input and output points are located in each base. Each group of four instructions loads the I/O ranges for a slave into temporary memory, the values for which are retrieved from the Remote Slave Worksheets. The WT instruction stores the entire buffer area to the master's shared memory. The Quick Reference Table shows the correct shared memory addresses in octal.

Write Input and Output Ranges for each Slave



The last four instructions write the slaves' range data to the Master's shared memory. Address 004 is the *start* of the slave data; the byte length of 12 writes 6 consecutive words of data.

Channel Configuration Worksheet

D2–RMSM Remote Master Module
Master Slot Address __4__ (1–7)_
Protocol Selected _RM–NET_ (RM–NET or SM–NET)

Circle one selection for each parameter (selections for each protocol are shown)

Configuration Parameter	RM–NET	SM–NET
Baud Rate (in KBaud), determined by required distance to last slave	19.2 [✓ 38.4]	19.2 38.4 153.6 307.2 614.4
Operator Interface	[✓ N/A]	YES NO
Auto Return to Network (either protocol)	[✓ YES] NO	YES NO

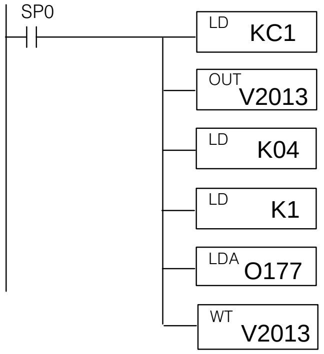
Starting Input V Memory Address: V40402 **Starting Output V Memory Address:** V 40502
Total Inputs 96 **Total Outputs** 112

Slave Station	No. of Inputs	No. of Outputs	Slave Station	No. of Inputs	No. of Outputs
0	N/A	N/A	16		
1	**32**	**48**	17		
2	**16**	**32**	18		
3	**48**	**32**	19		
4			20		
5			21		
6			22		
7			23		
8			24		
9			25		
10			26		
11			27		
12			28		
13			29		
14			30		
15			31		

Quick Reference Table of Shared Memory Addresses

D2–RMSM				
Configuration Byte				176
Setup Complete Byte				177
Slave	Input Address	Output Address	Number of Input Pts	Number of Output Pts
ALL	000	002	124	126
1	N/A	N/A	004	006
2	N/A	N/A	010	012
3	N/A	N/A	014	016
4	N/A	N/A	020	022
5	N/A	N/A	024	026
6	N/A	N/A	030	032
7	N/A	N/A	034	036

Write Setup Complete (store channel parameters to EEPROM)



Constant that commands master to store parameters to EEPROM

V memory buffer

Master module address

Number of bytes

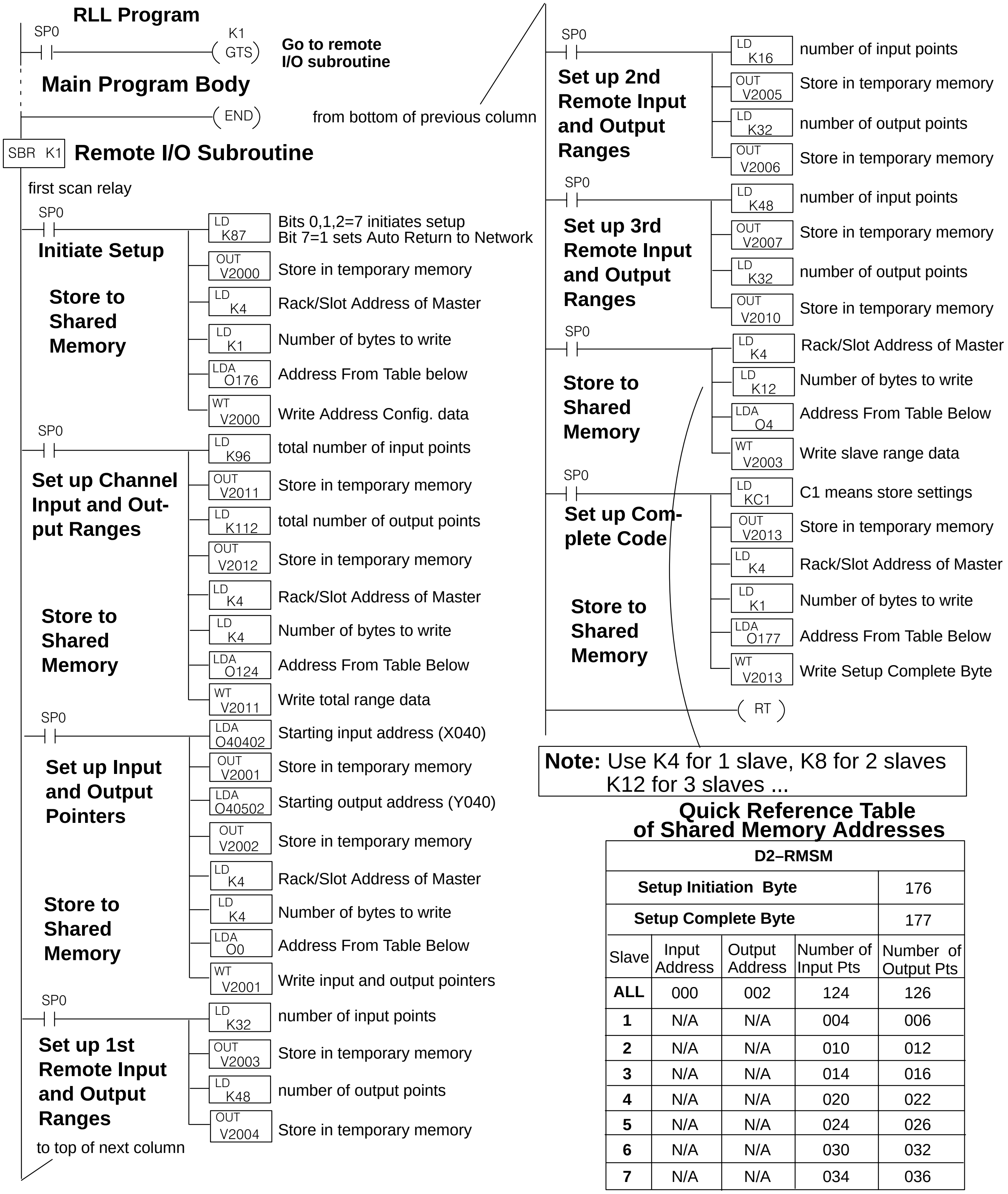
Shared Memory address of Setup Complete Byte

Write Master memory

We can now complete the setup program.This last block of logic tells the remote master to save the parameters in EEPROM (setup is complete). The setup complete logic structure is the same for any channel using a D2–RMSM as a master.

The completed setup program for this example is shown on the next page.

Completed Setup Program for X and Y Addressing



Note: Use K4 for 1 slave, K8 for 2 slaves K12 for 3 slaves ...

Quick Reference Table of Shared Memory Addresses

D2–RMSM				
Setup Initiation Byte				176
Setup Complete Byte				177
Slave	Input Address	Output Address	Number of Input Pts	Number of Output Pts
ALL	000	002	124	126
1	N/A	N/A	004	006
2	N/A	N/A	010	012
3	N/A	N/A	014	016
4	N/A	N/A	020	022
5	N/A	N/A	024	026
6	N/A	N/A	030	032
7	N/A	N/A	034	036

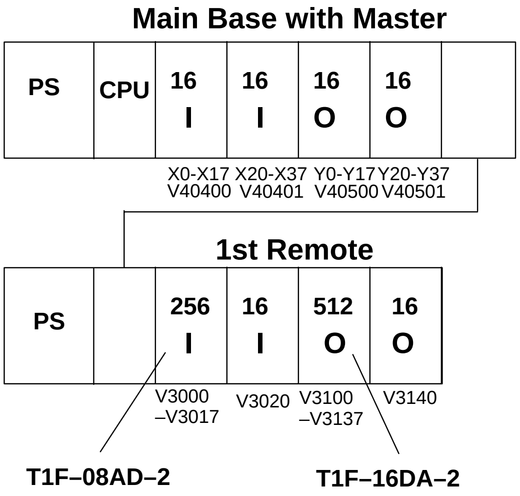
Example Program Using Analog I/O Modules

Example 2: Addressing using V–Memory

The following example uses Terminator I/O discrete and analog I/O modules. **It is recommended to use V memory addressing when using analog modules since each analog I/O channel uses a double (two) word each.** Thus, an 8 channel analog I/O module uses 256 discrete points and a 16 channel analog I/O module uses 512 discrete points. **Analog output modules are configured using the Module Control Byte** located in the most significant byte of the most significant word of channel 1 of the module. **V memory addressing requires the use of "Bit–of–Word" (DL250 only) instructions to address the I/O points.**

The first block of logic tells the remote master to initiate the setup, and to enable the Auto Return to Network option. To find the D2–RMSM shared memory addresses used in the setup program, refer to the Shared Memory Table at the end of this chapter.

Write Configuration Byte



Use Bit–of–Word instructions to address the I/O points when mapping the remote I/O to V memory.

Channel Configuration Sheet

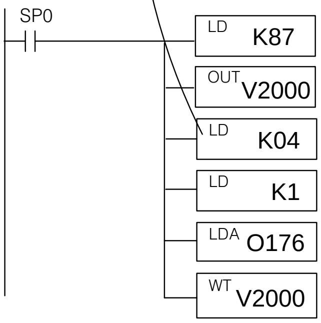
D2–RMSM Remote Master Module
Master Slot Address 4 (1–7)
Protocol Selected RM–NET (RM–NET or SM–NET)

Circle one selection for each parameter (selections for each protocol are shown)

Configuration Parameter	RM–NET	SM–NET
Baud Rate (in KBaud), determined by required distance to last slave	19.2 [✓ 38.4]	19.2 38.4 153.6 307.2 614.4
Operator Interface	[✓ N/A]	YES NO
Auto Return to Network (either protocol)	[✓ YES] NO	

Starting Input V Memory Address: V 3000
Starting Output V Memory Address: V v3100
Total No. Inputs 272
Total No. Outputs 528

Slave Station	No. Inputs	No. Outputs	Slave Station	No. Inputs	No. Outputs
0	N/A	N/A	16		
1	**272**	**528**	17		
2			18		
3			19		
4			20		
5			21		
6			22		
7			23		
8			24		
9			25		
10			26		
11			27		
12			28		
13			29		
14			30		
15			31		



LD K87 — Bits 0,1,2 ON initiates the setup
Bit 7 defines Auto Return to Network (ON=Yes)

OUT V2000 — Choose a word of available V memory to use as a buffer

LD K04 — Master address: High byte is rack (0), low byte is slot (4)

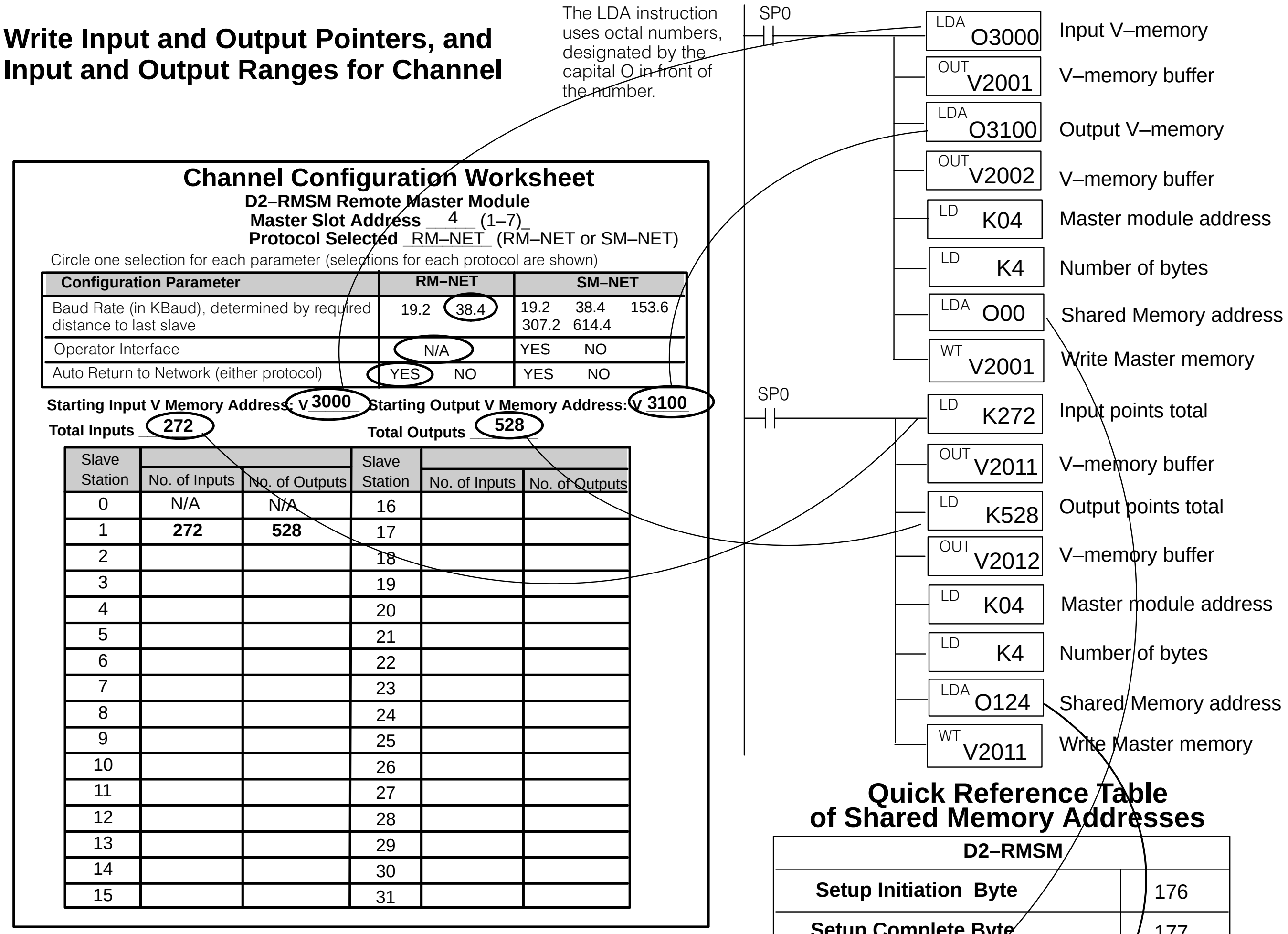
LD K1 — Number of bytes to write to shared memory (1 byte)

LDA O176 — Shared memory address of configuration byte

WT V2000 — Write value in lower byte of V2000 to Master memory

This block of logic tells the remote master the starting V-memory addresses for the inputs and outputs, and the total number of each for the channel. Use the LD, LDA, and OUT commands to load the starting addresses and point totals into temporary memory, then write the values to the master's shared memory. The Quick Reference Table shows the correct shared memory addresses in octal.

Write Input and Output Pointers, and Input and Output Ranges for Channel



The LDA instruction uses octal numbers, designated by the capital O in front of the number.

```
SP0
LDA  O3000   Input V–memory
OUT  V2001   V–memory buffer
LDA  O3100   Output V–memory
OUT  V2002   V–memory buffer
LD   K04     Master module address
LD   K4      Number of bytes
LDA  O00     Shared Memory address
WT   V2001   Write Master memory
SP0
LD   K272    Input points total
OUT  V2011   V–memory buffer
LD   K528    Output points total
OUT  V2012   V–memory buffer
LD   K04     Master module address
LD   K4      Number of bytes
LDA  O124    Shared Memory address
WT   V2011   Write Master memory
```

Channel Configuration Worksheet

D2–RMSM Remote Master Module

Master Slot Address 4 (1–7)

Protocol Selected RM–NET (RM–NET or SM–NET)

Circle one selection for each parameter (selections for each protocol are shown)

Configuration Parameter	RM–NET	SM–NET
Baud Rate (in KBaud), determined by required distance to last slave	19.2 [✓ 38.4]	19.2 38.4 153.6 307.2 614.4
Operator Interface	[✓ N/A]	YES NO
Auto Return to Network (either protocol)	[✓ YES] NO	YES NO

Starting Input V Memory Address: V 3000 **Starting Output V Memory Address:** V 3100

Total Inputs 272 **Total Outputs** 528

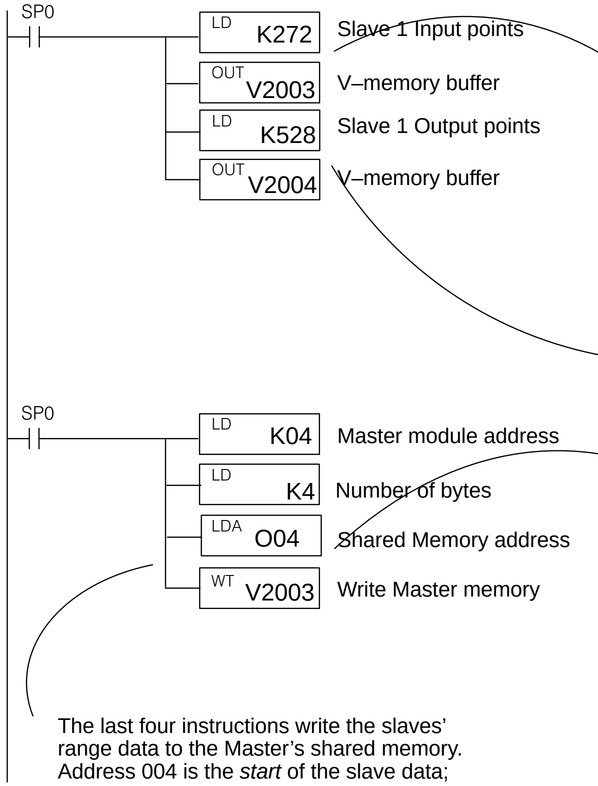
Slave Station	No. of Inputs	No. of Outputs	Slave Station	No. of Inputs	No. of Outputs
0	N/A	N/A	16		
1	**272**	**528**	17		
2			18		
3			19		
4			20		
5			21		
6			22		
7			23		
8			24		
9			25		
10			26		
11			27		
12			28		
13			29		
14			30		
15			31		

Quick Reference Table of Shared Memory Addresses

D2–RMSM				
Setup Initiation Byte				176
Setup Complete Byte				177
Slave	Input Address	Output Address	Number of Input Pts	Number of Output Pts
ALL	000	002	124	126
1	N/A	N/A	004	006
2	N/A	N/A	010	012
3	N/A	N/A	014	016
4	N/A	N/A	020	022
5	N/A	N/A	024	026
6	N/A	N/A	030	032
7	N/A	N/A	034	036

This block of logic tells the remote master how many input and output points are located in each base. Each group of four instructions loads the I/O ranges for a slave into temporary memory, the values for which are retrieved from the Remote Slave Worksheets. The WT instruction stores the entire buffer area to the master's shared memory. The Quick Reference Table shows the correct shared memory addresses in octal.

Write Input and Output Ranges for each Slave



The last four instructions write the slaves' range data to the Master's shared memory. Address 004 is the *start* of the slave data; the byte length of 4 writes 2 consecutive words of data.

Channel Configuration Worksheet

D2–RMSM Remote Master Module
Master Slot Address 4 (1–7)
Protocol Selected RM–NET (RM–NET or SM–NET)

Circle one selection for each parameter (selections for each protocol are shown)

Configuration Parameter	**RM–NET**	**SM–NET**
Baud Rate (in KBaud), determined by required distance to last slave	19.2 [✓ 38.4]	19.2 38.4 153.6 307.2 614.4
Operator Interface	[✓ N/A]	YES NO
Auto Return to Network (either protocol)	[✓ YES] NO	YES NO

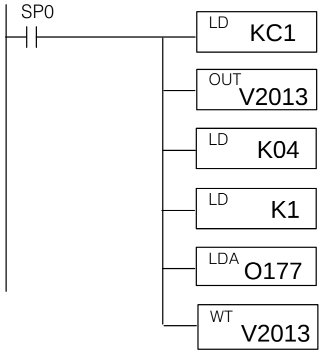
Starting Input V Memory Address: V 3000 **Starting Output V Memory Address: V** 3100
Total Inputs 272 **Total Outputs** 528

Slave Station	No. of Inputs	No. of Outputs	Slave Station	No. of Inputs	No. of Outputs
0	N/A	N/A	16		
1	272	528	17		
2			18		
3			19		
4			20		
5			21		
6			22		
7			23		
8			24		
9			25		
10			26		
11			27		
12			28		
13			29		
14			30		
15			31		

Quick Reference Table of Shared Memory Addresses

D2–RMSM				
Configuration Byte				176
Setup Complete Byte				177
Slave	Input Address	Output Address	Number of Input Pts	Number of Output Pts
ALL	000	002	124	126
1	N/A	N/A	004	006
2	N/A	N/A	010	012
3	N/A	N/A	014	016
4	N/A	N/A	020	022
5	N/A	N/A	024	026
6	N/A	N/A	030	032
7	N/A	N/A	034	036

Write Setup Complete (store channel parameters to EEPROM)



Constant that commands master to store parameters to EEPROM

V memory buffer

Master module address

Number of bytes

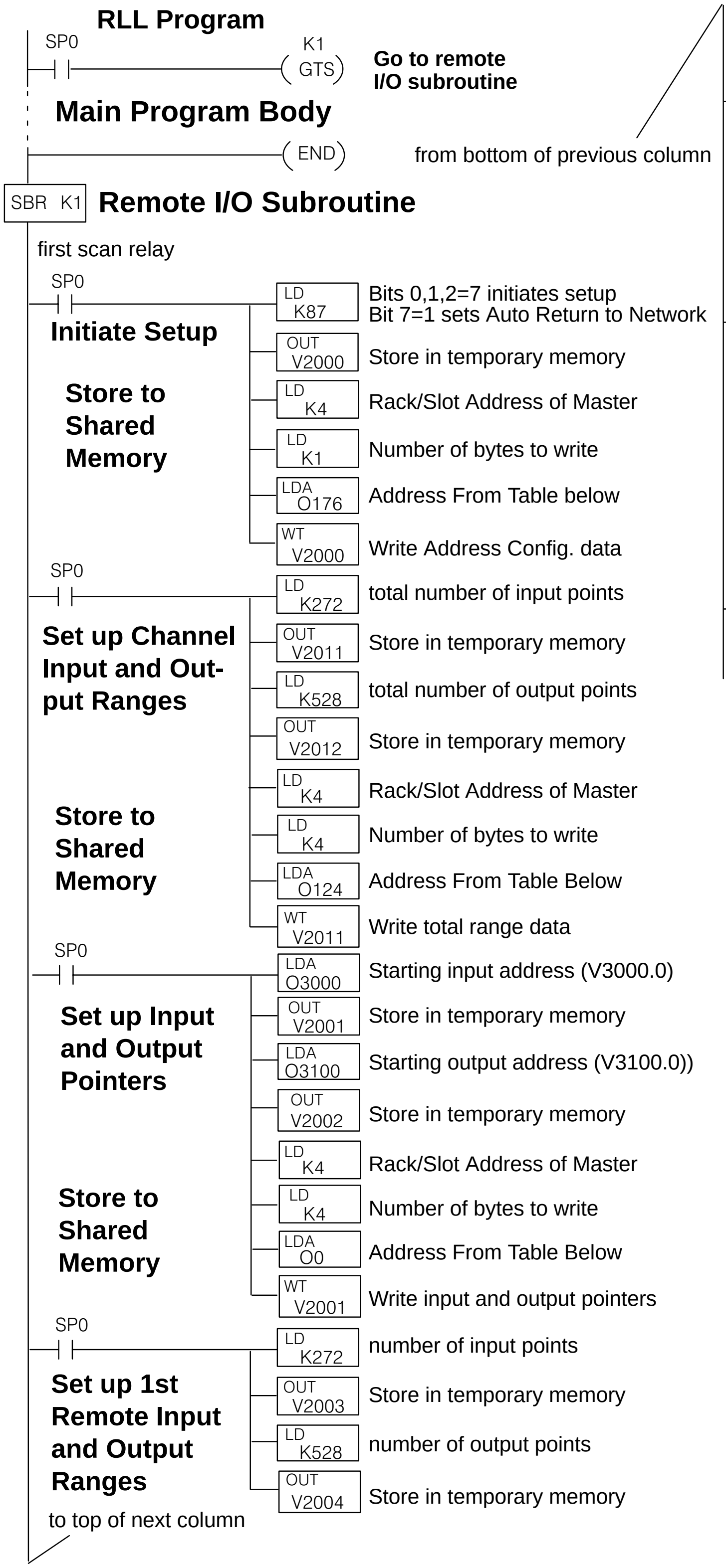
Shared Memory address of Setup Complete Byte

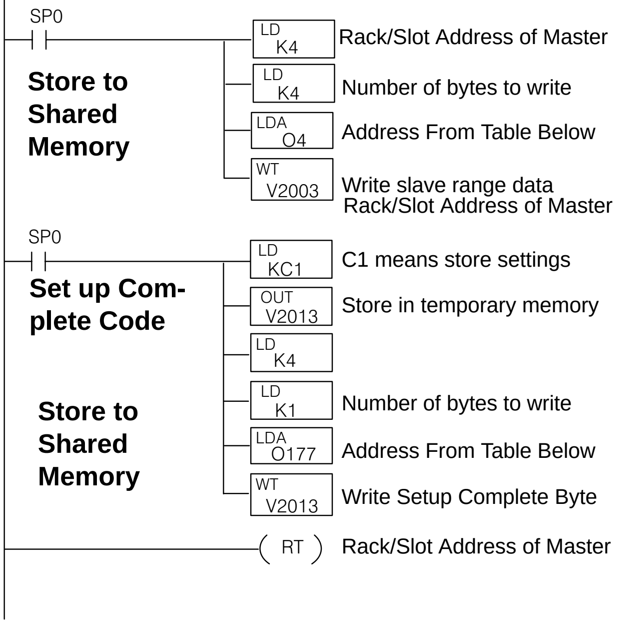
Write Master memory

We can now complete the setup program.This last block of logic tells the remote master to save the parameters in EEPROM (setup is complete). The setup complete logic structure is the same for any channel using a D2–RMSM as a master.

The completed setup program for this example is shown on the next page.

Completed Setup Program for V–Memory Addressing





Analog Programming example continued on next page

Quick Reference Table of Shared Memory Addresses

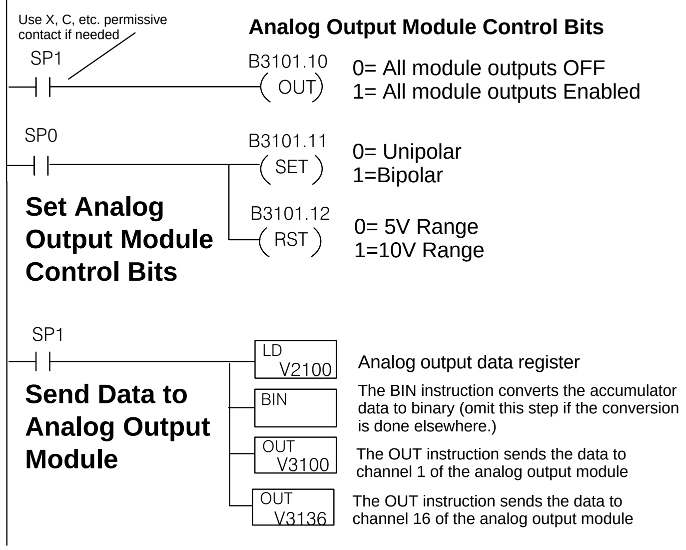
D2–RMSM				
Setup Initiation Byte				176
Setup Complete Byte				177
Slave	Input Address	Output Address	Number of Input Pts	Number of Output Pts
ALL	000	002	124	126
1	N/A	N/A	004	006
2	N/A	N/A	010	012
3	N/A	N/A	014	016
4	N/A	N/A	020	022
5	N/A	N/A	024	026
6	N/A	N/A	030	032
7	N/A	N/A	034	036

Completed Setup Program for V–Memory Addressing (con’t)

Main Program Body

Configure T1F–16DA–2 Analog Output Module:

– Bipolar
– 0–5VDC



Analog Output Module Control Bits

0= All module outputs OFF
1= All module outputs Enabled

0= Unipolar
1=Bipolar

0= 5V Range
1=10V Range

Set Analog Output Module Control Bits

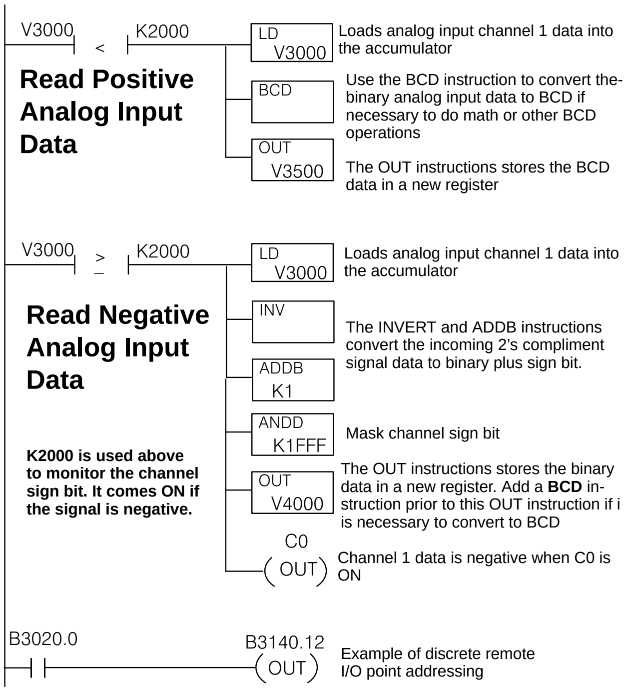
Send Data to Analog Output Module

Analog output data register

The BIN instruction converts the accumulator data to binary (omit this step if the conversion is done elsewhere.)

The OUT instruction sends the data to channel 1 of the analog output module

The OUT instruction sends the data to channel 16 of the analog output module



Read Positive Analog Input Data

Loads analog input channel 1 data into the accumulator

Use the BCD instruction to convert the-binary analog input data to BCD if necessary to do math or other BCD operations

The OUT instructions stores the BCD data in a new register

Read Negative Analog Input Data

Loads analog input channel 1 data into the accumulator

The INVERT and ADDB instructions convert the incoming 2’s compliment signal data to binary plus sign bit.

Mask channel sign bit

The OUT instructions stores the binary data in a new register. Add a **BCD** instruction prior to this OUT instruction if i is necessary to convert to BCD

Channel 1 data is negative when C0 is ON

K2000 is used above to monitor the channel sign bit. It comes ON if the signal is negative.

Example of discrete remote I/O point addressing

The Control Bits of an Analog Output module are located in the most significant byte of the most significant word of the first output channel (channel 1).

Channel 1 Memory Map
of 8&16-Channel Analog Output Module
(T1F–08DA, T1F–016DA)

Decimal Bit	07	06	05	04	03	02	01	00	Size
Octal Bit	07	06	05	04	03	02	01	00	
	Analog Value Channel 1								Write Byte 1
	Analog Value Channel 1								Write Byte 2
	not used								Write Byte 3
	Module Control Byte								Write Byte 4

Module Control Byte of 8&16-Channel Analog Output Module
(T1F–08DA, T1F–16DA)

Decimal Bit	31	30	29	28	27	26	25	24	Read/Write
Octal Bit	37	36	35	34	33	32	31	30	
Bit 24	**Outputs Enable** 0 = All outputs OFF 1 = All outputs Enabled								Write
Bit 25	**Unipolar / Bipolar** 0 = Unipolar selected 1 = Bipolar selected								Write
Bit 26	**5V / 10V Range** 0 = 5V range 1 = 10V range								Write
Bit 27	**0 – 20mA / 4–20mA Range** 0 = 0 – 20mA range 1 = 4 – 20mA range								Write
Bit 28 – 31	Reserved for system use								–

Changing Configurations

If you have stored a configuration to the D2–RMSM via the setup program and need to change it, follow these guidelines to ensure the module accepts the new configuration:

1. Change the constants in the setup program that are affected by the new system configuration. For example, if you add an I/O module to a remote slave unit, you must change the input or output range for that slave, as well as the range total for the channel. If the new range totals do not match the sum of the individual slave ranges, the D2–RMSM *will not* accept the new configuration. It will retain the old configuration, and give you an I/O error.
2. If you are removing a slave from the channel, you must change the logic of the setup program to clear that slave's range data in the D2–RMSM shared memory. Otherwise it will still see the old data from the previous configuration. For example, if you remove the third slave from our example system, you would load a constant of zero into the slave's input and output range data, located at buffer memory addresses V2007 and V2010. If removing I/O, remember to reduce the total I/O range values also.
3. After you have modified the setup program, cycle CPU power, or transition from the STOP to RUN mode to execute the new setup logic. This is necessary if the setup logic executes on the first CPU scan.
4. **If you get an error after making the appropriate set up program changes, it may be necessary to clear the shared memory in the remote master module**. To clear the shared memory in the master module, you will need to:
   1) Remove CPU base power and remove the remote master module from the base.
   2) Turn on Dip switch 8 on the master module and return it to the base.
   3) Apply power to the CPU base noting that the master module LEDs cycle through and then all come ON.
   4) Remove CPU base power and remove the remote master module from the base.
   5) Turn off Dip switch 8 on the master module and return it to the base.
   6) Apply power to the CPU base and check for proper remote I/O operation.

Shared Memory Table for D2–RMSM Remote Master

OCTAL ADDRESS	FUNCTION (Slaves 1–15)	FUNCTION (Slaves 16–31)	# Bytes
For memory addresses 000 to 077, the user's setup program must store the correct values into these locations.			
000	Starting V–memory address for inputs on the channel (in octal)	Number of input points for Slave 16	2
002	Starting V–memory address for outputs on the channel (in octal)	Number of output points for Slave 16	2
004	Number of input points for Slave 1	Number of input points for Slave 17	2
006	Number of output points for Slave 1	Number of output points for Slave 17	2
010	Number of input points for Slave 2	Number of input points for Slave 18	2
012	Number of output points for Slave 2	Number of output points for Slave 18	2
014	Number of input points for Slave 3	Number of input points for Slave 19	2
016	Number of output points for Slave 3	Number of output points for Slave 19	2
020	Number of input points for Slave 4	Number of input points for Slave 20	2
022	Number of output points for Slave 4	Number of output points for Slave 20	2
024	Number of input points for Slave 5	Number of input points for Slave 21	2
026	Number of output points for Slave 5	Number of output points for Slave 21	2
030	Number of input points for Slave 6	Number of input points for Slave 22	2
032	Number of output points for Slave 6	Number of output points for Slave 22	2
034	Number of input points for Slave 7	Number of input points for Slave 23	2
036	Number of output points for Slave 7	Number of output points for Slave 23	2
040	Number of input points for Slave 8	Number of input points for Slave 24	2
042	Number of output points for Slave 8	Number of output points for Slave 24	2
044	Number of input points for Slave 9	Number of input points for Slave 25	2
046	Number of output points for Slave 9	Number of output points for Slave 25	2
050	Number of input points for Slave 10	Number of input points for Slave 26	2
052	Number of output points for Slave 10	Number of output points for Slave 26	2
054	Number of input points for Slave 11	Number of input points for Slave 27	2
056	Number of output points for Slave 11	Number of output points for Slave 27	2
060	Number of input points for Slave 12	Number of input points for Slave 28	2
062	Number of output points for Slave 12	Number of output points for Slave 28	2
064	Number of input points for Slave 13	Number of input points for Slave 29	2
066	Number of output points for Slave 13	Number of output points for Slave 29	2
070	Number of input points for Slave 14	Number of input points for Slave 30	2
072	Number of output points for Slave 14	Number of output points for Slave 30	2
074	Number of input points for Slave 15	Number of input points for Slave 31	2
076	Number of output points for Slave 15	Number of output points for Slave 31	2

OCTAL ADDRESS	FUNCTION	DETAIL	# Bytes
100 – 121	Reserved		18
122	Status of Rotary Switches on module – **Read Only**	Data is 00 to 1F hex, representing the address of the module set by the rotary switches.	1
123	Status of DIP Switches on module – **Read Only**	Bit status represents the setting of each switch on the module's DIP Switch , which sets configuration parameters. 0=OFF, 1=ON. Bit 0 SW1 status Bit 1 SW2 status Bit 2 SW3 status Bit 3 SW4 status Bit 4 SW5 status Bit 5 SW6 status Bit 6 SW7 status Bit 7 SW8 status	1
124	Number of input points committed to the entire channel	User's setup program stores the correct BCD value to this memory location.	2
126	Number of output points committed to the entire channel	User's setup program stores the correct BCD value to this memory location.	2

<table>
<tr><th>OCTAL ADDRESS</th><th>FUNCTION</th><th>DETAIL</th><th># Bytes</th></tr>
<tr><td>130 – 131</td><td>Communication stop mode selection (communication stops when any specified slave fails)</td><td>In communication stop mode, the master stops updating the entire channel when a communication error occurs with any specified slave station. To select this mode for each slave, turn ON the corresponding bit of the shared memory shown below.
<table>
<tr><th></th><th>Address 130</th><th>Address 131</th></tr>
<tr><td>Bit 0</td><td>Entire channel stops when any slave fails</td><td>Slave 16</td></tr>
<tr><td>Bit 1</td><td>Slave 1</td><td>Slave 17</td></tr>
<tr><td>Bit 2</td><td>Slave 2</td><td>Slave 18</td></tr>
<tr><td>Bit 3</td><td>Slave 3</td><td>Slave 19</td></tr>
<tr><td>Bit 4</td><td>Slave 4</td><td>Slave 20</td></tr>
<tr><td>Bit 5</td><td>Slave 5</td><td>Slave 21</td></tr>
<tr><td>Bit 6</td><td>Slave 6</td><td>Slave 22</td></tr>
<tr><td>Bit 7</td><td>Slave 7</td><td>Slave 23</td></tr>
<tr><td>Bit 8</td><td>Slave 8</td><td>Slave 24</td></tr>
<tr><td>Bit 9</td><td>Slave 9</td><td>Slave 25</td></tr>
<tr><td>Bit 10</td><td>Slave 10</td><td>Slave 26</td></tr>
<tr><td>Bit 11</td><td>Slave 11</td><td>Slave 27</td></tr>
<tr><td>Bit 12</td><td>Slave 12</td><td>Slave 28</td></tr>
<tr><td>Bit 13</td><td>Slave 13</td><td>Slave 29</td></tr>
<tr><td>Bit 14</td><td>Slave 14</td><td>Slave 30</td></tr>
<tr><td>Bit 15</td><td>Slave 15</td><td>Slave 31</td></tr>
</table></td><td>2</td></tr>
</table>

OCTAL ADDRESS	FUNCTION	DETAIL	# Bytes
132 – 133	Slave removal mode selection (communication stops to only the slave(s) with a communication error)	In slave removal mode, the master stops updating only the slave(s) with a communication error. It continues updating the I/O for the other slaves on the channel. To select this mode for each slave, turn ON the corresponding bit of the shared memory shown below. Address 132 Address 133 Bit 0 Not used Slave 16 Bit 1 Slave 1 Slave 17 Bit 2 Slave 2 Slave 18 Bit 3 Slave 3 Slave 19 Bit 4 Slave 4 Slave 20 Bit 5 Slave 5 Slave 21 Bit 6 Slave 6 Slave 22 Bit 7 Slave 7 Slave 23 Bit 8 Slave 8 Slave 24 Bit 9 Slave 9 Slave 25 Bit 10 Slave 10 Slave 26 Bit 11 Slave 11 Slave 27 Bit 12 Slave 12 Slave 28 Bit 13 Slave 13 Slave 29 Bit 14 Slave 14 Slave 30 Bit 15 Slave 15 Slave 31	2
134	Communication hold or resume mode	The program can cause the communications on a channel to stop by setting the first bit in this byte ON. After communication stops, only a mode transition of the CPU (from STOP to RUN) will restart the communications. The bit is not cleared automatically, so if using this mode, the user program should clear this byte on the first scan.	1
135 – 137	Reserved		3
140	Network Error Flags – **Read Only**	Bit status represents network errors detected by the D2–RMSM. 0=OK, 1=ERROR Bit 0 Configuration Error (see Address 142 for details) Bit 1 Communication Error (see Address 144 for details) Bit 2 Diagnostics Error (see Address 150 for details)	2

OCTAL ADDRESS	FUNCTION	DETAIL	# Bytes
142	Configuration Error Code – **Read Only**	Error code in BCD 20 Total inputs exceeds 512 21 Total outputs exceeds 512 24 I/O address out of I/O range 25 I/O address allocated to bad range 29 A slave has more than 512 points 70 Discrepancy between current configuration and old one 71 A module is in the wrong slot 72 Slave configuration is different from old one 73 Different slave is there	1
143	Station Number of Configuration Error – **Read Only**	Station number in BCD	1
144	Communication Error Code – **Read Only**	Error code in BCD 01 slave does not respond 02 wrong I/O information 03 I/O update error : CRC check error	1
145	Station Number of Communication Error Code – **Read Only**	Station number in BCD	1
146	Communication Error Counter – **Read Only**	Number of communication errors detected since CPU went into RUN mode, in BCD	2
150	Diagnostics Error Code	Error code in BCD 0201 Terminal block removed 0202 module not present 0203 Blown fuse 0206 Low battery voltage 0226 Power capacity exceeded	2
152	Reserved		1
153	Station number of Diagnostics error – **Read Only**	Station number in BCD	1

OCTAL ADDRESS	FUNCTION	DETAIL	# Bytes
154 – 157	Reserved		4
160	Current bus scan time – **Read Only**	BCD value of current bus scan, in msec	2
162	Bus scan time upper limit	User can store BCD value of bus scan upper limit, in msec. Default is 100 msec.	2
164	Shortest bus scan time – **Read Only**	BCD value of shortest bus scan detected since CPU went into RUN mode, in msec	2
166	Longest bus scan time – **Read Only**	BCD value of longest bus scan detected since CPU went into RUN mode, in msec	2
170	Bus scan counter – **Read Only**	BCD value of number of bus scans detected since CPU went into RUN mode	2
172	Overlimit Bus scan counter – **Read Only**	BCD value of number of bus scans which have exceeded the scan time upper limit	2
174 – 175	Reserved		2
176	Setup Initiation Byte (includes Auto Return to Network)	User's setup program stores the correct bit pattern to this memory location to configure the following modes: Bits 0,1, and 2 must be ON to initiate setup of remote slave addressing Bit 7 ON=Specifies that offline slaves can return to the network without cycling CPU	1
177	Copy Configuration to EEPROM (Setup Complete)	User's setup program stores a BCD value to this location to log the parameters stored by the setup program to the Master's EEPROM. C1 – Signifies that setup is complete. Hint: This should be the last function of your setup program.	1
200 – 374	Reserved		125

OCTAL ADDRESS	FUNCTION	DETAIL	# Bytes
375	Slave Page Selection	User’s setup program stores a BCD value to this location to select the page of slave parameters for setup programming: 81 Slaves 1–15 82 Slaves 16–31	1
376 – 377	Reserved		2

Quick Reference Table of Shared Memory Addresses

D2–RMSM				
Setup Initiation Byte				176
Setup Complete Byte				177
Slave	Input Address	Output Address	Number of Input Points	Number of Output Points
ALL	000	002	124	126
1	N/A	N/A	004	006
2	N/A	N/A	010	012
3	N/A	N/A	014	016
4	N/A	N/A	020	022
5	N/A	N/A	024	026
6	N/A	N/A	030	032
7	N/A	N/A	034	036
8	N/A	N/A	040	042
9	N/A	N/A	044	046
10	N/A	N/A	050	052
11	N/A	N/A	054	056
12	N/A	N/A	060	062
13	N/A	N/A	064	066
14	N/A	N/A	070	072
15	N/A	N/A	074	076
2nd page of slave range data				
16	N/A	N/A	000	002
17	N/A	N/A	004	006
18	N/A	N/A	010	012
19	N/A	N/A	014	016
20	N/A	N/A	020	022
21	N/A	N/A	024	026
22	N/A	N/A	030	032
23	N/A	N/A	034	036
24	N/A	N/A	040	042
25	N/A	N/A	044	046
26	N/A	N/A	050	052
27	N/A	N/A	054	056
28	N/A	N/A	060	062
29	N/A	N/A	064	066
30	N/A	N/A	070	072
31	N/A	N/A	074	076

Troubleshooting Remote I/O

Troubleshooting Quick Steps

If the remote I/O channel does not seem to be working correctly, check the following items. These items represent the problems found most often.

1. 1. Cable and connections. Incorrectly wired cables and loose terminations cause the majority of problems. Verify you've selected the proper cable configuration and check the cable, making sure it is wired correctly. Also check the cable routing to ensure that the installation guidelines in Chapter 2 were followed.
1. 2. Incorrect Baud Rate. Make sure you've set all T1K–RSSS units to match the communication parameters set on the master station.
1. 3. Incorrect protocol. Make sure you've set all T1K–RSSS units to match the protocol setting on the master station.
1. 4. Setup program. Check the setup program for errors such as incorrect pointers or constants, or writing to the wrong module address. Be sure that the total inputs and outputs values match the sum of the individual slave input and output ranges; otherwise, the D2–RMSM *will not* accept the setup data. If program errors were corrected and the remote I/O channel still does not seem to be working correctly, it may be necessary to clear the shared memory in the remote master module. Refer to step 4 in the Changing Configurations section earlier in this chapter.

Time Saver Hint

NOTE: If you need more in-depth troubleshooting, see the chart on the next page. It provides several different indicator patterns that may help identify your exact problem.

Troubleshooting Chart

off ☐ on ■ flash ▨

The following chart identifies the indicator status, possible cause, and corrective action for a variety of commonly found problems.

Master Station Indicators	Slave Station Indicators	Possible Cause	Corrective Action
RUN ☐ DIAG ☐ I/O ☐ LINK ☐ RUN is off.	RUN ☐ DIAG ☐ I/O ☐ LINK ☐	1. Master PLC power is disconnected. 2. Remote Master is defective.	1. Check the PLC power source. 2. Replace the Remote Master.
RUN ■ DIAG ☐ I/O ☐ LINK ☐ RUN is on.	RUN ☐ DIAG ☐ I/O ☐ LINK ■ LINK is on.	1. Switch setting on master or slave station is incorrect. 2. Communications wiring is incorrect.	1. Check the DIP switches on Remote Master and slaves to ensure their baud rate and protocol settings match. 2. Check the communications wiring and termination resistors.
RUN ▨ DIAG ☐ I/O ■ LINK ☐ RUN is flashing, I/O is on.	RUN ☐ DIAG ☐ I/O ☐ LINK ☐	1. Setup program is not correct. 2. I/O totals do not match values in D2–RMSM shared memory 124 and 126.	1. Check the setup program to ensure pointer values and configuration constants are correct. 2. Check the I/O totals against the sum of the individual slave ranges in the setup program.
RUN ☐ DIAG ☐ I/O ☐ LINK ■ LINK is on.	RUN ☐ DIAG ☐ I/O ▨ LINK ☐ I/O is flashing	1. I/O module failure at slave. 2. Slave module is missing 24VDC power. 3. Slave base pwer budget overloaded.	1. Check the I/O modules in the slave unit for failures.
RUN ▨ DIAG ☐ I/O ☐ LINK ☐ Lights blink in sequence, then all lights turn on.	RUN ▨ DIAG ☐ I/O ☐ LINK ☐ Lights blink in sequence, then all lights turn on	1. Module's Diagnostic DIP switch is ON.	1. Check the Diagnostic DIP switch on Master or slave to ensure that it is off.
RUN ■ DIAG ☐ I/O ☐ LINK ☐ RUN is on.	RUN ☐ DIAG ☐ I/O ■ LINK ☐ I/O is on.	1. Rotary switches' setting for slave ID exceeds valid address for chosen protocol.	1. Check rotary switches on slave for valid unit number: must be 31 or less for SM–NET, must be 7 or less for RM–NET

Special CPU Memory for Diagnostics

Communication Status Flags in V-memory

This table provides a listing of the individual flags in V-memory for communication status. The corresponding bit of V-memory turns ON when the slave is communicating. Station 0 represents the master; its bit turns on when communication begins with its slaves. You may use ***Direct***SOFT or the application program to monitor these flags. If there is a communications error, this memory may not show the correct data.

	Master in Slot No.:							
	0	1	2	3	4	5	6	7
Station	N/A	V7661	V7662	V7663	V7664	V7665	V7666	V7667
0	Bit 0							
1	Bit 1							
2	Bit 2							
3	Bit 3							
4	Bit 4							
5	Bit 5							
6	Bit 6							
7	Bit 7							
8	Bit 8							
9	Bit 9							
10	Bit 10							
11	Bit 11							
12	Bit 12							
13	Bit 13							
14	Bit 14							
15	Bit 15							

Error Flags in V-memory

This table provides a listing of the individual flags in V–memory for slave errors. The corresponding bit of V-memory turns ON when the slave has an error. Station 0 represents the master; its bit turns on when an error occurs with any slave. You may use ***Direct***SOFT or the application program to monitor these flags. If there is a communications error, this memory may not show the correct data.

	Master in Slot No.:							
	0	1	2	3	4	5	6	7
Station	N/A	V7671	V7672	V7673	V7674	V7675	V7676	V7677
0	Bit 0							
1	Bit 1							
2	Bit 2							
3	Bit 3							
4	Bit 4							
5	Bit 5							
6	Bit 6							
7	Bit 7							
8	Bit 8							
9	Bit 9							
10	Bit 10							
11	Bit 11							
12	Bit 12							
13	Bit 13							
14	Bit 14							
15	Bit 15							

D2–RMSM Memory for Diagnostics

Status and error information about the D2–RMSM Remote Master module and its attached remote I/O network are available in the Remote Master shared memory described earlier in this chapter.

Hardware Status

Octal address status bytes 122 – 123 available in the D2–RMSM shared memory report the hardware settings. You can implement logic to read these bytes to check your configuration without having to remove the module.

Bus Scan Status

Octal address status bytes 160–172 available in the D2–RMSM shared memory provide information on bus performance. You can implement logic to read these bytes to check your configuration without having to remove the module.

Network Errors

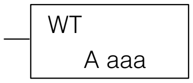
Octal address status bytes 140 – 146 available in the D2–RMSM shared memory provide information on network errors and their location. You can implement logic to read these bytes to check your configuration without having to remove the module.

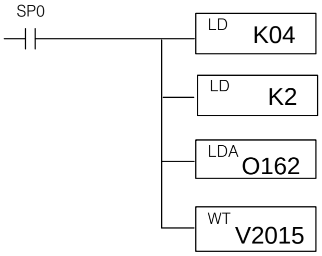
The next section provides specific examples on how to read status data from the Master module.

How to Access Diagnostics Information

To access diagnostics information, we exchange data with the D2–RMSM module. The remote master unit is an intelligent module, which means it operates asyncronously from the CPU, and it has its own memory. We use the CPU instructions described below to communicate with an intelligent module.

The WT instruction writes a block of data (1–128 bytes max.) to an intelligent I/O module from a block of V-memory in the CPU. The function parameters (module base/slot address, number of bytes, and the intelligent I/O module memory address) are loaded into the first and second level of the accumulator stack, and the accumulator by three additional instructions. In the WT instruction, Aaaa specifies the starting V-memory address where the data will be written from in the CPU. Listed below are the steps to program the WT instruction:





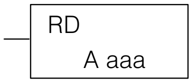
Load the base number (0) into the first byte and the slot number (1–7) into the second byte of the second level of the accumulator stack.

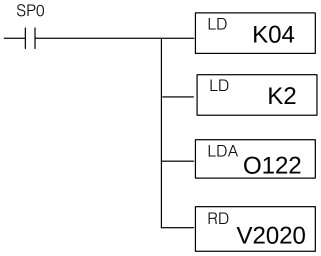
Load the number of bytes to be transferred into the first level of the accumulator stack.

Load the intelligent module address which will receive the data into the accumulator. We use the LDA to convert the octal address into its HEX equivalent.

Insert the WT instruction, which specifies the starting V–memory location where the data will be written from in the CPU.

The RD instruction reads a block of data (1–128 bytes max.) from an intelligent I/O module into the CPU's V–memory. The function parameters (module base/slot address, number of bytes, and the intelligent I/O module memory address) are loaded into the first and second level of the accumulator stack, and the accumulator by three additional instructions. In the RD instruction, Aaaa specifies the starting V–memory address where the intelligent module stores the data in the CPU. Listed below are the steps to program the RD instruction:





Load the base number (0) into the first byte and the slot number (1–7) into the second byte of the second level of the accumulator stack.

Load the number of bytes to be transferred into the first level of the accumulator stack.

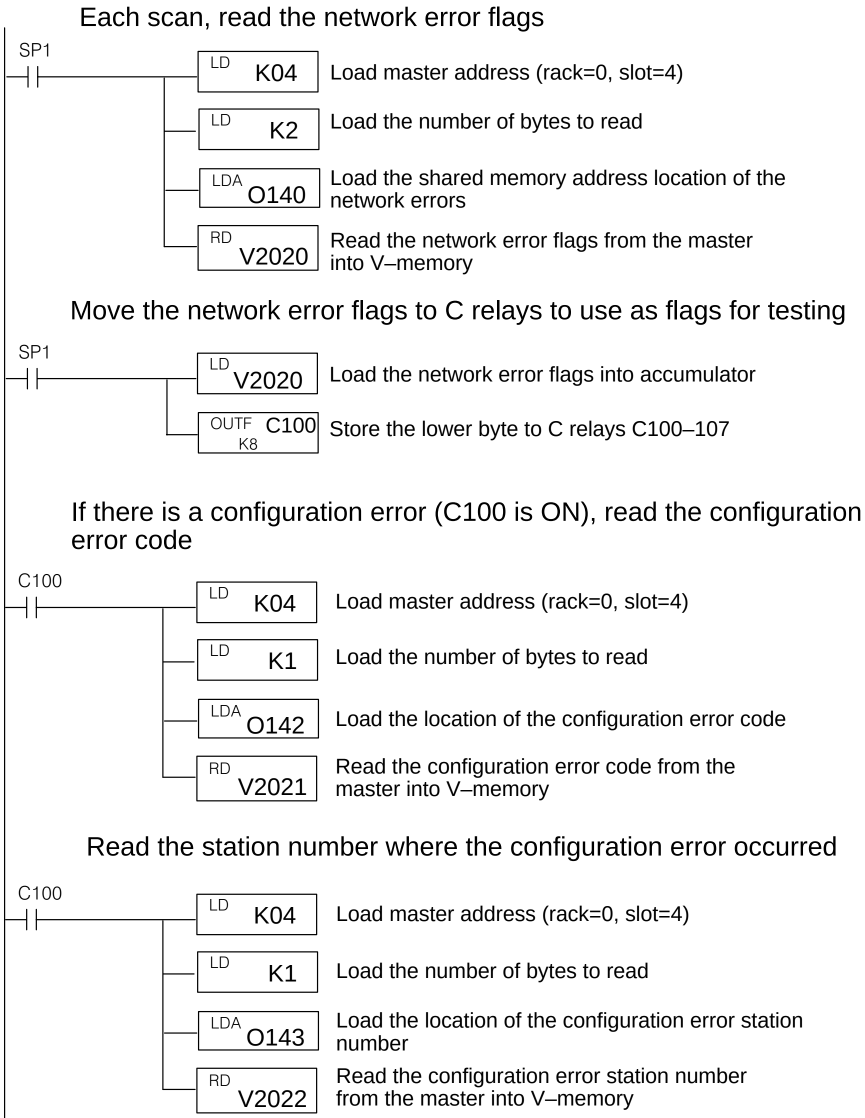
Load the intelligent module address from which the data will be read into the accumulator. The parameter must be a HEX value.

Insert the RD instruction, which specifies the starting V–memory location where the data will be stored.

Example 1: Reading Diagnostic Errors

The diagnostic error information can assist you in locating errors on a remote I/O network, either during installation or for a previously operating system. During installation, we might expect configuration errors caused by incorrect switch settings or an invalid setup program. For a previously operating system, the diagnostics can help locate such faults as a slave not responding, an I/O module not present, or a loose terminal block.

In this example, we read the network error flags each scan, and if there is a configuration error present, we read the error details.



Each scan, read the network error flags

SP1

LD K04	Load master address (rack=0, slot=4)
LD K2	Load the number of bytes to read
LDA O140	Load the shared memory address location of the network errors
RD V2020	Read the network error flags from the master into V–memory

Move the network error flags to C relays to use as flags for testing

SP1

LD V2020	Load the network error flags into accumulator
OUTF C100 K8	Store the lower byte to C relays C100–107

If there is a configuration error (C100 is ON), read the configuration error code

C100

LD K04	Load master address (rack=0, slot=4)
LD K1	Load the number of bytes to read
LDA O142	Load the location of the configuration error code
RD V2021	Read the configuration error code from the master into V–memory

Read the station number where the configuration error occurred

C100

LD K04	Load master address (rack=0, slot=4)
LD K1	Load the number of bytes to read
LDA O143	Load the location of the configuration error station number
RD V2022	Read the configuration error station number from the master into V–memory

To read communication errors (C101 ON) and diagnostic errors (C102 ON), implement similar logic to check the flag and read the error details.

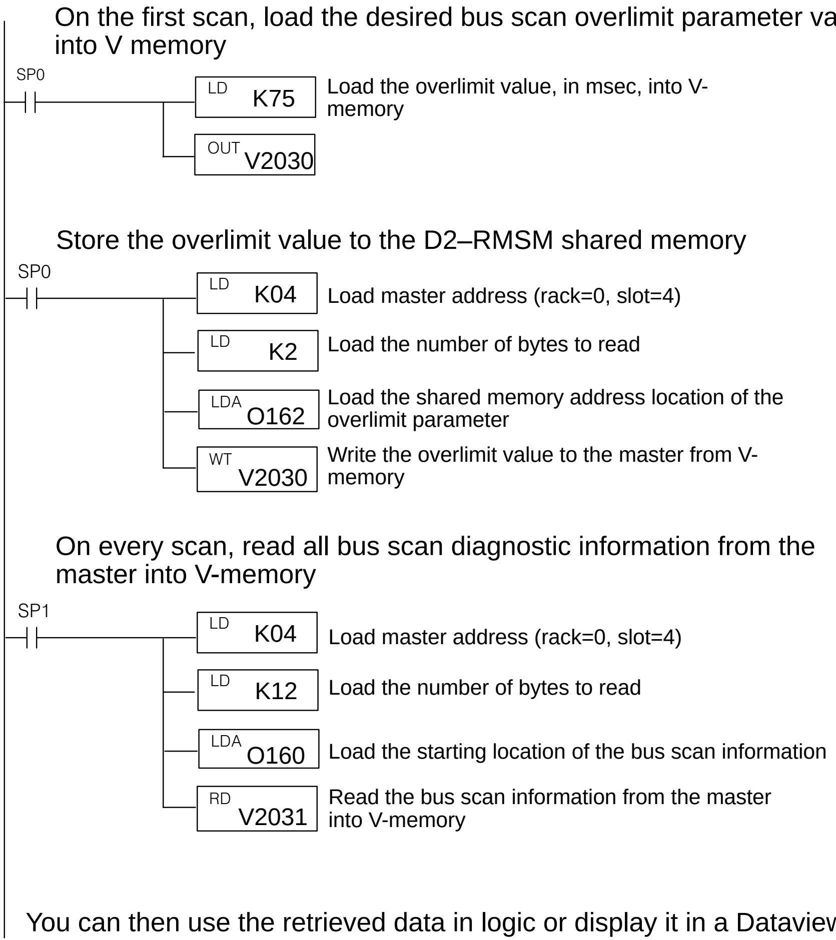
You can then use the retrieved data in logic or display it in a Dataview in ***Direct***SOFT to determine the nature and location of the error. The Network Error Table describes the error codes.

Example 2: Writing Bus Scan Overlimit and Reading Bus Scan Status

In certain applications, the scan time of the remote I/O bus can be an important factor in the response time of the system. Factors which affect the scan time include number of slaves on the bus and the baud rate. Required bus performance may dictate your system layout. For example, you may want to increase the number of remote channels in the system to decrease the number of slaves on each channel. Or you may need to choose SM–NET as the protocol to operate at a higher baud rate.

Bus scan performance data includes current bus scan time, the longest and shortest scans detected, a scan counter, and a scan overlimit counter. The overlimit counter records the number of times the scan has exceeded the overlimit value. The overlimit value, in msec, can be set by the user’s logic; the default is 100 msec.

In this example, we demonstrate how to set the bus scan overlimit parameter, and then read the bus scan data to check performance.



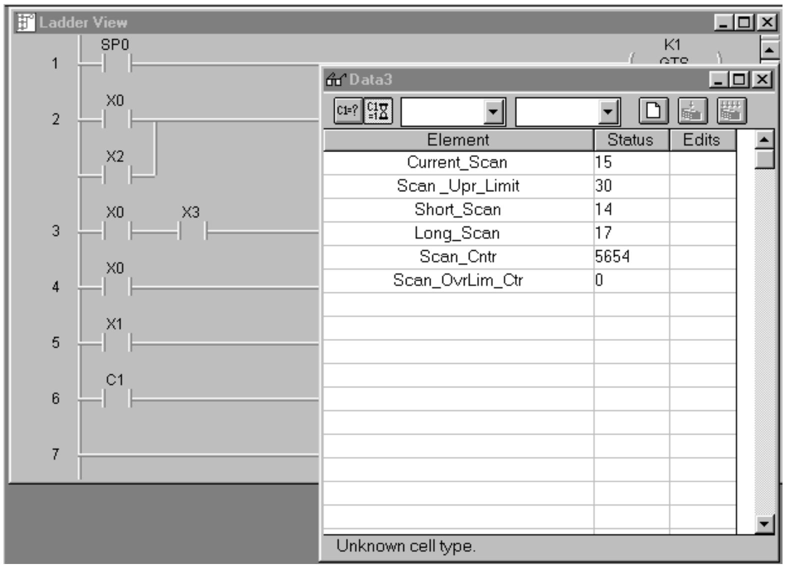
On the first scan, load the desired bus scan overlimit parameter value into V memory

Store the overlimit value to the D2–RMSM shared memory

On every scan, read all bus scan diagnostic information from the master into V-memory

You can then use the retrieved data in logic or display it in a Dataview in ***Direct***SOFT (shown on the next page) to monitor bus performance. The Bus Scan Status Table describes the definitions of the status values.

Bus scan performance data displayed in a Dataview



Element	Status	Edits
Current_Scan	15	
Scan _Upr_Limit	30	
Short_Scan	14	
Long_Scan	17	
Scan_Cntr	5654	
Scan_OvrLim_Ctr	0	

Unknown cell type.