

DV-1000™

DirectVIEW

Manual Number D-24VIEW-M

Manual Revisions

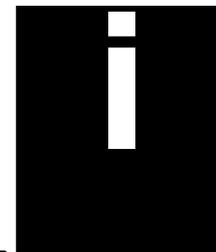
If you contact us in reference to this manual, be sure and include the revision number.

Title: DV-1000 *Direct*VIEW™

Manual Number: D-24VIEW-M

Issue	Date	Effective Pages	Description of Changes
Original	1/94		Original Issue
2 nd Edition	8/95		Complete revision
Rev A	9/95		
Rev B	2/96		
Third Edition	7/97	Cover/Copyright Survey Contents Manual History 1-1 - 1-18 2-1 - 2-11 3-1 - 3-12 4-1 - 4-65 5-1 - 5-7 6-1 - 6-34 7-1 - 7-18 A-1 - A-3 B-1 - B-4 C-1 - C-6 Index	Complete revision Downsize format Added support for DL130, DL250, DL350, and DL450 CPUs
Rev A	12/97	Contents Manual History 1-2, 1-3 2-2, 2-3 4-58 - 4-61 6-2	Revised Chapter 1, Introduction entries Added Rev A changes Updated both pages to newer format Deleted use of dual DV-1000s with DL430 Added six instructions to "Move Numeric Data" section of program (revised this on the example program disk, made Rel 2.1) Reworded Note near top of page
Rev B	5/98	Manual Revisions 2-4, 2-10, 4-39, 4-46, 4-47, 4-61, 6-19 Examples diskette (Rel. 2.2)	Added Rev B changes Made minor corrections before reprinting Revised example programs so they will work with all <i>Direct</i> SOFT versions

Table of Contents



Chapter 1: Getting Started

Introduction	1-2
The Purpose of this Manual	1-2
Supplemental Manuals	1-2
Technical Support	1-2
Chapters	1-3
DirectVIEW 1000 Data Access Unit Overview	1-3
DirectVIEW™ 1000 Features	1-4
Getting Acquainted	1-4
Display	1-5
Keypad	1-5
Cables	1-5
Software Examples on Disk	1-5
<i>DirectSOFT</i> Support	1-5
Display and Keypad Basics	1-6
Clear V-Memory First!	1-6
Keypad	1-6
Keypad Conventions Used in this Manual	1-6
CHG PRE Key (Change Preset)	1-7
MSG Key (Message)	1-7
STAT Key (Status)	1-7
CURSOR and +/- Keys	1-7
OPT Key (Optional Modes)	1-8
CLEAR and ENTER Keys	1-8
Setup Parameters, the Key to DV-1000 Success!	1-9
Purpose of Setup Parameters	1-9
Programming Setup Parameters	1-9
Quick Tour of DV-1000 Operation	1-10
Status Display Mode	1-10
Message Display Mode	1-11
Change Preset Mode	1-12
Bit Control Mode	1-13
Operator Interface Design Basics	1-14
Man-Machine Interface	1-14
Monitor and Control	1-15
Purposes of Monitoring	1-15
Purposes of Control	1-15
Frequently Asked Questions	1-16
Specifications	1-18



Chapter 2: Installation Guide

Introduction	2-2
Step 1: Choosing Single or Dual DV-1000s	2-2
Dual DV-1000 Operating Characteristics	2-3
DL130, DL230 Connection	2-3
DL240 Connection	2-3
DL250, DL350, DL430, DL440, DL450 Connection	2-3
Step 2: PLC Selection	2-4
Step 3: Selecting a Mounting Location	2-5
Step 4: Panel Mounting	2-6
Step 5: Cable Selection	2-7
DL105, DL205, DL350, DL450 Connection	2-7
DL430, DL440 Connection	2-7
Custom Cables	2-8
Step 6: Connecting the DV-1000 to the CPU	2-9
Step 7: Installing the Example Programs	2-9
Step 8: Starting DirectSOFT	2-11
Initialize the CPU	2-11
Loading an Example Program	2-11

Chapter 3: DV-1000 Setup Parameters

Overview	3-2
Purpose of Setup Parameters	3-2
Location of Setup Parameters	3-2
Types of Setup Parameters	3-2
How the DV-1000 Uses Setup Parameters	3-3
Setup Parameter Ladder Rung	3-3
Parameter Definitions	3-4
V-Memory Maps	3-6
Entering Setup Parameters	3-7
Methods for Entering the Setup Parameters	3-7
Parameter Setup By Ladder Program	3-7
Using the LDA Instruction for Pointer Setup Parameters	3-8
Powerup Default Operational Mode	3-9
Powerup Default Setup Parameter	3-9
Powerup Sequence	3-10
Powerup Default Example Program	3-11
Chapter Summary	3-12
Summary of Key Points	3-12



Chapter 4: Message Display Mode

Overview	4-2
Feature List	4-2
Message Priority	4-2
System Requirements for Example Programs	4-3
DL405 Requirements	4-3
DL350 Requirements	4-3
DL205 Requirements	4-4
DL105 Requirements	4-4
System Messages	4-5
Selecting Message Mode	4-5
Fault Instruction Message	4-5
System Error Display	4-6
Viewing Message Logs (DL240, DL250, DL350, DL440 and DL450 Only)	4-6
Fault Message Log (DL240, DL250, DL350, DL440 and DL450 Only)	4-7
System Error Log (DL240, DL250, DL350, DL440 and DL450 Only)	4-8
User Messages	4-9
Setup Parameters for User Messages	4-10
Message Data Parameters	4-10
Choosing Data Block Locations	4-10
Ladder Example for Message Setup Parameters	4-11
Parameter Setup Program #1	4-11
Displaying Numbers	4-13
Displaying Changing Values	4-14
Displaying Text	4-15
ASCII Codes	4-15
Using LDD and OUTD Instructions	4-17
Turning Data into Messages	4-19
Numbering of Display Positions	4-19
Display Maps	4-19
How Message Data Gets to the Display	4-20
Combined Numeric and Text Displays	4-21
Parameter Setup Program #2	4-22
Unmasking Numeric Positions	4-23
Placing Numbers and Text Together	4-24
Using the ASCII Constant (ACON) Instruction	4-25
ACON Example Program #1	4-26
Choosing ACON Box Text Length	4-27
ACON Example Program #2	4-29

Continued, next page

Chapter 4, continued

Message Display Applications and Techniques	4-32
Multiple Message Displays	4-32
Dynamic Text	4-36
Blinking Text	4-38
Polarity Sign for Numeric Output	4-41
Embedded Time and Date (DL240, DL250, DL350, DL440 and DL450 Only)	4-44
Bar Graph Example, (DL240, DL250, DL350, DL440 and DL450 Only)	4-49
Bar Graph Example, DL240 Analog Potentiometers	4-53
Automatic Scrolling Display, (DL240, DL250, DL350, DL440 and DL450 Only)	4-57
Embedded Decimal Point	4-62
Chapter Summary	4-65
Summary of Key Points	4-65

Chapter 5: Status Display Mode

Overview	5-2
Status Display Format	5-2
Selecting Byte or Word Displays	5-3
Selecting the Address	5-4
Selecting the Data Type	5-5
Using the Bookmark	5-6
Chapter Summary	5-7
Summary of Key Points	5-7

Chapter 6: Change Preset Mode

Overview	6-2
“Change Preset” Defined	6-2
How Change Preset Works	6-2
Title and Data Fields	6-3
Preset Title Types Available	6-3
Setup Parameters for Change Preset Mode	6-4
Location of Preset Variable Lists	6-4
Pointer and Block Sizes	6-4
Change Preset Setup Program	6-5
Establishing the Lists	6-6
Accessing Change Preset Variables	6-8
Selecting the List to Display	6-8
Cursor Positioning On Title or Data	6-9
Changing the Preset Value	6-9
Pre-labeled Timer and Counter Presets	6-10
Scrolling Through Change Preset Lists	6-12
Using Presets With Timer Box Instructions	6-13
Using Presets With Counter Box Instructions	6-13
User-titled Presets	6-14
User-Titled Text Labels	6-14
Default User Title List	6-17
User-titled Text Example	6-19
Individual Default User Titles	6-22
Combination Titles Example	6-25
Change Preset Password	6-28
Unlocking Access to Change Presets	6-28
Locking Access to Change Presets	6-29
Forgot the Password?	6-29
Special Topics for Change Presets	6-30
Timer and Counter Presets with Custom Titles	6-30
Buffered Preset Values	6-31
Operator’s Guide to Change Preset Mode	6-32
Selecting the List to Display	6-32
Cursor Positioning On Title or Data	6-32
Scrolling Through Change Preset Lists	6-33
Changing the Preset Value	6-33
Entering a Password	6-33
Locking Access to Change Presets	6-33
Chapter Summary	6-34
Summary of Key Points	6-34

Chapter 7: Bit Control Mode

Overview	7-2
Keypad Function in Bit Control	7-3
Accessing Bit Control	7-3
Setup Parameters for Bit Control	7-4
Using the Keypad To Do Bit Control	7-6
Selecting Bit Control and Status Modes	7-6
Keypad Bit Mapping	7-7
Exiting Bit Control Mode	7-8
Bit Control Applications	7-9
I/O Debug	7-9
Bit Control With Message Display Mode	7-11
Multiplexed Bit Control	7-15
Bit Control Toggle Function	7-17
Chapter Summary	7-18
Summary of Key Points	7-18

Appendix A: Troubleshooting Guide

Troubleshooting Guide	A-2
-----------------------------	------------

Appendix B: Reference Data

Setup Parameter Tables	B-2
ASCII Table	B-4

Appendix C: DV-1000 Worksheets

Message Display Worksheets	C-2
Fault Messages	C-2
Message Display Output Maps	C-3
Display Output Grids	C-4
Change Preset Worksheet	C-5
Create Title Lists	C-5
Timer and Counter Numbering Conversion Chart	C-6

Index

Getting Started

1

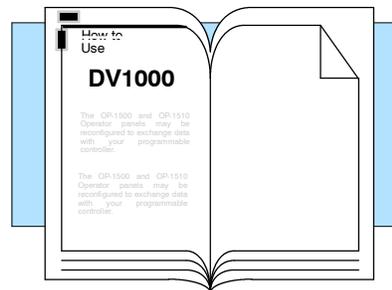
In This Chapter. . . .

- Introduction
 - *DirectVIEW*[™] 1000 Features
 - Display and Keypad Basics
 - Setup Parameters, the Key to DV-1000 Success
 - Quick Tour of DV-1000 Operation
 - Operator Interface Design Basics
 - Frequently Asked Questions
 - Specifications
-

Introduction

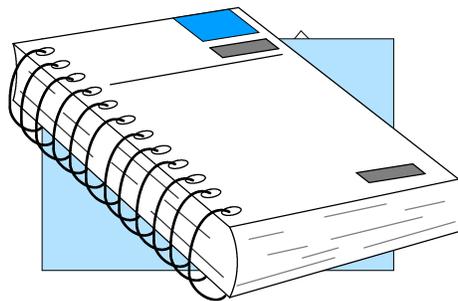
The Purpose of this Manual

This manual shows the various features and modes of the **DirectVIEW 1000** (DV-1000). Your application may require the use of some of these modes, or all of them. This manual can help you decide which modes to use, and how to configure the CPU to support the DV-1000 in those modes. In the chapters on DV-1000 operational modes there are example programs to help you write the required supporting ladder program. If you are a new user, however, you may need to refer to the User Manual for the PLC you are using.



Supplemental Manuals

The DL105 User Manual (D1-USER-M), the DL205 User Manual (D2-USER-M), the DL305 User Manual (D3-USER-M; make sure you have the version covering the DL350 CPU) and the DL405 User Manual (D4-USER-M) contain related information, such as the instruction set definitions for your CPU type. In addition, the **DirectSoft Quick Start Manual** (QS-DSOFT-M) may also be useful. These manuals are not absolutely necessary to use the DV-1000, but might come in handy for an occasional reference.



Technical Support

We realize that even though we strive to be the best, we may have arranged our information in such a way you cannot find what you are looking for. First, check these resources for help in locating the information:

- **Table of Contents** - chapter and section listing of contents, in the front of this manual
- **Quick Guide to Contents** - chapter summary listing on the next page
- **Appendices** - reference material for key topics
- **Index** - alphabetical listing of key words, at the end of this manual

You can also check our online resources for the latest product support information:

- **Internet** - the address of our Web site is <http://www.plcdirect.com>
- **Bulletin Board Service (BBS)** - call (770)-844-4209

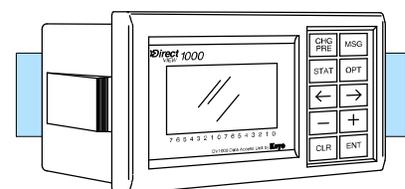
If you still need assistance, please call us at 800-633-0405. Our technical support group is glad to work with you in answering your questions. They are available Monday through Friday from 9:00 A.M. to 6:00 P.M. Eastern Standard Time. If you have a comment or question about any of our products, services, or manuals, please fill out and return the 'Suggestions' card that was shipped with this manual.

Chapters The main contents of this manual are organized into the following seven chapters and Appendices A, B and C:

1	Getting Started	provides an overview of the features and provides general specifications. The importance of setup parameters and what they do are shown. "Quick Tour of DV-1000 Operation" covers the operational modes and the main features of each mode. A list of <i>Frequently Asked Questions</i> is located near the end of this chapter.
2	Installation Guide	explains how to select the CPU type and a communications cable, how to mount the unit in a control panel and connect it to your CPU, and how to install the example programs disk and start <i>DirectSOFT</i> to begin your ladder program.
3	DV-1000 Setup Parameters	explains the purpose of setup parameters, how they are used, and gives example programs. Special topics include selecting the Powerup Default Mode.
4	Message Display Mode	shows how to access System Messages, including Error Messages and Fault Messages. It covers User Messages, and shows how to create your own text and numeric output and includes several example programs.
5	Status Display Mode	tells how to view the status of CPU data types (X, Y, GX, C, SP, T, CT, S, V and P).
6	Change Preset Mode	covers the concept of changing V-memory data, the three types of titles you may attach to the values as labels, and password protection (optional) for changing preset values. An Operator's Guide covers the keypad procedure for changing presets.
7	Bit Control Mode	discusses how to enter and exit Bit Control Mode, and how to use it in machine debug applications.
A	Troubleshooting Guide	Appendix A provides a list of typical problems you may encounter along with the most likely causes and solutions.
B	Reference Data	Appendix B provides the setup parameter tables and a table of ASCII characters and their hex ASCII codes.
C	DV-1000 Worksheets	Appendix C provides worksheets that you may copy and use to plan your application program.

DirectVIEW 1000 Data Access Unit Overview

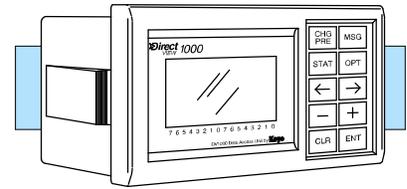
The DV-1000 is a small, low-cost data access unit which connects directly to all DL105, DL205 and DL405 CPUs, and to DL305 models having a D3-350 CPU (it is not compatible with the other DL305 CPUs). Its main purpose is to provide access for monitoring and controlling data in the CPU, and is usually permanently installed in an operator interface, but it can also be used portably as a debugging tool.



DirectVIEW (DV-1000)

DirectVIEW™ 1000 Features

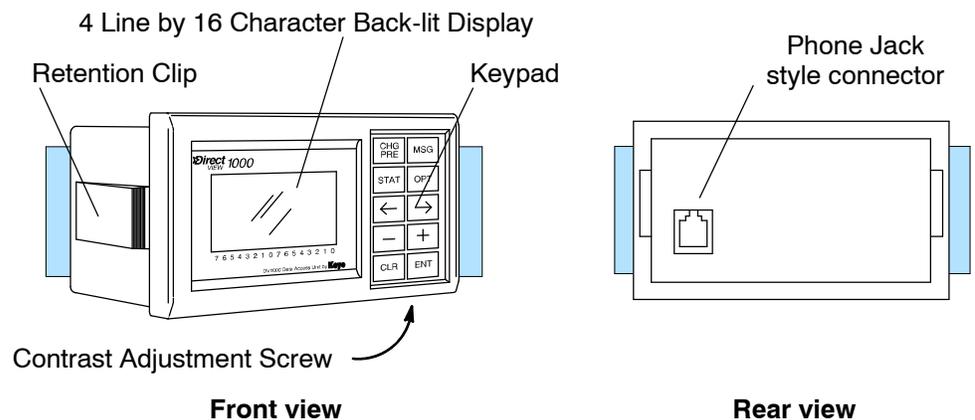
The **DirectVIEW™ 1000** (DV-1000) has several different modes which are accessible from its keypad. *Most modes require some ladder logic in the PLC and setup parameters in V-memory, which are essential for the DV-1000 to function!* This manual contains many program examples to acquaint you with all the capabilities of the DV-1000, and help you with the required setup parameters and ladder program. Some of the main features and benefits are:



DirectVIEW (DV-1000)

- Works with all DL105, DL205 and DL405 CPUs, and DL350 CPUs
- Features a 4-line by 16-character back-lit display
- Monitors V-memory data values
- Displays text and numeric data generated with your ladder program
- Can change preset (any V-memory) values
- Displays CPU-generated error messages (message log)
- Single cable connection to CPU
- Easy snap-in mounting
- The DV-1000 device is UL® Listed

Getting Acquainted Before connecting the DV-1000 to your PLC, we'll first study its main features. The drawing below shows a front and rear view of the unit. The 4-line by 16-character display is back-lit for viewing in various ambient lighting conditions. You can control the contrast of the LCD segments by adjusting a potentiometer accessible with a small screwdriver under the bottom of the unit. To the right of the display is a keypad featuring ten keys. These are general-purpose keys that allow you to select various operating modes, select particular data for monitoring, and to change data values. The DV-1000 is designed to fit into a rectangular cutout in the control panel of an operator interface. A retention clip on each side keeps it in place after installation. A modular jack at the rear of the unit provides an easy connection to the CPU.



Display

The DV-1000 display contains 4 lines by 16 characters, and each character is formed by a 5 x 7 LCD dot matrix. The unit's internal processor generates an ASCII character set, and outputs menu messages associated with the keypad.

S	T	A	T	U	S	:		R	U	N					
S	T	E	P	:		F	O	R	M	P	A	R	T		
M	O	L	D		T	E	M	P	.	3	2	7	F		
L	O	T		N	O	.	4	1	6	3					

7 6 5 4 3 2 1 0 7 6 5 4 3 2 1 0

You can create your own messages by using ladder logic and special setup parameters in V-memory. The permanent numbers below the bottom edge of the display label individual bits of byte or word status displays.

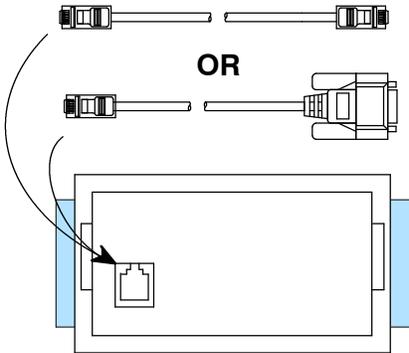
Keypad

The keypad contains ten keys, located along the right side of the DV-1000. The primary keys on the unit have a blue colored background, and are dedicated for changing the operational modes. The secondary keys have a gray colored background, and are multi-purpose keys used for cursor movements and incrementing or decrementing values in the display.

Change Preset	CHG PRE	MSG	Display messages
Monitor Status	STAT	OPT	Optional Modes
Cursor Left	←	→	Cursor right
Decrement Value	-	+	Increment Value
Clear	CLR	ENT	Enter

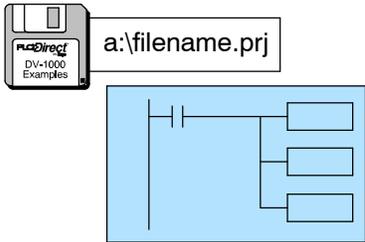
Cables

There are basically two types of cables that may be used with the DV-1000. The type you will use depends mainly on the PLC type that will connect to your DV-1000. Therefore, the appropriate cable must be ordered as a separate item. See Chapter 2 for specific part number information for the proper cable.



Software Examples on Disk

The chapters on individual modes contain several ladder program examples. A *diskette containing the files for these examples is included with this manual.* The diskette symbol in the margin beside an example program indicates it is on the diskette. See the section near the end of Chapter 2, titled "Installing the Example Programs".



NOTE:The DL430 CPU does not support all instructions used in the example programs.

NOTE: *DirectSOFT* Release 2.0 programming software has a utility to configure the DV-1000; however, before using this utility it is important to understand the V-memory relationship between the DV-1000 and the PLC. See the *DirectSOFT* Users Manual (DA-DSOFT-M) for more information.

Display and Keypad Basics

This section will familiarize you with how to use the keypad, along with the display response for each key you press. Its purpose is *not to demonstrate all of the modes or display screens*. The remaining chapters in this manual contain that information.

NOTE: These exercises must be done in a safe learning environment. **DO NOT** use a CPU that is actually controlling a process, in order to avoid accidentally changing V-memory data needed by the ladder program.

Clear V-memory First!

The following exercises assume the DV-1000 is online with the PLC, and the CPU program, V-memory, and system parameters are clear. If your CPU has random data in these locations, then your displays will likely not match the examples.

1. Connect the communications cable from your personal computer communications port to your PLC's programming port on the CPU.
2. Start **DirectSOFT** on your personal computer.
3. Select a link to go online with the CPU.
4. Save your program to a project file, if you have a program not yet saved.
5. Verify the CPU is in program mode. From the menu bar, select **PLC**, then **PLC Modes**, then **Program**. Then select "OK", or press Return.
6. From the menu bar, select **PLC**, then **Clear PLC memory**, then **All**. Then select "OK", or press Return.
7. From PLC menu, choose Setup, then **Initialize Scratchpad**. This ensures the DV-1000 setup parameters are initialized to zeros.

Keypad

You may recall that the keypad is color-coded, based on key functions. The blue keys are dedicated for changing the operational modes. The gray keys are multi-purpose, used for cursor movements and incrementing or decrementing values in the display.

Change Preset			Display messages
Monitor Status			Optional Modes
Cursor Left			Cursor Right
Decrement Value			Increment Value
Clear			Enter

Keypad Conventions Used in this Manual

This manual uses some keypad conventions. When keypad entries are required, key symbol(s) will be shown, preceded by the word "Press". Example 1 asks you to press the **Status** Key followed by the **Enter** key. Example 2 asks you to press the **Change Preset** key, followed by pressing the **Cursor Right** Key twice. The graphic arrow points to the resulting display beside or below the key sequence.

PRESS

Example 1

PRESS

Example 2

NOTE: When pressing multiple keys or pressing a key repetitively in a key sequence, please **pause** for a second between keystrokes. This allows the DV-1000 time to process each keystroke before the next keypad entry occurs.

CHG PRE Key
(Change Preset)

Press the **Change Preset Key** when you need to change V-memory data. This mode requires setup parameters in V-memory. Because V-memory is cleared at this point, you will see the error message to the right, which is normal. Note the absence of a cursor in this display, indicating the cursor keys are disabled.

PRESS  

* S E T U P E R R O R *																				
C H E C K V A L U E I N																				
V 7 6 2 0 T O V 7 6 2 2																				
	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0				

MSG Key
(Message)

Press the **MSG key** to view messages from the CPU. This mode requires setup parameters in V-memory. However, since V-memory is presently cleared the display shows a valid default "message", consisting of all zeros.

PRESS  

0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0				

STAT Key
(Status)

Press the **Status Key** to view the current status of various CPU memory locations. This mode *does not* require setup parameters in V-memory. The default memory type displayed upon entry to Monitor Status Mode is the X input type, starting with X0. The right half of the display shows eight discrete points (one byte) per line. The particular binary pattern shown to the right is an example only. Your specific display depends on the current status of your system.

PRESS  

	X	0	0																	
	X	1	0																	
	X	2	0																	
	X	3	0																	
	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0				

 = binary 0,  = binary 1

CURSOR and +/- Keys

The **Cursor Right** and **Left** Keys move the cursor on the top line, and the **Plus (+)** and **Minus (-)** Keys scroll the display addresses. If the display is in Status Mode as above, press the **Cursor Right** Key to move the cursor over to the adjacent "0". With the cursor over the address, press the **Plus (+)** Key twice to increment X00 to become X20.

PRESS    

	X	2	0																	
	X	3	0																	
	X	4	0																	
	X	5	0																	
	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0				

Now press the **Minus (-)** Key twice to decrement the top display line back to X00. The Plus and Minus keys are also used to select data types, as well. First press the **Cursor Left** key to move the cursor over the top line "X". Now press the **Plus (+)** Key once, and the "X"s in the display will change to "Y"s.

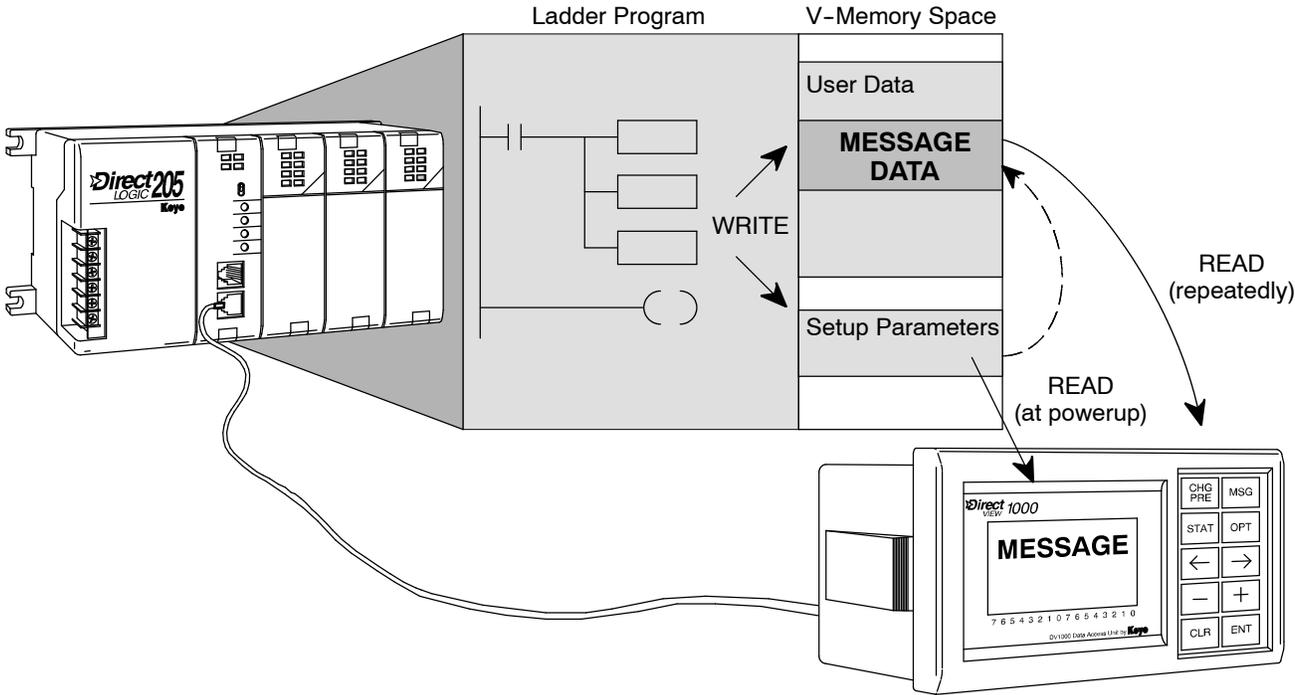
PRESS   

	Y	0	0																	
	Y	1	0																	
	Y	2	0																	
	Y	3	0																	
	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0				

Setup Parameters, the Key to DV-1000 Success!

Purpose of Setup Parameters

Most DV-1000 modes require setup parameters. Refer to the figure below. These are V-memory locations in the CPU reserved for DV-1000 use. Their purpose is: **Setup parameters simply tell the DV-1000 where to find its display data. Accordingly, the DV-1000 is completely lost without its setup parameters!**

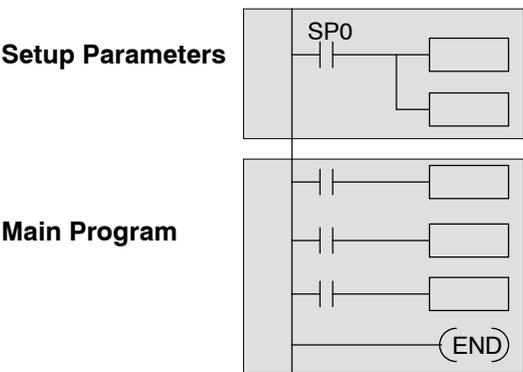


Typically, the ladder program writes the setup parameters to V-memory on the first CPU scan. These point to the locations of blocks of data (also written by the ladder program), which the DV-1000 needs to generate messages, preset lists, etc. By reading setup parameters after powerup, the DV-1000 is able to locate and read its operational data from the data blocks elsewhere in V-memory. The DV-1000 re-reads these data blocks continuously during operation.

Programming Setup Parameters

To the right is a typical program outline to support the DV-1000. On the first scan, the first rung places setup parameters in their reserved V-memory locations. The main program follows, which moves data to or from the data blocks referenced by the setup parameters as required.

Chapter 3 covers setup parameters in general. Then, each chapter on an operational mode includes several setup examples for that mode.



We highly recommend reading Chapter 3 on Setup Parameters thoroughly before attempting to use any mode that requires setup parameters!

Message Display Mode
(see Chapter 4)

In Message Display Mode, display output can be from one of three different sources: System Messages (includes Fault Messages and Error Messages), and User Messages as shown.

Fault Messages are generated by using the Fault Message Box in ladder logic.

System Error Messages are automatically generated by the CPU upon an error event. Fault Messages and System Error Messages have display priority over User Messages.

User Messages let you create numeric and text output to the entire display under ladder logic control. *Only User Messages require setup parameters.*

Fault Message

*	P	A	R	T		J	A	M	,	Z	O	N	E		1
---	---	---	---	---	--	---	---	---	---	---	---	---	---	--	---

Error Message

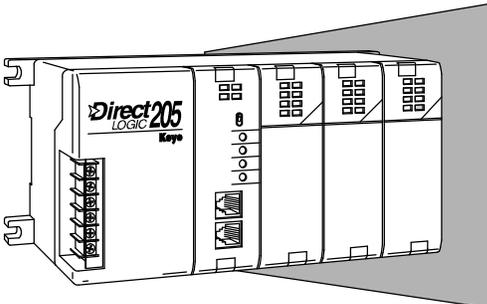
E	0	4	2			N	O			C	P	U		B	A	T	T
---	---	---	---	--	--	---	---	--	--	---	---	---	--	---	---	---	---

User Message

C	O	N	V	E	Y	O	R		S	P	E	E	D	S			
L	i	n	e			1	=		1	2	3		f	p	m		
L	i	n	e			2	=		4	5	6		f	p	m		
L	i	n	e			3	=		7	8	9		f	p	m		
						7			6								
						6			5								
						5			4								
						4			3								
						3			2								
						2			1								
						1			0								
						7			6								
						6			5								
						5			4								
						4			3								
						3			2								
						2			1								
						1			0								

DL240, DL250, DL350, DL440 and DL450 CPUs can record up to 16 Error Messages and 16 Fault Messages in separate message logs as shown below. It attaches a time/date stamp to messages when they occur. These may be viewed individually with the DV-1000.

Example Message Log



	DATE	TIME	FAULT MESSAGE
01	08/10/95	09:35:50	PART JAMMED
02	08/11/95	08:00:43	BIN EMPTY
03	08/11/95	07:15:53	OVER TEMP
04	08/20/95	17:22:48	LOW FLOW
05	08/30/95	17:22:24	PUMP FAULT
06	08/30/95	17:22:24	GATE STUCK
:	:	:	:
16	08/02/95	9:22:16	SETUP INVALID

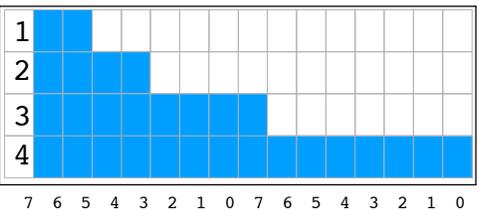
User Messages require ladder programming and setup parameters. Chapter 4 includes several example programs designed to show you how to add these features to your own messages:

- Include text with numerical data
- Blinking characters
- Multiple screens with paging
- Signed numbers (+/-)
- Time and date stamp in message
- Create bar graphs for analog data
- Long messages that scroll

Time and Date Stamp

M	A	C	H	I	N	E		S	T	A	T	U	S				
F	a	u	l	t	=			B	i	n		E	m	p	t	y	
T	i	m	e		=	1	1	:	3	2	:	5	7	A	M		
D	a	t	e		=	0	7	/	0	5	/	9	5				
						7			6								
						6			5								
						5			4								
						4			3								
						3			2								
						2			1								
						1			0								
						7			6								
						6			5								
						5			4								
						4			3								
						3			2								
						2			1								
						1			0								

Bargraph Display



Change Preset Mode (see Chapter 6)

Change Preset Mode presents data that you can view on the display and edit with the keypad. *Setup parameters are required.* Titles (labels) accompany the data, giving them meaning for your application. “Change Preset” just means “change V-memory data value”. Password protection is also available, if desired.

TITLE FIELD				DATA FIELD						
M	y	T	i	t	l	e	0	0	0	0
M	y	T	i	t	l	e	0	0	0	0
M	y	T	i	t	l	e	0	0	0	0
M	y	T	i	t	l	e	0	0	0	0

7 6 5 4 3 2 1 0 7 6 5 4 3 2 1 0

Three types of titles are available in Change Preset Mode:

- User-titled Presets allow you to create your own text label of up to eight characters in length.
- Pre-titled Timer labels (1 to 99) are available if you have timers and can use ready-made labels.
- Pre-titled Counter labels (1 to 99) are available if you have counters and can use ready-made labels.

M	y	T	i	t	l	e	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---

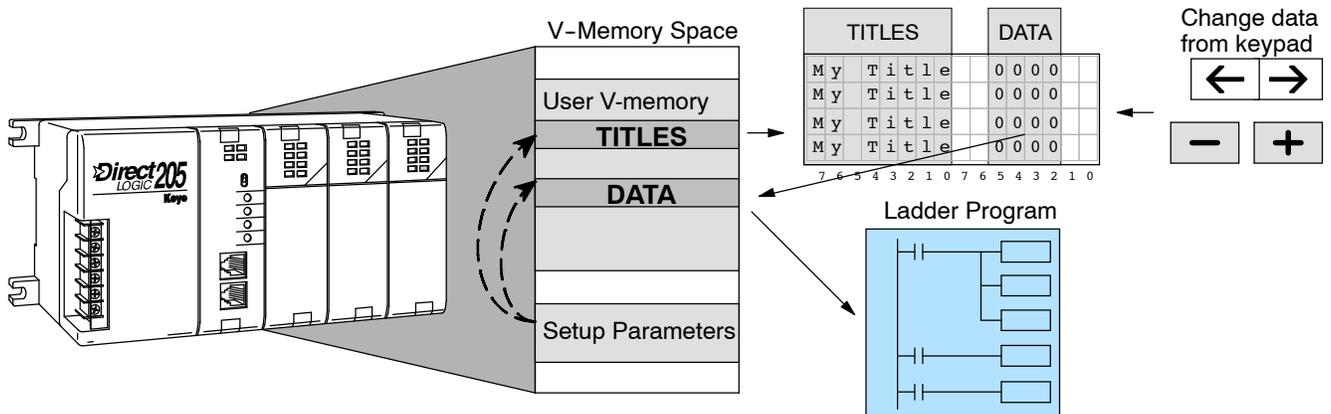
T	I	M	E	R	1	0	0	0	0
---	---	---	---	---	---	---	---	---	---

C	O	U	N	T	E	R	1	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

With proper setup parameters, you can establish lists of presets with text labels you create. The Change Preset Mode has built-in display scrolling capability. You can scroll to the variable name of the data you want to change, move the cursor to the data field, and change the data using the keypad. Like using thumb-wheel switches, the data in V-memory changes immediately to match the display.

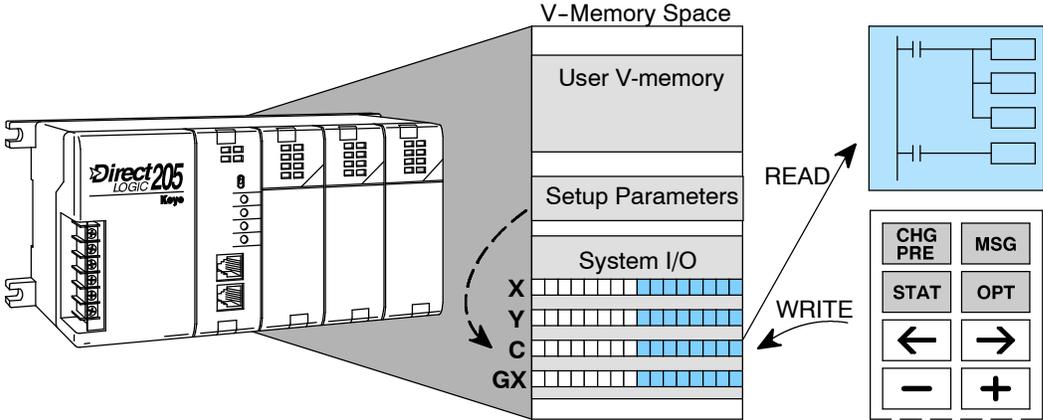
USER TITLES	DATA
S e t P o i n t	0 0 0 0
V a l u e	0 0 0 0
H i A l a r m	0 0 0 0
L o A l a r m	0 0 0 0
S o a k T i m e	0 0 0 0
T e m p 1	0 0 0 0
T e m p 2	0 0 0 0
G a l / M i n	0 0 0 0

Change Preset operation is depicted below. Setup parameters point to the location of title and data lists in V-memory, also defining the list length. The DV-1000 presents these as matched lists, so that a title and its corresponding data are together on the same display line. Keypad entries can request data changes, which immediately updates the data on the display and the data in V-memory. Finally, the ladder logic program uses the new data to update the machine control process.



Bit Control Mode
(see Chapter 7)

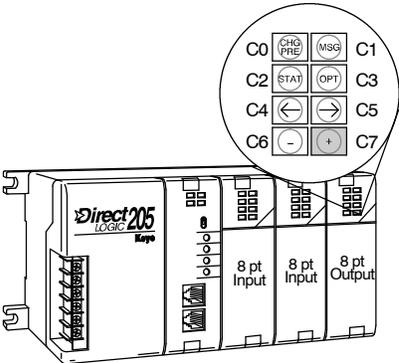
Bit Control Mode temporarily reassigns eight keys on the keypad for dedicated control of eight I/O bits. A *Setup Parameter* is required. In the drawing below, the setup parameter points to a system I/O location for either X, Y, C, or GX type I/O points. This example's setup parameter points to a control relay location, controlling the first eight relays. The keypad switches operate as momentary, normally open switches. When ladder logic uses these bit control I/O points as inputs, keypad entries can request I/O bits to turn on as long as keys are pressed.



While the keypad is in Bit Control Mode, the display may be in either Message Display, Status Display, or Change Preset Mode.

WARNING: Bit Control Mode is designed for debug purposes only. There is no automatic indication that normal keypad functionality has been suspended.

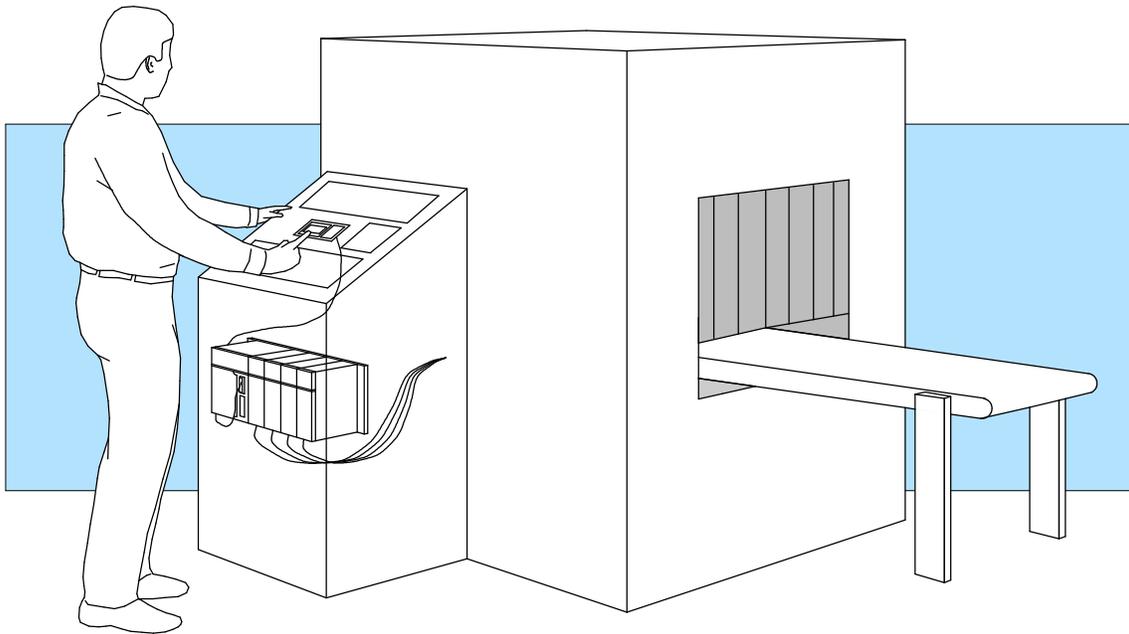
With a simple parameter setup and ladder program, you can use Bit Control Mode to turn on an output module's output points. In the example system to the right, the eight keys shown from the keypad have been configured to turn on control relays C0 through C7. Then the main ladder program uses these to turn on outputs Y0 through Y7.



Operator Interface Design Basics

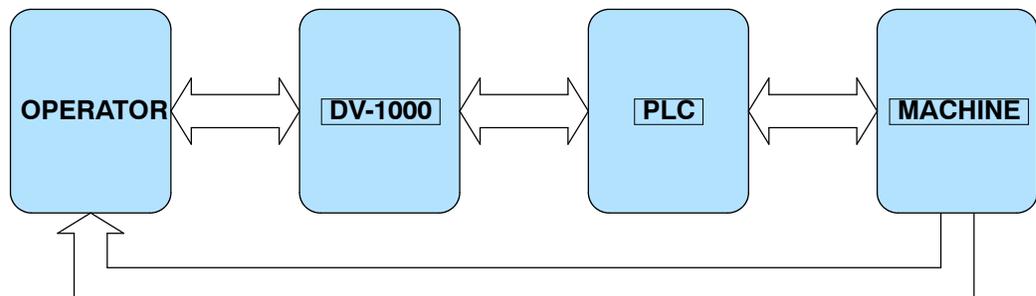
Man-Machine Interface

The DV-1000 provides access to PLC data to the user while the CPU is running the RLL program, and the process or machine is running. In most applications, the DV-1000 is a permanent part of the operator interface. The operator's panel shown in the drawing below is at the top of the control cabinet, located at the side of the machine. The operator panel contains all the dedicated operator interface devices, such as switches, gauges, control knobs, etc. The DV-1000 is one of these devices which forms the entire operator interface.



In the transparent view of the control cabinet, follow the single cable from the DV-1000 to the PLC inside. From there, a wiring bundle connects it through the rear of the control cabinet to sensors and other field devices located inside the machine. The conveyor which moves the product through the machine may also be controlled by the PLC.

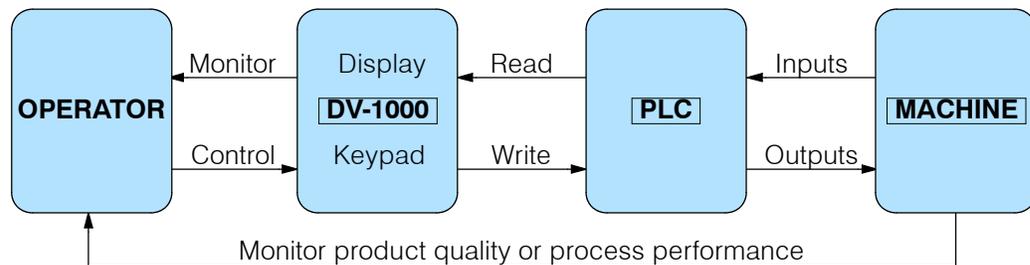
Next we examine the interaction and flow of information between all the players in the man-machine interface. The following diagram arranges them in the order they communicate.



Action begins with the human operator, who wants to know the machine status or make an adjustment to the process. From the control panel, the operator can access data through the DV-1000, which connects to the PLC inside the control cabinet. In turn, the PLC connects to the machine or factory process through wiring to sensors, relays, solenoids, motors, and so on.

Monitor and Control

The DV-1000 features several operating modes that may be used in a variety of ways. But at a basic level, it provides two types of accesses to data: **monitor** and **control**. Refer to the drawing below.



The drawing shows the flow of information between the operator and the machine or process.

Purposes of Monitoring

The control panel *communicates the status of the machine or process to the operator*. Some of the kinds of information it conveys are:

- Production totals
- Machine setup and process status information
- Quality control statistics
- I/O point status for troubleshooting

Use **Message Display Mode** (see Chapter 4) for these types of messages. For example, a diagnostic message that says “Part Jam, Zone 3” gives an operator a good idea of the nature of the problem and its location. Use **Status Display Mode** (see Chapter 5) to view the PLC’s I/O bit status for troubleshooting.

Purposes of Control

The control panel enables an operator to *change the process instructions or setpoints*. Some of the goals accomplished by control inputs are:

- Change a process variable setpoint during runtime (such as temperature) in order to optimize the process or machine performance
- Select a particular product setup from a menu
- Perform machine debug by turning on specific control bits or outputs
- Manually jog a machine or increment through process steps in order to to clear a part jam or fault condition
- Control major machine functions (Start, Stop, etc.) **see note below**

Use **Change Preset Mode** (see Chapter 6) to change process variables or select a product setup menu. Use **Bit Control** (see Chapter 7) for machine debug tasks.

NOTE: For controlling major machine functions such as Start, Stop, Run, Jog, etc, we recommend using individual dedicated control devices, not the DV-1000 keypad.

Frequently Asked Questions

NOTE: If you have general questions regarding the DV-1000 and your application, please check the following list of typical questions we receive. If you have already installed or programmed your DV-1000 and are having difficulties, refer to the Troubleshooting Guide in Appendix A at the end of this manual. If you still need assistance, please call us toll-free for technical support.

Can I use the DV-1000 to change data in the PLC?

Yes. There are two modes available for changing PLC data:

- Change Preset Mode lets you individually edit V-memory locations as a 4-digit BCD number, from a list of either 16 or 32 data word locations, and up to 99 timer presets and 99 counter presets (depending on CPU type).
- Bit Control Mode dedicates 8 of the 10 keys on the keypad for single-bit control. These operate as eight momentary, normally off pushbuttons.

Is there password protection for modes that allow the operator to change PLC data?

Yes, there is for Change Preset Mode. See Chapter 6 for more on this topic.

How many DV-1000s can be connected to the PLC?

A maximum of two DV-1000s may be directly connected to the DL240 and DL450 CPUs. See Chapter 2 for other options, and general information on this topic.

Can the PLC cause the DV-1000 to always power up in a certain mode?

Yes. The powerup default mode may be selected by using a particular entry in the parameter setup table. See Chapter 3 for more on this topic.

Is there a way to cause the DV-1000 to stay in Bit Control Mode (or any mode that I choose)?

You can set up the DV-1000 to power up in particular modes. However, if the operator presses certain keys on the keypad, this takes the DV-1000 out of its original powerup mode.

Can the PLC cause the DV-1000 to change modes during normal operation (PLC run mode)?

No. After establishing the powerup mode, further DV-1000 mode changes only occur upon keypad entry.

When does the DV-1000 read its setup parameters from the PLC?

These are read one time just after powerup, and any time a mode change is requested from the keypad.

What's the best way to enter setup parameters?

We recommend imbedding the setup as a part of the ladder program. Using a SP0 contact on the rung, it only executes on the first PLC scan. See Chapter 3 for more on setup parameters.

I need to display the phrase "TEMP 1", followed by the present value of the temperature in PLC V-memory, and also to allow changing that value right on the display. Is there a way to do this?

Yes. Use Change Preset Mode, with user-titled labels.

Can I use the DV-1000 to change timer or counter presets in the PLC?

Yes. The Change Preset Mode will let you do this. See Chapter 6 for more information on this topic.

Can the display show more ASCII characters than just letters of the alphabet?

Yes, the DV-1000 character set includes several special symbols. See Appendix B for a complete listing of characters and symbols with their ASCII codes.

Do I have to enter the ASCII codes in instruction boxes, or can I just type in the letters?

Actually, you may do it either way. The LD/OUT and LDD/OUTD instructions may place ASCII codes in the text table, or the ACON instruction box can convert characters in the box to ASCII codes (see Chapter 4 for more on this topic).

I need to show more than the display's 4 lines of text. Can I scroll or swap display screens?

Yes. The proper ladder logic will allow you to do this. Examples of multiple display screens and scrolling techniques may be found in Chapter 4.

Can I use the DV-1000 keypad to control machine functions, like Start, Stop, Step Jog, Run, etc.?

While technically possible, we **strongly recommend against** this type of application. Major machine control functions are best implemented with larger, dedicated switches, knobs, etc. The keys on the DV-1000 are intended primarily for various monitoring functions, or for occasionally changing V-memory Preset Values. *See the next question and answer!*

Are there other operator interfaces available from PLC Direct?

Yes. Please call our Technical Support Line (1-800-633-0405) for the latest information on other **Direct**LOGIC compatible products available from us or from industry affiliates.

Can the PLC sense when the operator makes keypad entries?

It depends. Bit Control Mode is designed for general key detection for eight of the ten available keys, which are redefined from their normal function. In the other modes, DV-1000 keypad activity cannot be detected in the PLC.

Can the display indicate when the DV-1000 is in Bit Control Mode?

Yes, but with some qualification. The display can be in Message Display Mode and the keypad in Bit Control Mode simultaneously (which is selectable as a powerup default mode). Ladder programming can detect keypad activity, and coordinate the message display to provide visual feedback from the keypad entry. However, the operator can leave the Message/Bit Control Modes if they desire.

Can I display a numeric value in Message Mode with a leading +/- sign?

Yes. An example ladder program that does this is in Chapter 4.

Can I display a blinking text message during an alarm condition?

Yes. An example ladder program that does this is in Chapter 4.

I plan to use the DV-1000 only with a DL105 or DL205. Are there low-cost DirectSOFT programming packages available just for these models?

Yes. The PC-PGM-105 and PC-PGM-205 programming packages are available, each at an attractive price for the DL105-only and DL205-only users.

What is the purpose of the the adjustment screw at the bottom of the DV-1000 housing?

Rotate this screw to adjust the contrast of the LCD segments on the display.

Specifications

<p>CPUs Supported</p> <p>DL130, DL230, DL240, DL250, DL350, DL430, DL440, and DL450 CPUs (see Section 2, Step 5 for specific communication port and cabling information)</p>	<p>Status Display</p> <p>Displays 16 or 32 point bit status for the following data types X, Y, GX, C, SP, T, CT, S</p> <p>Displays numeric values for V and P data types.</p>
<p>Cables and Connectors</p> <p>For DL105/DL205/DL350/DL450 - Part# DV-1000CBL 6.6ft. (2m) Cable with RJ12 connectors</p> <p>For DL430/DL440/DL450 - 2 methods: Part# D4-1000CBL, 6.0ft. (1.85m) Cable with an RJ12 and a 15-pin male D-sub connector (preferred), or Part # FA-CABKIT, Use the Universal Cable Kit to attach the DV-1000CBL to the CPU port</p>	<p>Change Preset Values</p> <p>DL130, DL230 and DL240 CPUs up to 16 user-titled values</p> <p>DL250, DL350 and all DL405 CPUs up to 32 user-titled values</p> <p>Also includes:</p> <p>1-99 values titled as TIMERxx</p> <p>1-99 values titled as COUNTERxx</p>
<p>Message Display</p> <p>One 4 x 16 character message display is available (message must be in CPU program)</p> <p>Displays text and embedded numeric values which update with the application program</p> <p>Displays PLC System Error Messages and Fault Message Outputs</p>	<p>Bit Control</p> <p>Assigns 8 contiguous points to the DV-1000 keypad</p> <p>Eight keys on the keypad operate as momentary normally open pushbutton switches</p> <p>Bit data types which can be assigned are: X, Y, GX, and C</p>
<p>Environmental</p> <p>Operating Temperature 32 to 122 °F (0 to 50 °C)</p> <p>Storage Temperature -4 to 158 °F (-20 to 70 °C)</p> <p>Humidity 30 to 95% (non-condensing)</p> <p>Environmental Air No corrosive gases</p> <p>Vibration MIL STD 810C 514.2</p> <p>Shock Resistance MIL STD 810C 516.2</p> <p>Noise Immunity NEMA ICS3-304</p> <p>Regulatory Agency Approvals UL® Listed</p> <p>Power 150 mA @ 5VDC obtained through PLC port</p> <p>Dimensions 5.12" W x 2.83" H x 1.03" D 130mm W x 72mm H x 26mm D</p> <p>Weight 5.8oz. (165.7 g)</p>	

Installation Guide

In This Chapter. . . .

- Introduction
 - Step 1: Choosing Single or Dual DV-1000s
 - Step 2: PLC Selection
 - Step 3: Selecting a Mounting Location
 - Step 4: Panel Mounting
 - Step 5: Cable Selection
 - Step 6: Connecting the DV-1000 to the CPU
 - Step 6: Installing the Example Programs
 - Step 8: Starting *Direct*SOFT
-

Introduction

This section guides you through the process of installing the DV-1000 in your application. You can use the relevant sections to either make a permanent installation, or just a temporary connection on your desktop for developing your application program. The installation steps in this section are:

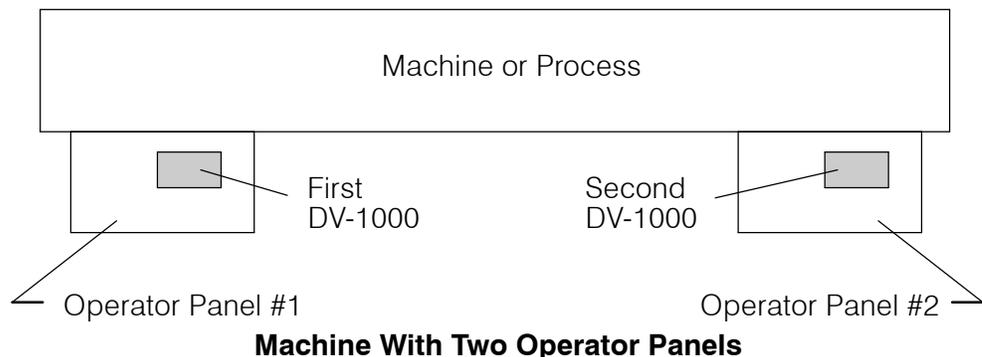
- Step 1: Choosing Single or Dual DV-1000s
- Step 2: PLC Selection
- Step 3: Select a Mounting Location
- Step 4: Panel Mounting
- Step 5: Cable Selection
- Step 6: Connecting the DV-1000 to the CPU
- Step 7: Installing the Example Programs
- Step 8: Starting *DirectSOFT*

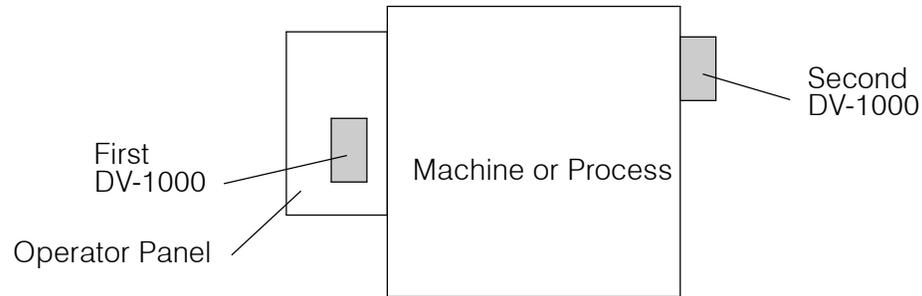
After the installation, you'll be ready to begin programming and using your DV-1000.

NOTE: . If you have trouble while programming or using your DV-1000, refer to the *Troubleshooting Guide in Appendix A* of this manual.

Step 1: Choosing Single or Dual DV-1000s

DL240, DL250, DL350, DL440 and DL450 CPUs can support two DV-1000 units (DL130, DL230 and DL430 CPUs can support only one DV-1000: DL130 and DL230 CPUs only have one communications port and only the top communications port on a DL430 may be used to connect a DV-1000). Connecting a second DV-1000 to the CPU requires no additional programming beyond what is required for the first one. While most applications only require one DV-1000 per machine, or per PLC, occasionally it is advantageous to add a second one. Refer to the drawing below. For example, some machines have two operator stations that are some distance apart. In other cases, the machine needs only one control panel, but a second DV-1000 placed elsewhere on the machine could make it more convenient for personnel to access data (such as monitoring machine status).





Machine With Operator Panel and Monitoring Station

Dual DV-1000 Operating Characteristics

To help you decide whether dual DV-1000s are right for your application, we list some of the operating characteristics:

- Both DV-1000s share the same setup parameter table in the CPU's V-memory. After powerup, they both read the same parameters, and read the same data blocks elsewhere in V-memory for message data, preset titles, and so on.
- If you select a powerup default mode other than "Previous Mode", both units will power up in the mode you select (via the setup parameter).
- The keypads operate independently, so the DV-1000s can be placed in different modes during operation.
- In all monitoring functions, the units operate independently. One unit can view X input point status while the other views V-memory locations, for example.
- In all control functions, the units operate in a logical OR fashion. Either unit can change a preset, and the result is reflected at the other unit as well. Bit control also works in a logical OR fashion.

Knowing these operating characteristics, you need only one DV-1000 connected to the CPU as you develop the application program. When your programming is finished, just plug in the second DV-1000!

DL240, DL450 Connection

The DL240 and DL450 CPUs are best suited for dual DV-1000 applications, because both DL240 communication ports and the top and middle DL450 ports may connect directly to DV-1000s. Be sure to configure both ports for K-sequence protocol.

DL250, DL350, DL440, Connection

The DL250, DL350 and DL440 CPUs can connect to two DV-1000s, but not as simply as a DL240 or DL450. The various methods are as follows:

- By adding Data Communication Modules (DCM), you can connect additional DV-1000s.
- A second DV-1000 may be connected directly to the CPU, by using the bottom communication port and adding an external +5V supply (since the bottom port does not supply +5V). Use the cable diagrams later in this chapter for connector pin-out information.
- A DL405 Smart Slice product can connect to one DV-1000 (applies to DL405 products only).

Step 2: PLC Selection

The DV-1000 works with all DL105, DL205 and DL405 series CPUs, in addition to DL350 CPUs. At this point you may already know which PLC family and type best fits your application. However, differences in the availability of features exist that you may want to factor into your decision. The table below outlines the feature differences.

DV-1000 FEATURES	DL105 DL230	DL240	DL250, DL350, DL430, DL440, DL450
Selectable Power-up Mode	Yes	Yes	Yes
Text and Numeric Messages	Yes	Yes	Yes
Status Available of V-Memory Data Types:	X, Y, C, SP, T, CT, S, V, P	X, Y, C, SP, T, CT, S, V, P	X, Y, GX, C, SP, T, CT, S, V, P
Change Preset Locations	16	16	32
Change Preset Password	Yes	Yes	Yes
Titled Timer Preset Values, Number Available	16	99	99
Titled Counter Preset Values, Number Available	16	99	99
Bit Control	Yes	Yes	Yes
Number of DV-1000s Connectable Directly to CPU	1	2	1 (2 for DL450)

Also consider the availability of certain features in each CPU type that supports programming for the DV-1000, given in the following table.

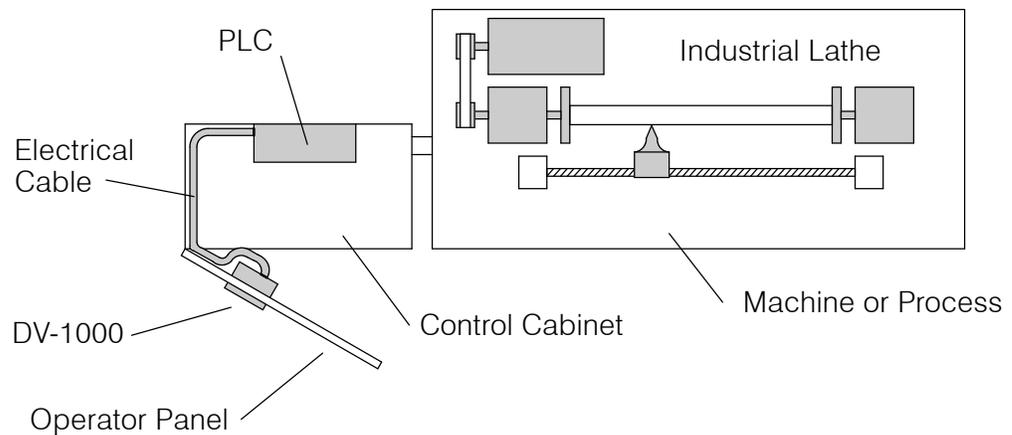
CPU Features That Support DV-1000 Programming	DL130 DL230	DL430	DL240, DL250, DL350, DL440, DL450
ACON Instruction (ASCII Const.)	Yes	No	Yes
MOVMC Instruction	Yes	No	Yes
Can Connect CPU simultaneously to DV-1000 and <i>DirectSOFT</i>	No	Yes	Yes

Overall, the **DL240, DL250, DL350, DL440** or **DL450** CPUs are the best choices for DV-1000 applications. The main inconvenience with the DL430 is its lack of ACON and MOVMC instructions that help in Message Display Mode. Use of the DL130 or DL230 requires switching its single communications port between the DV-1000 and *DirectSOFT* programming while you are developing the ladder program.

Step 3: Selecting a Mounting Location

Before actually installing the DV-1000 in your application, we recommend doing a sketch of the control panel or operator interface, or wherever the DV-1000 will be installed. One goal in doing this sketch is to determine the length of cable needed to connect the DV-1000 to the PLC. The sketch needs to show the DV-1000 and the PLC to which it connects. Try to include the following details:

- Operator Panel location on machine or factory floor
- Operator Panel layout, including DV-1000 mounting location(s)
- Control Cabinet layout, including PLC mounting location
- Electrical cable connecting DV-1000 to PLC (showing cable length)

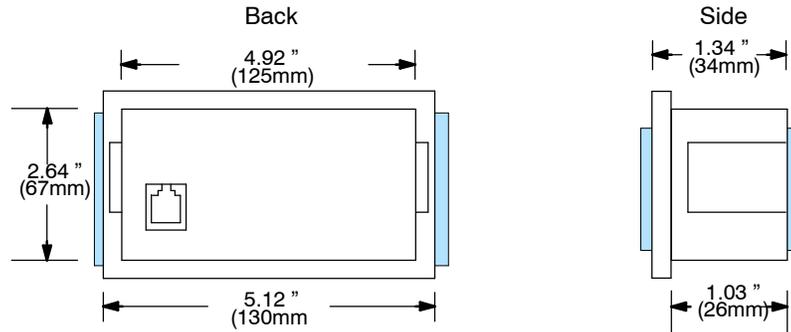


Example Application Sketch (Top View)

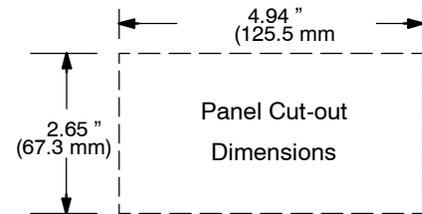
If your application requires two DV-1000s in the operator interface, include them both in the sketch. If possible, do Step 3 before finalizing your application layout. This planning may eliminate the need to make a custom cable in the event standard cables are too short for your initial layout.

Step 4: Panel Mounting

The DV-1000 is designed to easily snap into a rectangular cutout in a control panel or other surface panel at the machine. On each side of the housing there is a retention clip to keep the unit in place after installation. The drawing below gives the physical dimensions of the DV-1000 housing.



The panel cut-out dimensions are shown to the right. This size rectangle will provide necessary clearance for the body of the unit, but will allow the outer housing bezel to cover the edges of the cut-out for a nice finished appearance. The optimum panel thickness for using the retention clips is 1/16" to 1/8".



When your panel cut-out is finished, you're ready to mount the DV-1000 in the control panel. Simply push it in from the front, and it will snap into place. If you need to remove the DV-1000, just press the retention clips inward while pushing the unit from the rear toward the panel's front side, and it should just slip out.

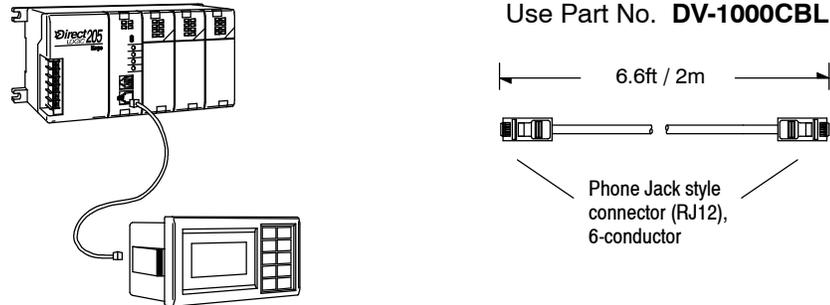
NOTE: If possible, avoid mounting other control panel devices directly under the DV-1000. Doing so may interfere with access to the brightness adjustment screw.

Step 5: Cable Selection

In this step we select the appropriate cable to connect the DV-1000 to your CPU. Cables come in two versions, which differ in the connector type at one end. One version is for connection to all DL105, DL205 and DL350 CPUs. The other is for DL430 and DL440 CPUs. DL450 CPUs can use either version.

DL105, DL205 DL350, DL450 Phone Jack Style Connection

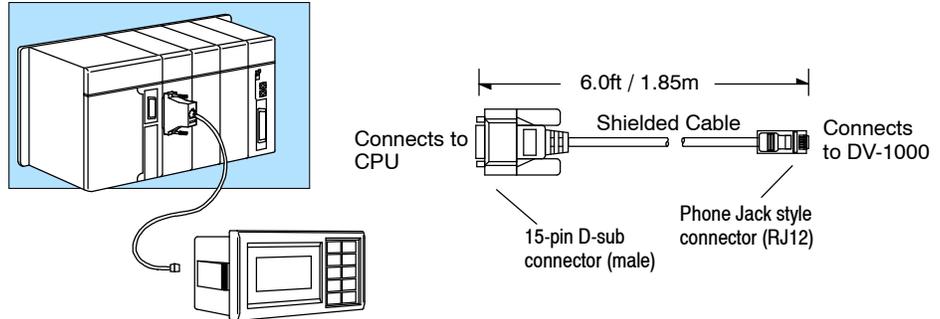
The DV-1000 connects to the single phone-jack-style communications port on a DL130 or DL230, the top port on a DL250, DL350, or DL450, or to either port on a DL240. The standard cable and its part number are listed in the following figure.



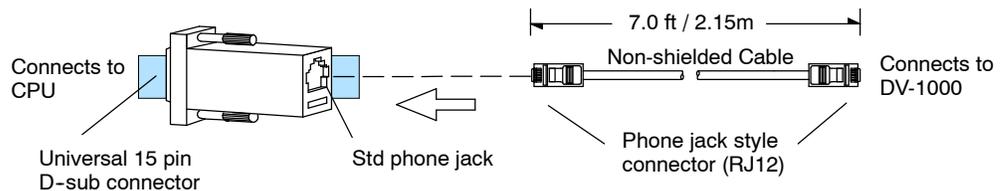
DL430, DL440, DL450 15-Pin Connection

The DV-1000 connects to the 15-pin top port on DL430 and DL440 CPUs and the middle port on DL450 CPUs. The bottom port on these CPUs do not provide the needed +5V. There are two methods for making these connections, shown below.

Method 1 (preferred): Use Part No. **D4-1000CBL**



Method 2: Use Part No. **FA-CABKIT**



NOTE: The DV-1000 uses K sequence protocol to communicate to the PLC. Some TI435[®] CPUs could reliably connect to only one device at a time using K sequence protocol. K sequence protocol is available on all ports on DL105, DL205, DL405 and DL350 CPUs.

Custom Cables

The first method (the preferred method) uses a special shielded cable with a modular phone-jack-style connector on one end and a 15-pin D-shell connector on the other. The connectors plug directly into the DV-1000 and CPU port.

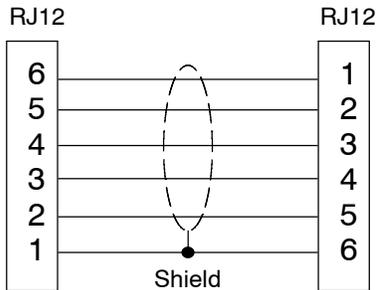
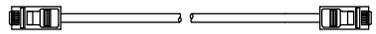
The second method uses a non-shielded cable and an adapter plug from the cable kit. The cable (same as DL105, DL205, DL350, DL450 cable) has a modular phone-jack-style connector at both ends, so either end will connect to the DV-1000. The other end connects to an adapter to go from a 6-conductor modular to a 15-conductor D-shell to connect to the CPU port.

In some applications the length of the standard PLC*Direct* cable may not be quite long enough. You may make your own cable, but observe the following guidelines:

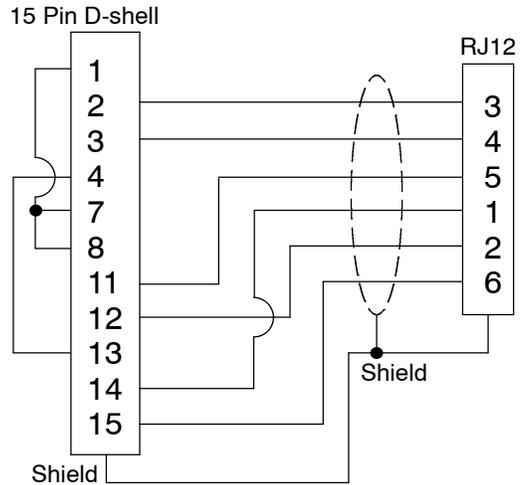
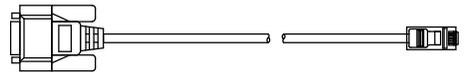
- Use a shielded type cable. Be sure to connect its shield at both ends to the appropriate connector pins.
- Do not exceed 15 feet in length.

NOTE: The standard cables are approximately 6 feet long. If you have determined the need for a cable longer than 6 feet, you may use a slightly longer one (up to 15 feet). The noise immunity of the DV-1000 communications may decrease with cables longer than 15 feet.

DL105, DL205, DL350, DL450 Connection



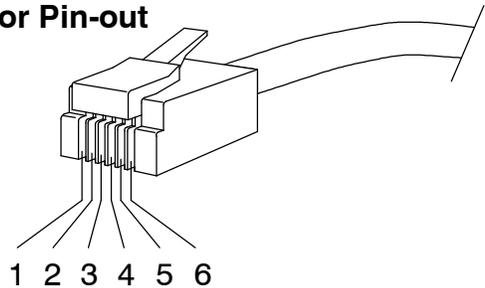
DL430, DL440, DL450 Connection



Pin Information

1	Common
2	+5VDC
3	RX
4	TX
5	+5VDC
6	Common

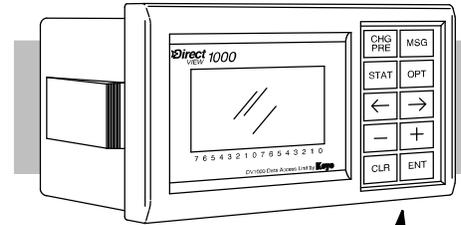
RJ12 Connector Pin-out



Step 6: Connecting the DV-1000 to the CPU

In the first five steps we have selected the number of DV-1000s, PLC type, decided where to mount the PLC and DV-1000, and selected the proper cable to connect them. Now we're ready to connect the DV-1000 to the CPU. After doing so, turn on the PLC by applying electrical power. If properly connected, the DV-1000 will turn on whenever the PLC is on (the CPU "PWR" LED is illuminated). The back-light is always on whenever the DV-1000 is powered.

After the DV-1000 is powered, you can adjust the display contrast. An adjustment screw is accessible at the bottom of the unit through a small hole. Use a small Philips screwdriver to adjust the contrast for ambient lighting conditions and desired viewing angle.

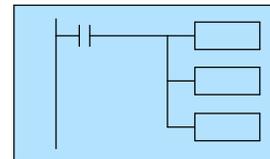


Contrast Adjustment Screw
(on bottom of unit)

In almost all cases, the DV-1000 display will show some message at first powerup. The exact message on the display depends mostly on the current CPU mode, but also the contents of CPU program memory and variable memory.

Step 7: Installing the Example Programs

A diskette of example programs is included with this manual. All of the example programs in the manual are on the diskette. One of the best ways to learn the DV-1000 is to load and run these programs. It is possible to load the examples from the diskette. However, we recommend copying them to the hard drive in your computer, and keep the original diskette in a safe place.



To install the example programs if **using Windows 3.1**, follow these steps:

1. Make a new directory on the hard drive in your computer. For example, if the hard drive is drive C, type:

MD C:\DV-1000

2. Copy all the files from the example program disk to the new directory. For example, if the diskette is in drive A: and the hard drive is drive C:, type:

COPY A:*.* C:\DV-1000*.*

To install the example programs if using **WIN 95**, follow these steps:

1. Select the **Explorer** icon and open. If the hard drive is drive C, select the **(C:)** icon.
2. Make a new directory in the hard drive of your computer. For example, Select the **File** menu, then select **New** and then **Folder**. Notice the **New Folder** icon that appears. Select the folder and name it "DV-1000" by selecting the **File** menu and selecting **Rename**. Type in the new name.
3. Copy all the contents of the example program disk. Insert the diskette in drive A, and select and open the **3 1/2 Floppy (A)** icon. Notice the disk contains two directories and one text file: "130_230", "240_450", and "Readme.txt". Select all three by opening the **Edit** menu and selecting **Select All**. Open the **Edit** menu again and select **Copy**.
4. Paste the program disk contents into the new C drive "DV-1000" directory. Open the "DV-1000" directory, open the **Edit** menu and select **Paste**.

After these steps, you're ready to start **DirectSOFT** and run the example programs. Open the README file in the examples directory for instructions on which set of examples to use with your PLC. Use the examples in the **105** directory if using any DL105 MicroPLC. Use the examples in the **230** directory if using a DL205 with a D2-230 CPU. Use the **240_250** examples if using a DL205 with a D2-240 or D2-250 CPU. Use the **350_405** examples if using a DL305 with a D2-350 CPU or any DL405 CPU.

Step 8: Starting *DirectSOFT*

Initialize the CPU

The DV-1000 relies on the ladder program and setup parameters in V-memory for much of its operation. Before we begin the series of examples and lessons in the following chapters, it is important to get your CPU in a known starting state. Only then will the examples in the following chapters in this manual work or make sense to you. The starting condition of the PLC that we need is with program memory cleared, and V-memory cleared. The following steps will guide you through this process.

1. Connect the communications cable from your personal computer communications port to your PLC's programming port on the CPU.
2. Start *DirectSOFT* on your personal computer.
3. Select a link to go online with the CPU.
4. Save the project file to disk at this time, if you created a program in the PLC that has not been saved to disk.
5. Verify the CPU is in program mode. From the menu bar, select **PLC**, then **PLC Modes**, then **Program**. Then select "OK", or press Return.
6. From the menu bar, select **PLC**, then **Clear PLC memory**, then **All**. Then select "OK", or press Return.
7. From PLC menu, choose Setup, then **Initialize Scratchpad**. This ensures the DV-1000 setup parameters are initialized to zero values.

NOTE: If you are using a DL130 or DL230 CPU, you probably noticed by now that it has only one communications port. Therefore, you will have to swap communications cables in that port in order to alternately use *DirectSOFT* and the DV-1000 with the CPU. Using a DL240 CPU which has two ports will alleviate this inconvenience.

Loading an Example Program

To load an example program from the DV-1000 directory on the hard drive, do the following:

1. Select the **Files** menu, then **Open Project**.
2. A dialog box will appear. Select the disk and directory where the example programs reside (for example, drive C:, directory \DV-1000).
3. Select the file name of the program you wish to load, then OK. When the program has loaded, its ladder rungs will appear on the monitor screen.
4. Select the **PLC** menu, then **Connect**, then select the link to use. All the program examples are saved without PLC link information, so you have to re-connect to your particular CPU. If a message appears which asks you to select the source of program to view, select **Disk**.
5. Ensure the CPU is in Program mode. Then download the program to the CPU. Select the **File** menu, **Write Program...**, then select **To PLC**.
6. When the program has downloaded, put the CPU in Run Mode. Select the **PLC** menu, **PLC Modes...**, then select **Run**.
7. Then follow the directions with the example program from this manual. Usually you will have to use the keypad to get the DV-1000 in a particular mode to see the program operate.

DV-1000 Setup Parameters

In This Chapter. . . .

- Overview
 - Parameter Definitions
 - Entering Setup Parameters
 - Using the LDA Instruction for Pointer Setup Parameters
 - Powerup Default Operational Mode
 - Chapter Summary
-

Overview

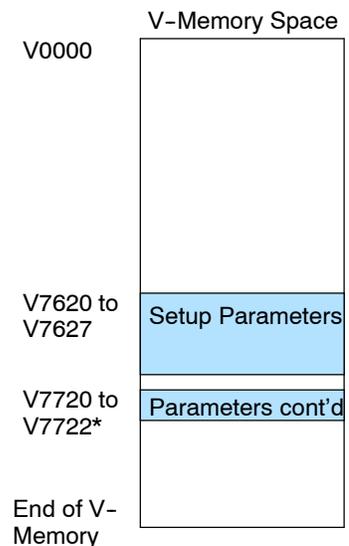
Purpose of Setup Parameters

Some of the operational modes of the DV-1000 have user-selectable features which require some user programming before those modes may be used. In the Display and Keypad Basics exercise of Chapter 1 we saw some “Setup Error” messages occur. These were normal because there were no setup parameters entered for the mode requested by our keypad entry. The goal of this chapter is to define the setup parameter requirements for all DV-1000 modes, and then show how easy it is to program these parameters.

All setup parameters reside in the CPU’s V-memory space, not in the DV-1000. This is the most fundamental concept in understanding setup parameters. The DV-1000 has no user memory of its own. Instead, a block of V-memory locations is reserved in the CPU specifically for these setup parameters.

Location of Setup Parameters

At powerup, the DV-1000 reads the setup parameters from the CPU’s V-memory. Refer to the image of V-memory to the right. The memory map starts at the top at V0000, and its width is one data word. Setup parameters occupy V-memory locations from V7620 to V7627 on all CPUs, and from V7720 to V7722 on all CPUs except DL130 and DL230 CPUs, which use locations V7640 to V7642. Although they are technically separated into two blocks, this manual simplifies the discussion by combining these into one block. All subsequent drawings of this memory map show DV-1000 setup parameters as one data block.

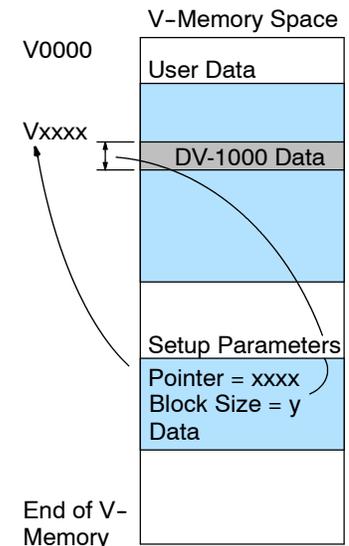


*DL130 and DL230 CPUs use locations V7640 to V7642 instead of V7720 to V7722.

Types of Setup Parameters

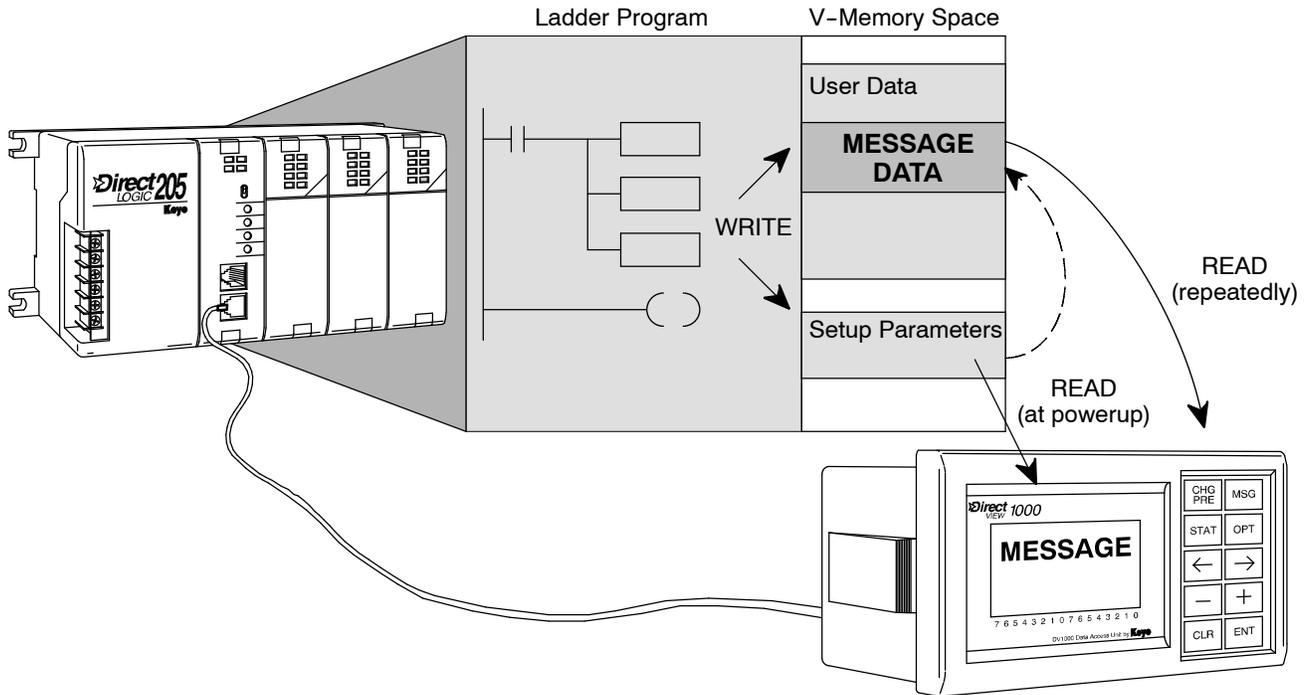
The individual data word contents of setup parameters belong to one of three types of functions:

- **Pointers** - simply point to the starting V-memory address of another data block in the User Data portion of V-memory that contains information useful to the DV-1000.
- **Block sizes** -tells how many V-memory locations (data words) are in the block referenced by the associated pointer.
- **Data** - constants which the DV-1000 reads for configuration purposes.



How the DV-1000 Uses Setup Parameters

As an example, let's look at how the DV-1000 uses setup parameters to display messages. At powerup, the ladder program writes the setup parameters. The DV-1000 uses the pointers and block sizes to find the message data for example, as shown below. During operation, the DV-1000 reads the message data repeatedly, and interprets it to create an output on the display.



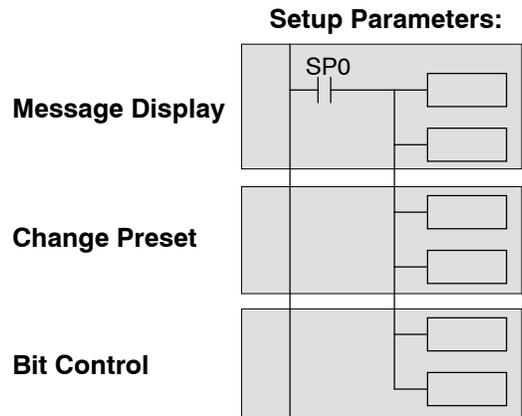
The DV-1000 applies the same basic procedure to all modes which require setup parameters:

- Read the setup parameters at powerup.
- Read or write the associated data for each mode during normal operation.

Setup Parameter Ladder Rung

Most operational modes of the DV-1000 require setup parameters. You'll first need to decide which modes are required in your application. You can even develop and test the ladder program for each mode separately. However, all the setup parameter instructions may be combined into a single rung, as shown to the right.

After the setup parameter rung, the main program begins.



Parameter Definitions

The setup parameters consist of a total of eleven V-memory locations. Together, they contain several pointers, block sizes, and data. The following table shows the setup parameters as one group. Following the description of each parameter, the DV-1000 mode which uses that parameter is listed. The remaining column references other chapters for more information on how to use specific setup parameters. This table applies to all CPUs.

PLC CPU V-memory Locations	DV-1000 Parameter Description	Operational Mode	See Chapter Number
V7620	Change Preset Values Pointer	CHG PRE	6
V7621	Change Preset Titles Pointer	CHG PRE	6
V7622	Change Preset Block Size	CHG PRE	6
V7623	Numeric Message Pointer	MSG	4
V7624	Text Messages Pointer	MSG	4
V7625	Bit Control Pointer	BIT CNTRL	7
V7626	Powerup Operational Mode	Power-up Default	3
V7627	Change Preset Value Password	CHG PRE	6
V7720*	Titled Timer Preset Value Pointer	CHG PRE	6
V7721*	Titled Counter Preset Value Pointer	CHG PRE	6
V7722*, High byte	Titled Timer Preset Block Size	CHG PRE	6
Low byte	Titled Counter Preset Block Size	CHG PRE	6

*DL130 and DL230 CPUs use different memory locations here: V7640 instead of V7720, V7641 instead of V7721, and V7642 instead of V7722.

The table on the following page gives further details about the setup parameters. Following each parameter description, the next column gives the proper data type for each parameter. In general, pointers are address locations which are in octal. Block sizes are simply the number of V-memory locations, so it's easiest to think of these quantities as BCD numbers. Other data such as the password is also a BCD number. The ranges columns list the acceptable range of addresses for pointers, or simple numeric ranges for block sizes and data. Be sure to find the column for the particular CPU you are using.

PLC CPU V-memory Locations	DV-1000 Parameter Description	Data Type	DL130 DL230 Ranges	DL240, Ranges	DL250 DL350 DL430 Ranges	DL440 Ranges	DL450 Ranges
V7620	Change Preset Values Pointer	Octal	V2000 to V2377, V4000 to V4177	V2000 to V4377	V1400 to V7377	V1400 to V7377, V10000 - V17777	V1400 to V7377, V10000 - V37777
V7621	Change Preset Titles Pointer	Octal	V2000 to V2377, V4000 to V4177	V2000 to V4377	V1400 to V7377	V1400 to V7377, V10000- V17777	V1400 to V7377, V10000- V37777
V7622	Change Preset Block Size	BCD	1 - 16	1 - 16	1 - 32	1 - 32	1 - 32
V7623	Numeric Message Pointer	Octal	V2000 to V2377, V4000 to V4177	V2000 to V4377	V1400 to V7377	V1400 to V7377, V10000- V17777	V1400 to V7377, V10000- V37777
V7624	Text Message Pointer	Octal	V0000 to V2377, V4000 to V4177	V2000 to V4377	V1400 to V7377	V1400 to V7377, V10000- V17777	V1400 to V7377, V10000- V37777
V7625	Bit Control Pointer	Octal	X, Y, or C V-mem. locations	X, Y, or C V-mem. locations	X, Y, GX, or C V-mem. locations	X, Y, GX, or C V-mem. locations	X, Y, GX, or C V-mem. locations
V7626	Power-up Operational Mode	BCD	0, 1, 2, 12, 3	0, 1, 2, 12, 3	0, 1, 2, 12, 3	0, 1, 2, 12, 3	0, 1, 2, 12, 3
V7627	Change Preset Value Password	BCD	0000 to 9999	0000 to 9999	0000 to 9999	0000 to 9999	0000 to 9999
V7720*	Titled Timer Preset Value Pointer	Octal	-	V2000 to V4377	V1400 to V7377	V1400 to V7377, V10000- V17777	V1400 to V7377, V10000- V37777
V7721*	Titled Counter Preset Value Pointer	Octal	-	V2000 to V4377	V1400 to V7377	V1400 to V7377, V10000- V17777	V1400 to V7377, V10000- V37777
V7722*, High byte	Titled Timer Preset Block Size	BCD	-	1 to 99	1 to 99	1 to 99	1 to 99
V7722*, Low byte	Titled Counter Preset Block Size	BCD	-	1 to 99	1 to 99	1 to 99	1 to 99

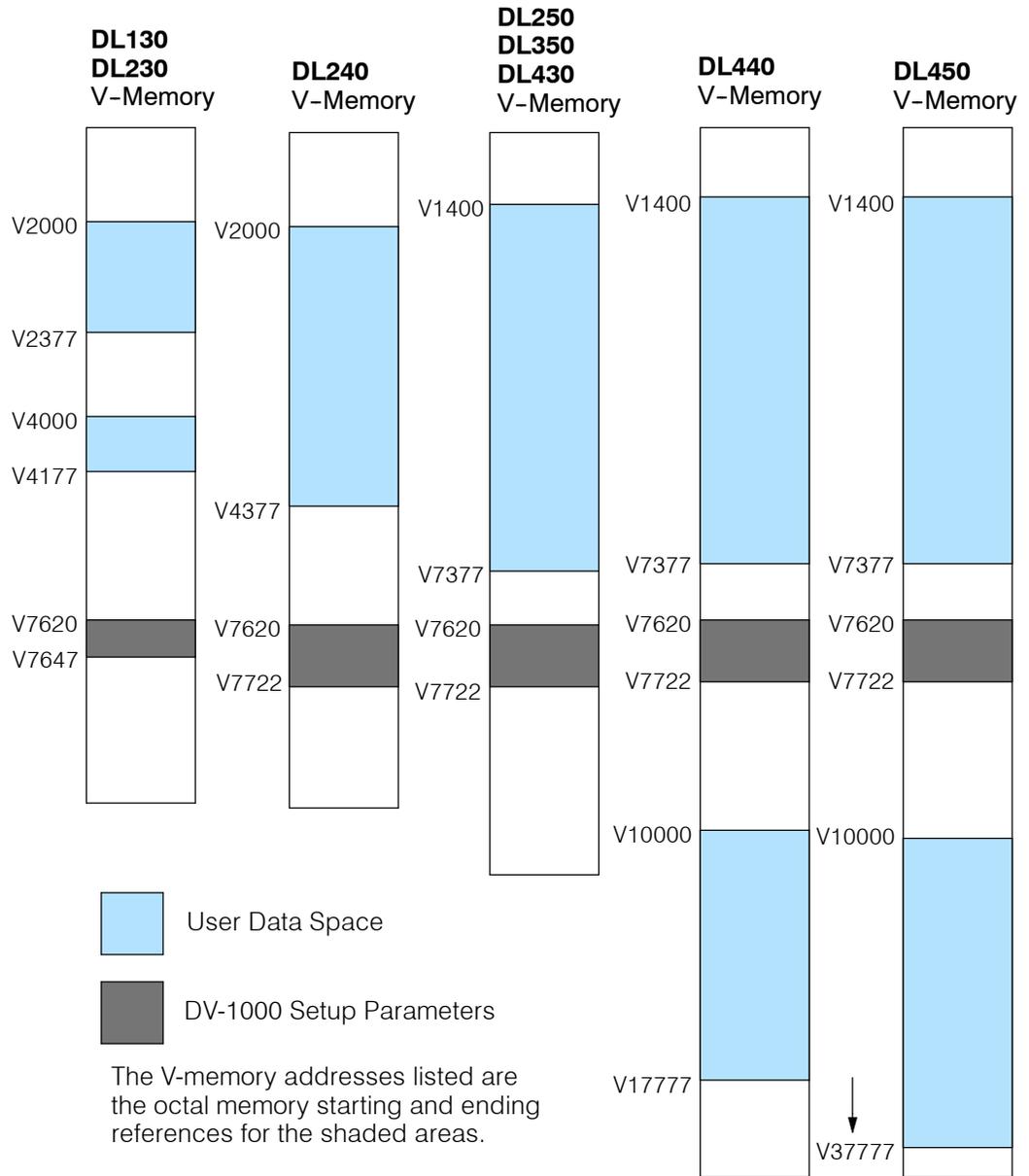
*DL130 and DL230 CPUs use memory locations V7640 thru V7642 here.

V-Memory Maps

The following figure summarizes the V-memory map information for the eight CPUs listed in the previous table. These memory graphs show the identical location of the setup parameters for all CPU types. The amount of user data memory space increases with each CPU type from left to right. For each CPU, the setup parameters which are pointers must point to space within the user data space shown.

In order to simplify examples in this manual, we will confine DV-1000 related data to a memory area common to all CPU types. Therefore, the examples will use a block of memory starting at V2000. This allows specific example ladder programs to work for all CPU types. The only exception to this is that DL130 and DL230 CPUs do not have memory locations V7720-V7722 and use V7640-V7642 instead.

Setup Parameters



Entering Setup Parameters

Methods for Entering the Setup Parameters

Three main techniques are available for setting the values of the DV-1000 setup parameters:

Using your RLL/RLL^{PLUS} program - (the recommended approach) Ladder logic initializes any required setup parameters during the first scan (use contact SP0). The DV-1000 reads these at powerup or when a keypad entry requests a mode change. This method has the *advantage* of imbedding the setup parameter values in the main ladder program which relies on them, also enabling you to add comments to the setup parameters.

Using the DirectSOFT memory editor or DV-1000 setup utility - You can use the memory editor or DV-1000 setup utility in **DirectSOFT** to enter the proper setup parameter values in specific V-memory locations. Both methods provide tools to allow you to quickly enter values as different data types (BCD/HEX, Octal, Text...). The *disadvantage* to using these methods is the setup parameters are susceptible to change or loss with no indication given to the user. Some scenarios are:

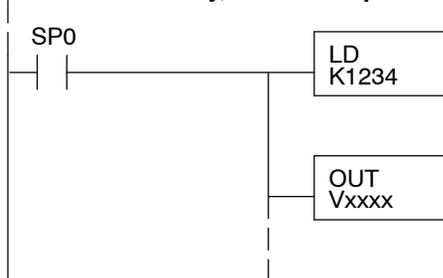
- The battery which supports retentive V-memory locations can become weak or may be removed, causing a loss of setup parameters in the CPU V-memory during a power failure.
- Someone else may inadvertently edit parameter values, overwriting the original settings.
- If someone swaps the CPU for another and copies the ladder program from the old to the new CPU, it is easy to forget about copying the setup parameters as well.

Because of these scenarios and their resulting confusion, we recommend the first method above: initializing the setup parameters in the application ladder program.

Parameter Setup By Ladder Program

To initialize setup parameters, the ladder program must load the desired constants into specific V-memory locations. The DV-1000 reads its setup parameters from V-memory at each powerup, and after a mode change from the keypad. The ladder program needs only to initialize setup parameters on the first scan. Soon after the first scan, the DV-1000 retrieves its setup parameters from V-memory, and uses them thereafter. The following general ladder program shows the recommended ladder program arrangement.

First Scan Only, Load Setup Parameters



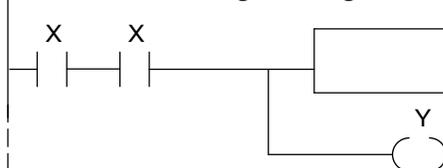
Load the desired setup value into the accumulator ("K1234" is an example only). Sometimes this will be a constant, or other times an octal address.

Use the LDA instruction when loading octal addresses!

Then place the value in the proper V-memory location for the selected setup parameter.

Repeat the above procedure for as many setup parameters as are required by the DV-1000 modes to be used.

Main Ladder Program Begins



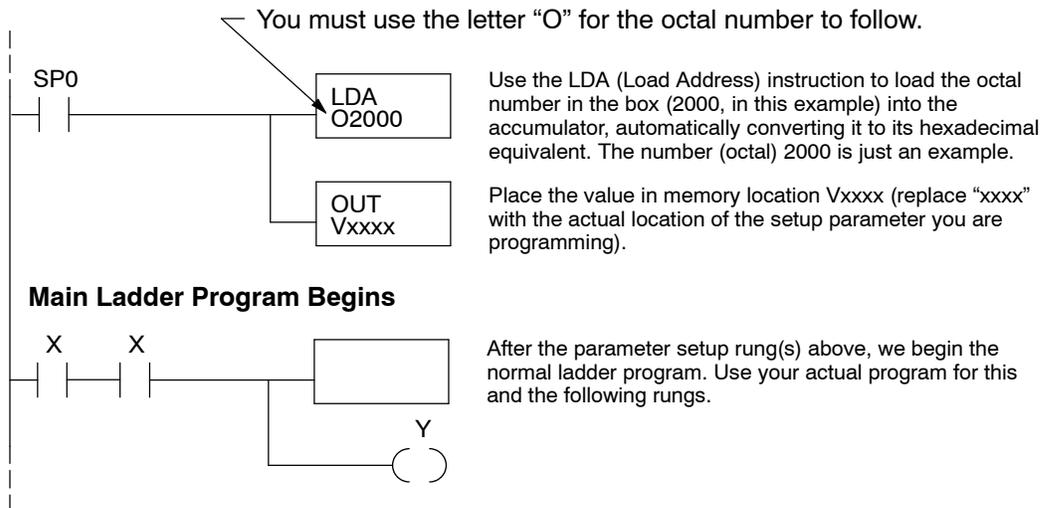
After the parameter setup rung(s) above, we begin the normal ladder program. Use your actual program for this and the following rungs.

Using the LDA Instruction for Pointer Setup Parameters

The previous section on the Power-up Default parameter demonstrates how to program a *constant* in the setup parameter table and see the results. Most of the remaining parameters are of the address *pointer* type. We will only cover the general case of pointers in this section, so refer to specific chapters on the modes corresponding to any specific pointers type parameters you may be interested in.

It is usually easiest to think of address pointers as octal numbers, just as they are numbered in the I/O map. However, the address pointers must be stored in hex format. The **Load Address (LDA)** box instruction makes the *octal-to-hex conversion automatically*. The following ladder example assumes you want a pointer to V-memory location (octal) V2000.

First Scan Only, Load Address Pointer Setup Parameter



Powerup Default Operational Mode

Powerup Default Setup Parameter

We will begin to use setup parameters with the simplest and most fundamental of them all: the powerup default mode. A single constant in the setup parameter table is all that's required. The keypad and display exercise in Chapter 1 demonstrated that several operational modes are available by using the keypad. In an actual factory installation, it is unlikely that an operator will be present to use the keypad at each system powerup. Therefore, it is important to provide a method to determine beforehand the mode the DV-1000 automatically enters at powerup. It's a good idea to program the powerup default parameter, regardless of which DV-1000 mode(s) you intend to use. The available selections are:

- Enter previous mode (at power-down)
- Enter Change Preset Mode
- Enter Message Display Mode without Bit Control
- Enter Message Display Mode with Bit Control
- Enter Status Display Mode

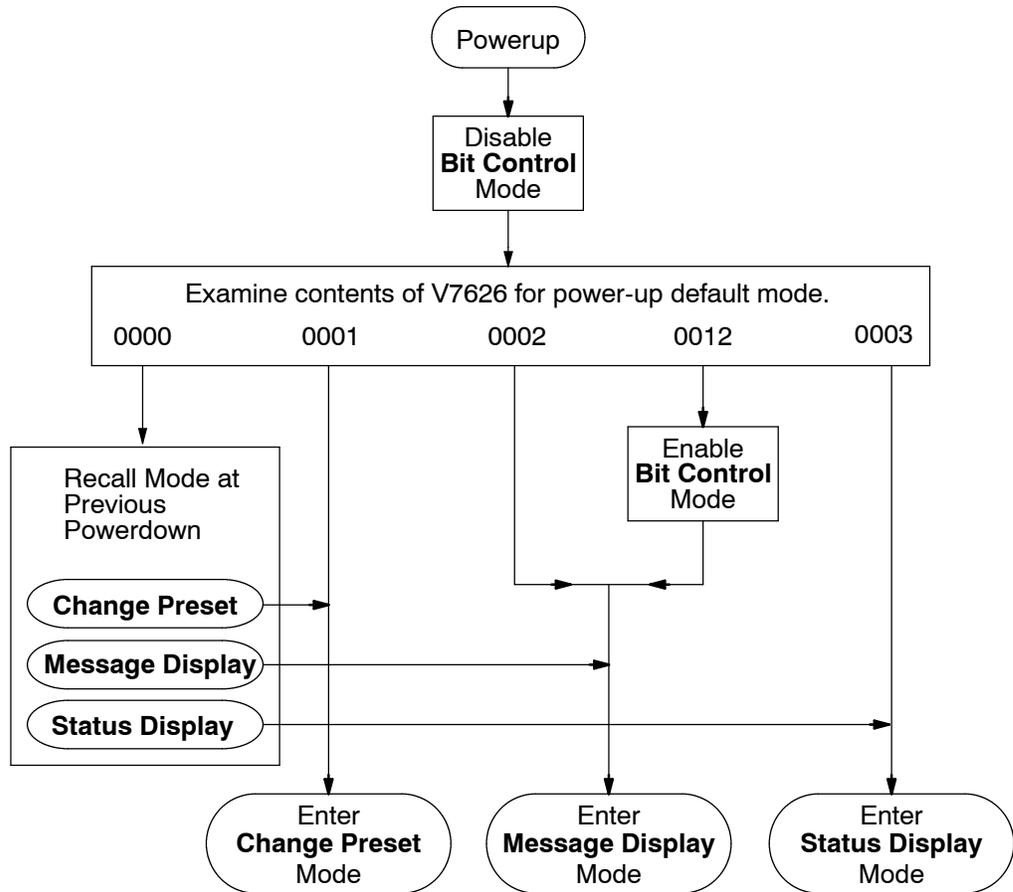
In order to select the proper power-up default mode for your application, you need to know something about how the DV-1000 will be used in the finished machine or factory process. In some situations, a single operator will frequently use the keypad and change DV-1000 modes from one to another. They may expect the DV-1000 to remain in the mode they were last using, even after a power cycle. The first choice on the list above will do this. In other situations, multiple personnel will use the keypad. Or, the application may use the DV-1000's display mainly for monitoring purposes. In these cases you may want to set up the DV-1000 to enter a specific operational mode at every powerup, which the remaining selections in the list will do.

A single parameter selects the powerup default operational mode, stored in BCD format at V7626. The following table lists the default choices and the required setup parameters.

Power-up Default Operational Mode	V7626 BCD Value
Previous Mode: Change Preset, or Message Mode, or Status Mode	0000
Change Preset	0001
Message Mode <i>without</i> Bit Control Mode	0002
Message Mode <i>with</i> Bit Control Mode	0012
Status Mode	0003

NOTE: The power-up default "Previous Mode" (code 0000) will power up any of three modes, but Bit Control is not offered (for safety reasons). So, even if you manually put the DV-1000 in Bit Control Mode before the power cycle, the unit will not power up in Bit Control Mode. This is done for safety reasons, because there is no constant indication that the unit is in Bit Control Mode. If you want the DV-1000 to power up in Bit Control Mode, you must choose "Message Mode *with* Bit Control" by entering "0012" in location V7626.

Powerup Sequence The following flow chart shows the DV-1000's actions on powerup. It begins with Bit Control disabled. Then it reads the setup parameter at V7626 for the power-up default mode.



Select the value to place in V7626 according to the desired default powerup mode:

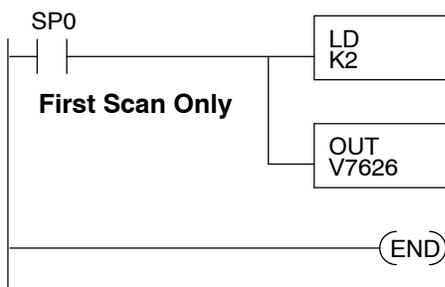
- Previous Mode (at power-down) - Power down in either Change Preset, Message Display, or Status Display modes. The DV-1000 will power up in the previous mode.
- Change Preset Mode - the operator uses the keypad to change data values at selected memory locations shown on the display.
- Message Display Mode - display messages (text and numbers). This can be *with* or *without* Bit Control Mode, because the two modes are independent. Message Display Mode (once entered) utilizes only the display, while Bit Control Mode (once entered) utilizes only the keypad.
- Status Display Mode - to monitor values of V-memory locations selected from the keypad.

NOTE: If you use Message Mode *with* Bit Control enabled as the power-up default, we recommend using your ladder program to write a message to the DV-1000 display indicating bit control mode. See the chapter on Bit Control Mode for more details, including an example program.

Powerup Default Example Program

Now we give an example ladder program to enter the Power-up Default Operational Mode you have selected in V7626. The program uses "Message Mode *without* Bit Control", just for example. An END coil on the last rung makes this a complete but simple example program.

Load Setup Parameters



Load the constant K2 into the accumulator, to select Message mode without Bit Control.

Place the value in memory location V7626, the location of the Power-up Default Operation Mode selection.

After the parameter setup rung(s) above, we begin the normal ladder program. Insert your actual program before the end coil.

To test the program and confirm our understanding of the Powerup Default mode, enter the program above into your CPU. Then put the CPU in run mode, which will place the constant K2 in memory location V7626 on the first scan. Now follow the steps below to test the Powerup Default feature.

PRESS **STAT**



		X	0	0																
		X	1	0																
		X	2	0																
		X	3	0																

The goal is just to have the DV-1000 in some mode other than the powerup default which we have selected in the program above. It is now in Status Display Mode. Now power-cycle the DV-1000 by unplugging it or removing power to the CPU. Then restore power, and do not press any key on the DV-1000 keypad at this point. The display below (or perhaps a setup error message) should appear after 2 or 3 seconds. This confirms the DV-1000 read the constant K2 default selection at V7626 and entered the Message Display Mode which we had chosen.

(NO KEY PRESS REQUIRED)



0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Chapter Summary

Now we have covered the various types of setup parameters, and their locations in V-memory. The Powerup Default parameter and LDA instruction have been covered in detail. The remainder of the setup parameters are discussed in each chapter on the corresponding modes.

Summary of Key Points

Now we may summarize some of the key points we have learned about setup parameters in this chapter:

- Setup parameters occupy V-memory in the CPU, not DV-1000 memory.
- The DV-1000 only reads the setup parameters at powerup, or when a key on the keypad is pressed.
- It's a good idea to program the powerup default parameter, regardless of which DV-1000 mode(s) you intend to use.
- Parameters belong to one of three types: Pointers, Block Sizes, or Data.
- Enter pointers as octal (address) numbers, while block sizes and data are always BCD numbers.
- You can program setup parameters using your RLL program or by editing V-memory directly. However, it is generally more desirable to use the RLL program.
- You only need to program the setup parameters once in a ladder program. Use the special contact SP0 to activate the setup rung on the first scan only.
- You only need to program setup parameters for the mode(s) you intend to use. The instructions to set up the various modes may be combined into the same rung.
- All ladder examples in this manual use V-memory user data space starting at V2000. In this way, the examples shown will work across the various CPU types.
- It is generally best to chart (plan) your V-memory map before writing the application RLL program. This ensures there will be V-memory space available for the DV-1000's data blocks for the mode(s) used.

Message Display Mode

In This Chapter. . . .

- Overview
 - System Messages
 - User Messages
 - Setup Parameters for User Messages
 - Displaying Numbers
 - Displaying Text
 - Using LDD and OUTD Instructions
 - Turning Data Into Messages
 - Combined Numeric and Text Displays
 - Using the ASCII Constant (ACON) Instruction
 - Message Display Applications and Techniques
 - Chapter Summary
-

Overview

Feature List

The Message Display Mode of the DV-1000 provides a *monitoring* function. It supports System Messages from the CPU (no setup parameters required).

- Error Messages
- FAULT instruction messages from ladder logic

The DL240, DL250, DL350, DL440 and DL450 CPUs record a message log of 16 error messages and 16 FAULT instruction messages, each with a time/date stamp. The DV-1000 provides access to these message logs from its keypad.

With Message Display Mode you can create your own displays (User Messages) using setup parameters and ladder programming.

- Create text or numeric messages
- Mix text and numeric messages
- Implement blinking (flashing) characters, for alarm conditions, etc.
- Create multiple screens that let you switch from one to another
- Display signed values (+/- sign follows actual value)
- Embed a decimal point in a number
- Embed the time and date in a message
- Use the extended ASCII character set for effects such as analog bar graphs, or other symbolic information
- Generate long messages that continuously scroll through the display

Message Priority

In Message Display Mode, display output can come from three sources: (System) Fault Messages and Error Messages, and (DV-1000) User Messages. To the right are examples of each.

In normal conditions, user messages are the default display. However, system messages have display priority. For example, if the battery is removed the error message "E042 NO CPU BATT" temporarily replaces the user message.

When a Fault Message Box is executed, its display output has priority over both system error messages and user messages. When the cause of a higher priority message ceases, the next lower priority message reappears automatically. The **prioritized order** is:

1. System Fault Message (highest)
2. System Error Message
3. User Messages (lowest)

System Fault Message

*	P	A	R	T		J	A	M	,	Z	O	N	E		1

7 6 5 4 3 2 1 0 7 6 5 4 3 2 1 0

System Error Message

E	0	4	2			N	O			C	P	U		B	A	T	T

7 6 5 4 3 2 1 0 7 6 5 4 3 2 1 0

User Message

C	O	N	V	E	Y	O	R			S	P	E	E	D	S		
L	i	n	e			1	=			1	2	3		f	p	m	
L	i	n	e			2	=			4	5	6		f	p	m	
L	i	n	e			3	=			7	8	9		f	p	m	

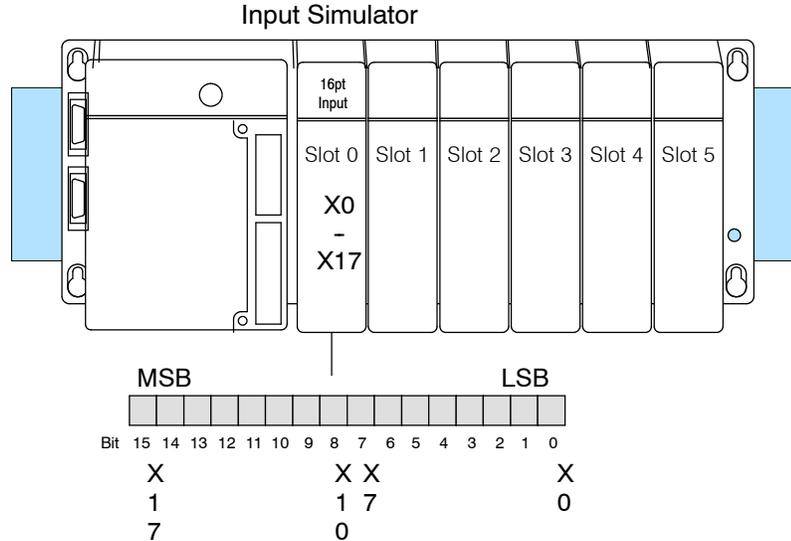
7 6 5 4 3 2 1 0 7 6 5 4 3 2 1 0

System Requirements for Example Programs

A quick way to learn how the DV-1000 works is to load an example program related to your application, and begin modifying it to do what you want it to do. Example ladder programs in this chapter occasionally require an external input to cause the display to change in some particular way. The programs require up to two inputs: X0 and X1. So, this is a good time to prepare your system to run the example programs as you arrive at each one.

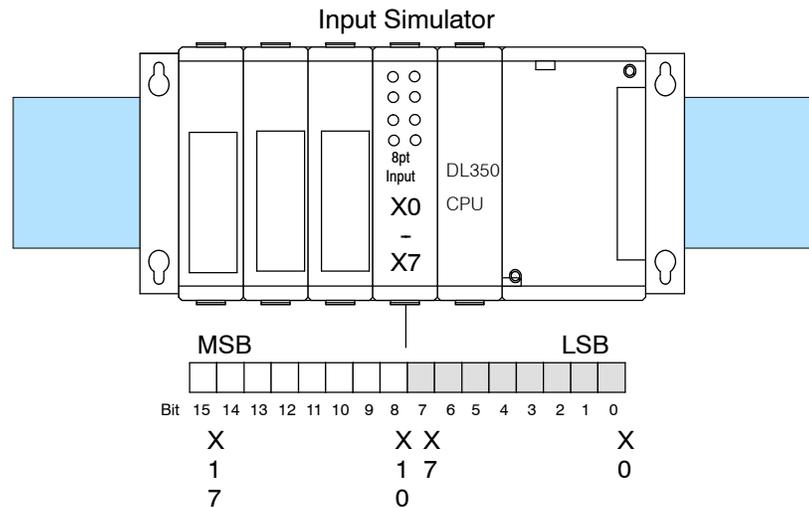
DL405 Requirements

If you are using a DL405 system, we recommend using the input simulator module. If you locate it in the base as the closest input module to the CPU, it will log in as X0 through X17 as shown in the following diagram:



DL350 CPU Requirements

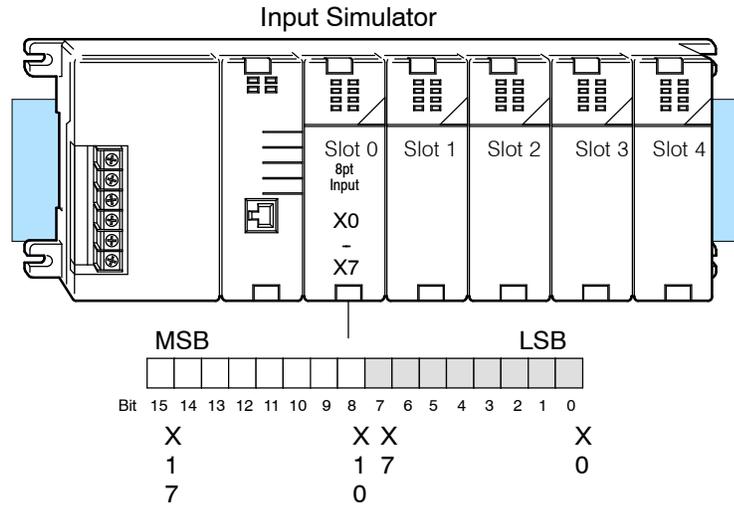
If you are using a DL305 system with a DL350 CPU, we recommend using the input simulator. If you locate it in the base as the closest input module to the CPU, it will log in as X0 through X7 as shown in the following diagram:



Message Display Mode

DL205 Requirements

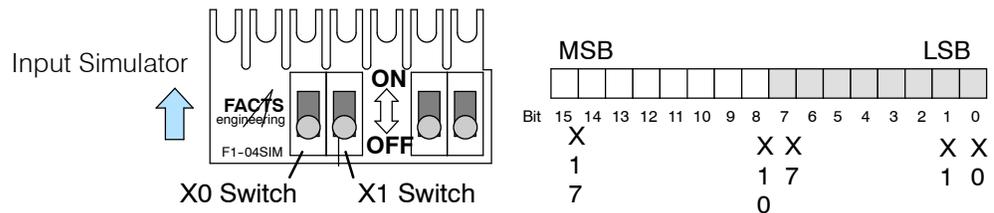
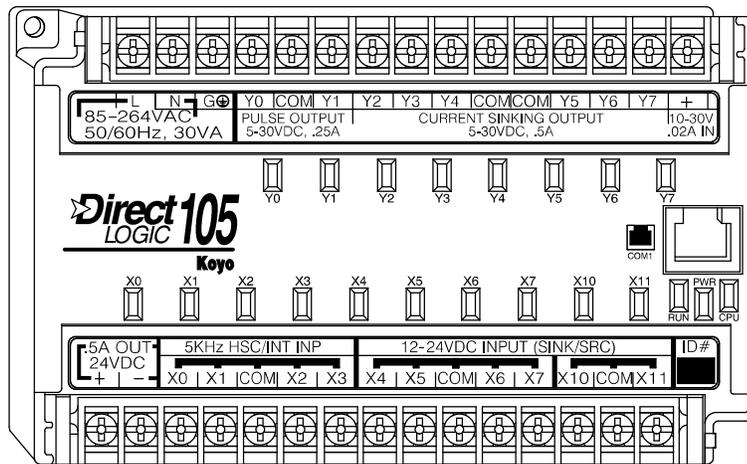
If you are using a DL205 system, we recommend using the input simulator. If you locate it in the base as the closest input module to the CPU, it will log in as X0 through X7 as shown in the following diagram:



DL105 Requirements

If you are using a DL105 system with DC inputs, we recommend using the input simulator, shown below, which provides four input switches for inputs X0 through X3. DC-powered versions need two wires from the power input to the two left-most terminals on the simulator. The input simulator will not work in DL105s with AC type inputs. See the DL105 User Manual (D2-USER-M) for more information on the input simulator.

NOTE: When starting *Direct* SOFT, be sure to initialize the CPU scratchpad or some example programs will not work (inputs X0 and X1 will be inactive). From **PLC** menu, choose **Setup**, then **Initialize Scratchpad**.



System Messages

Selecting Message Mode

You may select Message Display Mode at any time from the keypad by pressing the **Message** Key (unless the keypad is in Bit Control Mode). User messages require setup parameters to tell the DV-1000 where to find its message data in V-memory. If the parameters are not set and V-memory contains all zeros, the display below will appear.

PRESS 



0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

7 6 5 4 3 2 1 0 7 6 5 4 3 2 1 0

The next section shows how to program the setup parameters and generate your own message. However, we first discuss the higher priority system messages.

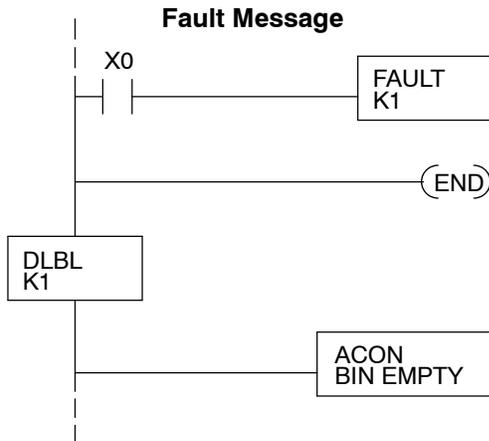
System Errors and the Fault Message instruction box in ladder logic generates messages for the outside world. They can be viewed using **DirectSOFT**, a Hand-held Programmer, or the DV-1000. The DL240, DL250, DL350, DL440 and DL450 CPUs retain a log of up to 16 system error messages and a log of up to 16 fault messages which may also be viewed.

Fault Instruction Message

The following ladder program example will send a Fault Message to the display as long as contact X0 is on. When X0 goes off, the display returns to the user-generated message. Although the FAULT instruction can display 23 characters on a Hand-Held Programmer, **limit the number of characters to 15 for the DV-1000 (top line).**



a:\msg1.prj



Output a Fault Message when X0 is active. Constant K1 references the Data Label area that contains the text message. **NOTE:** If using DL105 be sure CPU is initialized to make X0 operational.

The end coil terminates the main program section.

The Data Label box marks the beginning of a data area containing ACON or NCON boxes. The reference number for this area is "1", specified by K1.

Use the ASCII Constant (ACON) box to type the text for the Fault Message. Limit this line to 15 characters maximum.

Load the program above and test it by turning on X0. While X0 is on, the fault message will be displayed. When it is turned off, the fault message is removed and the original message display returns.

Fault Instruction Message

*	B	I	N	E	M	P	T	Y											

7 6 5 4 3 2 1 0 7 6 5 4 3 2 1 0

NOTE: The ladder program above generates fault messages which immediately appear on the display. However, note that the fault instruction makes an entry into the fault message log on each scan the fault box is active. Therefore, this approach fills up the message log in 16 CPU scans with duplicate entries. To make only one entry in the log per fault event, use the next ladder example with the PD coil.

System Error Display

System error messages create their own text when the error event occurs. When the DV-1000 is in Message Mode, the error code and message are displayed as long as the error persists. Or, you may press the **Clear** Key to acknowledge the message, and it will be removed from the log and from the display.

System Error Message

E	0	4	2	N	O	C	P	U	B	A	T	T							

7 6 5 4 3 2 1 0 7 6 5 4 3 2 1 0

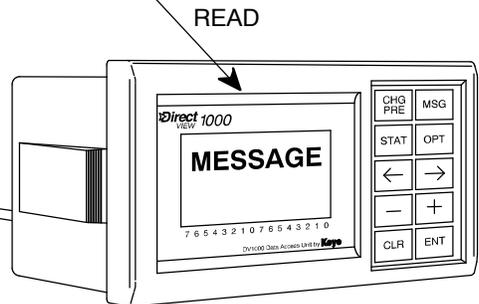
Viewing Message Logs (DL240, DL250, DL350, DL440 and DL450 Only)

The DL240, DL250, DL350, DL440 and DL450 CPUs record up to 16 System Error Messages and 16 Fault Messages in separate message logs. The PLC attaches a time/date stamp to each error or fault message when they occur. These may be viewed one at a time with the DV-1000, as depicted in the following figure.

Example Message Log

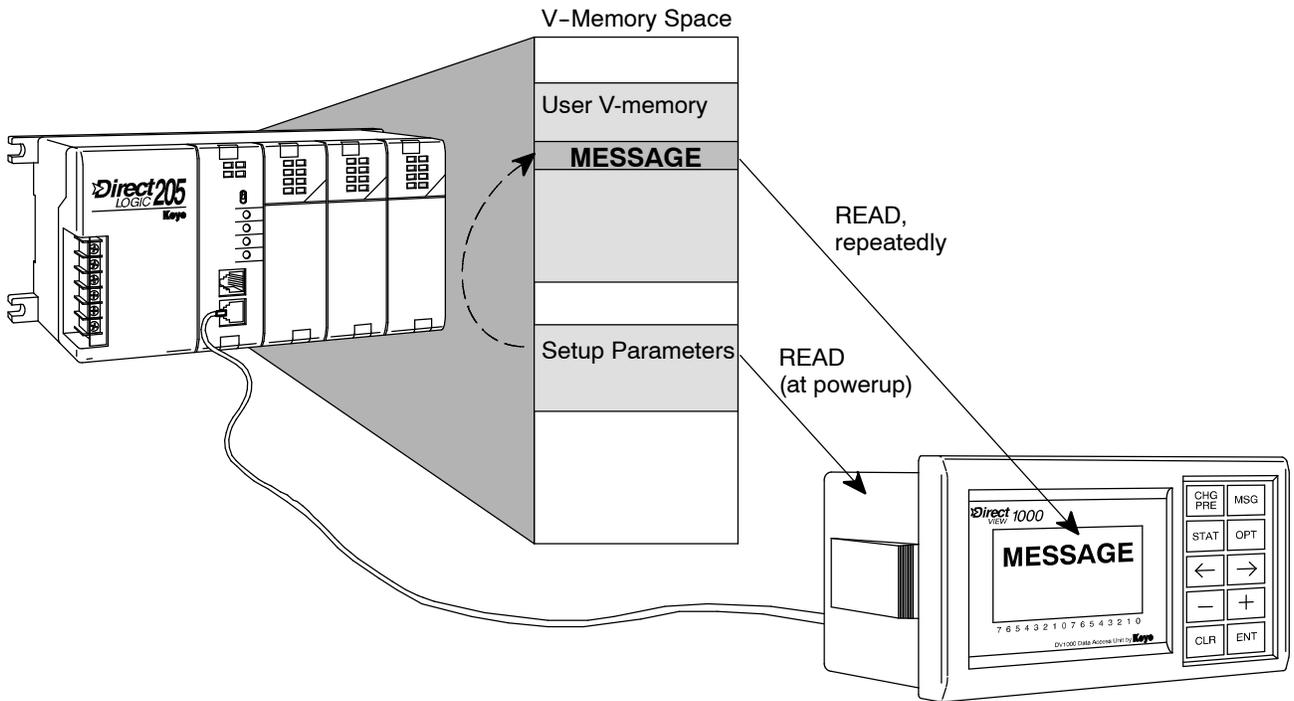
	DATE	TIME	FAULT MESSAGE
01	08/10/95	09:35:50	PART JAMMED
02	08/11/95	08:00:43	BIN EMPTY
03	08/11/95	07:15:53	OVER TEMP
04	08/20/95	17:22:48	LOW FLOW
05	08/30/95	17:22:24	PUMP FAULT
06	08/30/95	17:22:24	GATE STUCK
:	:	:	:
16	09/02/95	9:22:16	SETUP INVALID

Message Display Mode

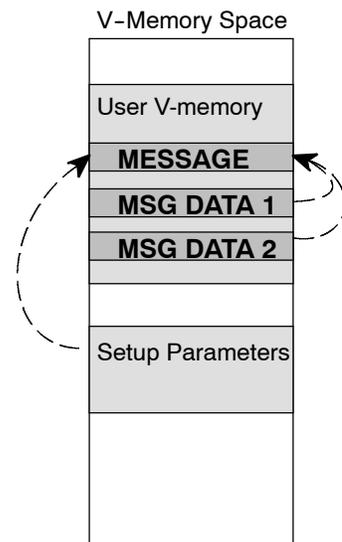


User Messages

User Messages rely on data stored in V-memory to actually create the message. The process is shown in the following figure. After powerup, the DV-1000 reads the setup parameters. Certain parameters can be programmed to point to other blocks of information in V-memory. The DV-1000 reads the text and numeric data pointed to by the setup parameters. Then it combines text and numeric data following simple rules to create the display output. Then it reads the V-memory message data again, and repeats the process over and over.



The DV-1000 currently reads the setup parameters at powerup, and when a key on the keypad is pressed. This means that the ladder program cannot simply change the pointer value for message data. Instead, it must move new data into the original message data block. This chapter covers the use of ACON and MOVMC instructions, which make this task easier.



Message Display Mode

Setup Parameters for User Messages

The DV-1000 is capable of displaying numbers or alphabetical characters, or a combination of both (alphanumeric). All of the programming to do this must be contained in the CPU's ladder logic program. This means that a portion of the ladder program is dedicated to the DV-1000 operation, while the remainder of the program handles machine or process operation. The Message Display Mode does require setup parameters (see Chapter 3 for an introduction to setup parameters).

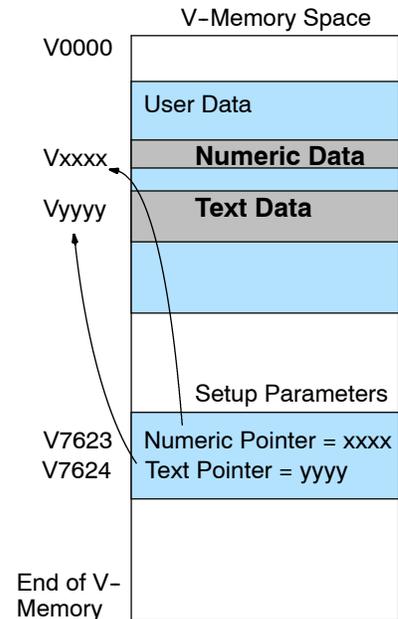
Message Data Parameters

There are two pointers in the setup parameters which pertain to message displays:

- Numeric Message Pointer
- Text Message Pointer

These two setup parameters are located at V7623 and V7624 respectively. The diagram to the right shows how the values xxxx and yyyy point to the address locations of blocks of data in the user data space of V-memory.

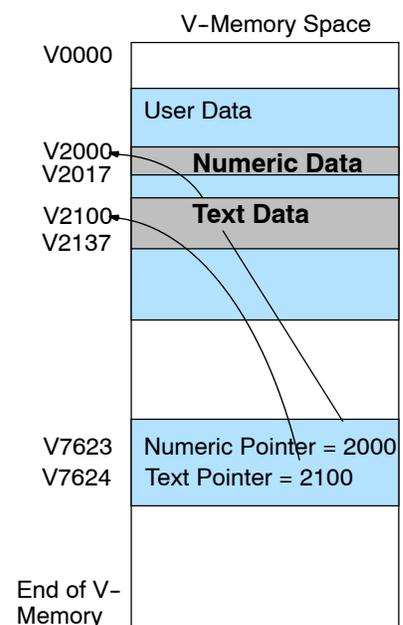
The relative sizes of the shaded blocks indicate that the text data block (32 words) is twice the size of the numeric data (16 words). We explain why this is true a bit later in this chapter. These block sizes are fixed (there is no block size setup parameter for these).



Choosing Data Block Locations

Now we decide where to place our numeric and text data blocks for use in the example programs in this chapter. As described in Chapter 2, we will use an available memory area common to all CPU types, starting at V2000. Therefore, numeric data occupies 16 word locations, from V2000 to V2017. We'll arbitrarily place the text table starting at V2100. It occupies 32 word locations, extending down to V2137. Note that either text or numeric data may be placed first in V-memory. However, the blocks must not overlap each other, but one may immediately follow the other.

The locations we have chosen here for numeric and text data are examples only. The location you choose for your application may be different.

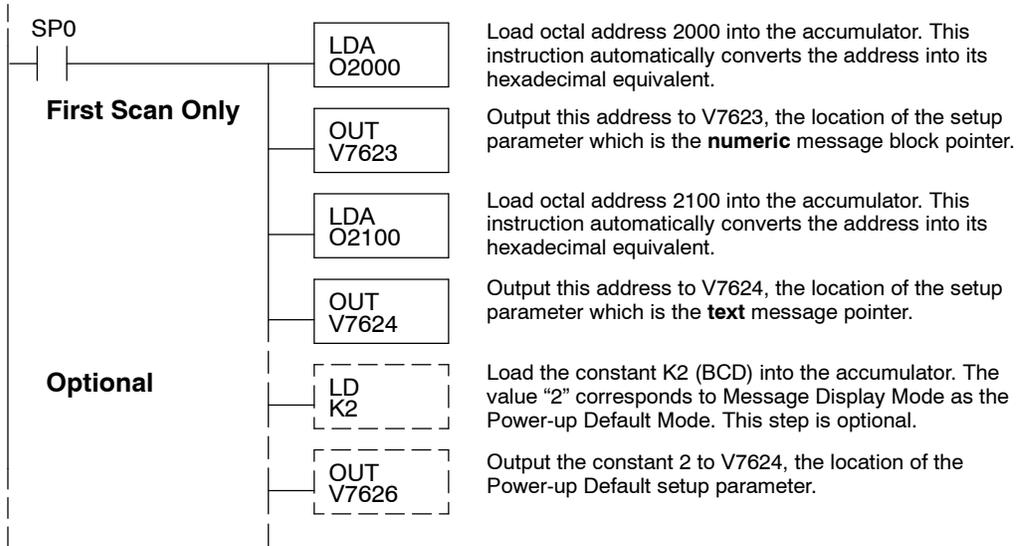


Ladder Example for Message Setup Parameters

Now that we have chosen locations for numeric and text data, we can create the setup portion of the ladder logic program. The following ladder program locates the data blocks according to the memory map on the previous page. Also, we include instructions which make Message Mode the DV-1000 power-up default mode. For the ladder examples in this chapter, the DV-1000 will automatically power up in Message Display Mode. All ladder examples in this chapter will use the following program as the first rung to program the setup parameters.

Parameter Setup Program #1

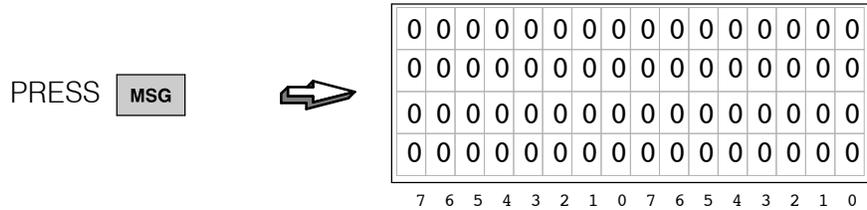
Parameter Setup: Numeric and Text Data



After entering the setup program above, you can test it by powering up the PLC and DV-1000. Note that the V-memory data areas must be cleared (all zeros). The display to the right will appear without your having to use the keypad.

0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0

As you program and use the DV-1000, it will eventually be in other modes when you need to use the Message Display Mode. Just press the **Message** Key on the keypad. If the setup parameters exist and are valid, the message display will appear. If they are not, the error message will be displayed: "Setup Parameter Error". If this occurs, examine the parameter setup rung in the ladder program, using the program above as an example. Verify the numeric and text data blocks are located in available user data space of V-memory (refer to Chapter 3 for CPU-specific memory maps).

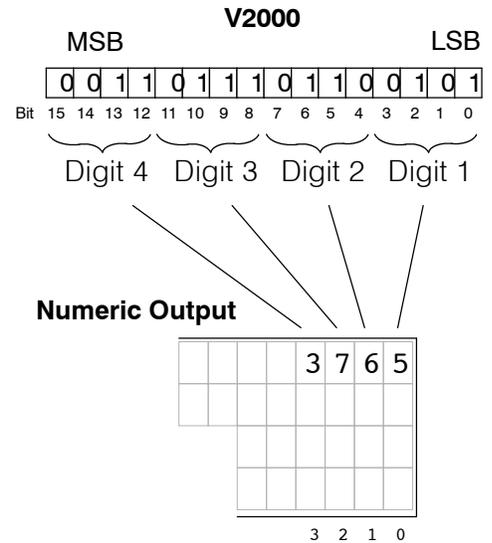


NOTE: Remember to load the example programs while the CPU is in program mode. After loading the program, take the CPU from program mode to run mode. Most of the examples in this chapter have a first scan rung (SP0). This requires a program-to-run mode transition or power cycle, or the example may not work properly!

Displaying Numbers

Values in the numeric data block are organized as 16-bit numbers. These may be BCD or hex numbers. In either case, they contain four digits. The example to the right shows memory location V-2000, which contains the number “3765”.

The DV-1000 interprets the numeric data block directly, and displays them as numbers. The value “3765” automatically appears on the display in the corresponding numeric display position when the same number exists in V-memory, and is referenced by the setup parameters.

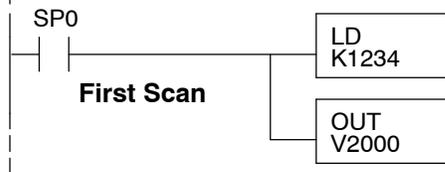


The following example shows how easy it is to display a number from your ladder logic program. All you need is the setup program in the previous section, followed by a rung that places the number “1234” as the first numeric data block entry. The DV-1000 then displays the number at the corresponding first numeric position on the display.



SP0 (Setup Parameter rung here)

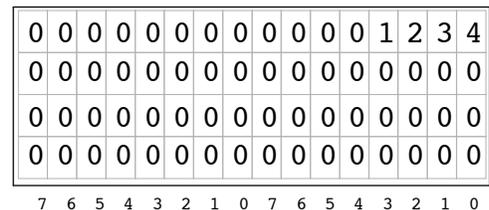
First Numeric Data Location Programmed



Load the arbitrary constant “1234” into the accumulator. This is the number we will display. We only need to do this once, on the first scan.

Output the constant “1234” to location V2000, the first numeric data location. This value will appear in the first numeric position in the display, shown below.

After loading the program above, you can test it by taking the PLC from Program to Run Mode. The BCD constant “1234” appears in the first numeric position of the display, in the upper right corner. We discuss the entire display output positions a bit further in this chapter.



Displaying Changing Values

In real applications, the numbers you want to display will often be changing. Process variables such as temperature, flow rate, or conveyor speed can be displayed in real time. While the setup parameters are written only once (first CPU scan), process variables must be constantly written. In our example, it means writing a changing number to location V-2000. The DV-1000 takes care of the rest of the work. Because our setup parameters specify the location of the numeric (and text) data, the DV-1000 constantly scans these so that any change can be observed in the display.

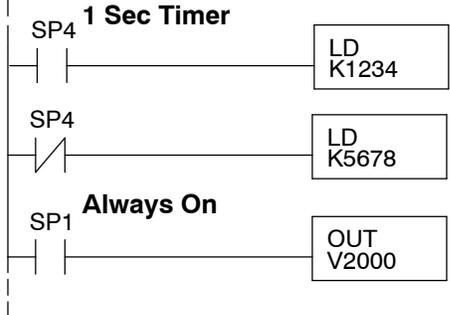
To simulate a changing value, we use the following program rungs to just alternate between two values. It uses a special relay contact SP4 as a 1 second timer (1/2 sec. on, 1/2 sec. off). Keeping the Parameter Setup rung, add the following rungs as the main program.



a:\msg4.prj

SP0 (Setup Parameter rung here)

Demonstration of Changing Values



For the first half of each second, load the arbitrary constant 1234 into the accumulator. Special contact SP4 is on 1/2 second, and off 1/2 second.

For the second half of each second, load the arbitrary constant 5678 into the accumulator. Special contact SP4 is on 1/2 second, and off 1/2 second.

Output whatever value is in the accumulator to location V2000. Half of the time it will be "1234" and the other half of the time it will be "5678".

0	0	0	0	1	2	3	4
	0	0	0	0	0	0	0
		0	0	0	0	0	0
			0	0	0	0	0
				0	0	0	0
					0	0	0
						0	0
							0

3 2 1 0

Alternates every 1/2 second



0	0	0	0	5	6	7	8
	0	0	0	0	0	0	0
		0	0	0	0	0	0
			0	0	0	0	0
				0	0	0	0
					0	0	0
						0	0
							0

3 2 1 0

The point is: Your ladder program needs to write the Setup Parameters only on the first scan, but it must update the numeric and text data in V-memory as often as their content changes. The DV-1000 reads the numeric and text data repeatedly during operation. If the text or numeric data changes, the display then automatically follows.

Displaying Text

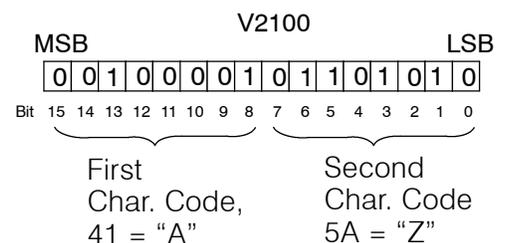
ASCII Codes

Next we discuss how to display text in message displays. The text data block is located at V2100 in these examples (only because that is where our setup parameter has defined it to be). However, we cannot place alphabetical characters directly in V-memory. Instead, we use a numeric code which *represents* text characters, called ASCII codes. Below is a portion of the ASCII table which lists capital letters (see Appendix B for the complete table of characters and symbols with their ASCII codes).

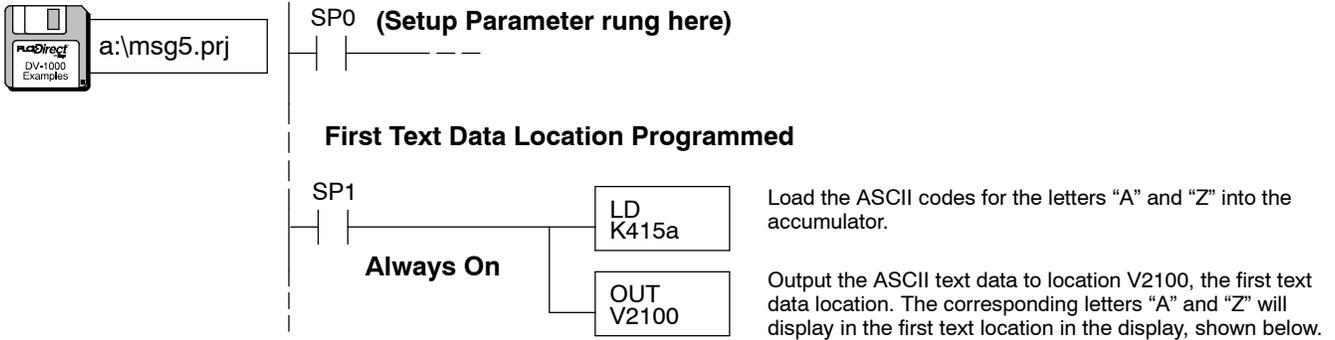
ASCII Code	Char.						
41	A	48	H	4F	O	56	V
42	B	49	I	50	P	57	W
43	C	4A	J	51	Q	58	X
44	D	4B	K	52	R	59	Y
45	E	4C	L	53	S	5A	Z
46	F	4D	M	54	T	-	-
47	G	4E	N	55	U	-	-

An ASCII code is an 8-bit binary number (byte) representing a single text character or symbol. Therefore, each V-memory location (16-bit data word) in our text table can contain two ASCII codes, representing two characters.

The example to the right uses the capital letters “A” and “Z”. The ASCII codes for these are 41 and 5A (in hexadecimal) respectively. Memory location V2100 is the first text data location, shown containing the codes for the letters “A” and “Z”.



Use the following ladder rung as the main program to load the ASCII codes for “A” and “Z” into the first text data location (keep the Setup Parameter rung in the program).



After loading the program above, you can test it by taking the PLC from Program to Run Mode. The letters “AZ” appear in the first text position of the display, in the upper *left* corner. Unless you have cleared V2000, the number “1234” or “5678” from the previous example will be displayed in the upper right corner.

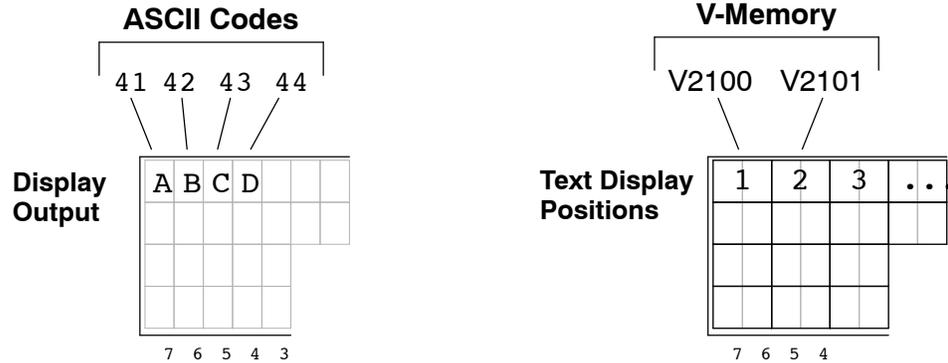
A	Z	0	0	0	0	0	0	0	0	0	0	1	2	3	4		
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
		7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0

Using LDD and OUTD Instructions

The regular LD and OUT instruction manipulates a 16-bit word, updating two ASCII characters on the display. However, we can use the Load Double (LDD) and Out Double (OUTD) to manipulate 32-bit double words, updating four characters at a time (*two text positions*)!

NOTE: If you have less than 10 characters to place, using the LDD instruction(s) is a good choice. **However, for placing more than a dozen characters adjacently, the ACON instruction is much easier and more efficient.** See the section on using the ACON instruction on page 4-25.

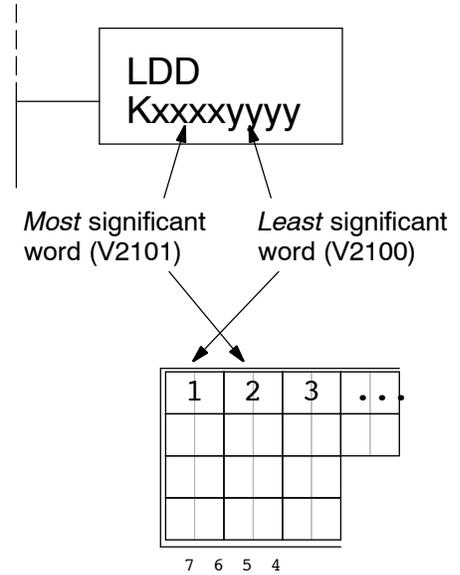
Suppose we place the character string “ABCD” in the first two text positions. The ASCII data for “ABCD” will be stored in V2100, and V2101, the first two data words in the text data block.



NOTE: You **must** swap positions with the first and second pair of ASCII codes in a LDD instruction. Read the following discussion to learn why this is necessary!

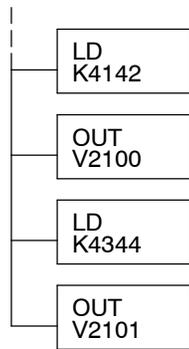
The Load Double Instruction accepts an 8-digit constant K, representing two 16-bit words. The most significant word xxxx is on the left in the LDD box. However, the DV-1000 displays the text of the most significant word on the right. This means that you must swap order of the two pairs of ASCII codes in the LDD box relative to how it is displayed.

The reason for this swap is that we read from left to right, and the ASCII codes are stored from lower memory address to higher memory addresses. On the other hand, computer data numbering goes from right (least significant) to left (most significant).

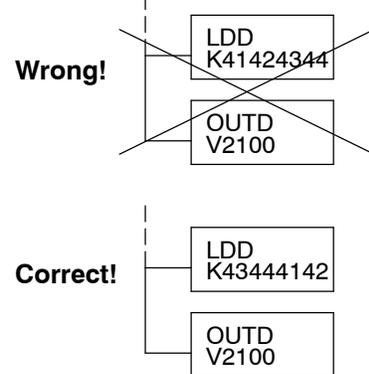


Now let's use the LDD instruction to place "ABCD" in the first two text positions. In the following figure, the method using the regular LD and OUT instructions is on the left. On the right are examples using the LDD and OUTD instructions, *without* the swap (wrong) and *with* the swap (correct).

Using LD and OUT Instructions



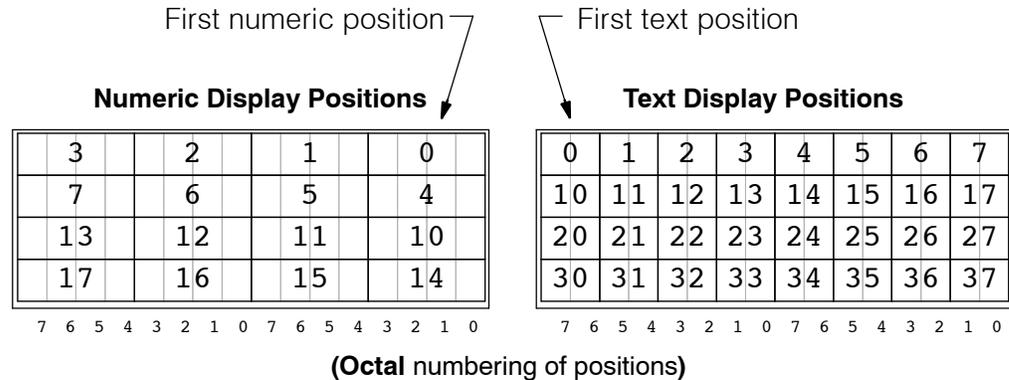
Using LDD and OUTD Instructions



Turning Data into Messages

Numbering of Display Positions

Now we have displayed a number and some text using single entries (one V-memory location) in the numeric and text tables. You have probably noticed that the first locations are in opposite corners of the display. Refer to the figure below. Numeric positions increment from *right to left*, like LSB to MSB orientation. Text positions increment from *left to right*, just as we read from a book. We number the positions in octal, and start with zero.



The display contains a total of 16 numeric and 32 text positions. Each position corresponds to one V-memory location (16-bit word). Each numeric position occupies 4 character spaces, while each text position occupies 2 character spaces. The example programs in this manual begins numeric data block at V2000 and text block data at V2100. The figure below shows how numeric and text data locations map to physical locations on the DV-1000 display. Because of the octal numbering, **the display position numbers are equal to the address offsets!**

Display Maps

Numeric Display Map

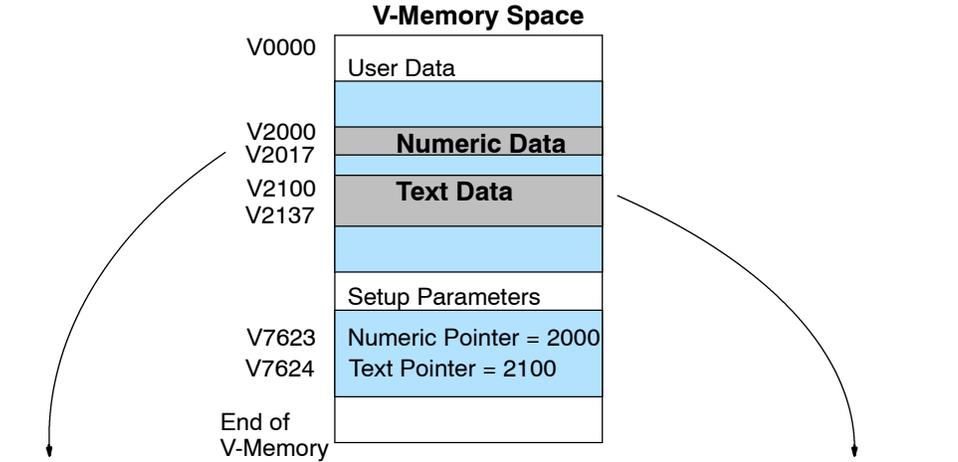
3 V2003	2 V2002	1 V2001	0 V2000
7 V2007	6 V2006	5 V2005	4 V2004
13 V2013	12 V2012	11 V2011	10 V2010
17 V2017	16 V2016	15 V2015	14 V2014

Text Display Map

0 V2100	1 V2101	2 V2102	3 V2103	4 V2104	5 V2105	6 V2106	7 V2107
10 V2110	11 V2111	12 V2112	13 V2113	14 V2114	15 V2115	16 V2116	17 V2117
20 V2120	21 V2121	22 V2122	23 V2123	24 V2124	25 V2125	26 V2126	27 V2127
30 V2130	31 V2131	32 V2132	33 V2133	34 V2134	35 V2135	36 V2136	37 V2137

Message Display Mode

How Message Data Gets to the Display The figure below shows the numeric and text data in V-memory. From there, follow the arrows to detailed numeric and text tables which show the V-memory contents for the examples thus far in this chapter. Notice how the offset from the base address (V2000 and V2100) for each data block corresponds to actual display position numbering. Follow the arrows to the bottom of the page, where the DV-1000 combines numeric and text information into one display.



Numeric Data

Position	V-Memory	Number
0	2000	1234
1	2001	0000
2	2002	0000
3	2003	0000
4	2004	0000
5	2005	0000
6	2006	0000
7	2007	0000
10	2010	0000
11	2011	0000
12	2012	0000
13	2013	0000
14	2014	0000
15	2015	0000
16	2016	0000
17	2017	0000

Text Data

Position	V-Memory	Data	Text
0	2100	415A	A Z
1	2101	0000	
2	2102	0000	
3	2103	0000	
4	2104	0000	
5	2105	0000	
6	2106	0000	
7	2107	0000	
10	2110	0000	
11	2111	0000	
12	2112	0000	
13	2113	0000	
14	2114	0000	
15	2115	0000	
16	2116	0000	
17	2117	0000	

Numeric Display Output

0	0	0	0	0	0	0	0	0	0	0	0	1	2	3	4
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

7 6 5 4 3 2 1 0 7 6 5 4 3 2 1 0

Text Display Output

A	Z														

7 6 5 4 3 2 1 0 7 6 5 4 3 2 1 0

DV-1000 Display

A	Z	0	0	0	0	0	0	0	0	0	0	0	1	2	3	4
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

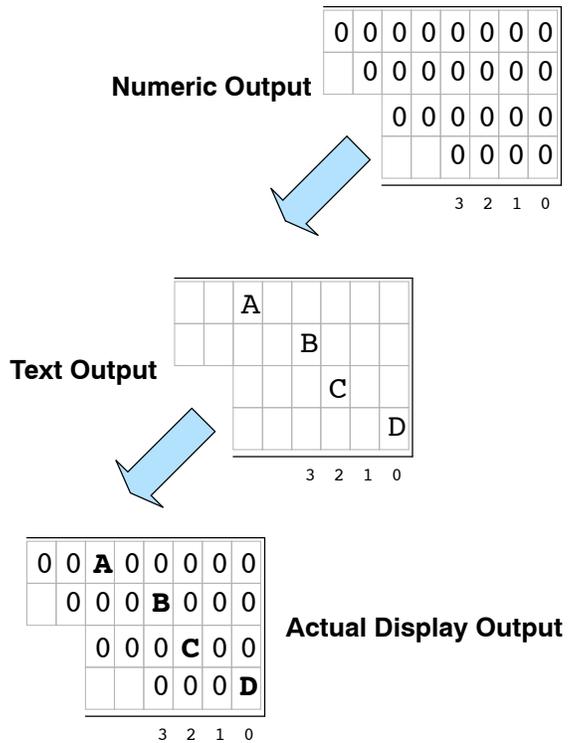
7 6 5 4 3 2 1 0 7 6 5 4 3 2 1 0

Combined Numeric and Text Displays

Obviously, text and numbers cannot occupy the same position on the actual DV-1000 display at the same time. The two V-memory data blocks certainly coexist, but the DV-1000 gives *display priority to the text data*. Each text character's data masks the corresponding numerical digit if the text's ASCII code is 20 (hex) or greater.

It is convenient to think of the text output as a *control mask* for numeric output. Refer to the figure to the right. If the numeric data block in V-memory is all zeros, the matching numeric output is also zeros, as shown. Now suppose the text data is also all zeros (null characters), except for four random locations as shown. Text data ASCII codes 41 through 44 hex produces the letters A, B, C, and D. Now we come to the actual display output. It is a combination of the numeric and text output characters. The DV-1000 uses a simple principle to determine what to display in each character location:

Any text character which has an ASCII code equal to 20 (hex) or greater masks (blocks) the numeric digit in the same display position. That's it. This works on a character-by-character basis.

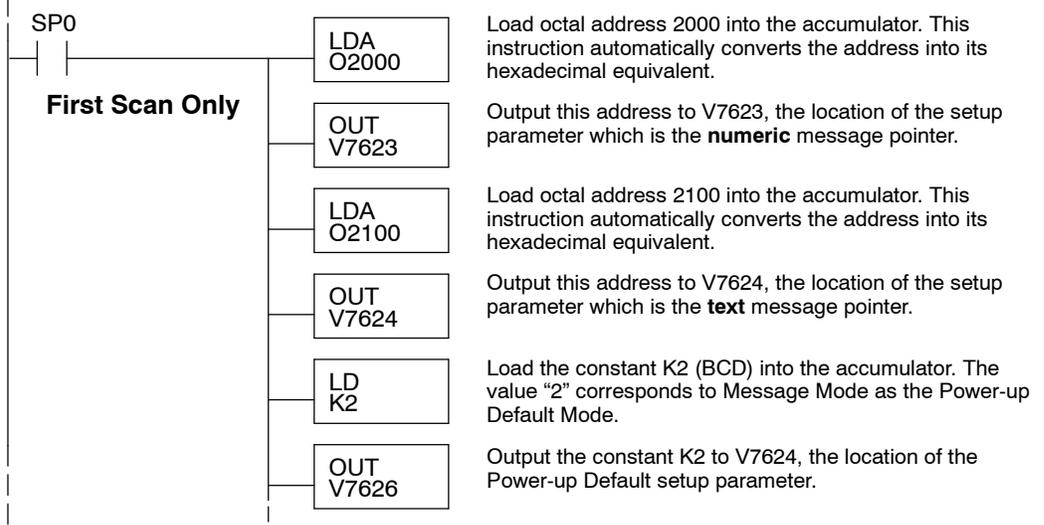


One of the first things you may want to do in your setup program is fully mask all numerical output, so we begin with a blank display (unless you use ACON boxes to fill the entire display). This is analogous to "starting with a clean slate". Then all the main ladder program has to do is write text where desired, and *unmask* numerical positions where numbers are desired. Perhaps the best character to use is the space character, ASCII code 20 (hex). The display has 64 character positions, requiring 32 words of 2020 hex. For the DL405 CPUs, use the FILL instruction. For the DL105, DL205 and DL350 CPUs, you can use a single LDD instruction followed by sixteen OUTD instructions.

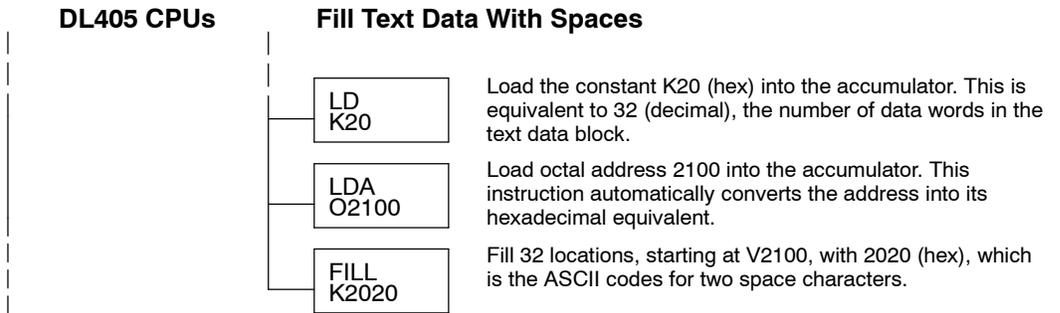
NOTE: You may recall seeing the display filled with zero (0) characters when you first powered up the DV-1000. Since the text data unmasked all the numeric locations, the numeric output (all zeros) was displayed.

Parameter Setup Program #2

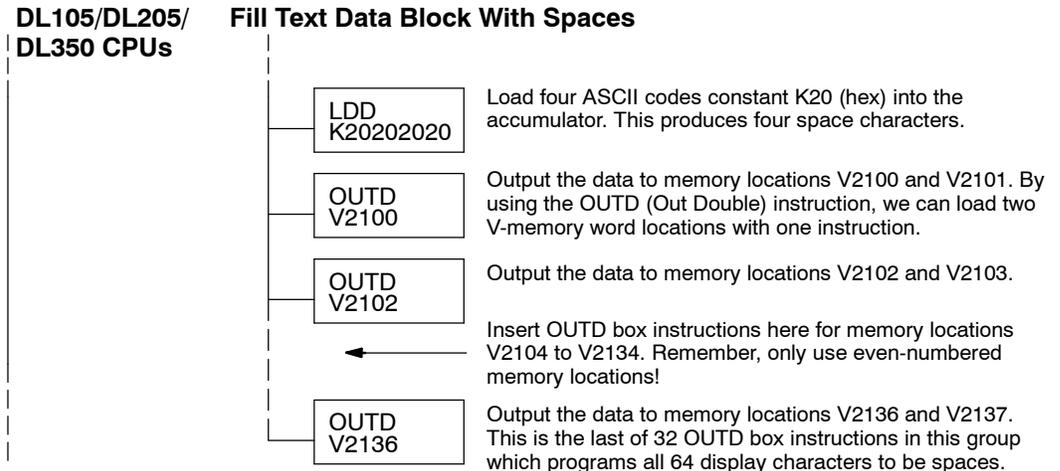
Parameter Setup: Numeric and Text Data



If you are using a DL405 type CPU, add the following ladder section to the parameter setup program above. The FILL instruction is ideal for this situation.

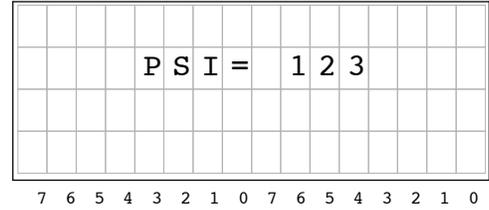


If you are using a DL105, DL205 or DL350 type CPU, add the following ladder section to the parameter setup program at the top of this page. The FILL instruction box is not available for these CPUs, so the program uses one LDD box and 16 OUTD boxes. Remember that this section executes only on the first scan (overall scan time is not affected).

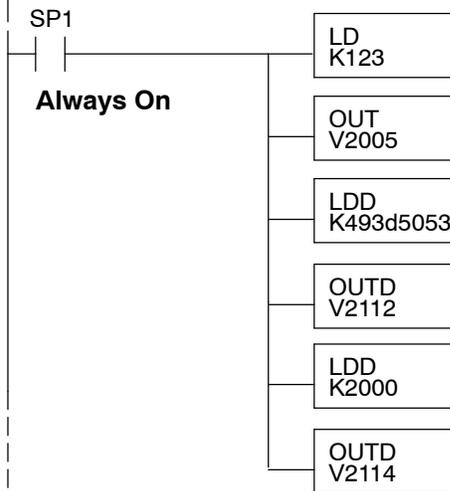


Placing Numbers and Text Together

Still using a blank display as a starting point, let's create a display featuring both text and numbers. Since there is more flexibility in text placement, we plan the display layout around using numeric position #5 for the content "123". The following program writes text and numeric mask characters in the same way.



a:\msg7.prj



Load the value "123" in the accumulator.

Output the data to memory location V2005. The actual contents of V2005 are "0123". However, the last instruction will leave the leading "0" masked, and unmask the "999".

Use a Load Double (LDD) to place the ASCII codes for the characters "PSI=" into the accumulator. Remember the LDD instruction swaps the text output positions.

Output the data to memory locations V2112 and V2113. The Out Double instruction updates two text positions at a time (two data words).

Use a Load Double (LDD) to place the ASCII codes for one space (masks leading 0) and three null characters (unmasks "123").

Output the data to memory locations V2114 and V2115. The Out Double instruction updates two text positions at a time (two data words).

Numeric Display Positions

3	2	1	0
7	6	5	4
13	12	11	10
17	16	15	14

Text Display Positions

0	1	2	3	4	5	6	7
10	11	12	13	14	15	16	17
20	21	22	23	24	25	26	27
30	31	32	33	34	35	36	37

Numeric Data

Position	V-Memory	Number
0	2000	0000
1	2001	0000
2	2002	0000
3	2003	0000
4	2004	0000
5	2005	0123
6	2006	0000
7	2007	0000
10	2010	0000
11	2011	0000
12	2012	0000
13	2013	0000
14	2014	0000
15	2015	0000
16	2016	0000
17	2017	0000

Text Data

Position	V-Memory	Data	Text
0	2100	2020	
1	2101	2020	
2	2102	2020	
3	2103	2020	
4	2104	2020	
5	2105	2020	
6	2106	2000	
7	2107	0000	
10	2110	2020	
11	2111	2020	
12	2112	5053	
13	2113	493d	
14	2114	2000	
15	2115	0000	
16	2116	2020	
17	2117	2020	

Using the ASCII Constant (ACON) Instruction

The examples so far in this chapter have covered DV-1000 display basics. The Load Double (LDD) instruction loads ASCII values into memory for only four characters to be displayed. This method requires looking up ASCII values from a table (or memorizing the table), and can potentially use a lot of LDD and OUTD instructions.

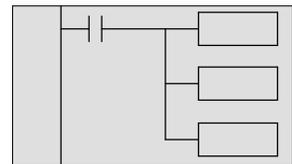
Fortunately, the ACON instruction (ASCII Constant) provides an easier method of text entry. The ACON box is available on DL105, DL205 and DL350 CPUs and on DL440 and DL450 CPUs (not available on DL430 CPUs). Using **DirectSOFT**, you can type the characters you want directly in the instruction box! After learning the LDD method and the ACON method, you can use either one or both, based on individual preferences and your application.

NOTE: In the CPU, the basic ACON function box only accepts two characters. If you are using a Hand-held Programmer in creating ladder logic to run the DV-1000 display, note that its ACON instruction is limited to *two* characters. However, **DirectSOFT** permits you to enter up to *forty* characters. **DirectSOFT** creates an extended ACON box for character entry, then subdivides it into multiple 2-character ACON boxes when downloading the program to the CPU. This section assumes you are using **DirectSOFT**.

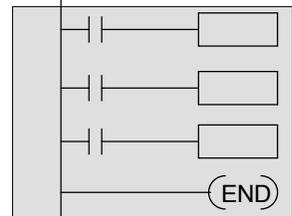
Using the ACON method of text entry adds new ladder elements onto our existing program. The figure to the right shows an outline of the program. The setup parameter rung is first, as described in Chapter 2. The main program follows, just as we have been creating main program examples in this chapter.

After the end of the main program (and the End Coil), we add a Data Label box. The ACON (ASCII Constant) box follows as the last program element.

Setup Parameters



Main Program



Data Label



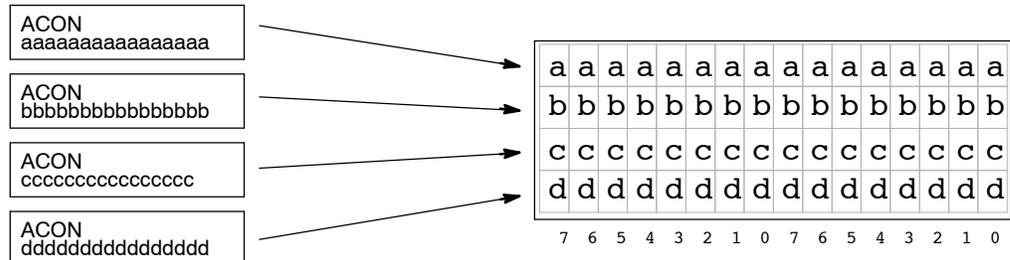
ASCII Constant



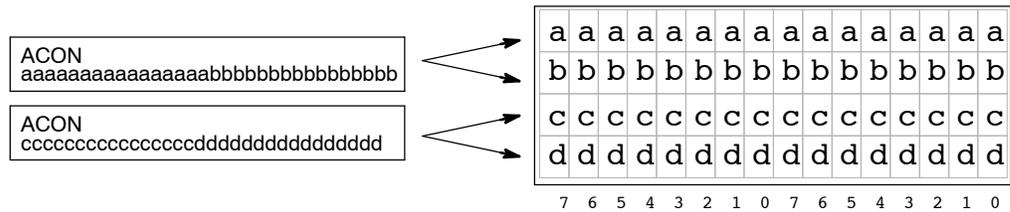
The main program section receives a new instruction, too. The MOVMC (Move Memory Cartridge) instruction reads the ACON data (the text data) into V-memory space so the main ladder program can use it. Note that the MOVMC requires supporting data to be loaded onto the stack before its use. The following example shows how this process works.

Choosing ACON Box Text Length

After using the ACON instruction to place a line of text on the first display row, we're ready to create a full-display message covering all four rows. The previous example used one 16-character ACON box. If we extend this method to generate a message for the entire display, we'll need four ACON boxes in separate data label areas. The organization of ACON boxes to display text is as follows:



You may recall that the ACON instruction box (using *DirectSOFT*) can accept up to 40 characters. Although there are many possible combinations, at least two ACON boxes are required to fill the DV-1000's 64-character display. To take maximum advantage of the ACON box capacity, let's create a display using just two ACON instructions. Using equally-sized ACON boxes, each one contains 32 characters which will fill two rows, as shown below:

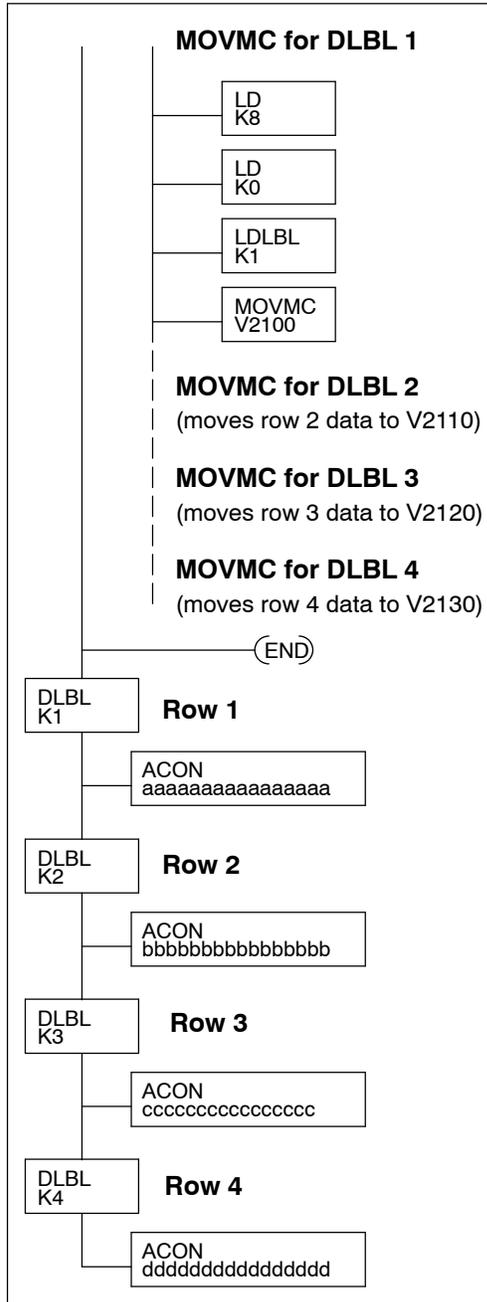


The text in the 32-character ACON Boxes wraps around from one row to a second row on the display. This makes very efficient use of the ACON instruction. However, you have to carefully count characters and spaces so the display output does what you want it to do.

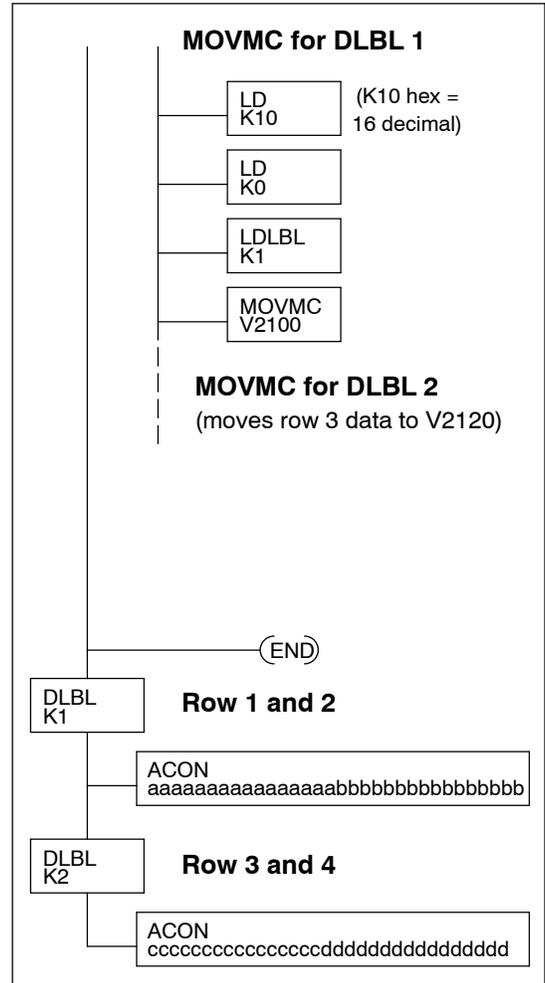
When writing your own programs, use the length of ACON text that best fits your application and is the easiest for you to use. In the interest of conserving space, most of the examples in this chapter which use ACONs use the 32-character version. However, the programs could have used twice as many 16-character ACON boxes instead.

The following ladder program outlines show equivalent 16-character and 32-character ACON box methods to generate the same display output. It assumes the text data block begins at V2100, but your memory map may differ.

16-Character ACONs



32-Character ACONs



ACON Example Program #2

This example shows the true power of the ACON method of text entry in creating display to the right. It shows the machine number and status, followed by a part count and production rate in parts per hour. Remember, the numeric locations of "1234" and "57" must be unmasked in the text data.

Desired Display

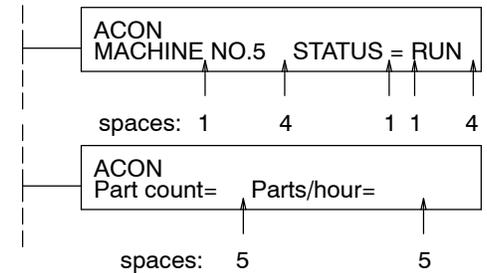
M	A	C	H	I	N	E		N	O	.	5						
S	T	A	T	U	S		=		R	U	N						
P	a	r	t		c	o	u	n	t	=	1	2	3	4			
P	a	r	t	s	/	h	o	u	r	=				5	7		

7 6 5 4 3 2 1 0 7 6 5 4 3 2 1 0

Also, because the ACON text covers the entire display, there is no need to write spaces to all character positions to create a blank starting display. Therefore, we can use the simpler Setup Program #1 that just sets up the numeric and text data blocks.

ACON boxes can contain a maximum of 40 characters. The DV-1000 display contains 64 characters, so we arbitrarily use two equally-sized ACON boxes, at 32 characters each. Insert spaces for blank display locations, counting them precisely.

- Data for the first ACON box contains the *top two lines* of display text, and begins at V2100.
- Data for the second ACON box contains the *bottom two lines* of display text, and begins at V2120.



Numeric Display Positions

3		2		1		0	
7		6		5		4	
13		12		11		10	
17		16		15		14	

7 6 5 4 3 2 1 0 7 6 5 4 3 2 1 0

Numeric Data

Position	V-Memory	Number
0	2000	0000
1	2001	0000
2	2002	0000
3	2003	0000
4	2004	0000
5	2005	0000
6	2006	0000
7	2007	0000
10	2010	1234
11	2011	0000
12	2012	0000
13	2013	0000
14	2014	0057
15	2015	0000
16	2016	0000
17	2017	0000

Text Display Positions

0	1	2	3	4	5	6	7
10	11	12	13	14	15	16	17
20	21	22	23	24	25	26	27
30	31	32	33	34	35	36	37

7 6 5 4 3 2 1 0 7 6 5 4 3 2 1 0

ACON Box 2 data ACON Box 1 data
Text Data

Position	V-Memory	Data	Text	Position	V-Memory	Data	Text
0	2100	4D41	M A	20	2120	5061	P a
1	2101	4348	C H	21	2121	7274	r t
2	2102	494E	I N	22	2122	2063	c
3	2103	4520	E	23	2123	6F75	o u
4	2104	4E4F	N O	24	2124	6E74	n t
5	2105	2E35	. 5	25	2125	3D20	=
6	2106	2020		26	2126	0000	
7	2107	2020		27	2127	0000	
10	2110	5354	S T	30	2130	5061	P a
11	2111	4154	A T	31	2131	7274	r t
12	2112	5553	U S	32	2132	732F	s /
13	2113	203D	=	33	2133	686F	h o
14	2114	2052	R	34	2134	7572	u r
15	2115	554E	U N	35	2135	3D20	=
16	2116	2020		36	2136	2020	
17	2117	2020		37	2137	0000	

The following program places numeric and text data into the locations shown above.

Message Display Mode



a:\msg9.prj

SP0 (Setup Parameter rung here)

Load Values Into Numeric Data Block

SP1

Always On

LD
K1234

Load the number "1234" into the accumulator. Your program would read in data from an analog input module for this step, etc.

OUT
V2010

Place "1234" in the numeric data block location corresponding to numeric display position 10.

LD
K57

Load the number "57" into the accumulator.

OUT
V2014

Place "57" in the numeric data block location corresponding to numeric display position 14.

Move ACON Data Into Text Data Block

SP0

First Scan

LD
K10

Load the number of data locations, which is 16 words (10 hex), or 32 characters.

LD
K0

Load the address offset. For nearly every MOVMC used for ACON data, there will be zero offset (use K0).

LDLBL
K1

Read from the ACON following Data Label K1.

MOVMC
V2100

Move data into V-memory starting at V2100, corresponding to the top two lines on the display.

LD
K10

Load the number of data locations, which is 16 words (10 hex), or 32 characters.

LD
K0

Load the address offset. For nearly every MOVMC used for ACON data, there will be zero offset (use K0).

LDLBL
K2

Read from the ACON following Data Label K2.

MOVMC
V2120

Move the data into V-memory starting at V2120, corresponding to the bottom two lines on the display.

Unmask Numeric Locations

SP0

First Scan

LDD
K0

Load the constant zero (ASCII null character) into the accumulator.

OUTD
V2126

Place zeros in text output position 26 and 27. This unmask numeric position 10.

LDD
K2020

Use a Load Double to update 4 character spaces. The K2020 actually implies K00002020. The zeros unmask the numeric "57", and the spaces (2020) hide its leading zeros.

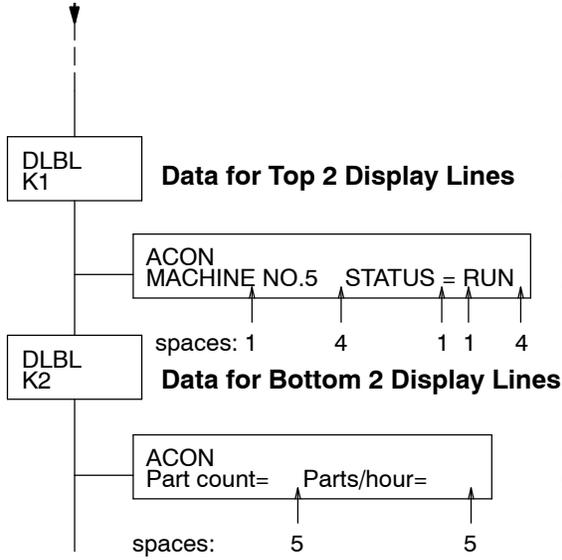
OUTD
V2136

Place zeros in text output position 36, and spaces in output position 37.

(END)

The end coil terminates the main program section.

(continued)



The Data Label box marks the beginning of a data area containing ACON or NCON boxes. The reference number for this area is "1", specified by K1.

Use ASCII Constant (ACON) boxes to enter text characters directly from the keyboard.

Use ASCII Constant (ACON) boxes to enter text characters directly from the keyboard.

Message Display Applications and Techniques

The material in this chapter up to this point has demonstrated basic procedures in getting information to the display. The following examples build on this foundation, showing solutions to typical applications. These programs are the “bells and whistles” of the display function. It’s a good idea to get the basic display screen working first, and then carefully add portions of these techniques to fine-tune your application program. The special display applications we will cover are:

- Multiple message displays
- Blinking text
- Dynamic text
- Embedding the time and date in a message
- Polarity sign for numbers
- Bar Graph Displays
- Automatic Scrolling Displays

Multiple Message Displays

In Message Mode, the DV-1000 continuously scans the numeric and text data in V-memory to combine their information and create a single display screen. To change the display message, we must update the numeric and/or text data blocks in V-memory accordingly. It’s possible to alternate between two or more display screens, based on some arbitrary event. For example, suppose we want either of the following display screens to appear, based on an operator input:

Display Screen 1

C	O	N	V	E	Y	O	R	S	P	E	E	D	S				
L	i	n	e	1	=	1	2	3	f	p	m						
L	i	n	e	2	=	4	5	6	f	p	m						
L	i	n	e	3	=	7	8	9	f	p	m						
	7	6	5	4	3	2	1	0		7	6	5	4	3	2	1	0

Display Screen 2

T	O	T	A	L	P	R	O	D	U	C	T	I	O	N			
L	i	n	e	1	=	1	1	1	1	1	1	1	1	1			
L	i	n	e	2	=	2	2	2	2	2	2	2	2	2			
L	i	n	e	3	=	3	3	3	3	3	3	3	3	3			
	7	6	5	4	3	2	1	0		7	6	5	4	3	2	1	0

In order to choose a programming strategy, we must do the following:

- Choose number of display screens
- Create the message (numeric and text) data
- Decide what event triggers display screen changes

In this example, we have 2 display screens, the contents are as shown, and the display will change based on the state of X0 (OFF = Display 1, ON = Display 2). An input simulator or simple switch is useful for creating switch X0. Since most of the display characters in the two display screens are different, we will use ACONs to move data in and out of the text and numeric tables. The ladder program will need to update the text characters once after each display screen change, because they remain fixed thereafter. The one-shot (positive differential) function box will help us write new display data just once. However, the numeric data must be constantly updated, because it changes in real time with the user machine or process. In this case, we will repeat the update each PLC scan.

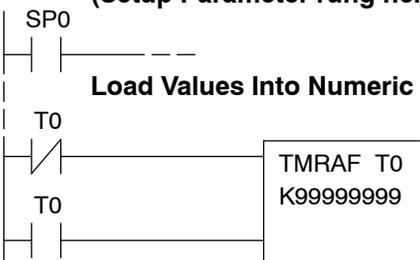
NOTE: If using DL105, be sure to initialize the CPU or input X0 will not activate. From **PLC** menu, choose **Setup**, then **Initialize Scratchpad**.



(Setup Parameter rung here)

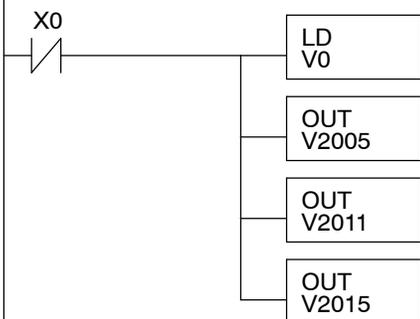
Note:

Load Values Into Numeric Data Block



Use a timer (fast accumulating type) to generate a changing number. Your application will have its own sources for real-time process data, so this rung will be different. Note that this is a 32-bit timer.

X0 Off = Screen 1



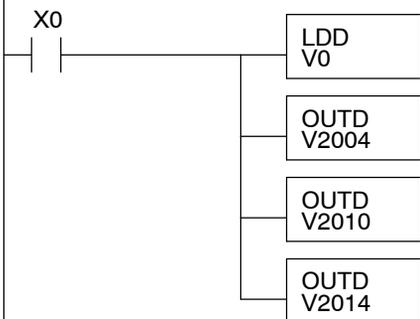
Load the timer value (which is mapped to location V0 and V1) into the accumulator. Here we only use 16 bits of the timer value.

Place the number in the numeric data block location corresponding to numeric display position 5.

Place the number in the numeric data block location corresponding to numeric display position 11.

Place the number in the numeric data block location corresponding to numeric display position 15.

X0 On = Screen 2

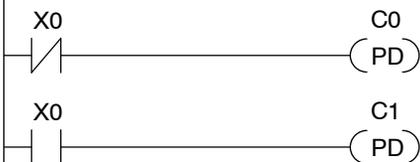


Load the timer value (which is mapped to location V0 and V1) into the accumulator. Here we use all 32 bits of the timer value.

Place the number in the numeric data block location corresponding to numeric display position 4.

Place the number in the numeric data block location corresponding to numeric display position 10.

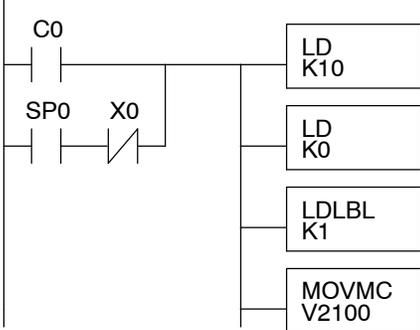
Place the number in the numeric data block location corresponding to numeric display position 14.



Activate control relay C0 for 1 scan when X0 goes from On to Off.

Activate control relay C1 for 1 scan when X0 goes from Off to On.

Load Screen 1 Data into Text Data Block



Load the number of data locations, which is 16 words (10 hex), or 32 characters.

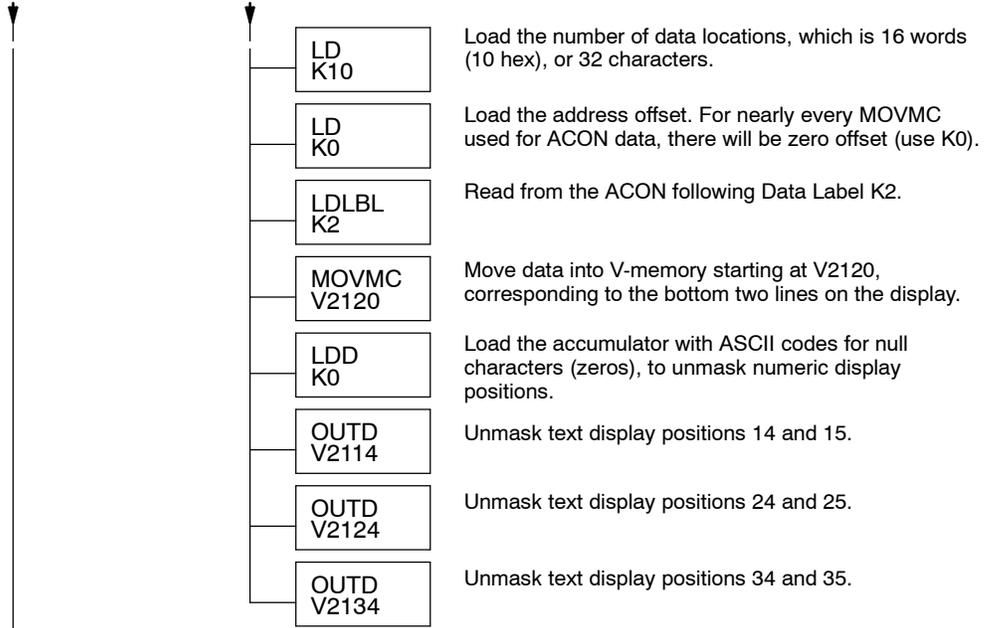
Load the address offset. For nearly every MOVMC used for ACON data, there will be zero offset (use K0).

Read from the ACON following Data Label K1.

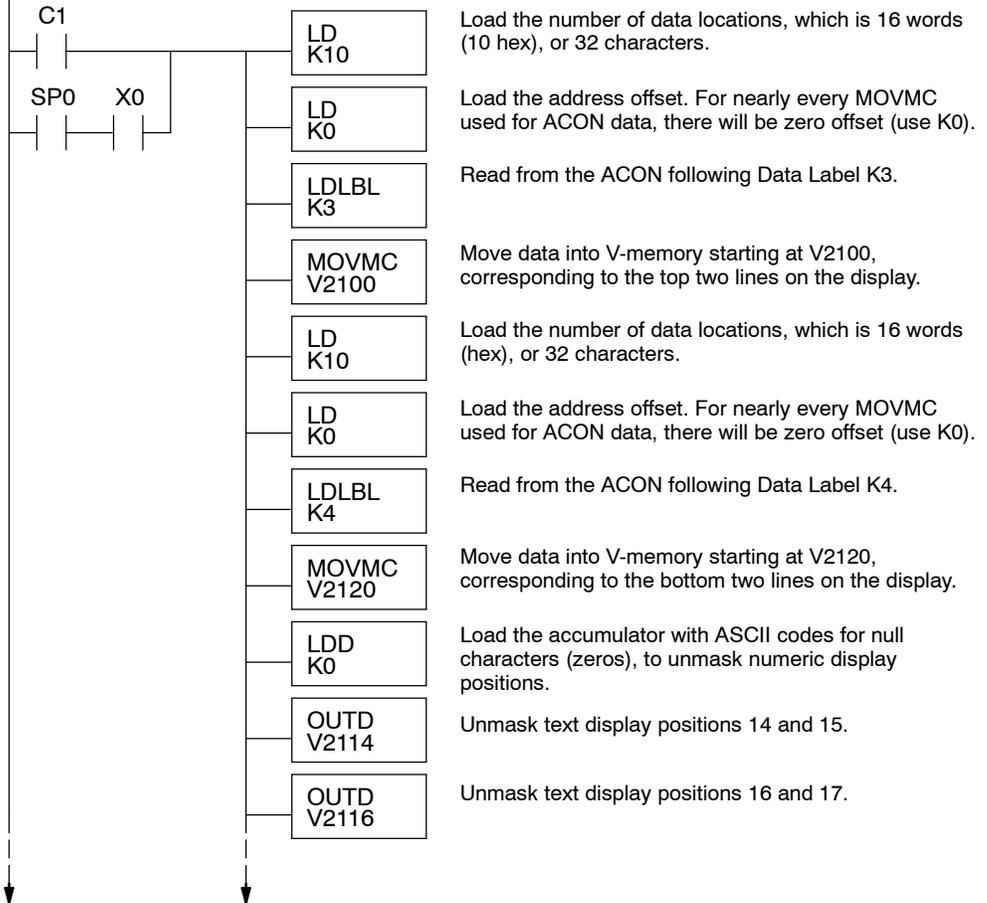
Move data into V-memory starting at V2100, corresponding to the top two lines on the display.

Message Display Mode

(continued)



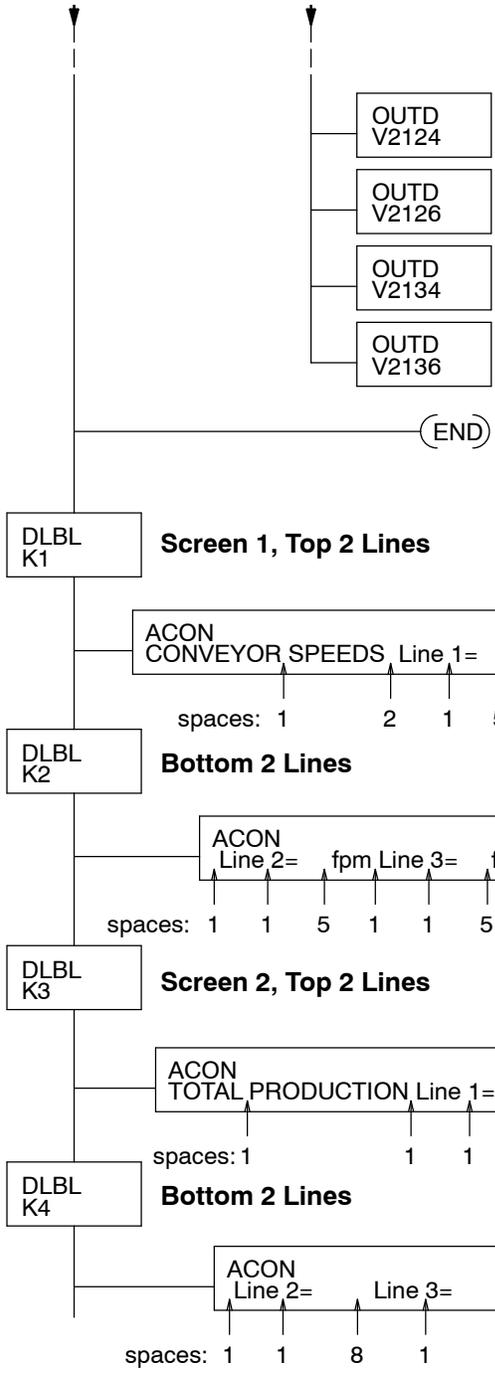
Load Screen 2 Data into Text Data Block



(continued)



a:\msg10.prj



Unmask text display positions 24 and 25.

Unmask text display positions 26 and 27.

Unmask text display positions 34 and 35.

Unmask text display positions 36 and 37.

Place an END coil here to mark the end of the main program. Following this are the ACON boxes containing screen data.

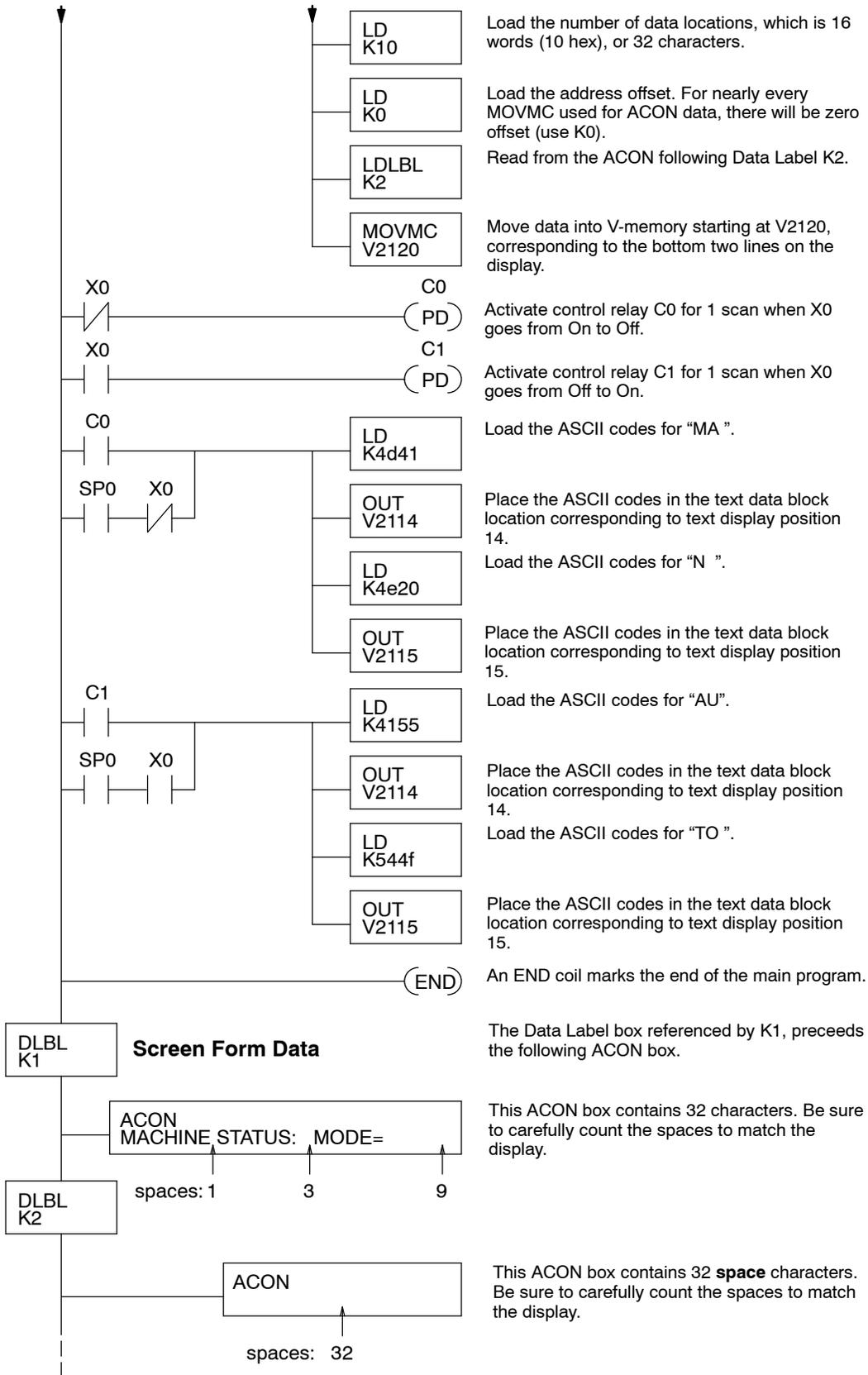
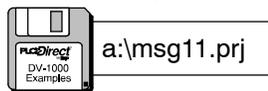
The Data Label box referenced by K1 precedes the following ACON box.

This ACON box contains 32 characters. Be sure to carefully count the spaces to match the display.

SAME

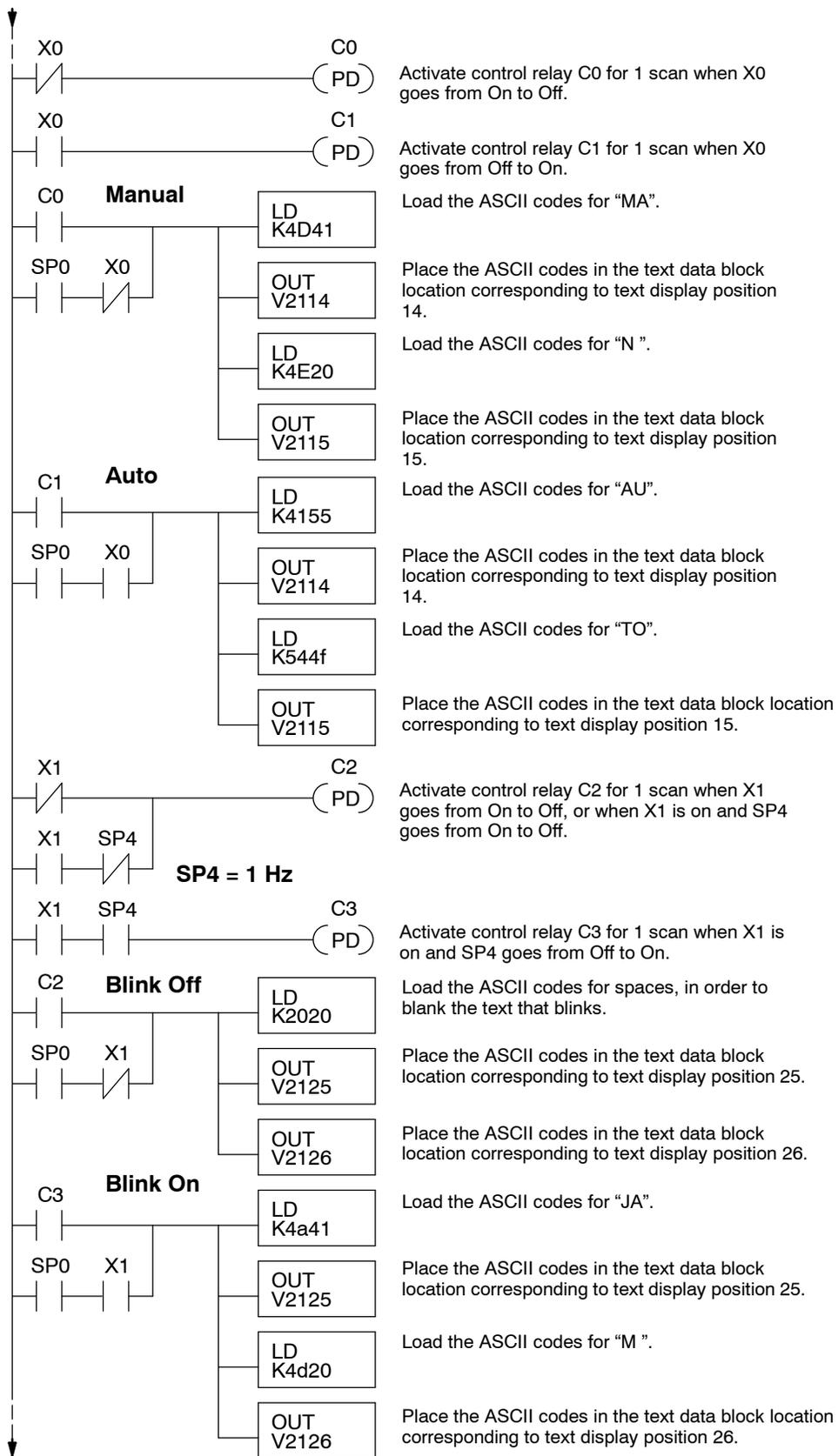
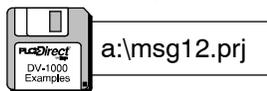
Message Display Mode

(continued)



Message Display Mode

(continued)

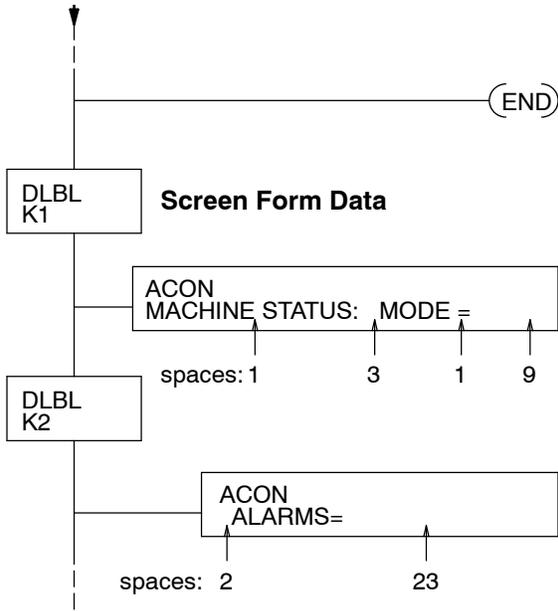


Message Display Mode

(continued)



a:\msg12.prg



Place an END coil, marking the end of the main program.

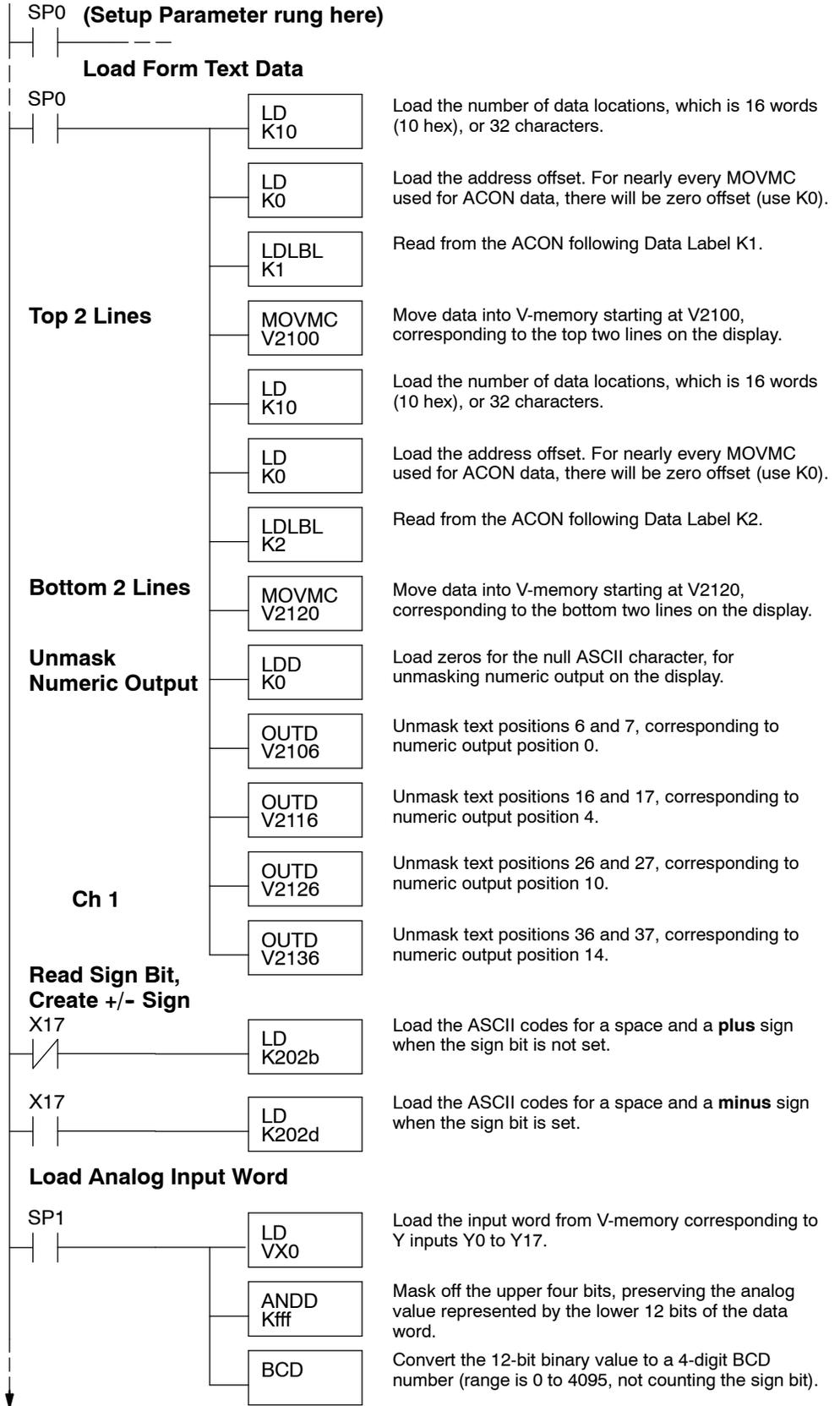
The Data Label box referenced by K1, precedes the following ACON box.

This ACON box contains 32 characters. Be sure to carefully count the spaces to match the display.

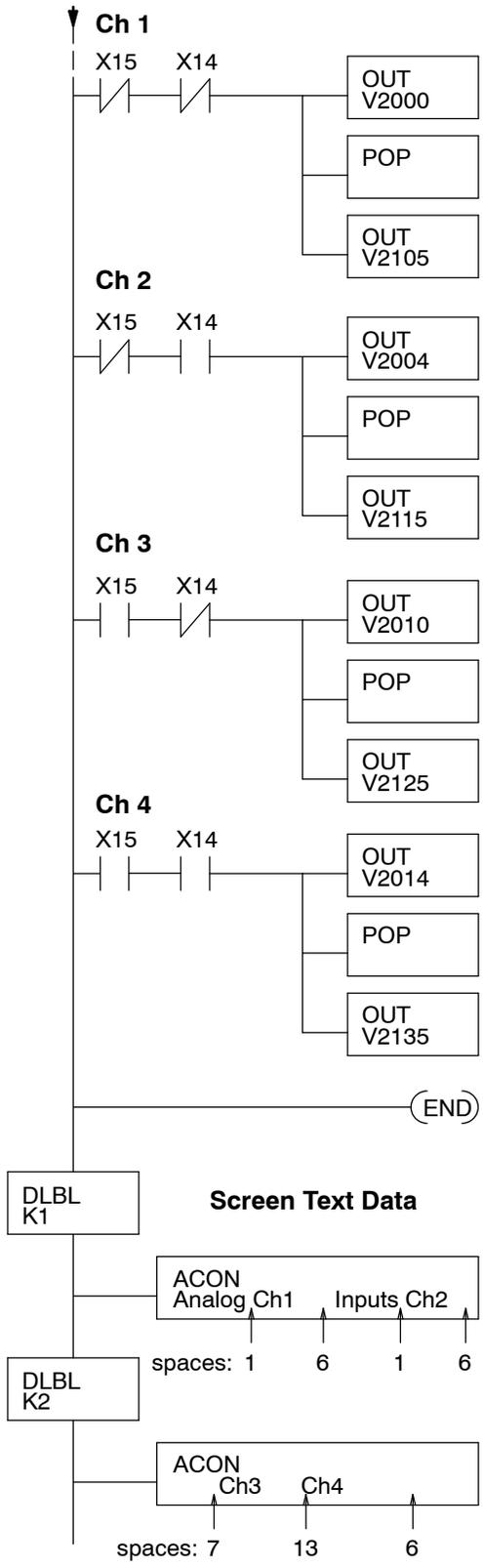
This ACON box contains 32 characters. Be sure to carefully count the spaces to match the display.



a:\msg13.prj



(continued)



Channel 1 data is being sent when X15 and X14 are off. The Out instruction moves the data from the accumulator to V2000, numeric display position 1.

Move the ASCII data for the algebraic sign from the stack into the accumulator.

Place the accumulator contents (algebraic sign in ASCII code) into the text display position 5, for channel 1.

Channel 2 data is being sent when X15 is off and X14 is on. The Out instruction moves the data from the accumulator to V2004, numeric display position 4.

Move the ASCII data for the algebraic sign from the stack into the accumulator.

Place the accumulator contents (algebraic sign in ASCII code) into the text display position 15, for channel 2.

Channel 3 data is being sent when X15 is on and X14 is off. The Out instruction moves the data from the accumulator to V2010, numeric display position 10.

Move the ASCII data for the algebraic sign from the stack into the accumulator.

Place the accumulator contents (algebraic sign in ASCII code) into the text display position 5, for channel 3.

Channel 4 data is being sent when X15 and X14 are on. The Out instruction moves the data from the accumulator to V2014, numeric display position 14.

Move the ASCII data for the algebraic sign from the stack into the accumulator.

Place the accumulator contents (algebraic sign in ASCII code) into the text display position 35, for channel 4.

Place an END coil, marking the end of the main program.

The Data Label box referenced by K1, precedes the following ACON box.

This ACON box contains 32 characters. Be sure to carefully count the spaces to match the display.

The Data Label box referenced by K1, precedes the following ACON box.

This ACON box contains 32 characters. Be sure to carefully count the spaces to match the display.

Message Display Mode

Embedded Time and Date (DL240, DL250, DL350, DL440 and DL450 CPUs Only)

In some applications you may want to embed time and date information in a message display output. The DL240, DL250, DL350, DL440 and DL450 CPUs have built-in real-time clocks. In a typical application, the time and date are displayed when a system fault occurs, along with the fault type. The example program in this section shows you how to create the display output below. On the left, the display shows a basic text form without the fault condition. When the particular fault “Bin Empty” occurs, the display fills in the fault, time, and date fields in the form, shown on the right.

Normal Display, X0 = Off

M	A	C	H	I	N	E	S	T	A	T	U	S		
F	a	u	l	t	=									
T	i	m	e	=										
D	a	t	e	=										

7 6 5 4 3 2 1 0 7 6 5 4 3 2 1 0

Fault Display, X0 = On

M	A	C	H	I	N	E	S	T	A	T	U	S			
F	a	u	l	t	=	B	i	n	E	m	p	t	y		
T	i	m	e	=	1	1	:	3	2	:	5	7	A	M	
D	a	t	e	=	0	7	/	0	5	/	9	5			

7 6 5 4 3 2 1 0 7 6 5 4 3 2 1 0

The program uses a combination of ACON boxes, LD/OUT and LDD/OUTD instructions to create the text portion of the display. The six numeric display positions contain both numbers and text formatting characters such as “:” or “/”. In some cases, the numbers have to be shifted to align them with the formatting characters.

Numeric Display Positions

	3		2		1		0
	7		6		5		4
	13		12		11		10
	17		16		15		14

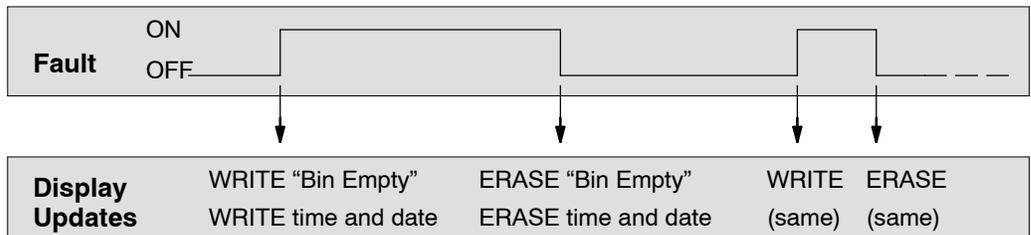
7 6 5 4 3 2 1 0 7 6 5 4 3 2 1 0

Text Display Positions

	0	1	2	3	4	5	6	7
	10	11	12	13	14	15	16	17
	20	21	22	23	24	25	26	27
	30	31	32	33	34	35	36	37

7 6 5 4 3 2 1 0 7 6 5 4 3 2 1 0

The following diagram shows the state of the fault input signal and the resulting display actions. Our example ladder program monitors the state of the fault signal through discrete input X0. In the Off-to-On transition, the ladder program writes “Bin Empty”, and fills in the time and date data. When input X0 makes the On-to-Off transition, the program erases the “Bin Empty” message and the time and date information. Future transitions of the X0 signal cause the same display updates.



At each display update, the ladder program needs only to write the new text output data to the text data block one time. So, the program uses a PD (positive differential) coil to sense both Off-to-On and On-to-Off transitions of X0. The control relays C0 and C1 are on for just one scan, respectively. In this way the ladder program only has to display updates when the fault signal X0 makes a transition, greatly minimizing any impact to the PLC scan time.

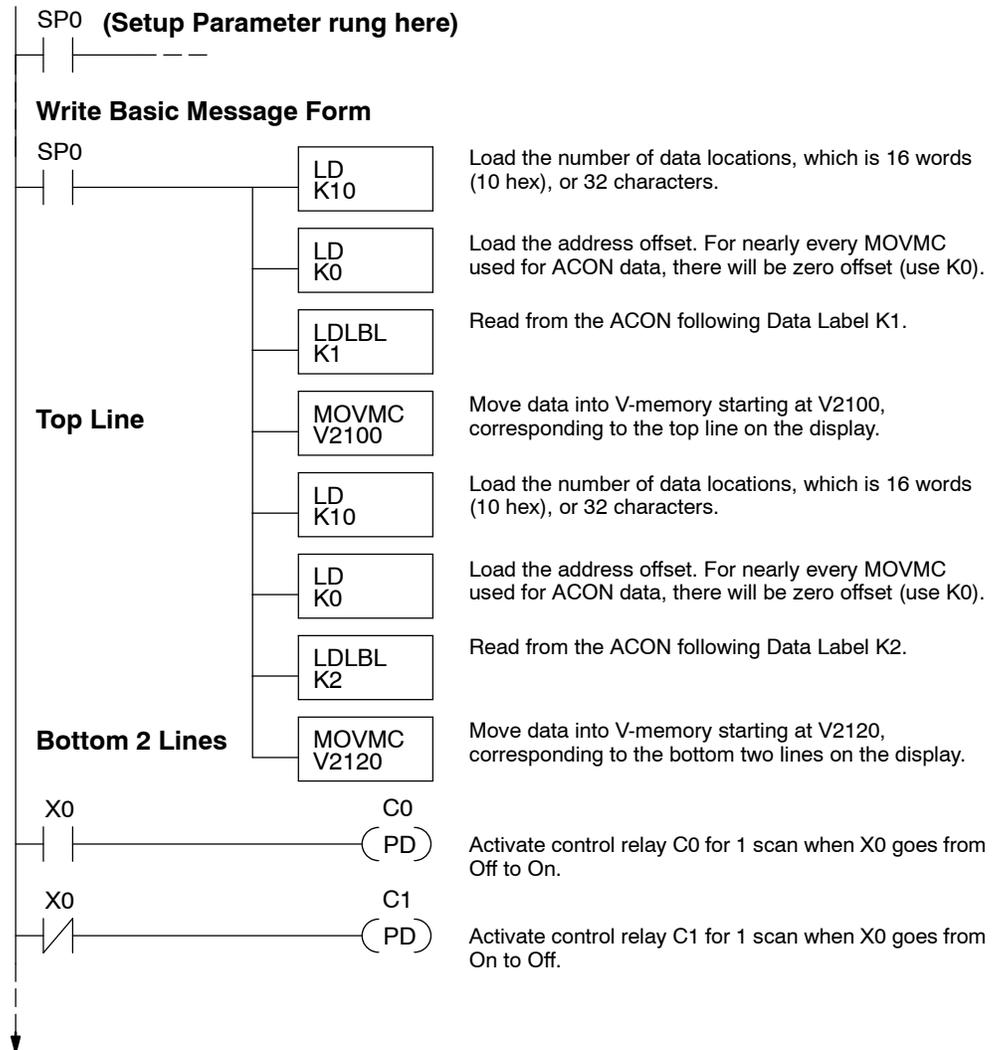
Real-time clock data is available in system V-memory (DL240, DL250, DL350, DL440 and DL450 CPUs), at the addresses in the table below. If the current time and date in your PLC requires setting, use **DirectSOFT**'s menu "PLC", then "Settings", then "Calendar".

Time Data	Location	Date Data	Location
Hours	V7770	Day	V7772
Minutes	V7767	Month	V7773
Seconds	V7766	Year	V7774

The following program reports the time and date when the error input X0 turns on. The display clears the information when X0 turns off.



a:\msg14.prj



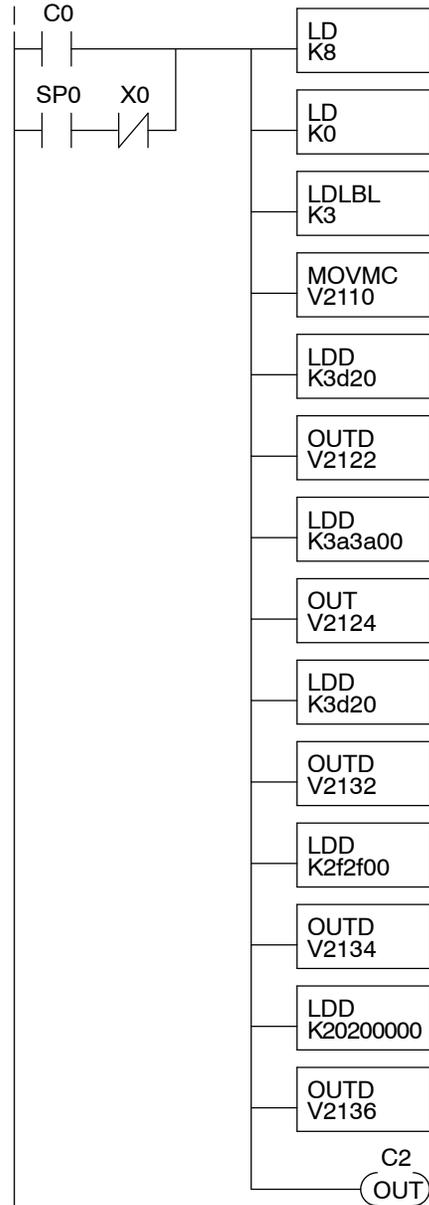
Message Display Mode

(continued)



a:\msg14.prj

Write Fault Message



Load the number of data locations, which is 8 words (16 characters).

Load the address offset. For nearly every MOVMC used for ACON data, there will be zero offset (use K0).

Read from the ACON following Data Label K3.

Move data into V-memory starting at V2110, corresponding to the second line of the display. This writes the fault type to the display.

Load the ASCII codes two null characters (0000), followed by the ASCII codes for “=”.

Place the characters “=” to the right of “Time”, on the third row of the display, and unmask the two character positions for the hours digits.

Load the ASCII codes for a colon, two null characters, and another colon.

Place the colons on the third line of the display for the time output, and place the null characters so they unmask the minutes digits.

Load the ASCII codes for two null characters (0000), followed by the ASCII codes for “=”.

Place the characters “=” to the right of “Date”, on the fourth row of the display, and unmask the two character positions for the years digits.

Load the ASCII codes for a “/”, two null characters, and another “/”.

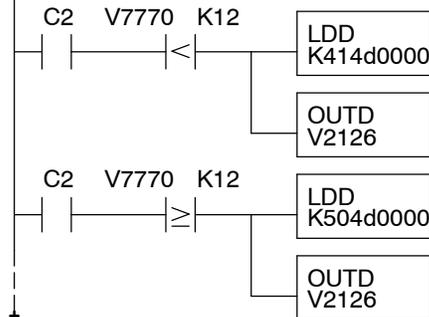
Place the “/” characters on the fourth line of the display for the date output, and place the null characters so they unmask the month digits.

Load the ASCII codes for two spaces, followed by two null characters.

Place these characters on the fourth line. The null characters unmask the year digits, and the spaces mask the last two character positions.

Use control relay contact C2 to extend the logic of this rung to more rungs, to AND with relational contacts.

Hours, AM and PM



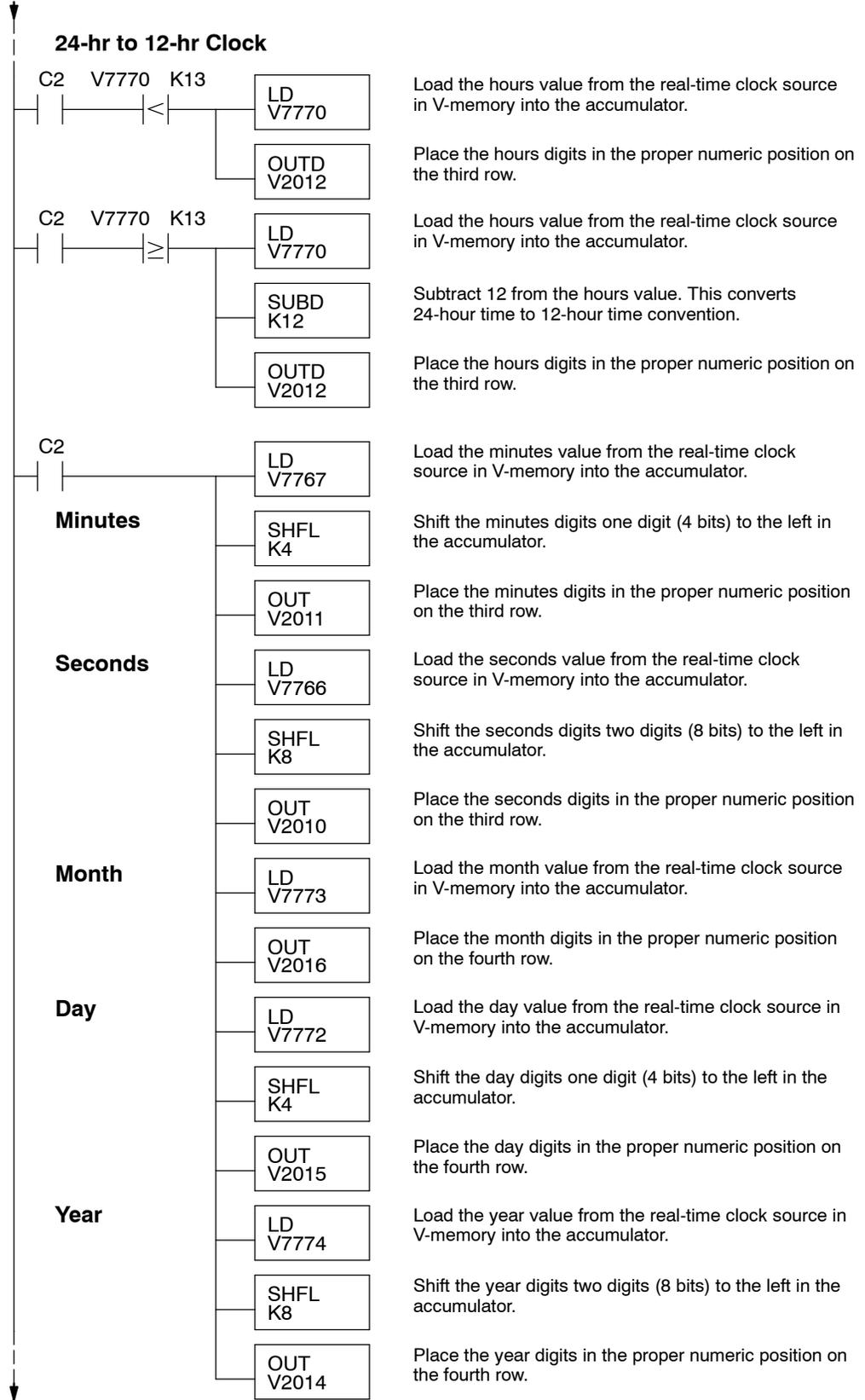
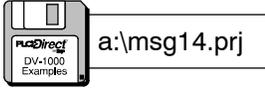
If the hours value is less than 12, then load the ASCII codes for “AM”. The null characters (0000) unmask the minutes digits.

Place the “AM” characters to the right of the time display on the third row.

If the hours value is 12 or greater, then load the ASCII codes for “PM”. The null characters (0000) unmask the minutes digits.

Place the “PM” characters to the right of the time display on the third row.

(continued)

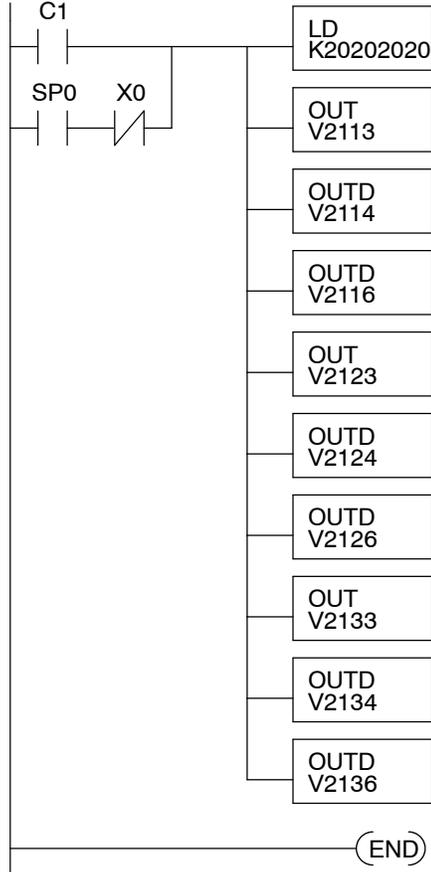


(continued)



a:\msg14.prj

Clear Fault Message

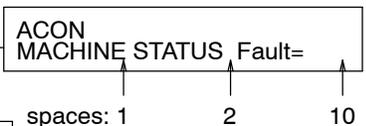


- LD K20202020 Load the ASCII codes for 4 spaces into the accumulator.
- OUT V2113 Clear text position 13.
- OUTD V2114 Clear text positions 14 and 15.
- OUTD V2116 Clear text positions 16 and 17.
- OUT V2123 Clear text position 23.
- OUTD V2124 Clear text positions 24 and 25.
- OUTD V2126 Clear text positions 26 and 27.
- OUT V2133 Clear text position 33.
- OUTD V2134 Clear text positions 34 and 35.
- OUTD V2136 Clear text positions 36 and 37.
- END Place an END coil, marking the end of the main program.

Message Display Mode

DLBL K1

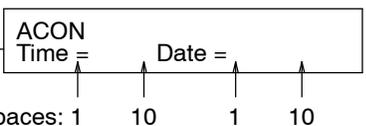
Data for Top 2 Display Lines



Use the ASCII Constant (ACON) box to enter text for the top two lines of the display. It contains 32 characters, counting the spaces.

DLBL K2

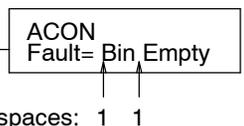
Data for Bottom 2 Display Lines



Use the ASCII Constant (ACON) box to enter text for the top two lines of the display. It contains 32 characters, counting the spaces.

DLBL K3

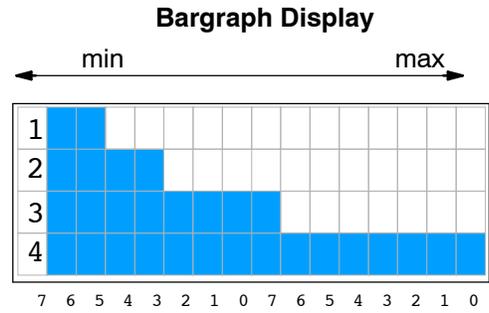
Data for Second Display Line



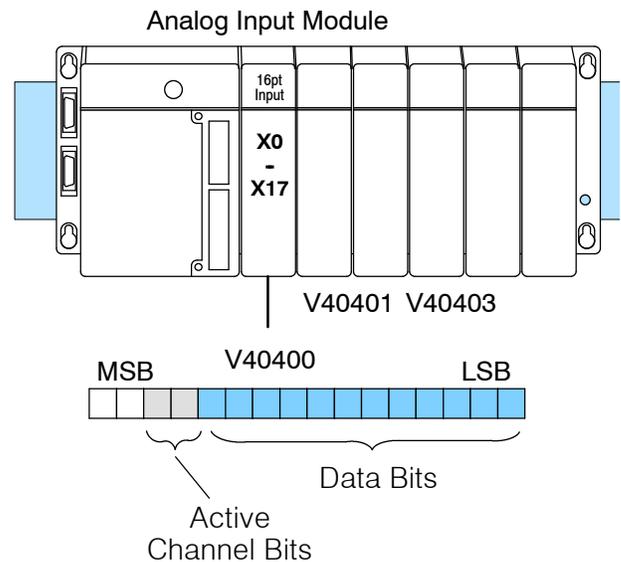
Use the ASCII Constant (ACON) box to enter text for the second line of the display. It contains 16 characters, counting the spaces.

Bar Graph Example (DL240, DL250, DL350, DL440 and DL450 CPUs Only)

This example create a four-channel linear bar graph using the DV-1000's extended ASCII character set. The ASCII code FF (hex) produces a solid block character. The ladder program generates text output to display a row of these characters whose length is proportional to a numerical value. The remainder of each row consists of spaces (20 hex). This creates the bar graph effect.



The figure to the right shows an analog input module in the first module slot in the base. Its points map to X0 to X17, corresponding to data word V40400 in V-memory. Its input word is shared among the four channels of the analog module. Only one channel is active on each scan. Ladder logic decodes the active channel bits, and store each channel's data separately. The bar graph display update is independent from the channel value update process.



The ladder program to create this display updates only one text position (two characters) per CPU scan. The following table lists location of analog values and pointers the program uses to keep track of where it is in the overall display update. Since there are 64 characters (32 text positions) in the display, the program is able to update the entire display every 32 CPU scans. The program adds approximately five milliseconds to the scan time of a DL240 CPU.

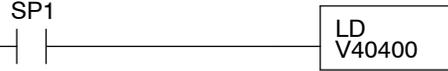
Variable	Location	Range of values
Raw Analog values	V2200 - V2203	0000 - FFFF
Processed Analog Values	V2204 - V2207	0001 - 0010
Character Pointer	V2210	0 - 15
Row Pointer	V2211	0 - 3
Raw Analog Pointer	V2212	O2200 - O2203
Processed Analog Pointer	V2213	O2204 - O2207
Text Data Pointer	V2214	O2100 - O2137
Scratchpad number	V2215	-



a:\msg15.prj

(Setup Parameter rung here)

Load Channel Data Values



Load the contents of V40400 (X0 to X17) into the accumulator.

Ch 1



Channel 1 data is being sent when X15 and X14 are off. The Out instruction places the data in V2200, storing the raw data for channel 1.

Ch 2



Channel 2 data is being sent when X15 is off and X14 is on. The Out instruction places the data in V2201, storing the raw data for channel 2.

Ch 3



Channel 3 data is being sent when X15 is on and X14 is off. The Out instruction places the data in V2202, storing the raw data for channel 3.

Ch 4



Channel 4 data is being sent when X15 and X14 are off. The Out instruction places the data in V2203, storing the raw data for channel 4.

Initialize Variables



Load the constant K0 into the accumulator.

First scan only



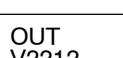
Initialize the character pointer to zero. This points to one of 16 characters on the current row.



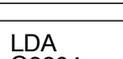
Initialize the row pointer to zero. This points to one of 4 rows of characters on the display.



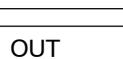
Load the octal address 2200 into the accumulator. V2200 is the location of the raw analog data.



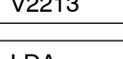
Initialize the raw analog value pointer at V2212 to point to the first analog value at V2200.



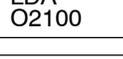
Load the octal address 2204 into the accumulator. V2204 is the location of the processed analog data.



Initialize the raw analog value pointer at V2213 to point to the first analog value at V2204.



Load the octal address 2100 into the accumulator. V2100 is the beginning of display text data.



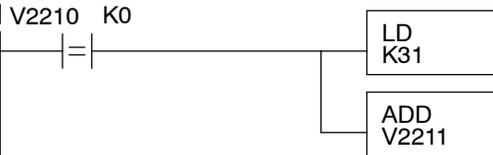
Initialize the display text pointer at V2214 to point to the first text display location at V2100.

(continued)



a:\msg15.prj

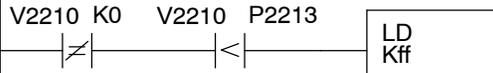
Write Channel Labels



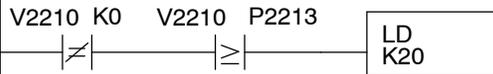
Load the ASCII constant for "1" into the accumulator. We will modify this with an offset to create numbers 1 through 4.

Use the row data as an offset for the ASCII codes. This will number the display as rows 1 through 4.

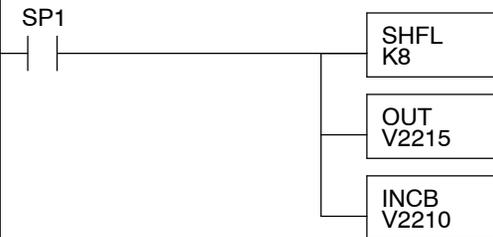
Write Bar Graph Components



If the processed analog value is less than the character pointer, load the ASCII code for the solid block character (bar graph component) into the accumulator.



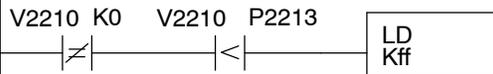
If the processed analog value is equal to or greater than the character pointer, load the ASCII code for the space character (blanks bar graph) into the accumulator.



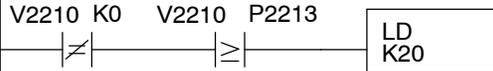
Move the "ff" or "20" into the second nibble of the accumulator.

Save the accumulator contents at V2215 while we calculate the lower nibble.

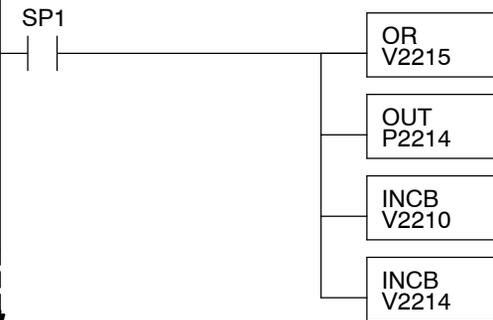
Increment the character pointer, in order to make the next compare.



If the processed analog value is less than the character pointer, load the ASCII code for the solid block character (bar graph component) into the accumulator.



If the processed analog value is equal to or greater than the character pointer, load the ASCII code for the space character (blanks bar graph) into the accumulator.



Combine the contents of the accumulator (lower nibble) with the saved contents of V2215 (upper nibble). We have a word now ready to write.

Write the bargraph word (2 characters) to the proper text position's address, pointed to by V2214.

Increment the character pointer, in order to make the next compare.

Increment the text data pointer, in order to write to the next text position on the display.

(continued)



a:\msg15.prj

End of Row

V2210 K10

LD K0

Load "0" into the accumulator.

OUT V2210

Reset the character pointer at V2210 to zero.

INCB V2211

Increment the row pointer at V2211.

LD P2212

Load the next raw analog value into the accumulator for processing.

ANDD kfff

Mask off any bits above the lower 12 bits, such as channel select numbers, etc. This assumes 12-bit analog values.

SHFR K8

Discard the lower 8 bits, and use the upper 4 bits to scale the value from 0 to 15 (0 to f hex).

OUT P2213

Write the processed analog value to the proper address, *pointed to* by V2213.

INCB P2213

Increment the processed analog value pointer.

INCB V2212

Increment the raw analog value pointer.

INCB V2213

Add one to the processed analog value, to scale it from 1 to 16 (1 to 10 hex).

End of Display

V2211 K4

LDA O2200

Load the beginning address of the raw analog values into the accumulator.

OUT V2212

Reset the raw analog value pointer at V2212 to point to V2200.

LDA O2204

Load the beginning address of the processed analog values into the accumulator.

OUT V2213

Reset the processed analog value pointer at V2213 to point to V2204.

LDA O2100

Load the beginning address of the text data block into the accumulator.

OUT V2214

Reset the text data pointer at V2214 to point to V2100.

LD K0

Load the constant zero into the accumulator.

OUT V2210

Reset the character pointer to zero.

OUT V2211

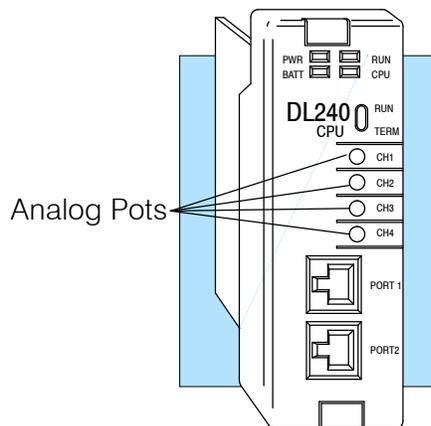
Reset the row pointer to zero.

(END)

Place an END coil, marking the end of the program.

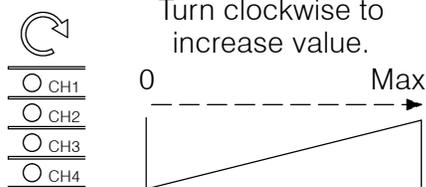
Bar Graph Example, DL240 Analog Potentiometers

The DL240 CPU features four built-in analog potentiometers. In this example we modify the previous bar graph program to read these four inputs. The potentiometers are accessible on the front bezel with a small screwdriver. These potentiometers map directly into system V-memory as 8-bit numbers, having a resolution of 1 part in 256.

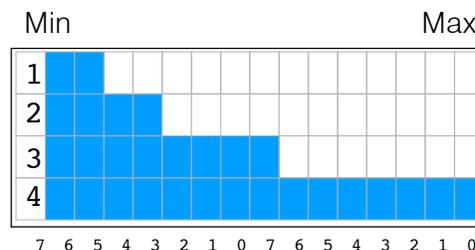


The ladder logic program takes the range of 0 to 255 and re-scales it to 0 to 15. In this way, the number of segments on each row can vary from 0 to 15, in proportion to the potentiometer adjustment.

Potentiometer Adjust



Display Output



To see this program work, just load the file from disk, and place the PLC in Run Mode.



a:\msg16.prj

SP0 (Setup Parameter rung here)

Set Up Analog Potentiometer Scalings

SP0

First scan only

LD
K0

Load the constant K0 into the accumulator.

OUT
V7640

Set the bottom of Channel 1 range to zero.

OUT
V7642

Set the bottom of Channel 2 range to zero.

LDA
V7644

Set the bottom of Channel 3 range to zero.

OUT
V7646

Set the bottom of Channel 4 range to zero.

LD
K15

Load the constant K15 into the accumulator.

OUT
V7641

Set the top of Channel 1 range to 15.

LDA
V7643

Set the top of Channel 2 range to 15.

OUT
V7645

Set the top of Channel 3 range to 15.

OUT
V7647

Set the top of Channel 4 range to 15.

Initialize Variables

SP0

First scan only

LD
K0

Load the constant K0 into the accumulator.

OUT
V2210

Initialize the character pointer to zero. This points to one of 16 characters on the current row.

OUT
V2211

Initialize the row pointer to zero. This points to one of 4 rows of characters on the display.

LDA
O3774

Load the octal address 3774 into the accumulator. V3774 is the location of the analog data.

OUT
V2212

Initialize the raw analog value pointer at V2212 to point to the first analog value at V2200.

LDA
O2204

Load the octal address 2204 into the accumulator. V2204 is the location of the processed analog data.

OUT
V2213

Initialize the raw analog value pointer at V2213 to point to the first analog value at V2204.

LDA
O2100

Load the octal address 2100 into the accumulator. V2100 is the beginning of display text data.

OUT
V2214

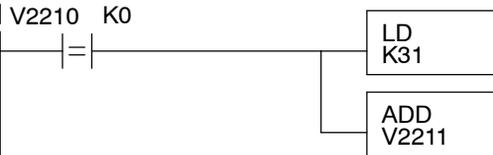
Initialize the display text pointer at V2214 to point to the first text display location at V2100.

(continued)



a:\msg16.prj

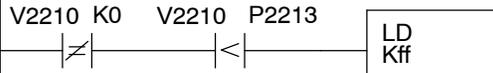
Write Channel Labels



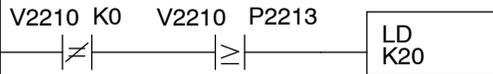
Load the ASCII constant for "1" into the accumulator. We will modify this with an offset to create numbers 1 through 4.

Use the row data as an offset for the ASCII codes. This will number the display as rows 1 through 4.

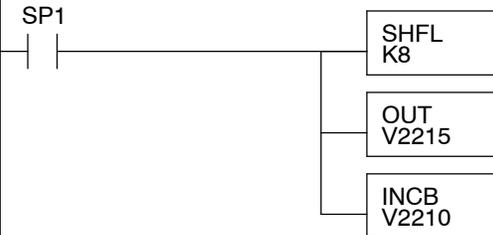
Write Bar Graph Components



If the processed analog value is less than the character pointer, load the ASCII code for the solid block character (bar graph component) into the accumulator.



If the processed analog value is equal to or greater than the character pointer, load the ASCII code for the space character (blanks bar graph) into the accumulator.



Move the "ff" or "20" into the second nibble of the accumulator.

Save the accumulator contents at V2215 while we calculate the lower nibble.

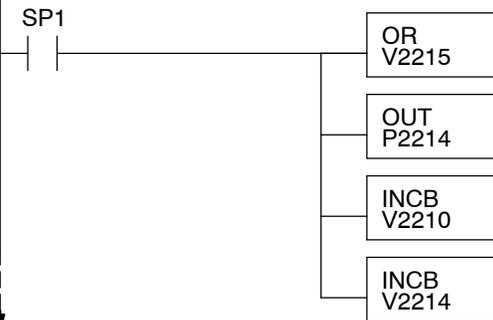
Increment the character pointer, in order to make the next compare.



If the processed analog value is less than the character pointer, load the ASCII code for the solid block character (bar graph component) into the accumulator.



If the processed analog value is equal to or greater than the character pointer, load the ASCII code for the space character (blanks bar graph) into the accumulator.



Combine the contents of the accumulator (lower nibble) with the saved contents of V2215 (upper nibble). We have a word now ready to write.

Write the bargraph word (2 characters) to the proper text position's address, pointed to by V2214.

Increment the character pointer, in order to make the next compare.

Increment the text data pointer, in order to write to the next text position on the display.

(continued)



a:\msg16.prj

End of Row

V2210 K10

LD
K0

Load "0" into the accumulator.

OUT
V2210

Reset the character pointer at V2210 to zero.

INCB
V2211

Increment the row pointer at V2211.

LD
P2212

Load the next raw analog value into the accumulator for processing.

BIN

Convert the accumulator contents to binary.

OUT
P2213

Write the processed analog value to the proper address, *pointed to* by V2213.

INCB
P2213

Increment the processed analog value pointer.

INCB
V2212

Increment the raw analog value pointer.

INCB
V2213

Add one to the processed analog value, to scale it from 1 to 16 (1 to 10 hex).

End of Display

V2211 K4

LDA
O3774

Load the beginning address of the analog values into the accumulator.

OUT
V2212

Reset the raw analog value pointer at V2212 to point to V2200.

LDA
O2204

Load the beginning address of the processed analog values into the accumulator.

OUT
V2213

Reset the processed analog value pointer at V2213 to point to V2204.

LDA
O2100

Load the beginning address of the text data block into the accumulator.

OUT
V2214

Reset the text data pointer at V2214 to point to V2100.

LD
K0

Load the constant zero into the accumulator.

OUT
V2210

Reset the character pointer to zero.

OUT
V2211

Discard the lower 8 bits, and use the upper 4 bits to scale the value from 0 to 15 (0 to f hex).

(END)

Place an END coil, marking the end of the program.

Automatic Scrolling Display (DL240, DL250, DL350, DL440 and DL450 CPUs Only)

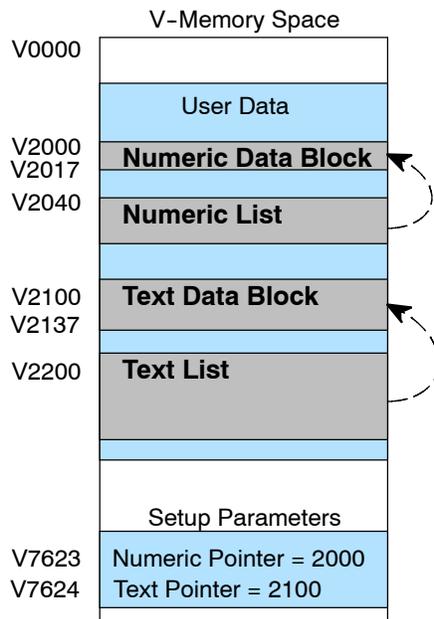
Occasionally you may want to monitor a list of process parameters larger than the DV-1000 display can show at one time. Earlier in this chapter a “dual display” example switched between two sets of information. In this example, the automatic scrolling technique provides hands-free monitoring of multiple screens of information.

The list to the right contains 10 items, followed by a blank line item. The example program scrolls down the list one item every two seconds, and starts again with the first item.

L	o	t	N	u	m	b	e	r			3	2	9	3
S	e	t	p	o	i	n	t				2	4	1	8
A	c	t	u	a	l	T	e	m	p		1	6	4	4
H	i	g	h	A	l	a	r	m			5	7	6	5
L	o	w	A	l	a	r	m				1	6	4	4
T	a	n	k	1	L	v	l				5	7	6	5
T	a	n	k	2	L	v	l				1	6	4	4
F	l	o	w	R	a	t	e				5	7	6	5
T	e	m	p	1							1	6	4	4
T	e	m	p	2							8	2	1	9

The information to be displayed will obviously not fit in the standard numeric and text data blocks. Consequently, we have to choose a method of moving the data into the standard data blocks. Refer to the memory map to the right.

Setup Parameters define the standard numeric block (at V2000) and text data block (at V2100) as in the other examples in this chapter. However, a separate numeric list (at V2040) and text list (at V2200) contains the all information to be scrolled through the display. Therefore, the main program moves a different portion of the lists into the corresponding data blocks every two seconds. Since the DV-1000 constantly re-reads the data blocks (pointed to by the setup parameters), it completes the scrolling effect.



To scroll the display message, the ladder program on the next page creates and uses the following variables to manage the data in the scrolling process.

Variable	Location	Range of values
List Item Pointer	V4000	0 to X
Item Pointer During Scroll	V4001	X to (X+3)
Text List Address Offset	V4002	0 to 40 (hex)
Text List Address Pointer	V4003	2200 to 3010 (octal)
Numeric Data Block Address Pointer	V4004	2000 to 2014 (octal)
Numeric List Address Pointer	V4005	2040 to (2040 +X) (octal)
List Length (called “X”)	V4006	1 to 20 (hex)



a:\msg17.prj

SP0 (Setup Parameter rung here)

Initialize Variables

SP0

First scan only

Move text data

Unmask numeric positions

Set Up Scroll Timer

LD Kb

Load the constant Kb hex (or 11 decimal) into the accumulator.

OUT V4006

Set the list length at V4006 to 11 items.

LD K58

Load the constant K58 (hex) into the accumulator. This is the number of words (88 decimal) we need to move to create the text data list. Counting the words in the ACON boxes, we have 20+20+20+20+8 = 88.

LD K0

Load the constant K0 into the accumulator. This is the offset for MOVMC, and is usually zero.

LDLBL K1

Load the data label K1 into the accumulator. The data is after the label K1.

MOVMC V2200

Move the data to the V-memory area starting at V2200. This instruction uses the three numbers from the stack which we loaded above.

LDD K0

Load the constant K0 into all 32 bits of the accumulator.

OUT V4000

Initialize the item number.

OUTD V2206

Unmask the numeric position for item 1.

OUTD V2216

Unmask the numeric position for item 2.

OUTD V2226

Unmask the numeric position for item 3.

OUTD V2236

Unmask the numeric position for item 4.

OUTD V2246

Unmask the numeric position for item 5.

OUTD V2256

Unmask the numeric position for item 6.

OUTD V2266

Unmask the numeric position for item 7.

OUTD V2276

Unmask the numeric position for item 8.

OUTD V2306

Unmask the numeric position for item 9.

OUTD V2316

Unmask the numeric position for item 10.

T0

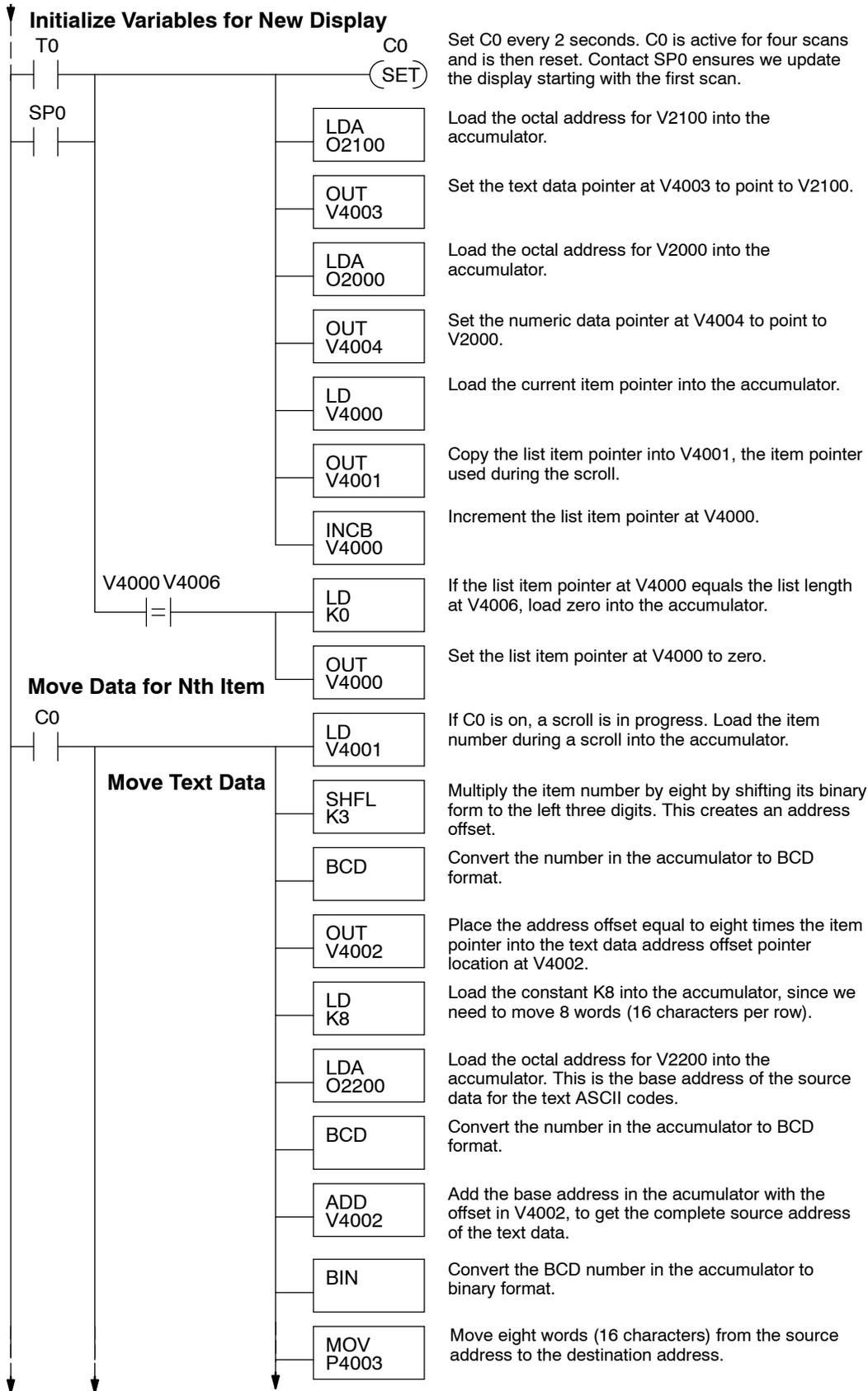
TMR T0 K20

Configure Timer 0 as a two-second self-resetting timer.

(continued)



a:\msg17.prj



Message Display Mode

(continued)



a:\msg17.prj

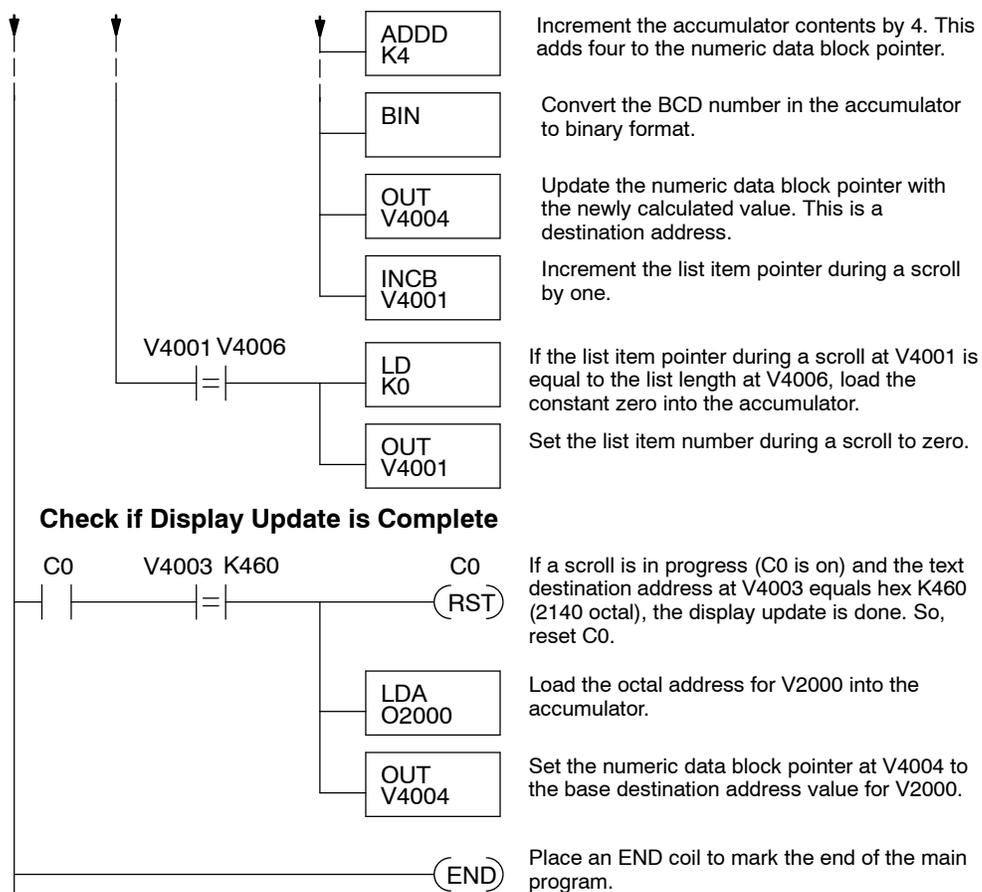
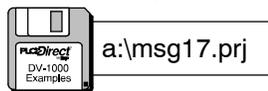
Move Numeric Data

LD V4001	Load the list item number at location V4001 into the accumulator.
BCD	Convert the number in the accumulator to BCD.
OUT V4001	Place the converted value back into location V4001.
LDA O2040	Load the list item pointer into the accumulator. This creates a source address for numeric list data.
BCD	Convert the number in the accumulator to BCD format.
ADD V4001	Add the list item number during the scroll at V4001 to the accumulator contents.
BIN	Convert the BCD number in the accumulator to binary format.
OUT V4005	Place the newly calculated numeric list source address pointer into its location at V4005.
LD V4001	Load the list item number at location V4001 into the accumulator.
BIN	Convert the BCD number in the accumulator to binary format.
OUT V4001	Place the converted value back into location V4001.
LD P4005	Load the numeric list data pointed to by V4005 into the accumulator.
OUT P4004	Place the data into the numeric data block destination, pointed to by the address pointer at V4004.
LD V4003	Load the current text data pointer value into the accumulator.
BCD	Convert the number in the accumulator to BCD format.
ADDD K8	Increment the accumulator contents by 8. This adds eight to the text data pointer.
BIN	Convert the BCD number in the accumulator to binary format.
OUT V4003	Update the text data pointer with the newly calculated value. This is a source address.
LD V4004	Load the current numeric data block pointer into the accumulator.
BCD	Convert the number in the accumulator to BCD format.

Increment Text Address Pointer

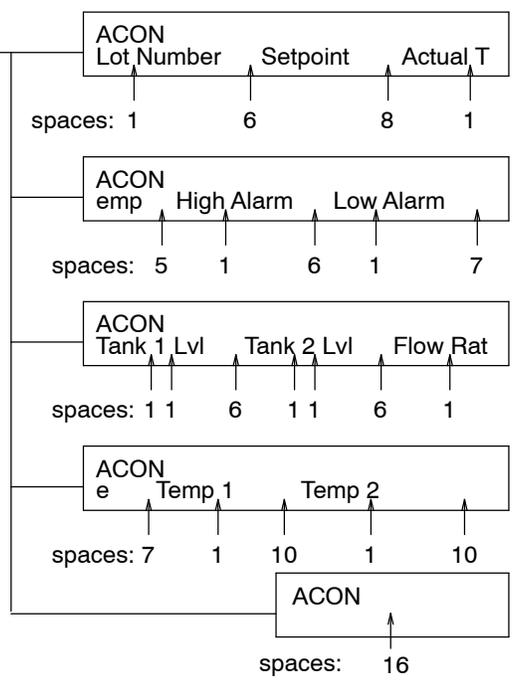
Increment Numeric Address Pointer

(continued)



DLBL
K1

Data for Variable List



The data label K1 marks the beginning of the ACON (ASCII constant) boxes which follow.

The next four ACON boxes hold 40 characters (20 words). The text they contain are the list contents. Be sure to carefully count the spaces.

SAME

Here we include some spaces at the end of the list, so that the blank line at the end of the list has 16 spaces (requires 8 words).

Message Display Mode

Embedded Decimal Point

Some process variables will include a fractional part that you may want to display by using a decimal point. The example screen to the right displays an oven temperature with a resolution of tenths of a degree Fahrenheit.

O	v	e	n	T	e	m	p	=	6	5	5	3	.	5	F

7 6 5 4 3 2 1 0 7 6 5 4 3 2 1 0

The decimal point occupies a character position in the middle of the number, because separate decimal point segments are not built in to each character or digit field. The ladder program begins with a binary number which can vary from 0 to ffff hex, or 0 to 65535 decimal. The number is an integer, but is actually ten times larger than the actual oven temperature in degrees. This creates an implied decimal point in the location shown, so we can display tenths of a degree. The ladder program reads the oven temperature from V2200, then converts it to BCD and displays it in the appropriate numeric output display positions.

Numeric Display Positions

	3		2		1		0
	7		6		5		4
	13		12		11		10
	17		16		15		14

7 6 5 4 3 2 1 0 7 6 5 4 3 2 1 0

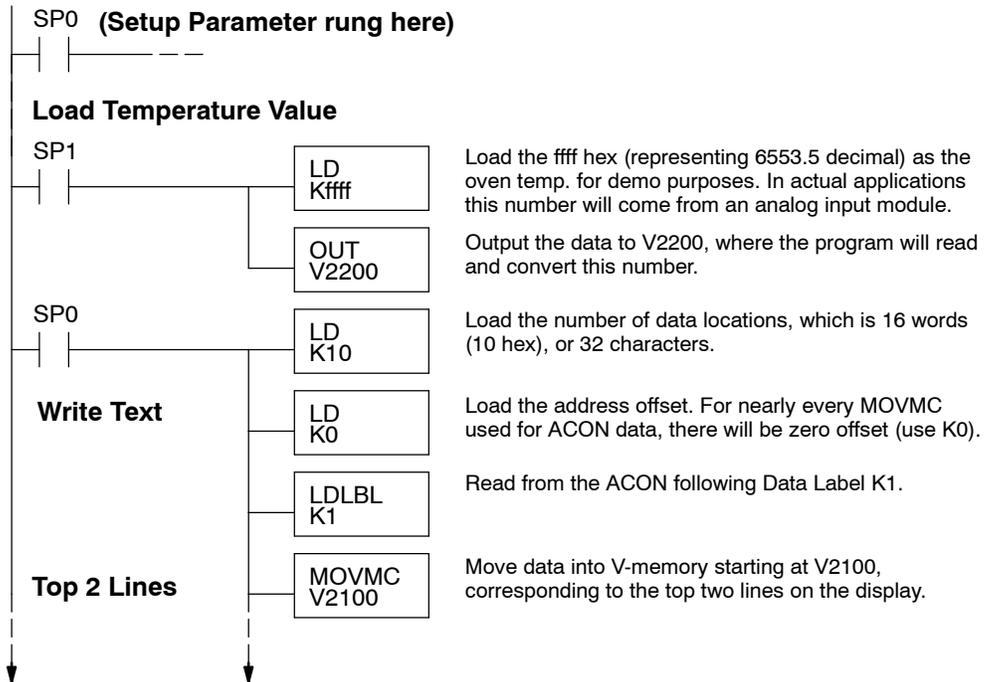
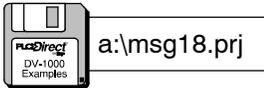
Text Display Positions

0	1	2	3	4	5	6	7
10	11	12	13	14	15	16	17
20	21	22	23	24	25	26	27
30	31	32	33	34	35	36	37

7 6 5 4 3 2 1 0 7 6 5 4 3 2 1 0

The program uses ACON boxes to generate text for “OvenTemp” and the remaining blank space on the display. The decimal point and the “F” character are written specifically to text positions embedded with null characters (ASCII code = 0) which unmask the digits. Shift and add instructions split apart the number’s digits to place them in numeric display positions 0 and 1, making room for the decimal point.

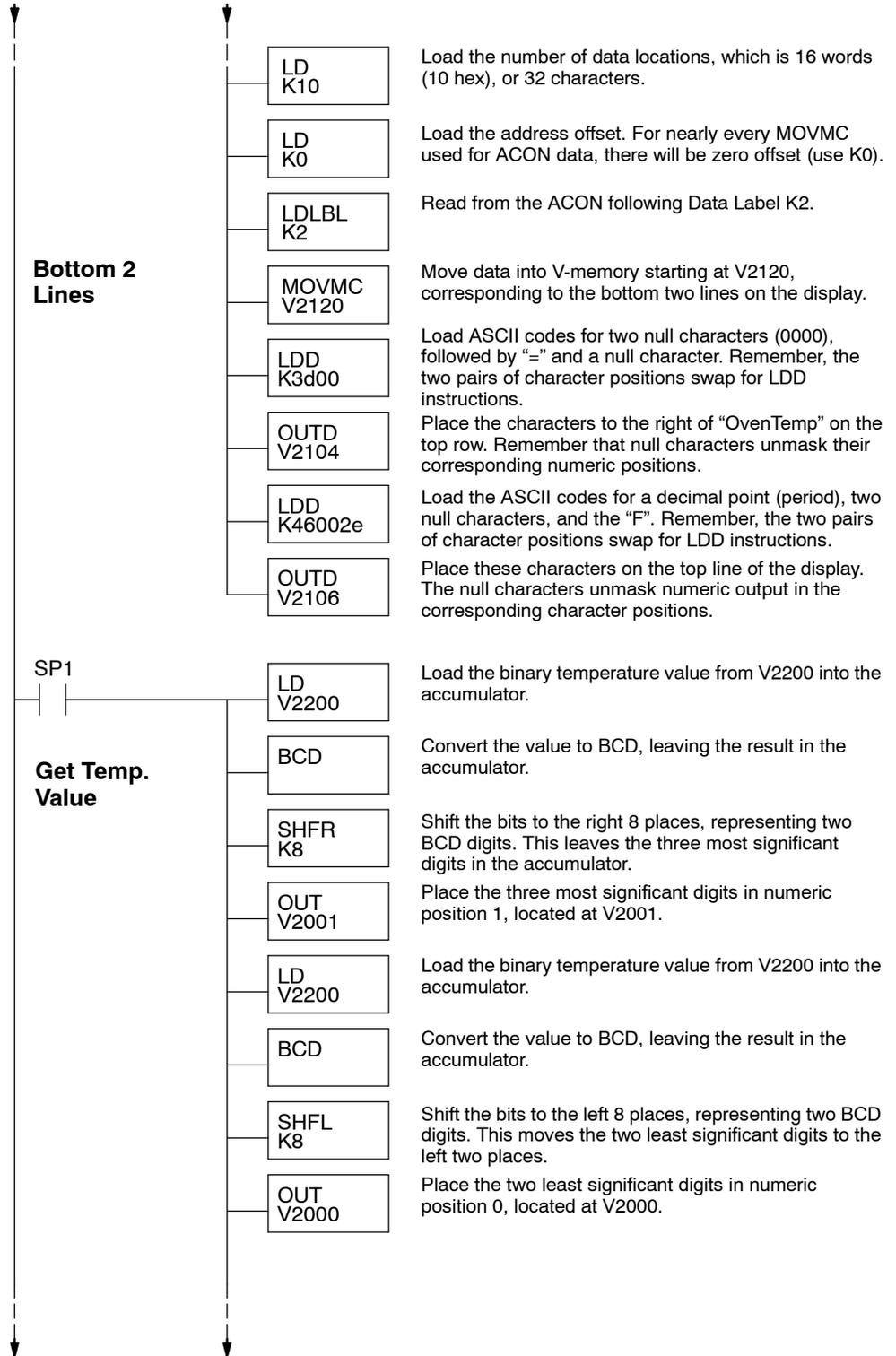
Message Display Mode



(continued)



a:\msg18.prj



Bottom 2 Lines

```
LD K10
LD K0
LDLBL K2
MOVMC V2120
LDD K3d00
OUTD V2104
LDD K46002e
OUTD V2106
```

Load the number of data locations, which is 16 words (10 hex), or 32 characters.

Load the address offset. For nearly every MOVMC used for ACON data, there will be zero offset (use K0).

Read from the ACON following Data Label K2.

Move data into V-memory starting at V2120, corresponding to the bottom two lines on the display.

Load ASCII codes for two null characters (0000), followed by "=" and a null character. Remember, the two pairs of character positions swap for LDD instructions.

Place the characters to the right of "OvenTemp" on the top row. Remember that null characters unmask their corresponding numeric positions.

Load the ASCII codes for a decimal point (period), two null characters, and the "F". Remember, the two pairs of character positions swap for LDD instructions.

Place these characters on the top line of the display. The null characters unmask numeric output in the corresponding character positions.

Get Temp. Value

```
LD V2200
BCD
SHFR K8
OUT V2001
LD V2200
BCD
SHFL K8
OUT V2000
```

Load the binary temperature value from V2200 into the accumulator.

Convert the value to BCD, leaving the result in the accumulator.

Shift the bits to the right 8 places, representing two BCD digits. This leaves the three most significant digits in the accumulator.

Place the three most significant digits in numeric position 1, located at V2001.

Load the binary temperature value from V2200 into the accumulator.

Convert the value to BCD, leaving the result in the accumulator.

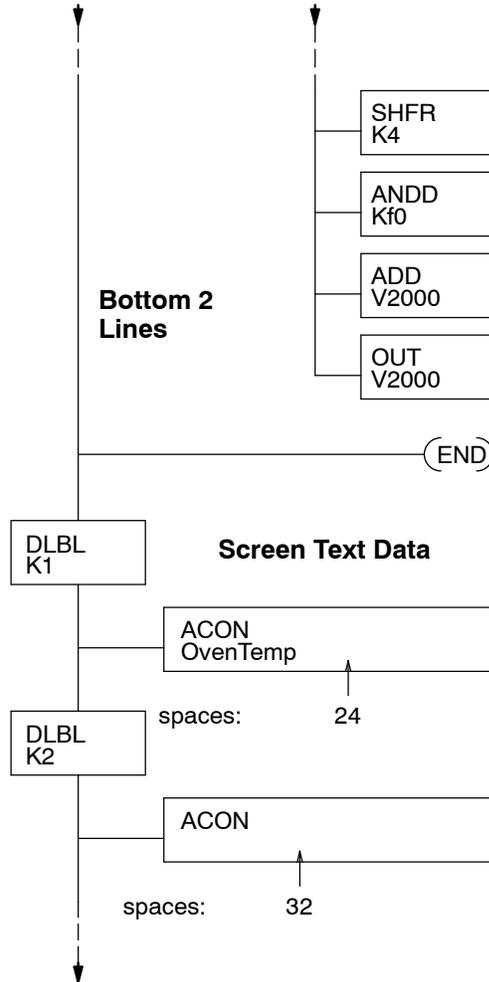
Shift the bits to the left 8 places, representing two BCD digits. This moves the two least significant digits to the left two places.

Place the two least significant digits in numeric position 0, located at V2000.

(continued)



a:\msg18.prj



Shift the bits to the right 4 places, representing one BCD digit. This moves the least significant digit back one digit to the right, leaving room for "F" at the end.

This forces all digits to the left of the least significant digit to zero.

Now we combine the isolated least significant digit back with the other digit. However, it has been shifted to the right to make room for the decimal point.

Output the two LSDs to numeric output position 0. They are spaced apart one digit, to make room for the decimal point, and have been moved to the left to make room for the "F".

Place an END coil, marking the end of the main program.

Screen Text Data

The Data Label box referenced by K1, precedes the following ACON box.

This ACON box contains 32 characters. Be sure to carefully count the spaces to match the display.

The Data Label box referenced by K2, precedes the following ACON box.

This ACON box contains 32 spaces. These fill the bottom two lines of the display.

NOTE: The resulting BCD number in V2000 and V2001 is useful only for display purposes. The actual numerical value is not valid for use in further computations (refer to the original value in V2200).

Chapter Summary

Summary of Key Points

Now we have covered how to use Message Display Mode to communicate the status of the machine to its operator.

We may summarize some of the key points we have learned about generating messages in this chapter:

- System Messages have priority over User Messages.
- User Messages can contain numerical values, or text.
- Numeric and Text Positions represent one 16-bit word of information.
- Numeric and Text output may be viewed simultaneously on the same display. Text output has mask and unmasking control over numeric output.
- Text is stored in V-memory in the form of ASCII codes.
- Ladder programs can load text data via the LD/OUT, LDD/OUTD, and MOVMC/ACON instructions.
- LDD (Load Double) instructions require you to swap positions of the ASCII codes of the first two characters with the second two characters, with respect to left-to-right display position orientation.
- ACON boxes is the preferred method for creating message data whenever you have more than a dozen characters to place together on the display.

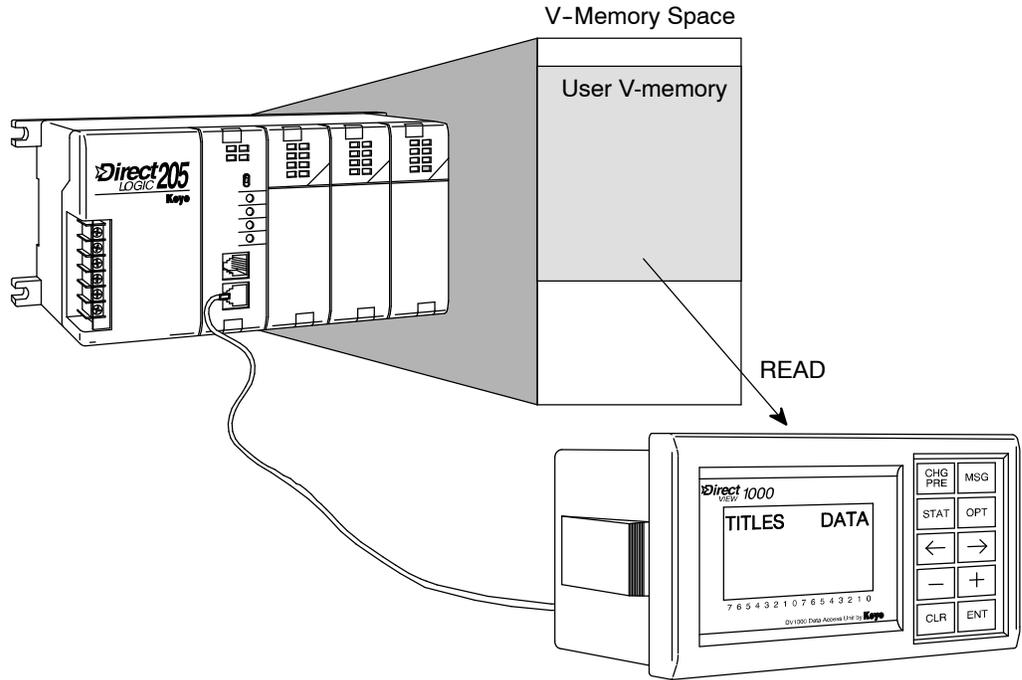
Status Display Mode

In This Chapter. . . .

- Overview
 - Selecting the Address
 - Selecting the Data Type
 - Using the Bookmark
 - Chapter Summary
-

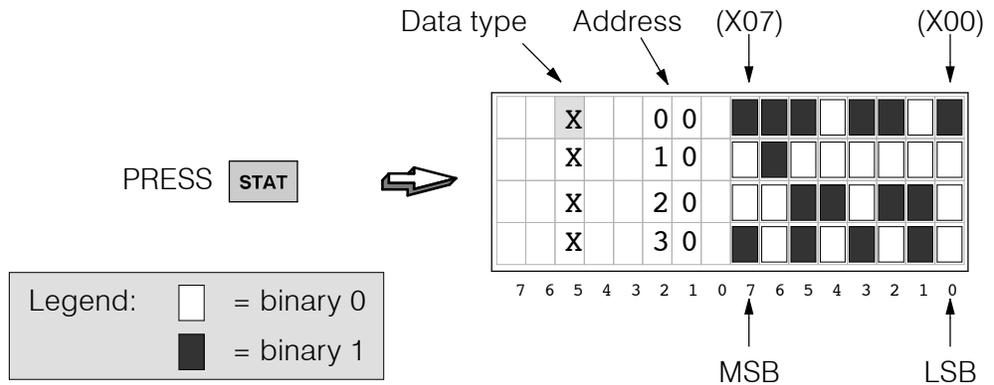
Overview

Status Display Mode allows you to view V-memory data in the CPU. *It requires no setup parameters or supporting ladder logic!* Therefore, you can walk up to any DL105, DL205, DL405 PLC or DL305 with a DL350 CPU, and connect a DV-1000 to view various CPU data types. This makes the DV-1000 a great debugging tool for machine startups or for troubleshooting in the field.



Status Display Format

Status Display Mode is accessible at any time by pressing the **Status** Key (unless the keypad is in Bit Control Mode). It *does not* require setup parameters, but you may select it as the default mode at powerup (see Chapter 3). The default display upon Status Display Mode entry is shown below.

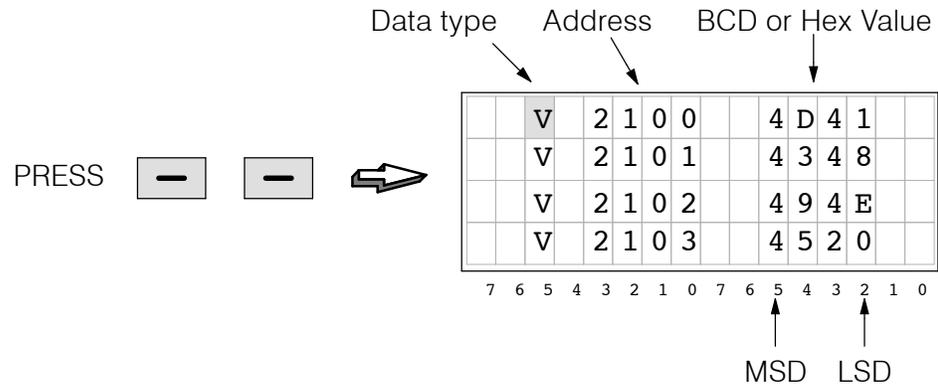


The left column lists the data type (X in the example). The next column lists the octal address, and the data bits are on the right. So the top row shows the status of the eight discrete inputs X00 through X07 in real time. **Recall that there are 8 bits in a byte, and two bytes (16 bits) in a data word!**

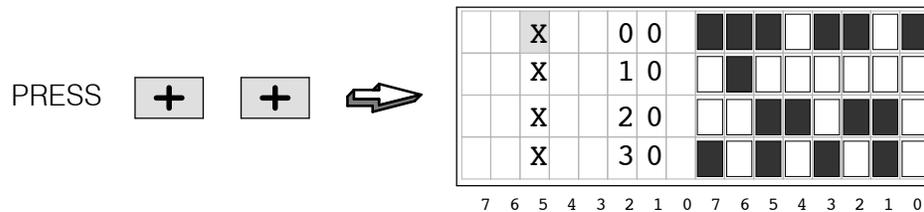
If you can switch the input at X0 on and off, do so and watch the display response. Across the bottom of the screen faceplate is the bit numbering, from LSB to MSB.

NOTE: The binary bit patterns or 4-digit word values in these displays are arbitrary examples. The bit patterns or values on your DV-1000 depends on the state of your CPU program and process.

Data types such as P or V are displayed as 4-digit BCD or hexadecimal numbers. Step to the V data type by pressing the **Minus (-)** Key twice.

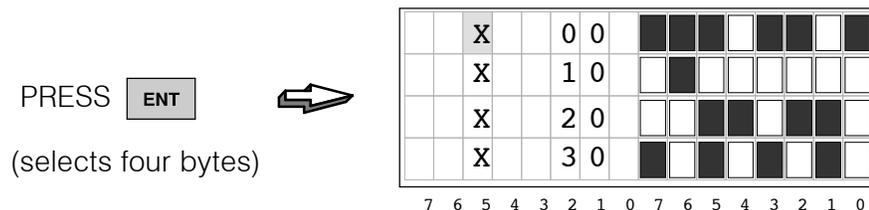
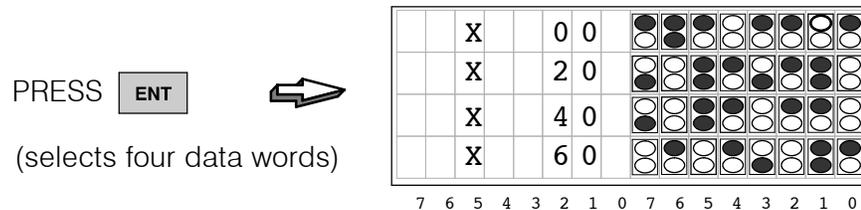


Now return to the X data type by pressing the **Plus (+)** key twice.



Selecting Byte or Word Displays

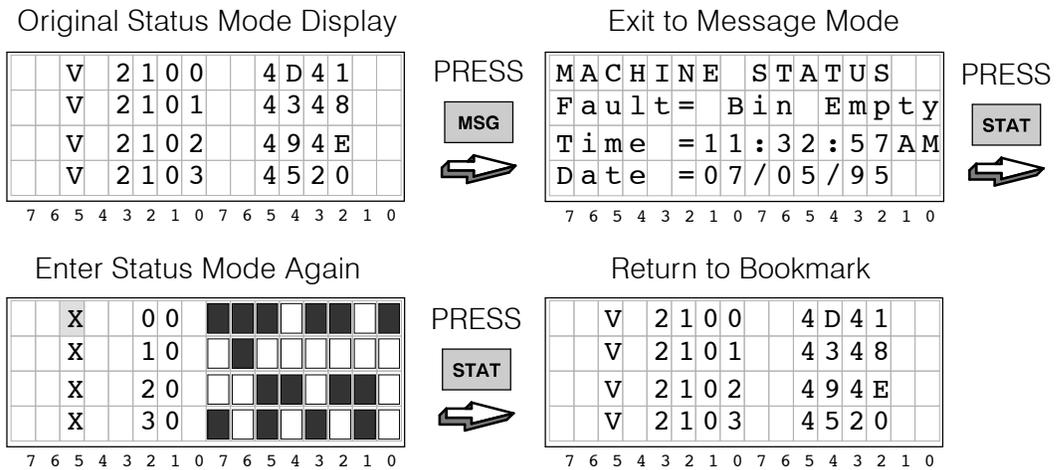
The default display above shows four bytes, or 32 bits of data. You can view eight bytes, or 64 bits by pressing the **Enter** Key. In the example display below, the top line shows X00 through X07, and X10 through X17 directly below. To return to 32-bit display format, just press the **Enter** Key again.



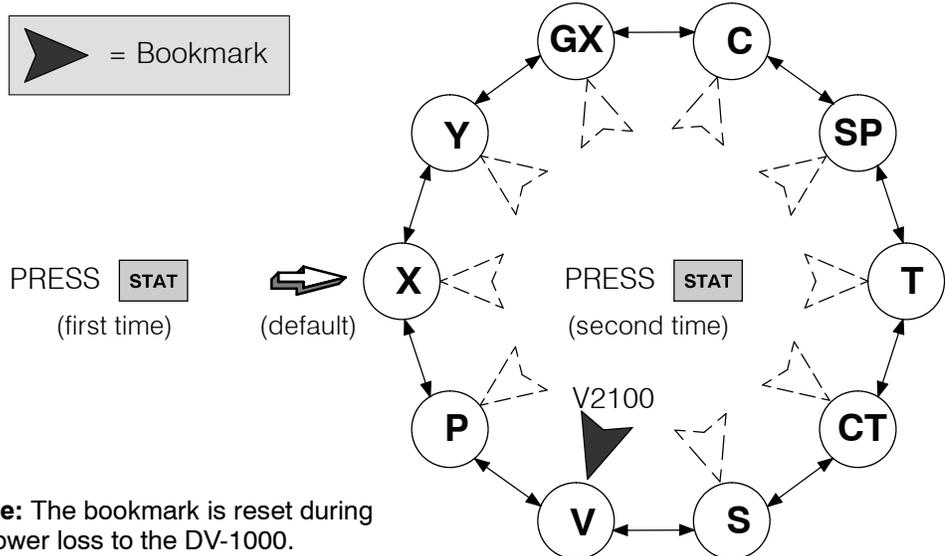
Using the Bookmark

As a convenience the Status Display Mode features a “bookmark”, or a memory of the data type and address last selected in Status Mode. This permits you to later return to Status Display Mode, and use the bookmark to easily recall the last data type and address location you were viewing.

To demonstrate how this works, suppose you are viewing the memory contents at V2100, as you were at the end of the previous section (select V2100 at this time if you have not already done so). Now, suppose you need to check for messages using Message Mode (Press the **Message** Key). After viewing any message, we want to return to Status Mode, displaying V2100 contents. To do this, press STAT once to view the default X00 data. Then **press STAT a second time** to return to the bookmark, and the data at V2100 immediately appears on the display!



The bookmark serves as a pointer to the previously viewed data type and address in Status Mode, as depicted below. The bookmark is set when you exit Status Display Mode, and it can reference any of the data types along with valid addresses.



Note: The bookmark is reset during a power loss to the DV-1000.

Chapter Summary

Summary of Key Points

Now we have covered how to use Status Display Mode to view V-memory contents. We may summarize some of the key points we have learned about setup parameters in this chapter:

- Status Mode requires no setup parameters.
 - For discrete bit displays, you can select byte or word format by toggling the **Enter** Key.
 - The cursor remains on the top line at all times. The addresses of the three rows below the top line are consecutive to the top line address.
 - Data types are selected from a circular list using the **Plus (+)** and **Minus (-)** Keys.
 - After powerup, the DV-1000 records the variable type and address you were viewing an time you exit Status Display Mode, saving it as a bookmark. After using other modes and returning to Status Display Mode, you can press the **Enter** Key twice to return to the variable type and address previously viewed.
 - The bookmark is always reset at each powerup.
-
- 

Change Preset Mode

In This Chapter. . . .

- Overview
 - Setup Parameters for Change Preset Mode
 - Accessing Change Preset Variables
 - Pre-labeled Timer and Counter Presets
 - User-titled Presets
 - Combination Titles Example
 - Change Preset Password
 - Special Topics for Change Preset
 - Operator's Guide to Change Preset Mode
 - Chapter Summary
-

Overview

“Change Preset” Defined

NOTE: DV-1000s which have not had firmware upgrade to version 1.5 will not have Timer and Counter Presets **when used with DL130 and DL230 CPUs.**

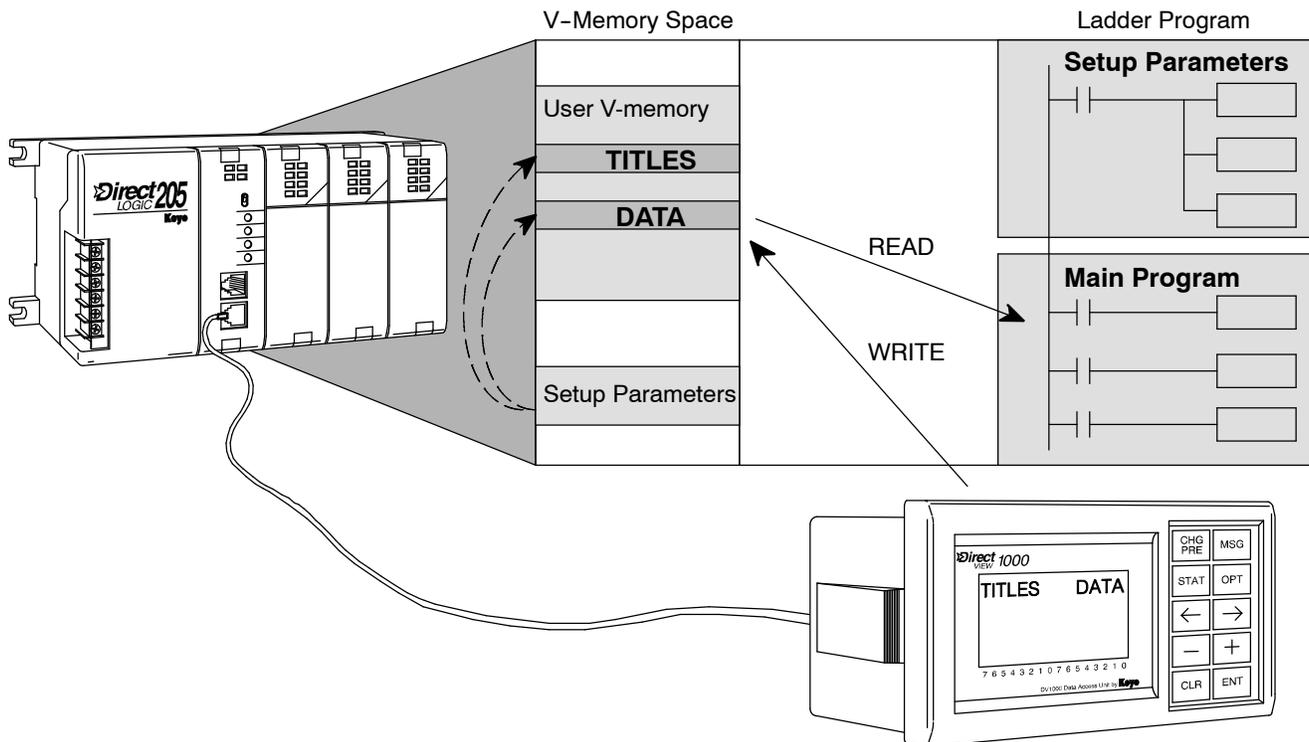
Change Preset Mode allows you to view V-memory contents and change them directly from the DV-1000 keypad. We use the word “preset” because it is normally associated with process control parameters such as timer and counter presets. Historically, a “preset” is a value accessible to the operator for adjusting while the machine or process is operating. Often implemented using thumb-wheel switches, one adjusts product quality and machine performance by making a series of typically careful and incremental changes to control parameters.

The DV-1000 Change Preset Mode emulates the thumb-wheel access to adjust PLC control parameters. However, the term “*preset*” really includes all of User V-memory, not just timers and counters. This concept is so important, we emphasize it here:

“Change Preset” means “Change V-Memory Data”!

How Change Preset Works

Change Preset Mode allows you to monitor and change V-memory data from the DV-1000 keypad. Refer to the figure below. The ladder program writes the setup parameters in V-memory (usually on the first scan). These contain pointers to titles (text labels for the data) and to the data itself. The DV-1000 reads these and provides access to edit the data. When the operator uses Change Preset Mode, the DV-1000 writes new values to the selected data in V-memory. Then the ladder program reads the data (usually on every scan) and uses it as a control parameter for the process.



Title and Data Fields

Change Preset Mode presents data that you can view on the display and edit with the keypad. The display format is relatively fixed. Shown to the right, the title field on each line occupies the first eight or nine character positions. All data is presented in the right column as 4-digit BCD numbers, representing a 16-bit word.

TITLE FIELD								DATA FIELD				
a	b	c	d	e	f	g	h		0	0	0	0
a	b	c	d	e	f	g	h		0	0	0	0
a	b	c	d	e	f	g	h		0	0	0	0
a	b	c	d	e	f	g	h		0	0	0	0

7 6 5 4 3 2 1 0 7 6 5 4 3 2 1 0

You may skip creating your own titles and use default titles as shown to the right. With the setup parameter value the DV-1000 will automatically use the V-memory address for the titles.

		V	2	3	0	0			3	5	8	6
--	--	---	---	---	---	---	--	--	---	---	---	---

Preset Title Types Available

Titles (labels) accompany the data, giving them meaning for your application. The title and data lists may be longer than the display can show at one time, but the lengths are programmable and are equal.

S	e	t	P	o	i	n	t	0	3	5	2
S	o	a	k	T	i	m	e	0	0	2	0
H	i	A	l	a	r	m	0	3	7	5	
L	o	A	l	a	r	m	0	3	2	5	

7 6 5 4 3 2 1 0 7 6 5 4 3 2 1 0

Three types of titles are available in Change Preset Mode, as shown below. User-titled Presets allow you to create your own text label of up to eight characters in length. The remaining Pre-titled Timer and Counter labels are “canned” (or fixed), However, they are convenient to use when you need generic timer or counter labels.

- 1. **User-Titled V-Memory Presets**
(create your own text titles)

M	y	T	i	t	l	e	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---

- 2. **Pre-Titled Timer Presets**
(use canned Timer 1 to Timer 99 list)

T	I	M	E	R	1	0	0	0	0
---	---	---	---	---	---	---	---	---	---

- 3. **Pre-Titled Counter Presets**
(use canned Counter 1 to Counter 99 list)

C	O	U	N	T	E	R	1	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

NOTE: The Pre-titled Timer and Counter Presets **only** label V-memory data on the DV-1000 display. They **do not** directly control Timer and Counter box parameters. Also, the *timer and counter preset numbering is in decimal, not in octal!*

The availability and number of title types varies with the CPU type connected to the DV-1000. Refer to table below for the availability of features for your particular CPU.

Feature	DL130, DL230, DL240	DL250, DL350, DL430, DL440, DL450
Available User-titled Presets	16	32
Available Pre-labeled Timer Preset Labels	99	99
Available Pre-labeled Counter Preset Labels	99	99

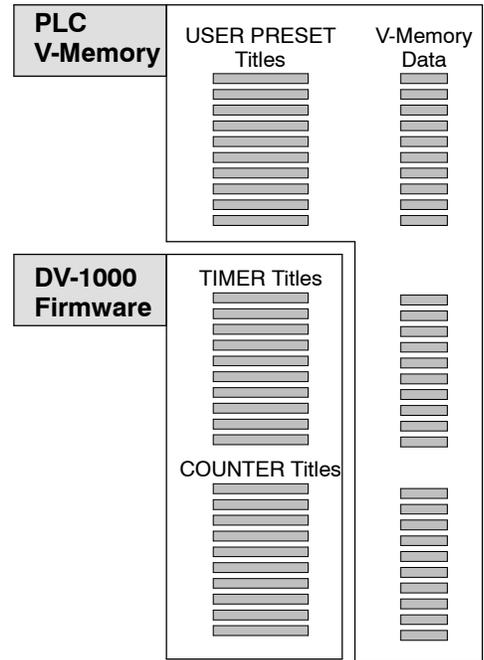
Setup Parameters for Change Preset Mode

Location of Preset Variable Lists

At this point we do a bit of orientation by discussing where the lists reside.

- PLC V-memory contains all the data value lists, along with User Preset titles (in ASCII code form). These lists require ladder programming, and we provide example programs in this chapter to help you do this.
- Timer titles and Counter titles are located in the DV-1000, and cannot be changed. Therefore, no programming is required for these.

The maximum number of User-titled Presets is 16 for DL130, DL230 and DL240 CPUs, and 32 for DL250, DL350 and all DL405 CPUs. A maximum of 99 Timer-titled presets and 99 Counter-titled presets are available on all systems.



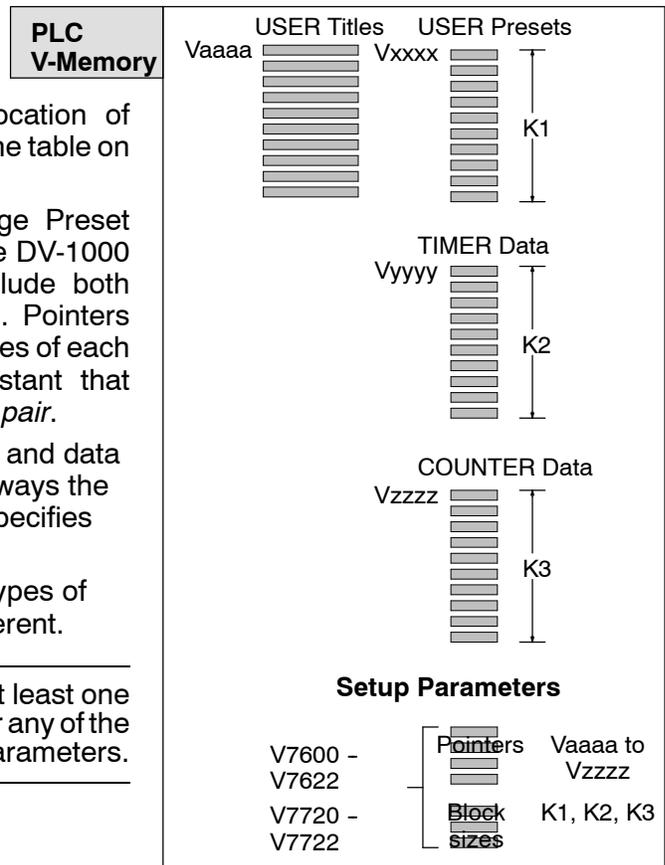
Pointer and Block Sizes

The lists which reside in V-memory require setup parameters as well as ladder programming. The location of setup parameters is listed in the table on the following page.

Setup parameters for Change Preset Mode lists are a subset of the DV-1000 setup parameters. They include both pointer and block size types. Pointers specify the beginning addresses of each list. Block sizes are a constant that specify the length of each list *pair*.

- The length of the titles list and data list for each title type is always the same, so the block size specifies both.
- The lengths of the three types of lists may be equal, or different.

NOTE: Each list **must** have at least one entry. You **cannot use zero** for any of the three block size (list length) parameters.

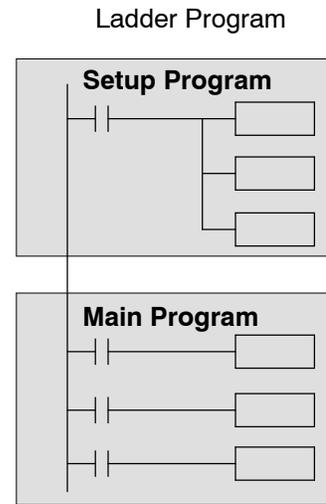


Change Preset Setup Program

The ladder program required to set up the DV-1000 for Change Preset Mode is very simple. In fact, the setup program needs only to execute on the first scan (use contact SP0). The things that it must do are:

- Specify the location of the titles and data.
- Specify the length of title and data lists.
- Create a password (or disable it)
- Load text data into the area for user titles, if User-titled Presets are used.

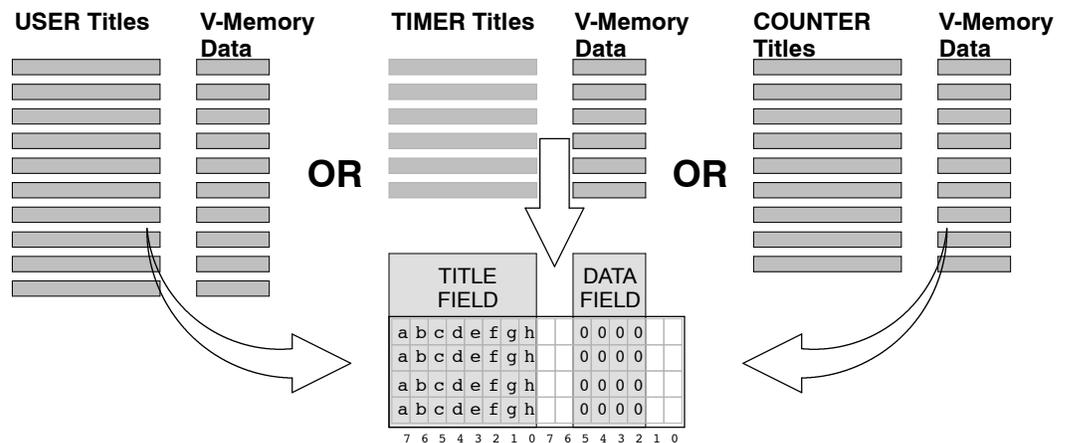
The first three of these items are part of the setup parameter location data. Later in this chapter we include several example ladder programs.



The following table lists the subset of the DV-1000 setup parameters which pertain only to Change Preset Mode.

V-Memory Location	Setup Parameter Description
V7620	User Preset Data Pointer
V7621	User Preset Titles Pointer
V7622	User Preset Block Size
V7627	Change Preset Password
V7720 (DL130 and DL230 CPUs use V7640)	Titled Timer Data Pointer
V7721 (DL130 and DL230 CPUs use V7641)	Titled Counter Data Pointer
V7722, high byte (DL130 and DL230 CPUs use Location V7642)	Titled Timer Preset Block Size
V7722, low byte (DL130 and DL230 CPUs use Location V7642)	Titled Counter Preset Block Size

The result of programming these setup parameters is shown below. The list lengths are independently programmable, as shown. The User titles text is also selectable.

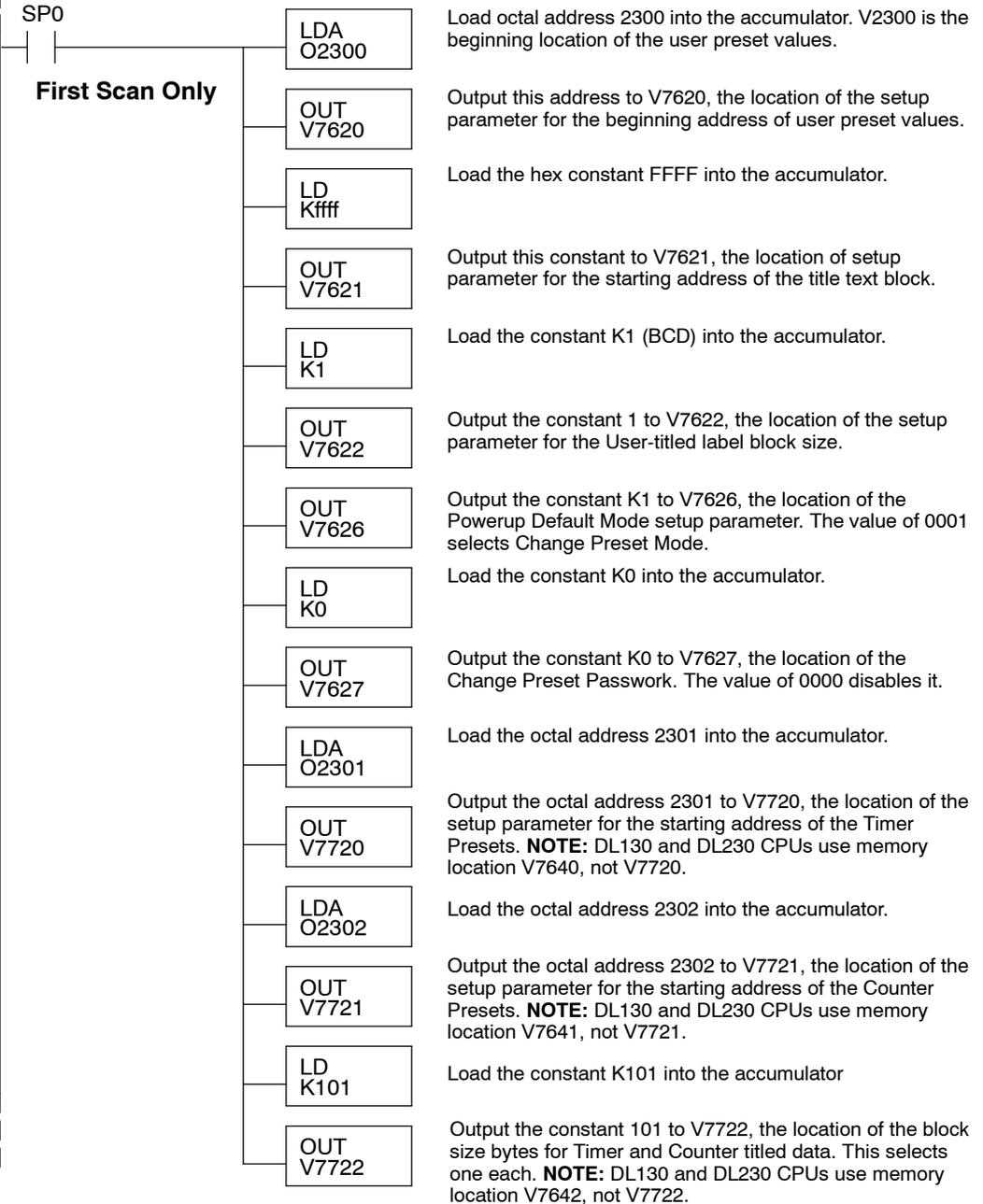


Now we use the information in the setup parameter table to write the program. Be sure to pay attention to the data type (octal or BCD) of each instruction that loads to the accumulator. This example only requires parameter setup (no main program required). Load this program into your CPU, and *follow the discussion on the next page to see how it performs the worksheet choices.*



a:\preset1.prj

Parameter Setup: Change Preset



Accessing Change Preset Variables

If you have loaded the example program in the Setup Parameters section, we're ready to see how it will perform for an operator. To enter Change Preset Mode, press **Change Preset** on the keypad. If the setup parameters for Change Preset Mode are missing or incomplete, you will see the display below on the left.

PRESS  

... **without** proper setup program

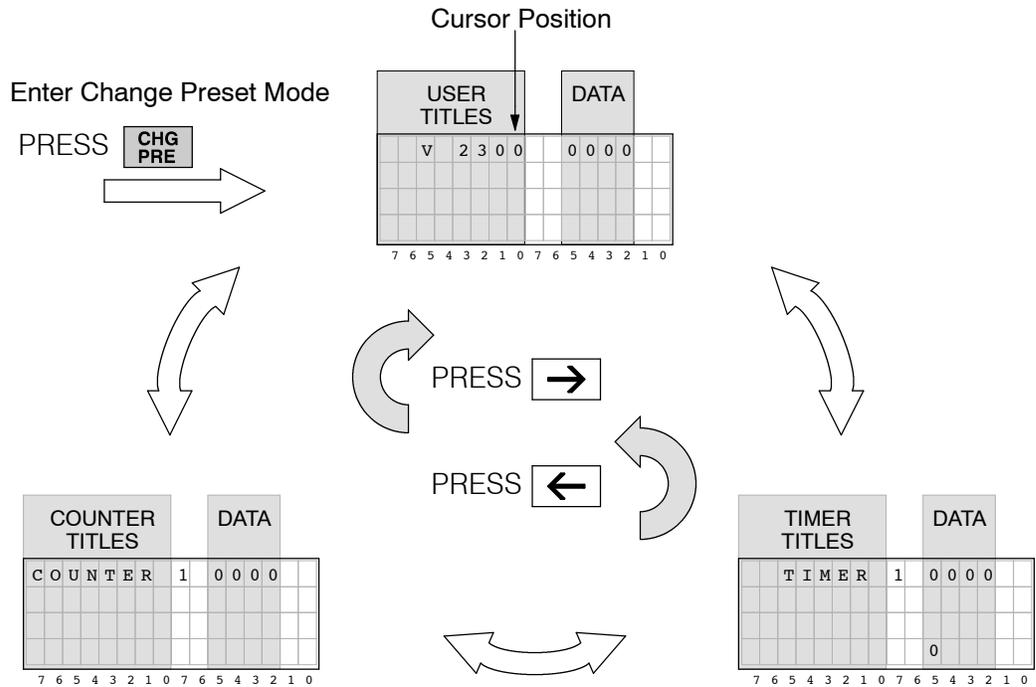
* S E T	U P	E R R O R	*																	
C H E C K	V A L U E	I N																		
V 7 6 2 0	T O	V 7 6 2 2																		
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0					

... **with** proper setup program

	V	2	3	0	0					0	0	0	0							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0					

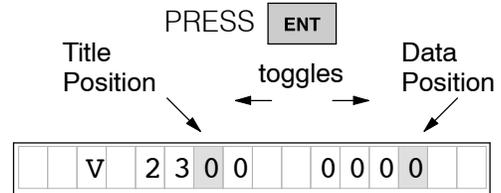
Selecting the List to Display

The three change preset lists we programmed in the first example setup program are accessible as a circular list. Refer to the figure below. Upon entry to Change Preset Mode, the first display is automatically the User-titled list. From there, use the **Right Arrow** and **Left Arrow** keys to move to the timer titles and counter titles displays.



Cursor Positioning On Title or Data

Press the **Enter** Key to toggle the cursor from the title to the data field and back. In the title field, the cursor always occupies the right-most character position. When the cursor is in the data field you are ready to edit the data.

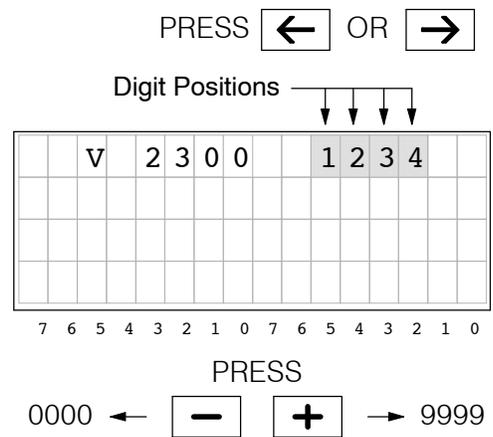


NOTE: Data is restricted to the range of 0000 to 9999 in Change Preset Mode. If the data you are viewing already has one or more digits in the hexadecimal range (A through F), you may only view it. The DV-1000 classifies the entire number as hexadecimal, and will not allow keypad entries to edit its value.

Changing the Preset Value

Once the cursor is in the data position, use the **Right** and **Left Arrow** keys to move the cursor among the four digit positions. This works in circular fashion, so moving past the end of the data jumps the cursor to the opposite end of the data value.

To increment a digit, press the **Plus (+)** Key. To decrement a digit, press the **Minus (-)** Key. The range of input change is from 0000 to 9999, BCD. Incrementing a digit past 9 or decrementing it past 0 automatically carries to or borrows from (respectively) the digit(s) to the left of the cursor position.



WARNING: Changing the preset value on the display as above immediately changes the value in PLC V-memory (the display is not buffered). Equipment damage or personnel injury may occur from improper use of this mode. Be sure to pause a moment after each keystroke to allow for the DV-1000 display update, so that you are viewing current values of Change Preset variables.

The data fields in the timer and counter displays are edited in exactly the same way as the User-titled Presets.



Pre-labeled Timer and Counter Presets

Pre-labeled Timer and Counter Presets are simpler than User-titled Presets, so we discuss these first. Remember that our setup must include at least one of each title type. So, we choose one User-titled Preset, (using the default label), sixteen Pre-titled Timer Presets, and seven Pre-titled Counter Presets. The following table summarizes our selections.

User Presets			Timer Presets		Counter Presets	
Text Titles	Text Locations	Data Locations	Titles	Data Locations	Counter Titles	Data Locations
(default)		V2200	Timer 1	V2300	Counter 1	V2320
			Timer 2	V2301	Counter 2	V2321
			Timer 3	V2302	Counter 3	V2322
			Timer 4	V2303	Counter 4	V2323
			Timer 5	V2304	Counter 5	V2324
			Timer 6	V2305	Counter 6	V2325
			Timer 7	V2306	Counter 7	V2326
			Timer 8	V2307		
				
			Timer 16	V2317		

We select no password, and use Change Preset as the Powerup Default Mode.

Password Enable/Disable	Password Value	Powerup Mode	Powerup Value
Disable	0000	Change Preset	0001

Using the worksheet above we can determine the setup parameters. The numbers are in bold text in the following table.

V-Memory Location	Setup Parameter Description	Format	Value	Notes:
V7620	User Preset Data Pointer	Octal	2200	start at V2200
V7621	User Preset Titles Pointer	Octal	FFFF	default titles
V7622	User Preset Block Size	BCD	1	1 title
V7626	Powerup Mode	BCD	0001	Change Preset
V7627	Change Preset Password	BCD	0000	Disabled
V7720*	Timer Data Pointer	Octal	2300	start at V2300
V7721*	Counter Data Pointer	Octal	2320	start at V2320
V7722*	Timer Preset Block Size (high byte)	BCD	1607	16 timers, 7 counters
	Counter Preset Block Size (low byte)			

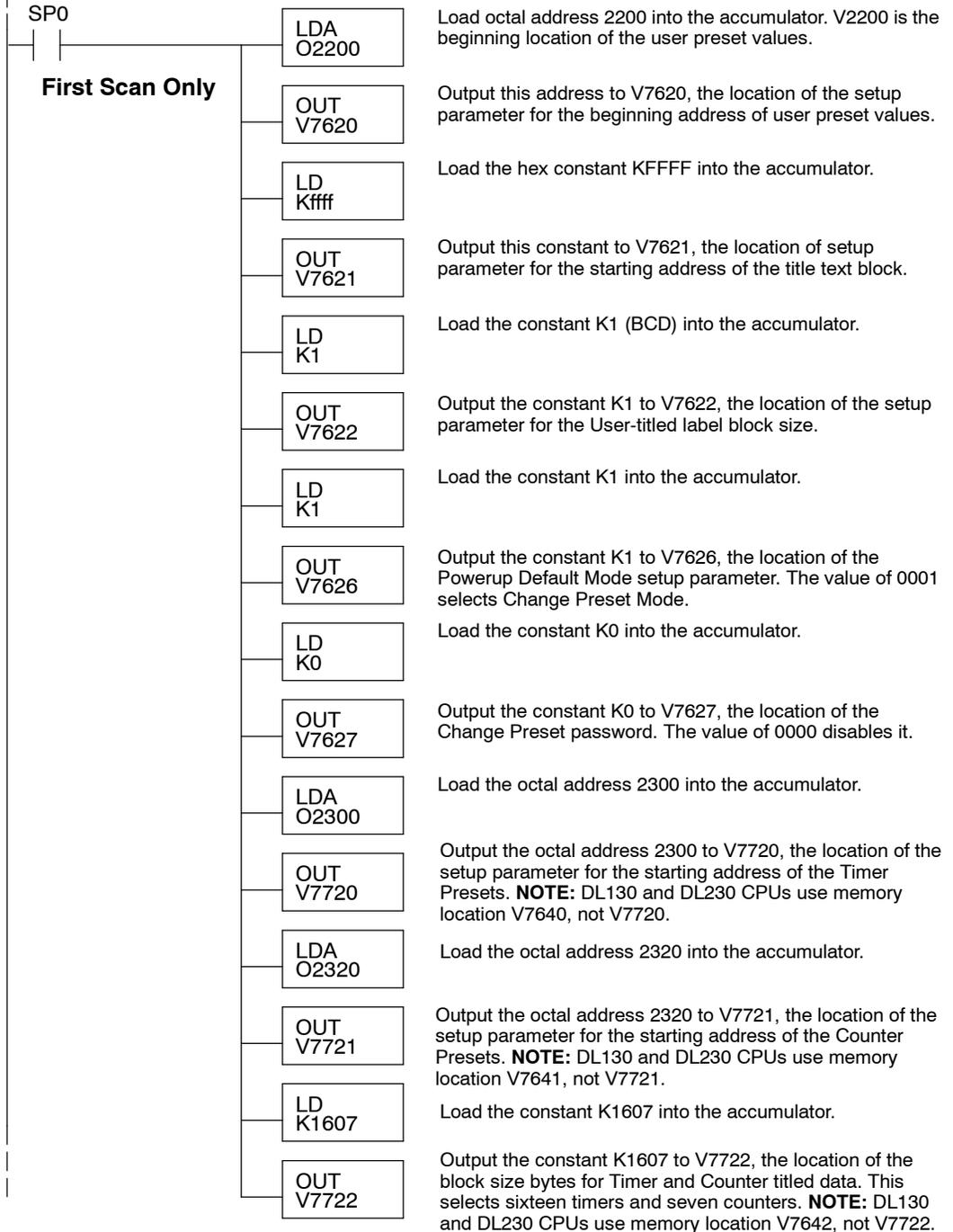
* DL130 and DL230 CPUs use different memory locations here: V7640 instead of V7620, V7641 instead of V7621, and V7642 instead of V7622.

In this step we use the information in the setup parameter table to write the program. Be sure to pay attention to the data type (octal or BCD) of each instruction that loads to the accumulator. Load this program into your CPU, and use Preset Mode to see how it performs the worksheet choices.

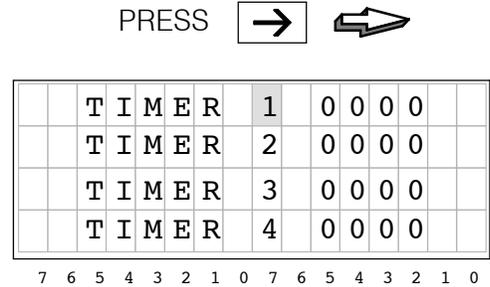
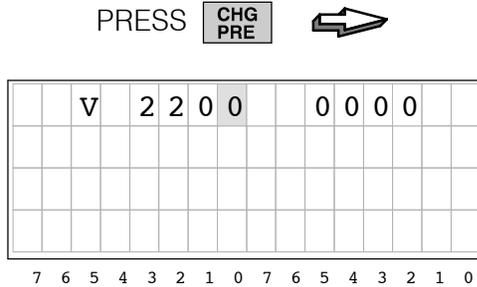


a:\preset2.prj

Parameter Setup: Change Preset



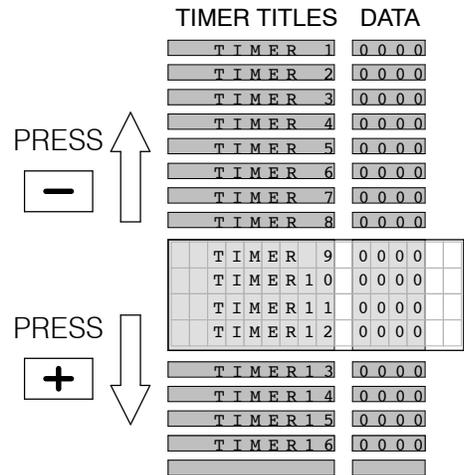
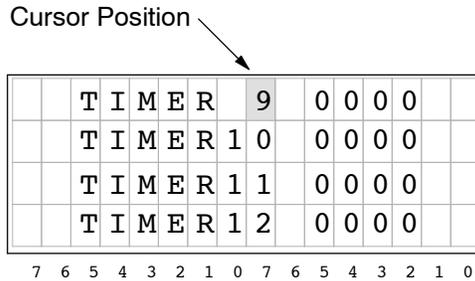
If you have loaded the Timer/Counter example program on the previous page, we're ready to see how it will perform for an operator. First, enter Change Preset Mode by pressing **Change Preset** on the keypad. Then press the **Right Arrow** Key to move to the timer titles list.



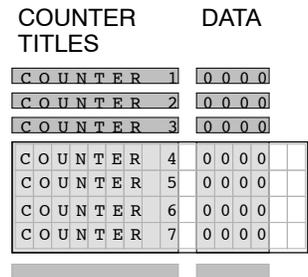
NOTE: In order for the new setup parameters to take effect, you must either press a key (preferably **Change Preset**), or power-cycle the PLC. Either event causes the DV-1000 to re-read its setup parameters from V-memory.

Scrolling Through Change Preset Lists

With Timer Preset Titles selected, leave the cursor over the titles field. Then use the **Plus (+)** Key to scroll downward. By repeating this you can access all sixteen timers. Then use the **Minus (-)** Key to scroll upward through the list.



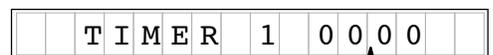
Access to Counter presets works just like timer preset labels. Press the **Cursor Right** Key to move to the counter titles display. You can then scroll through all seven counter titles by using the **Plus (+)** Key to scroll downward, and the **Minus (-)** Key to scroll upward.



NOTE: Appendix C of this manual contains a worksheet for Change Preset applications. It also includes a decimal-to-octal conversion table to help correlate timer label numbers with the numbering of actual timers and counters in the CPU.

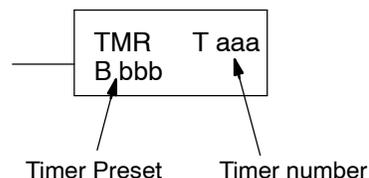
Using Presets With Timer Box Instructions

As mentioned at the beginning of this chapter, Timer and Counter Preset Labels serve only to label data on the DV-1000 display. These labels treat all user V-memory equally, and do not *directly* adjust ladder logic timer or counter instruction box presets. Instead, you use a common V-memory reference.



Timer Preset at V2300

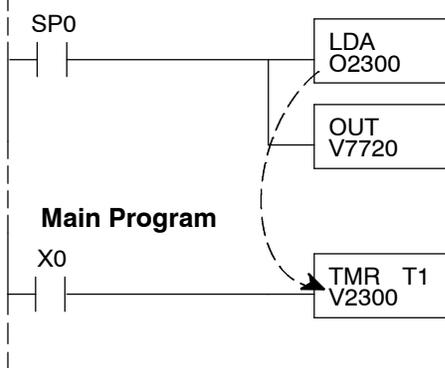
Timer Box



NOTE: The timer preset in the timer box must not be a constant Kx, if you want the Change Preset mode to adjust the timer preset!

Suppose we locate Pre-labeled “Timer 1” preset to be at V2300, as in the previous example. Now, we can associate it with an actual timer in a ladder program.

Setup Program



Load octal address 2300 into the accumulator.

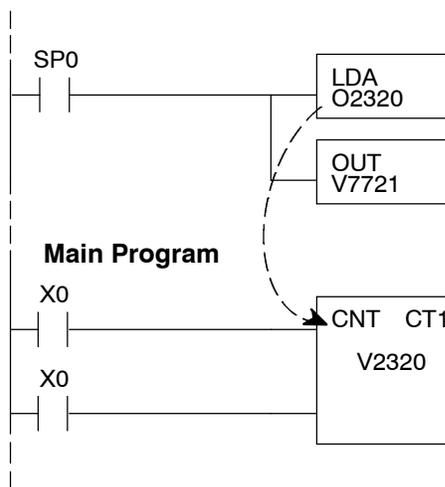
Output this address to V7720, the location of the setup parameter for the beginning address of Timer-titled Presets.

Turn on Timer 1 when X0 is on. Enter V2300 in the preset field for the timer.

Using Presets With Counter Box Instructions

Suppose we locate Pre-labeled “Counter 1” preset at V2320, as in the previous example. Now, we can associate it with an actual counter in a ladder program.

Setup Program



Load octal address 2320 into the accumulator.

Output this address to V7721, the location of the setup parameter for the beginning address of Counter-titled Presets.

Increment Counter 1 when X0 makes an off-to-on transition. When the counter value reaches the preset value in V2320, the counter status bit comes on. Input X1 resets the counter and turns off the counter status bit.

After choosing the titles and data to preset, we can fill out the following application worksheet. The four User Presets Data Locations are listed, and the text titles are left blank. Note that we have one timer and counter listed, because all three preset types must have at least one entry. Finally, we select the password (disabled) and the powerup mode. We arbitrarily choose Change Preset as the Powerup Default Mode.

User Presets			Timer Presets		Counter Presets	
Text Titles	Text Locations	Data Locations	Titles	Data Locations	Counter Titles	Data Locations
abcdefg	V2200	V2300	Timer 1	V2304	Counter 1	V2305

Password Enable/Disable	Password Value	Powerup Mode	Powerup Value
Disable	0000	Change Preset	0001

Using the worksheet above we can determine the setup parameters. The numbers are in bold text in the following table.

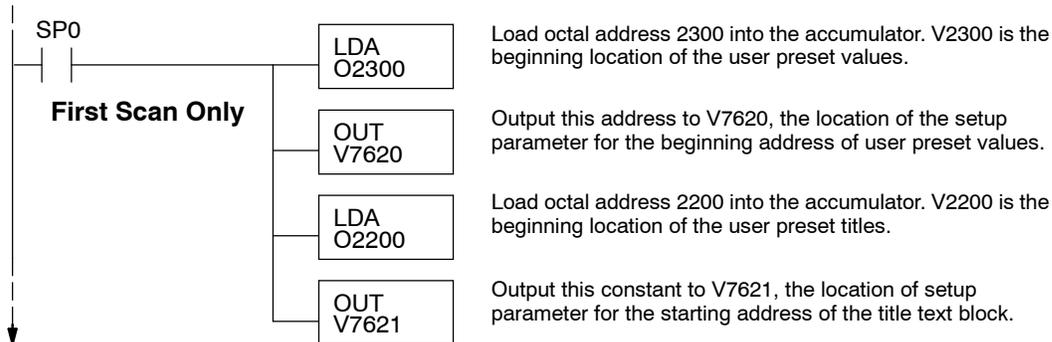
V-Memory Location	Setup Parameter Description	Format	Value	Notes:
V7620	User Preset Data Pointer	Octal	2300	start at V2300
V7621	User Preset Titles Pointer	Octal	2200	start at V2200
V7622	User Preset Block Size	BCD	0001	1 title
V7626	Powerup Mode	BCD	0001	Change Preset
V7627	Change Preset Password	BCD	0000	Disable password
V7720*	Timer Data Pointer	Octal	2301	start at V2304
V7721*	Counter Data Pointer	Octal	2302	start at V2305
V7722*	Timer Preset Block Size (high byte)	BCD	0101	one timer, one counter
	Counter Preset Block Size (low byte)			

* DL130 and DL230 CPUs use different memory locations here: V7640 instead of V7620, V7641 instead of V7621, and V7642 instead of V7622.



a:\preset3.prj

Parameter Setup: Change Preset

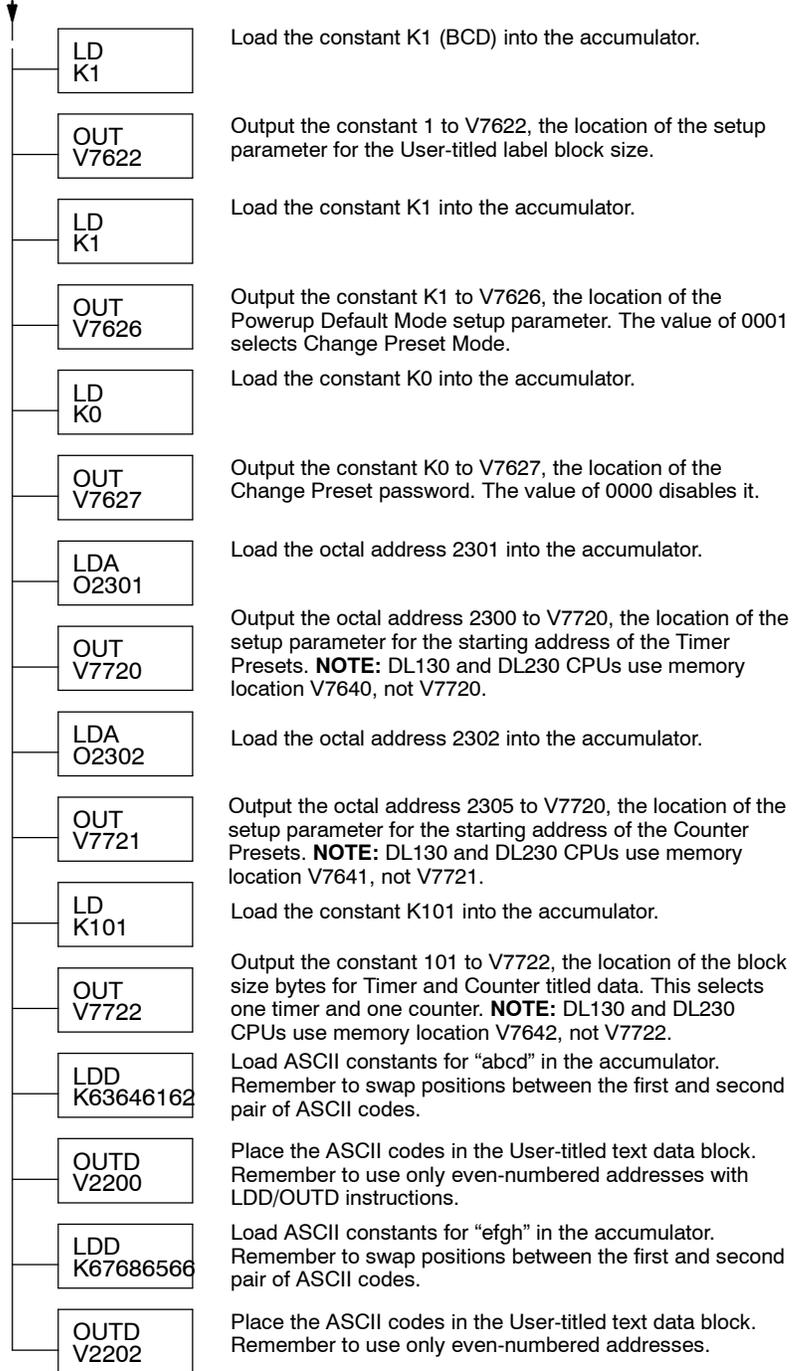


(continued)



a:\preset3.prj

Load
"abcdefgh"



The following diagram shows the resulting displays from the program example above.

a	b	c	d	e	f	g	h	0	0	0	0				
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0

T	I	M	E	R	1	0	0	0	0						
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0

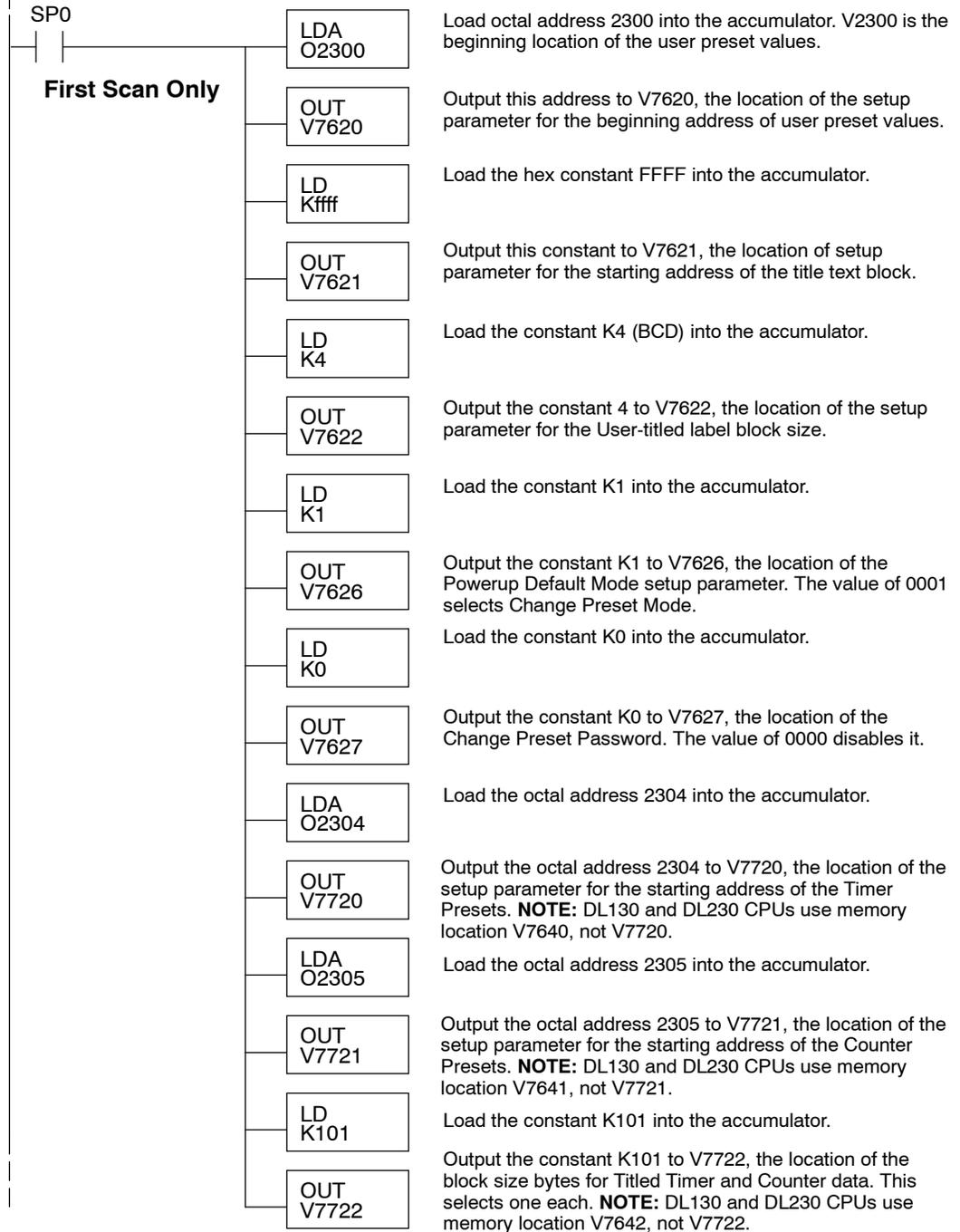
C	O	U	N	T	E	R	1	0	0	0	0				
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0

The following program example uses the previous setup table information.



a:\preset4.prj

Parameter Setup: Change Preset



The following diagram shows the resulting displays from the program above.

	V	2	3	0	0					0	0	0	0		
	V	2	3	0	1					0	0	0	0		
	V	2	3	0	2					0	0	0	0		
	V	2	3	0	3					0	0	0	0		
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0

	T	I	M	E	R	1	0	0	0	0					
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0

	C	O	U	N	T	E	R	1	0	0	0	0			
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0

User-titled Text Example

Now we will write our own User Titles, choosing meaningful names for a typical application. The list (shown to the right) is eight items long, more than the display can show at one time. However, the DV-1000 automatically adds scrolling capability. We will disable the password, and choose Change Preset as the Powerup Default Mode.

USER TITLES		DATA
SetPoint		0000
Actual		0000
Hi Alarm		0000
Lo Alarm		0000
SoakTime		0000
Temp 1		0000
Temp 2		0000
Gal/Min		0000

The following table lists our choices. The ASCII codes for the text of the User-titled Presets begins at V2200. Each title's text occupies four V-memory locations. One timer and counter are listed, just to meet the required minimum.

User Presets			Timer Presets		Counter Presets	
Text Titles	Text Locations	Data Locations	Titles	Data Locations	Counter Titles	Data Locations
SetPoint	V2200	V2300	Timer 1	V2310	Counter 1	V2311
Value	V2204	V2301				
Hi Alarm	V2210	V2302				
Lo alarm	V2214	V2303				
SoakTime	V2220	V2304				
Temp 1	V2224	V2305				
Temp 2	V2230	V2306				
Gal/Min	V2234	V2307				

Password Enable/Disable	Password Value	Powerup Mode	Powerup Value
Disable	0000	Change Preset	0001

Using the worksheet above we can determine the setup parameters. The numbers are in bold text in the following table.

V-Memory Location	Setup Parameter Description	Format	Value	Notes:
V7620	User Preset Data Pointer	Octal	2300	start at V2300
V7621	User Preset Titles Pointer	Octal	2200	start at V2200
V7622	User Preset Block Size	BCD	8	8 titles
V7626	Powerup Mode	BCD	0001	Change Preset
V7627	Change Preset Password	BCD	0000	Disabled
V7720*	Timer Data Pointer	Octal	2310	start at V2310
V7721*	Counter Data Pointer	Octal	2311	start at V2311
V7722*	Timer Preset Block Size (high byte)	BCD	0101	one timer, one counter
	Counter Preset Block Size (low byte)			

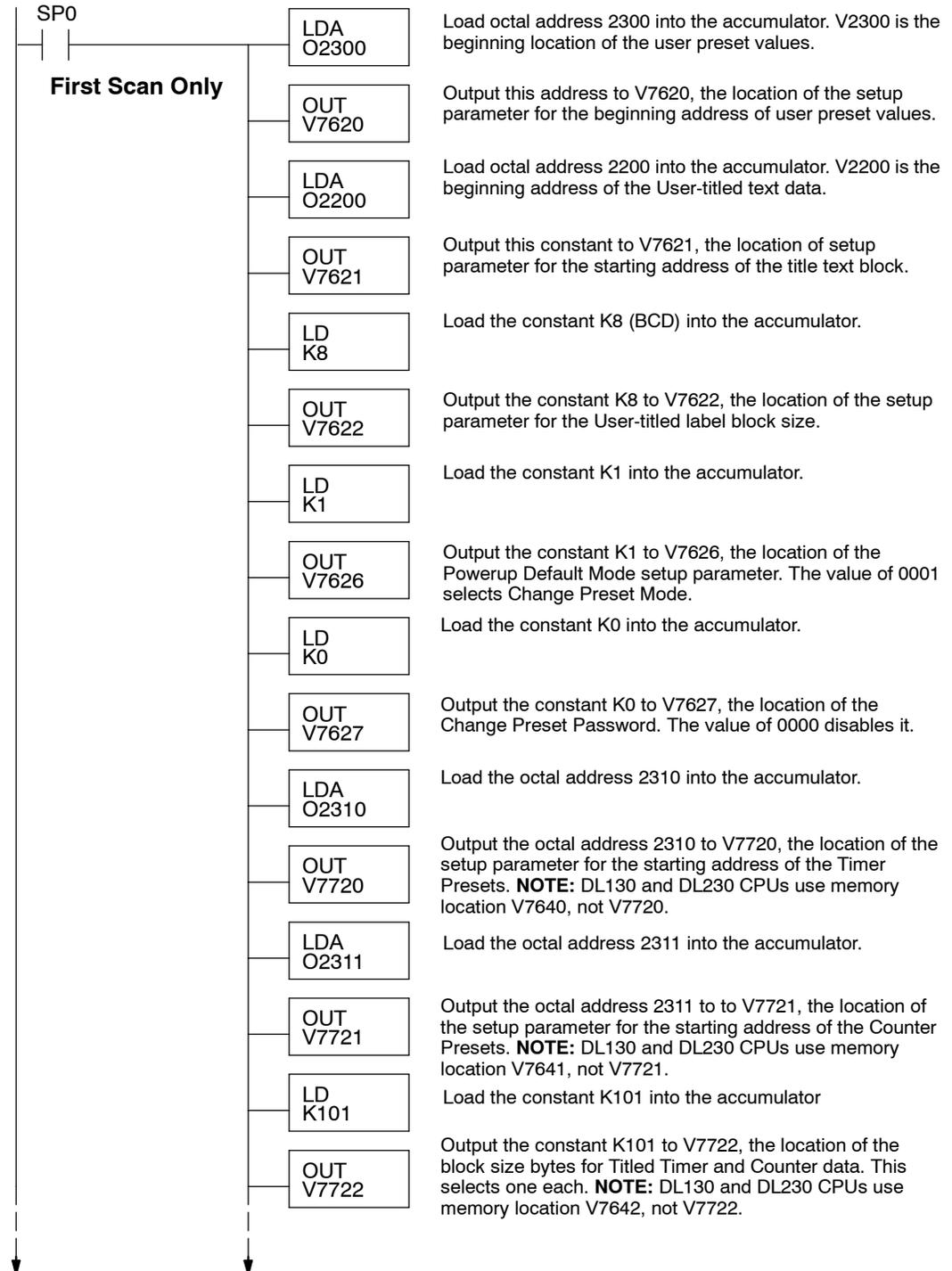
* DL130 and DL230 CPUs use different memory locations here: V7640 instead of V7620, V7641 instead of V7621, and V7642 instead of V7622.

In this step we use the information in the setup parameter table to write the program. The first portion programs the setup parameters. The second portion writes the User-Titled text data using MOVEMC and ACON boxes. See the Message Display Mode chapter for information on how these instructions work, if necessary.



a:\preset5.prj

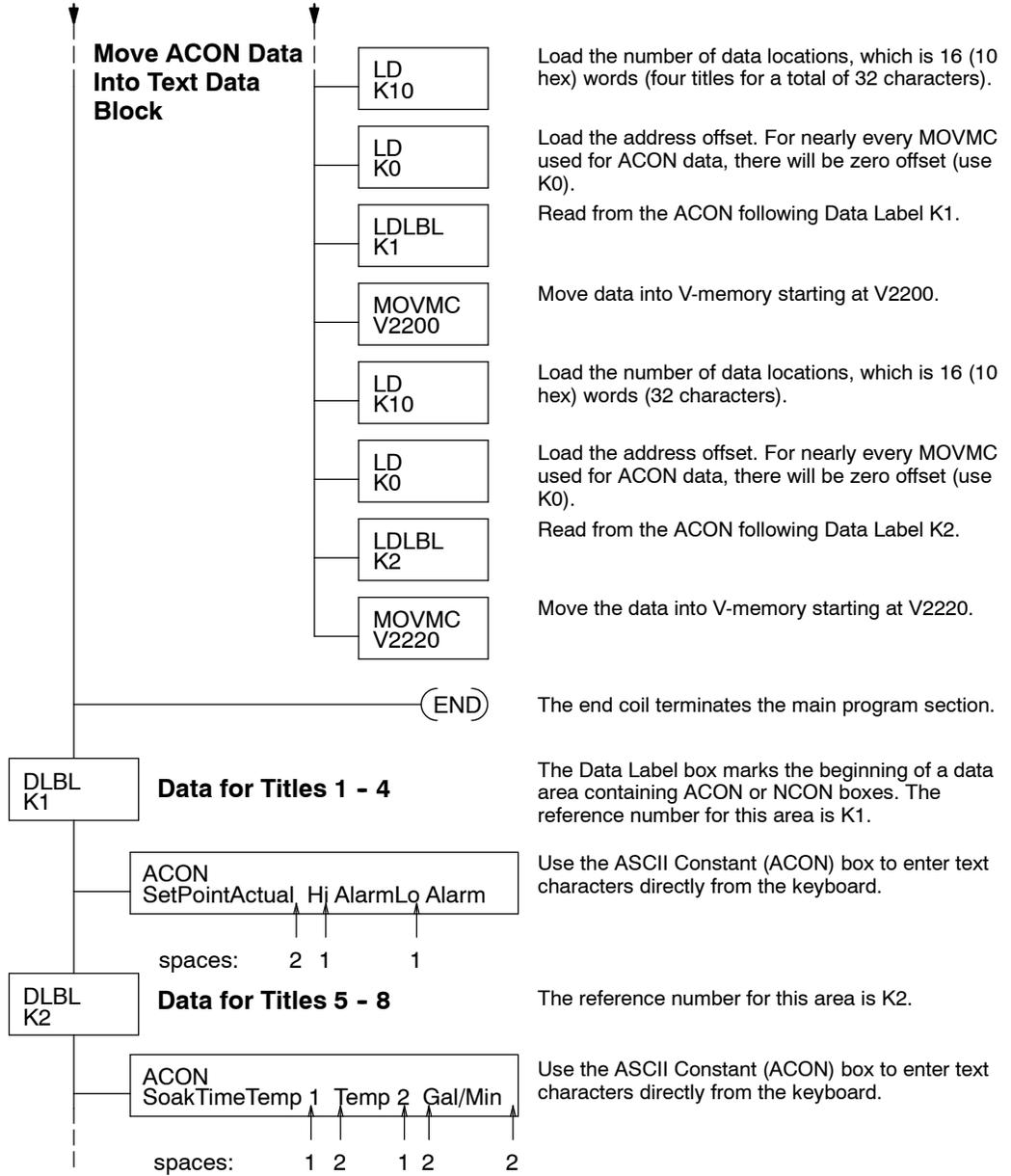
Parameter Setup: Change Preset



(continued)



a:\preset5.prj



The following diagram shows the resulting displays from the program above.

Setpoint	0000
Actual	0000
Hi Alarm	0000
Lo Alarm	0000
SoakTime	0000
Temp 1	0000
Temp 2	0000
Gal/Min	0000

TIMER 1 0000															
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0

COUNTER 1 0000															
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0

Individual Default User Titles

The User-titled presets also provides an option that lets you have custom titles and the default (Vxxx) titles. The setup for this is just as if all the titles are custom. However, if all the ASCII codes (4 word locations) for any title(s) is all zeros, then the DV-1000 substitutes the default title instead.

Desired Display

S	e	t	P	o	i	n	t			0	0	0	0		
A	c	t	u	a	l					0	0	0	0		
		V		2	3	0	2			0	0	0	0		
		V		2	3	0	3			0	0	0	0		

7 6 5 4 3 2 1 0 7 6 5 4 3 2 1 0

To select an individual default title, just enter “0000 0000” for its text data.

The title selections are summarized in the following table. Note the inclusion of one timer and counter, because all three preset types must have at least one entry. Finally, we select the password (disabled) and the powerup mode. We arbitrarily choose Change Preset as the Powerup Default Mode.

User Presets			Timer Presets		Counter Presets	
Text Titles	Text Locations	Data Locations	Titles	Data Locations	Counter Titles	Data Locations
Setpoint	V2200	V2300	Timer 1	V2304	Counter 1	V2305
Actual	V2204	V2301				
(V2302)	V2210	V2302				
(V2303)	V2214	V2303				

Password Enable/Disable	Password Value	Powerup Mode	Powerup Value
Disable	0000	Change Preset	0001

Using the worksheet above we can determine the setup parameters. The numbers are in bold text in the following table.

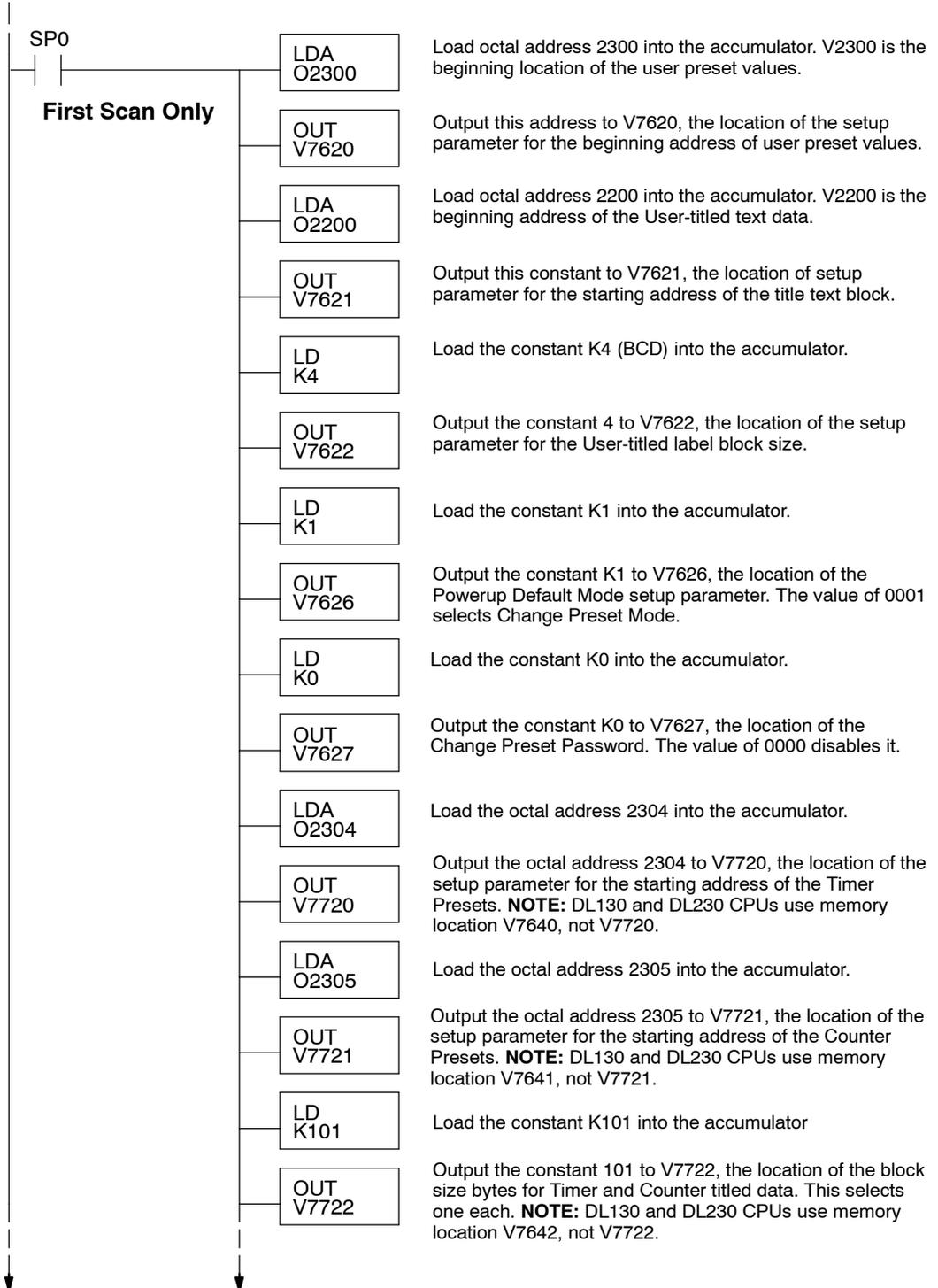
V-Memory Location	Setup Parameter Description	Format	Value	Notes:
V7620	User Preset Data Pointer	Octal	2300	start at V2300
V7621	User Preset Titles Pointer	Octal	2200	use default title
V7622	User Preset Block Size	BCD	4	4 titles
V7626	Powerup Mode	BCD	0001	Change Preset
V7627	Change Preset Password	BCD	0000	Disabled
V7720*	Timer Data Pointer	Octal	2304	start at V2304
V7721*	Counter Data Pointer	Octal	2305	start at V2305
V7722*	Timer Preset Block Size (high byte)	BCD	0101	one timer, one counter
	Counter Preset Block Size (low byte)			

* DL130 and DL230 CPUs use different memory locations here: V7640 instead of V7720, V7641 instead of V7721, and V7642 instead of V7722.

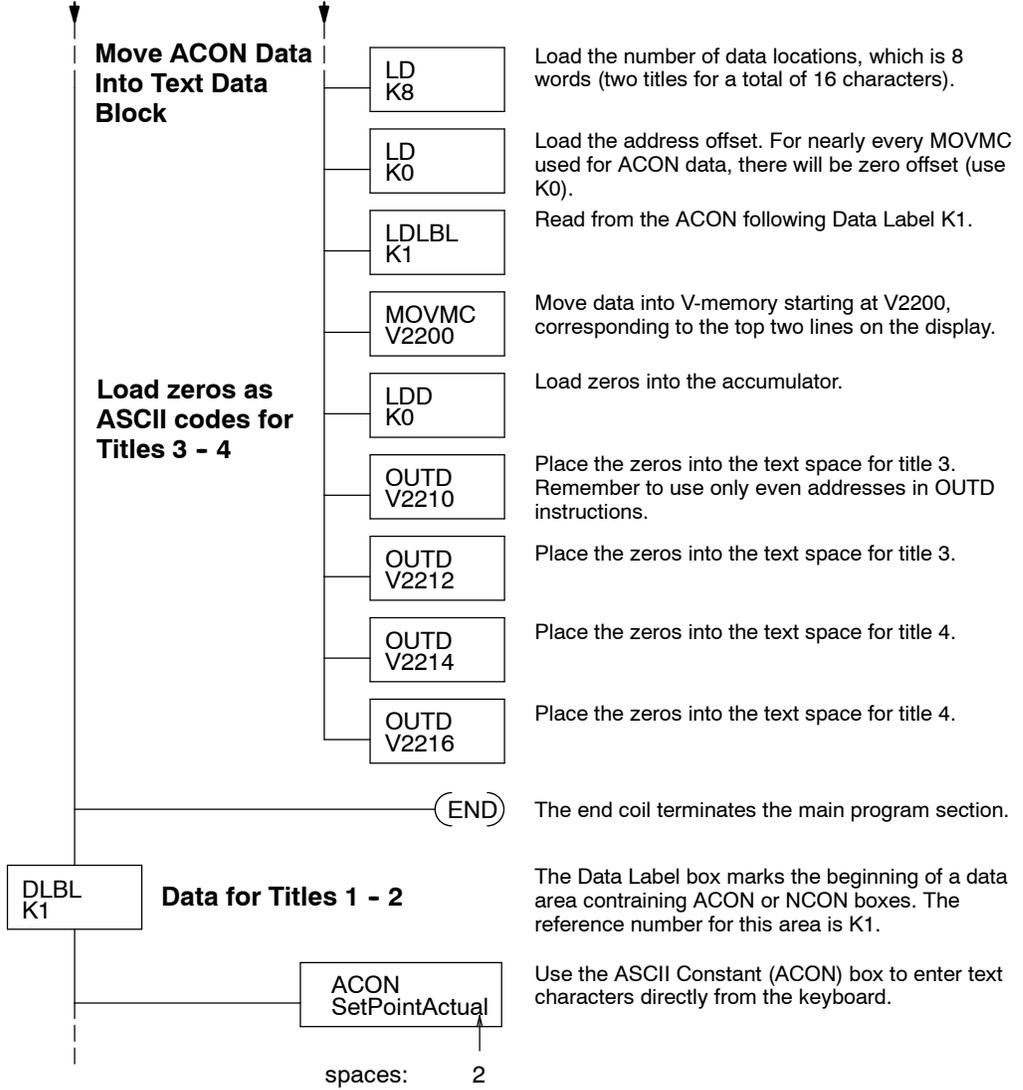
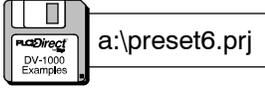


a:\preset6.prj

Parameter Setup: Change Preset



(continued)



The following diagram shows the resulting displays from the program above.

S	e	t	P	o	i	n	t		0	0	0	0		
A	c	t	u	a	l				0	0	0	0		
	V	2	3	0	2				0	0	0	0		
	V	2	3	0	3				0	0	0	0		

7 6 5 4 3 2 1 0 7 6 5 4 3 2 1 0

					T	I	M	E	R		1		0	0	0	0	

7 6 5 4 3 2 1 0 7 6 5 4 3 2 1 0

					C	O	U	N	T	E	R		1		0	0	0	0	

7 6 5 4 3 2 1 0 7 6 5 4 3 2 1 0

Combination Titles Example

As a comprehensive example, we'll use several presets of each type of title, and use a password.

- Six User-titled Presets plus two Default User-titled Presets
- Five Pre-titled Timer Presets
- Eight Pre-titled Counter Presets
- Password = 1234, Powerup Default Mode is Change Preset

NOTE: After loading the program for this example, a password entry is required in order to change presets. The next section covers the Change Preset Password.

The following table summarizes our choices above.

User Presets			Timer Presets		Counter Presets	
Text Titles	Text Locations	Data Locations	Titles	Data Locations	Counter Titles	Data Locations
SetPoint	V2200	V2300	Timer 1	V2310	Counter 1	V2330
Value	V2204	V2301	Timer 2	V2311	Counter 2	V2331
Hi Alarm	V2210	V2302	Timer 3	V2312	Counter 3	V2332
Lo Alarm	V2214	V2303	Timer 4	V2313	Counter 4	V2333
(V2304)	V2220	V2304	Timer 5	V2314	Counter 5	V2334
(V2305)	V2224	V2305			Counter 6	V2335
MixSpeed	V2230	V2306			Counter 7	V2336
SoakTime	V2234	V2307			Counter 8	V2337

Password Enable/Disable	Password Value	Powerup Mode	Powerup Value
Enable	1234	Change Preset	0001

Using the worksheet above we can determine the setup parameters (bold text).

V-Memory Location	Setup Parameter Description	Format	Value	Notes:
V7620	User Preset Data Pointer	Octal	2300	start at V2300
V7621	User Preset Titles Pointer	Octal	2200	start at V2200
V7622	User Preset Block Size	BCD	8	8 titles
V7626	Powerup Mode	BCD	0002	Message Mode
V7627	Change Preset Password	BCD	1234	code = 1234
V7720*	Titled Timer Data Pointer	Octal	2300	start at V2300
V7721*	Titled Counter Data Pointer	Octal	2320	start at V2320
V7722*	Timer Preset Block Size (high byte)	BCD	0508	5 timers, 8 counters
	Counter Preset Block Size (low byte)			

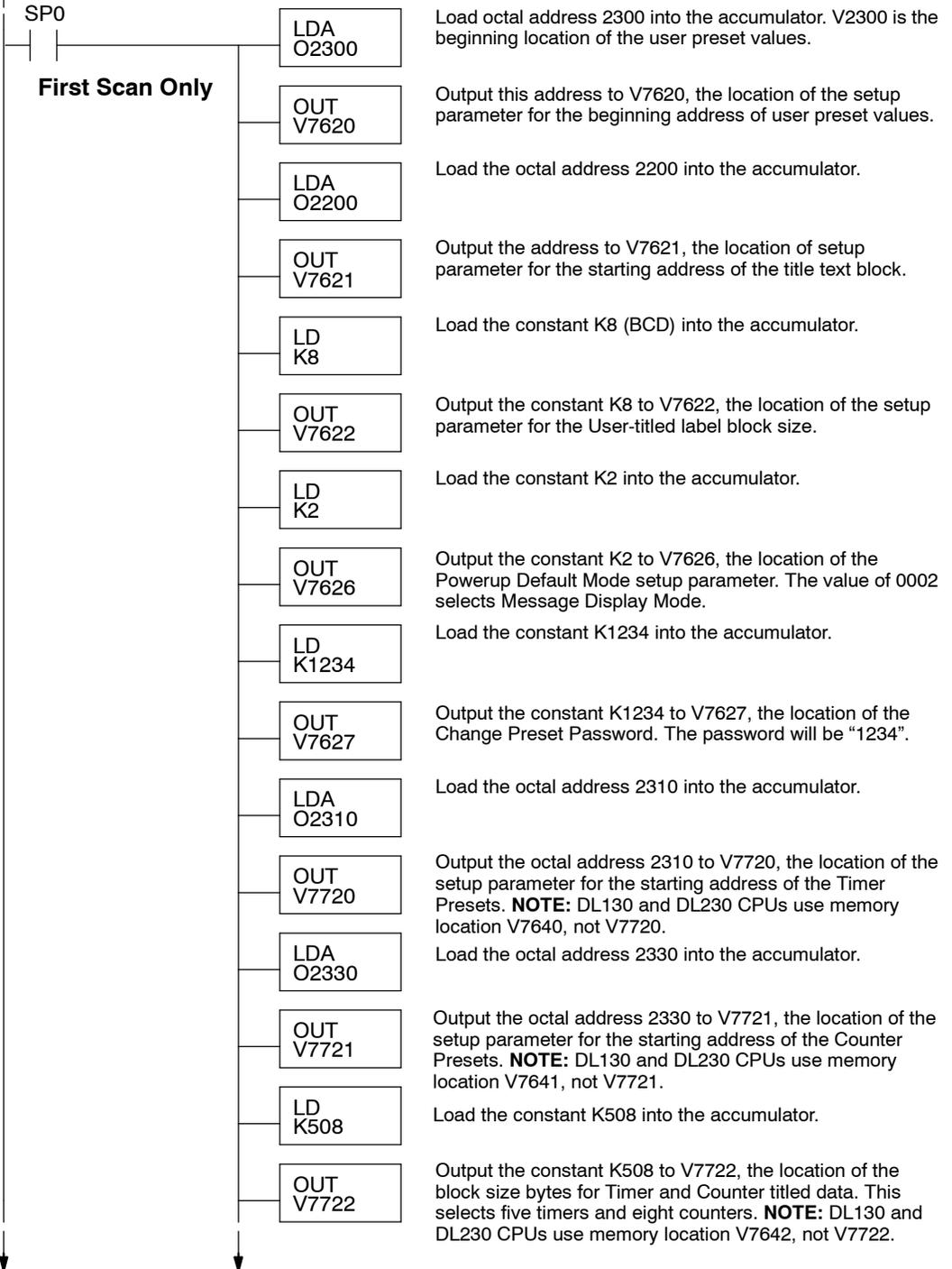
* DL130 and DL230 CPUs use different memory locations here: V7640 instead of V7720, V7641 instead of V7721, and V7642 instead of V7722.

In this step we use the information in the setup parameter table and worksheet to write the program. The setup parameter portion is first, followed by the MOVMC for the ACON boxes. One portion of the program loads zeros in for the ASCII codes of the text titles, so the default Vxxxx labels appear for those titles.

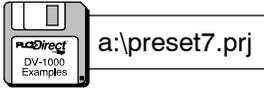


a:\preset7.prj

Parameter Setup: Change Preset



(continued)



Move ACON Data Into Text Data Block

LD K10

Load the number of data locations, which is 16 (10 hex) words (four titles for a total of 32 characters).

LD K0

Load the address offset. For nearly every MOVMC used for ACON data, there will be zero offset (use K0).

LDLBL K1

Read from the ACON following Data Label K1.

MOVMC V2200

Move data into V-memory starting at V2200, corresponding to the first four titles.

LD K8

Load the number of data locations, which is 8 words (16 characters).

LD K0

Load the address offset. For nearly every MOVMC used for ACON data, there will be zero offset (use K0).

LDLBL K2

Read from the ACON following Data Label K2.

MOVMC V2230

Move the data into V-memory starting at V2230, corresponding to titles 7 and 8.

LDD K0

Load a double word constant zero into the accumulator.

Use Default Titles for Titles 5 and 6

OUTD V2220

Place zeros in the text title location for the fifth text title.

OUTD V2222

Place zeros in the text title location for the fifth text title.

OUTD V2224

Place zeros in the text title location for the sixth text title.

OUTD V2226

Place zeros in the text title location for the sixth text title.

(END)

The end coil terminates the main program section.

DLBL K1

Text for Titles 1 - 4

The Data Label box marks the beginning of a data area containing ACON or NCON boxes. The reference number for this area is specified by K1.

ACON SetPointActual Hj AlarmLo Alarm

Use the ASCII Constant (ACON) box to enter text characters directly from the keyboard.

spaces: 2 1 1

DLBL K2

Text for Titles 7 and 8

ACON MixSpeedSoakTime

Use the ASCII Constant (ACON) box to enter text characters directly from the keyboard.

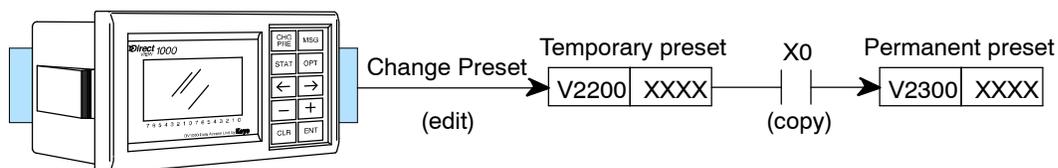
spaces:

Buffered Preset Values

V-memory values change immediately when you edit them in Change Preset Mode. This is safely done if you make relatively small incremental changes and monitor their effects on the process. However, some applications may require you to make a single step change to one or more presets. Situations that may require this include:

- Changing a single preset to a new value, avoiding values in between
- Changing several presets to new values at the same moment (scan)
- Coordinating a preset change with other external events

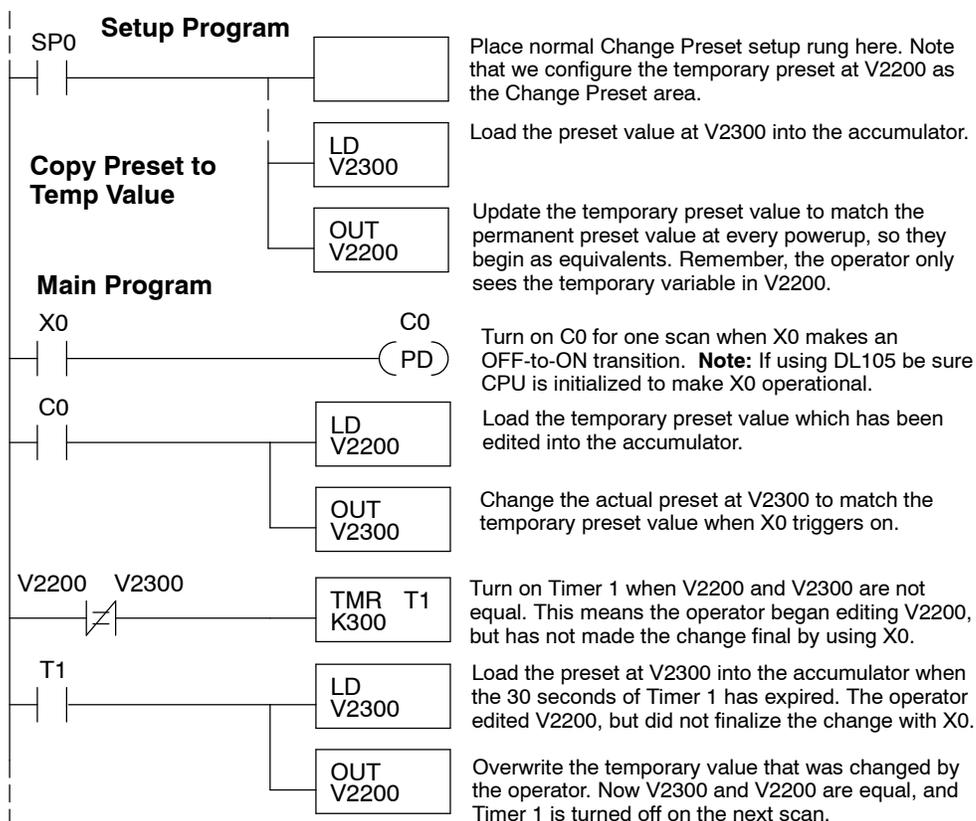
We can solve these problems by using Change Preset to update a temporary variable. See the figure below. When the ladder program detects an event contact, it copies the temporary variable to the permanent variable location.



In the following program, the permanent preset value is at V2300 and the temporary preset value is at V2200. We would like to update V2300 only when input X0 has an off-to-on transition. The program also has a time-out feature. For example, enter a new value in location V2200. V2200 and V2300 no longer match so the timer starts. Turn on X0 within 30 seconds to update V2300 to match the new V2200 value. If X0 is not turned on within 30 seconds of entering the new value the program automatically changes V2200 back to match the original V2300 value. Note that changing Timer 1's preset value changes the amount of time allowed to turn on X0.



a:\preset9.prj



Operator's Guide to Change Preset Mode

This 2-page guide contains condensed instructions for machine operators on how to use Change Preset Mode. It assumes the DV-1000 installation and programming are complete.

To enter Change Preset Mode, just press the **Change Preset** Key on the keypad. The User-titled Presets will appear.

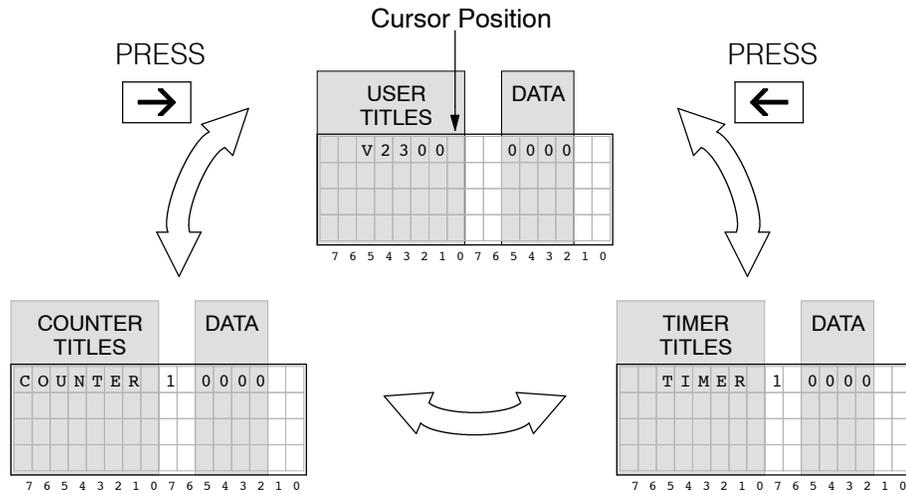
PRESS  

S	e	t	P	o	i	n	t					0	4	2	5				
A	c	t	u	a	l							0	4	3	2				
H	i		A	l	a	r	m					0	4	5	0				
L	o		A	l	a	r	m					0	3	9	5				

7 6 5 4 3 2 1 0 7 6 5 4 3 2 1 0 05

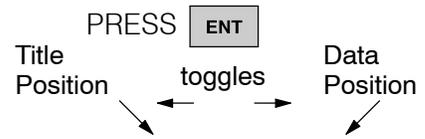
Selecting the List to Display

Three change preset lists are accessible in a circular list. Refer to the figure below. Upon entry to Change Preset Mode, the first display is automatically the User-titled list. From there, use the **Right Arrow** and **Left Arrow** Keys to move to the timer titles and counter titles displays.



Cursor Positioning On Title or Data

Press the **Enter** Key to toggle the cursor between the title and data fields. When the cursor is in the data field you are ready to edit the data.



NOTE: If pressing the **Enter** Key does not move the cursor to the data position, access to change presets is locked. You must first enter the correct password (see next page).

S	e	t	P	o	i	n	t					0	0	0	0				
A	c	t	u	a	l							0	0	0	0				
	V		2	3	0	2						0	0	0	0				
	V		2	3	0	3						0	0	0	0				

7 6 5 4 3 2 1 0 7 6 5 4 3 2 1 0

WARNING: Changing the preset value on the display immediately changes the value in PLC V-memory (the display is not buffered). Equipment damage or personnel injury may occur from improper use of this mode. Be sure to pause a moment after each keystroke to allow for the DV-1000 display update, so that you are viewing current values of Change Preset variables.

Chapter Summary

Summary of Key Points

Now we have covered Change Preset title types and how to edit data using the keypad.

We may summarize some of the key points we have learned about Change Preset Mode in this chapter:

- *Change Preset* simply means *Change V-memory data*.
- Changing data on the display **immediately** changes the value in the PLC. There is no prompt for confirmation of the change.
- In order for the change of a preset (V-memory data) to change the behavior of your process, some instruction(s) in the ladder main program has to *read* the V-memory data and use it.
- Three types of preset titles are available in Change Preset Mode.
- If you use Change Preset Mode in your application, all three title types must be set up for at least one title. This means the three block size setup parameters must be equal to one or greater.
- Access to changing presets can be password protected with password codes 0001 - 9999. If you do not wish to use a password, program the code "0000" into the password location to disable the password feature.
- If you are using a Timer or Counter Box Instruction and you want to change its preset value with Preset Mode, it **must** be a Vxxxx variable type, not a constant Kx!
- If preferred, you can have User-titled preset labels for timers and counters in the ladder program. The pre-labeled timer and counter titles are just for your convenience, and to conserve V-memory when required.
- Change Preset Mode will allow the editing of BCD numbers (0000 to 9999). If a V-memory location contains a hex number, Change Preset will not allow the editing of its value!
- The setup program for change Preset Mode can generally be confined to execute on the first scan, as do all the program examples in this chapter.
- The Operator's Guide near the end of this chapter contains instructions for a machine operator on how to change presets. Feel free to copy its two pages and post it on the machine as a resource for its operator(s).
- Appendix C contains worksheets for Change Preset Mode for you to copy and use to create your application program.

Bit Control Mode

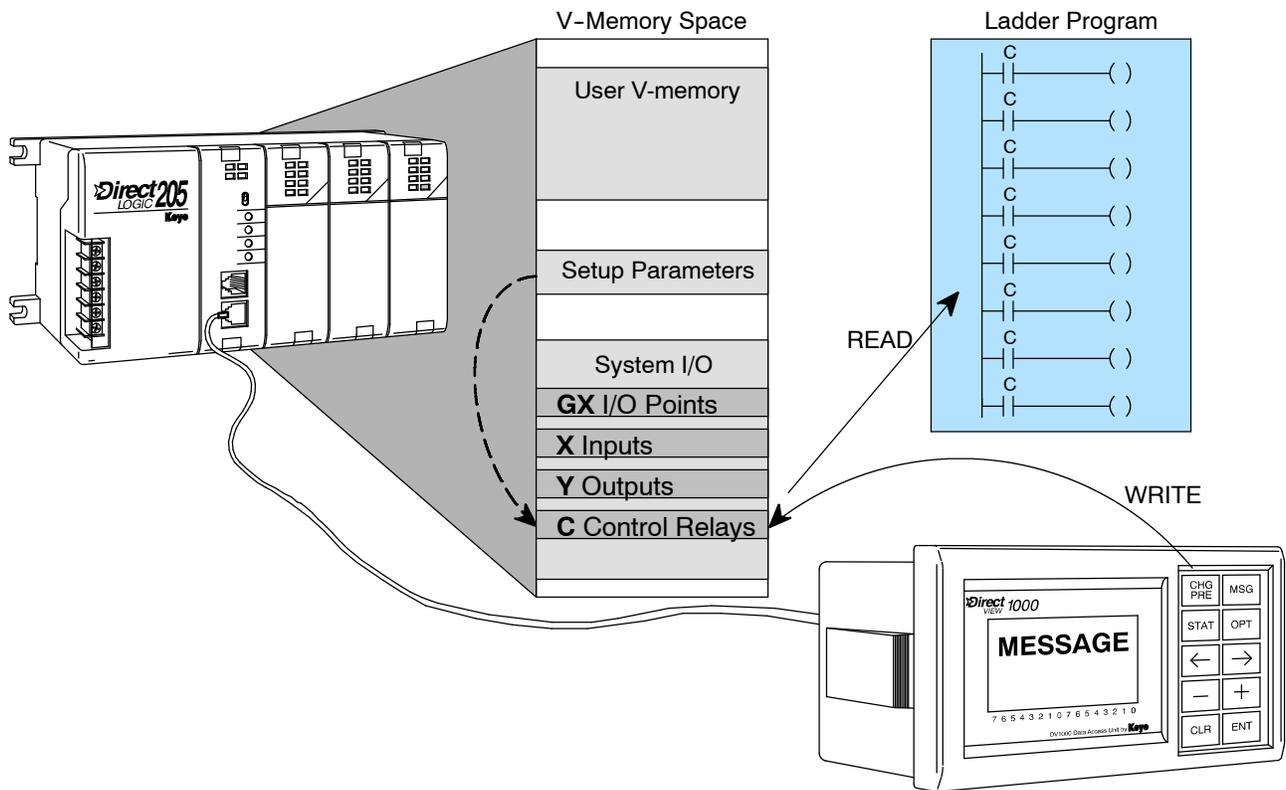
In This Chapter. . . .

- Overview
 - Setup Parameters for Bit Control
 - Using the Keypad To Do Bit Control
 - Bit Control Applications
 - Chapter Summary
-

Overview

Bit Control Mode permits you to use keys on the DV-1000 keypad for individual control of eight I/O bits. The types of I/O bits that may be controlled are X, Y, and C. The GX type is also available on DL405 CPUs only. For most applications, C type (control relays) are the best choice.

The following figure shows an expanded view of the PLC's V-memory space. A DV-1000 setup parameter in V-memory points to a system I/O data word. It may point to an X, Y, C, or GX word location (we use control relays (C) as an example). The DV-1000 keypad will control the lower 8 bits of the word. At powerup the DV-1000 reads this Bit Control setup parameter. Then, whenever you select Bit Control Mode the DV-1000 keypad controls (writes) the state of the eight I/O bits.



The drawing above shows how the DV-1000 keypad can control eight bits in V-memory. However, for anything meaningful to happen something else has to read the bits and act on their status. This may occur in two ways:

- For X, C, and GX input types, ladder logic must reference the bit addresses as an input contact.
- For Y and GX output types, an output module point must exist at the addresses. In this case the ladder program must **not** reference the same output bits, in order to avoid a conflict.

Setup Parameters for Bit Control

The following table lists the subset of the DV-1000 setup parameters which pertain to Change Preset Mode. The parameter at V7625 selects the address of the bit-controlled word in system I/O space. The parameter at V7626 selects the powerup default mode.

V-Memory Location	Setup Parameter Description
V7625	Bit Control I/O Pointer
V7626	Powerup Default Mode

Now we have to choose the I/O address of the bits we want to control. Refer to the columns in the following tables which correspond to the type of CPU in your system. Since our PLCs map their discrete I/O bits into V-memory, we have to choose the corresponding address.

I/O Type	DL130, DL230		DL240		DL250, DL350	
	Discrete Address (octal)	Word Address (octal)	Discrete Address (octal)	Word Address (octal)	Discrete Address (octal)	Word Address (octal)
Input Points	X0 - X177	V40400 - V40407	X0 - X477	V40400 - V40423	X0 - X777	V40400 - V40437
Output Points	Y0 - Y177	V40500 - V40507	Y0 - Y477	V40500 - V40523	Y0 - Y777	V40500 - V40537
Control Relays	C0 - C377	V40600 - V40617	C0 - C377	V40600 - V40617	C0 - C1777	V40600 - V40677
Global Inputs	N/A	N/A	N/A	N/A	N/A	N/A

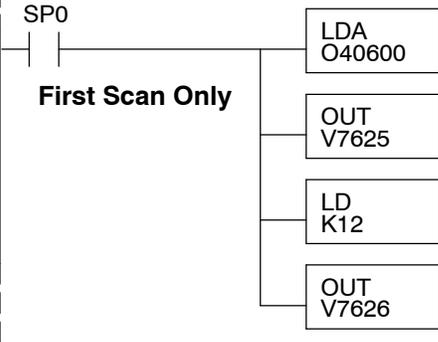
I/O Type	DL430		DL440		DL450	
	Discrete Address (octal)	Word Address (octal)	Discrete Address (octal)	Word Address (octal)	Discrete Address (octal)	Word Address (octal)
Input Points	X0 - X477	V40400 - V40423	X0 - X477	V40400 - V40423	X0 - X1777	V40400 - V40477
Output Points	Y0 - Y477	V40500 - V40523	Y0 - Y477	V40500 - V40523	Y0 - Y1777	V40500 - V40577
Control Relays	C0 - C737	V40600 - V40635	C0 - C1777	V40600 - V40677	C0 - C3777	V40600 - V40777
Global Inputs	GX0 - GX777	V40000 - V40037	GX0 - GX1777	V40000 - V40077	GX0 - GX2777 GY0 - GY2777	V40000 - V40137 V40200 - V40377

For example, suppose we assign Bit Control to the eight control relays C0 to C7. The table above gives the address of these as V40600, which we enter at V7625. Finally, we select Message Mode with Bit Control by entering "0012" in V7626. The following program does the parameter setup for these choices.



a:\bitctrl1.prj

Parameter Setup: Bit Control



Load octal address 40600 into the accumulator. V40600 is the location of C0 to C17.

Output this address to V7625, the location of the setup parameter for Bit Control.

Load the BCD constant K12 into the accumulator. It is the code to select Bit Control and Message Mode. This is optional, as you may select a different powerup mode.

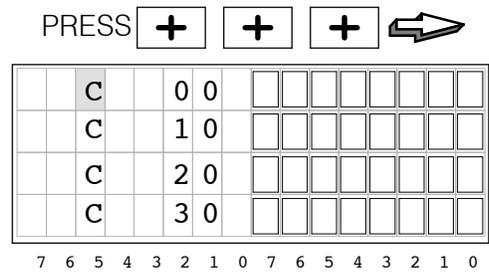
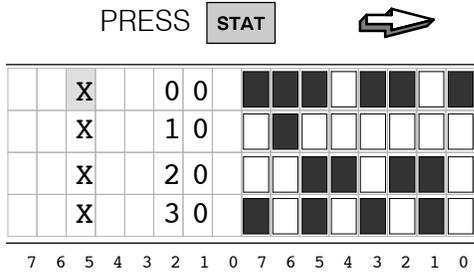
Output this constant to V7626, the location of setup parameter for the default powerup mode.

Bit Control Mode

Using the Keypad To Do Bit Control

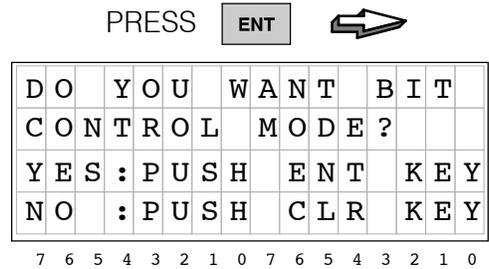
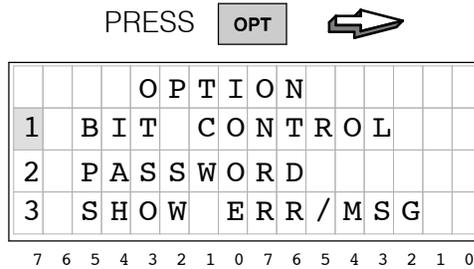
Selecting Bit Control and Status Modes

This section requires the parameter setup program of the previous section to be loaded in your CPU. If you have done so, we're ready to see first-hand how bit control works from the keypad. The setup parameter you have loaded for V7625 points to control relays C0 to C7, located at V40600. Now, enter Status Display Mode to see bit control work. Then select variable type "C".

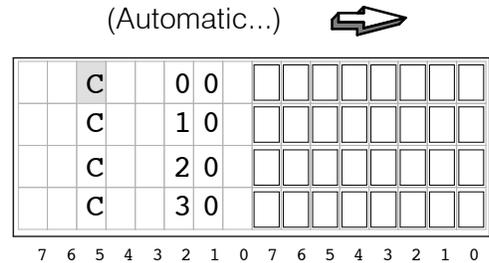
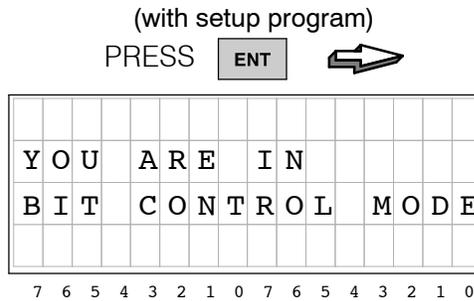


NOTE: when using some CPUs, the plus (+) only needs to be pressed once.

With Status Mode set up, now use the Options Menu to select Bit Control Mode.



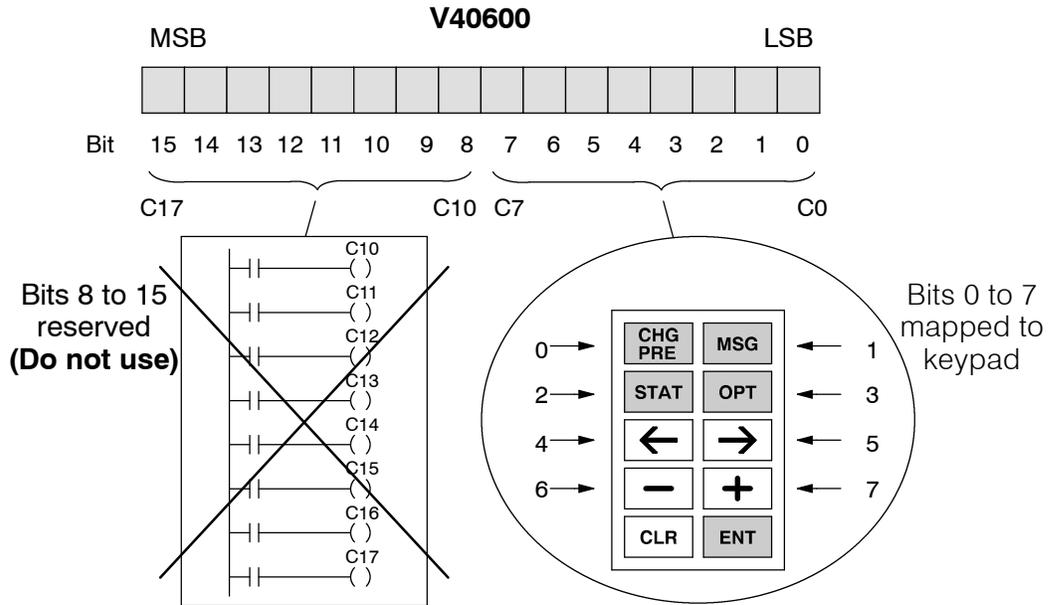
NOTE: Line 3 (SHOW ERR/MESG) does not apply to some CPUs.



After selecting Bit Control, the Status Mode display automatically returns. *The keypad is now in Bit Control Mode, and the display is in Status Mode!* This permits us to observe changes in C0 to C7 in real time for Bit Control key actions. Note that the display cursor is absent now, because the keypad function has changed.

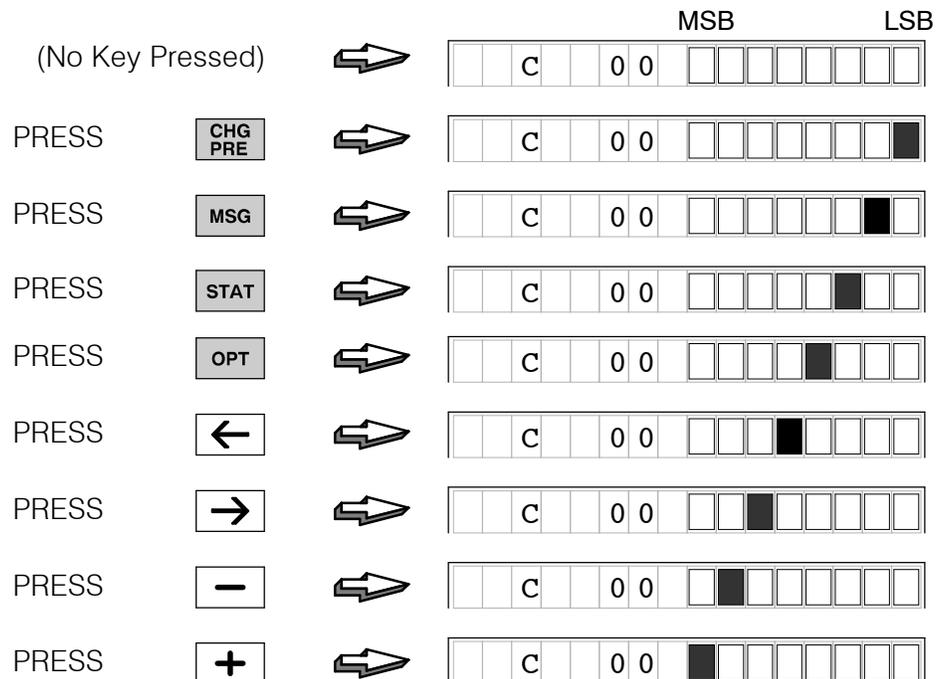
Keypad Bit Mapping

Now we can have a closer look at the status of the bits in V40600 during bit control. In the figure below, the keypad maps to bits 0 through 7 as shown.



NOTE: Since the DV-1000 does word write operations, it writes zeros to bits 8 through 15 (C10 to C17). Therefore, avoid using these eight I/O points in your ladder program in order to avoid a conflict. **This holds true for any X, Y C, and GX I/O point word address pointed to by V7625.**

To observe Bit Control in action, follow the keystrokes in the following diagram. Notice the relative binary weighting of each key, and the normally-off momentary nature of each key switch.

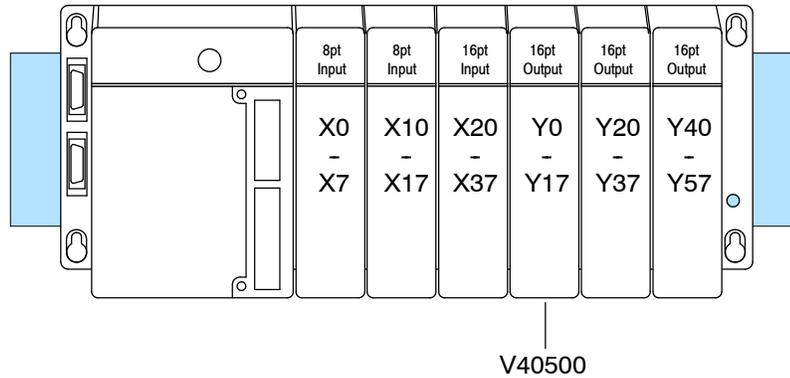


Bit Control Applications

I/O Debug

Bit Control Mode is most often used for debugging machines or processes. Using the setup parameter at V7625 we can configure Bit Control for X, Y, C, and GX types of I/O points. It's a good idea to plan the I/O points you want to use in Bit Control, and integrate it into the main ladder program. The main reason is that **Bit Control requests I/O points on. It is not a forced I/O feature!**

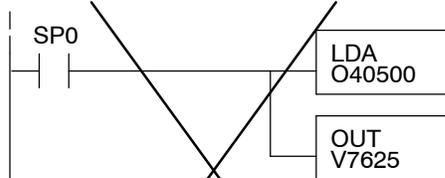
For example, consider the system shown below. Suppose we want to test output Y0 using Bit Control.



The I/O address of Y0 to Y17 is at V40500. The following program example sets up Bit Control Mode for Y0 to Y7. It shows Y0 being normally controlled by X0. However, **ladder logic will overwrite the DV-1000's requested on state of Y0 at the end of every scan, because Y0 is also referenced as an output coil in the program!** See the next example for the proper method to do this.

WRONG!

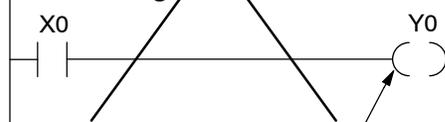
Parameter Setup: Bit Control



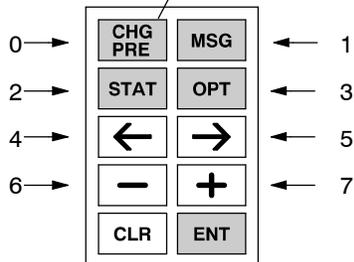
Load octal address 40500 into the accumulator. V40500 is the location of Y0 to Y17.

Output this address to V7625, the location of the setup parameter for bit control.

Main Program



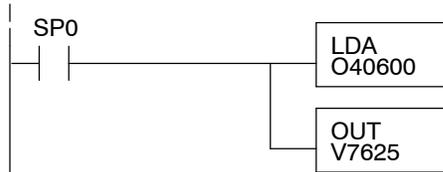
Y0 is normally controlled by X0 in the application. It is also requested on during Bit Control, when the Change Preset Key is pressed.



Instead of trying to bit control Y0 directly, we use a control relay and do a logical OR with the normal control logic for Y0. Then we set up Bit Control Mode for C0 to C7. Now the conflict is eliminated, because C0 is only referenced as an input in the program.

CORRECT!

Parameter Setup: Bit Control



Load octal address 40600 into the accumulator. V40600 is the location of C0 to C17.

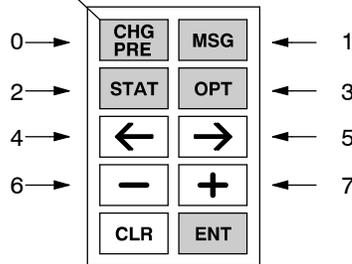
Output this address to V7625, the location of the setup parameter for bit control.

Main Program



Y0 is normally controlled by X0 in the application. It is also controlled by C0 which is requested on during Bit Control, when the Change Preset Key is pressed.

Bit Control Mode



Bit Control With Message Display Mode

The ladder program in this example coordinates Bit Control keypad entries with Message Display output. The display announces the two modes as shown, and prompts you to press any bit control key. When any key is pressed, the message on the bottom line changes to name the key pressed.

B	I	T	C	O	N	T	R	O	L	M	O	D	E		
&	M	E	S	S	A	G	E	M	O	D	E				
P	r	e	s	s	K	e	y	s	-	-	-	-	>		
(	n	o	k	e	y	p	r	e	s	s	e	d)		
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0

PRESS  

B	I	T	C	O	N	T	R	O	L	M	O	D	E		
&	M	E	S	S	A	G	E	M	O	D	E				
P	r	e	s	s	K	e	y	s	-	-	-	-	>		
C	H	G	P	R	E	K	e	y							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0

PRESS  

B	I	T	C	O	N	T	R	O	L	M	O	D	E		
&	M	E	S	S	A	G	E	M	O	D	E				
P	r	e	s	s	K	e	y	s	-	-	-	-	>		
M	S	G	K	e	y										
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0

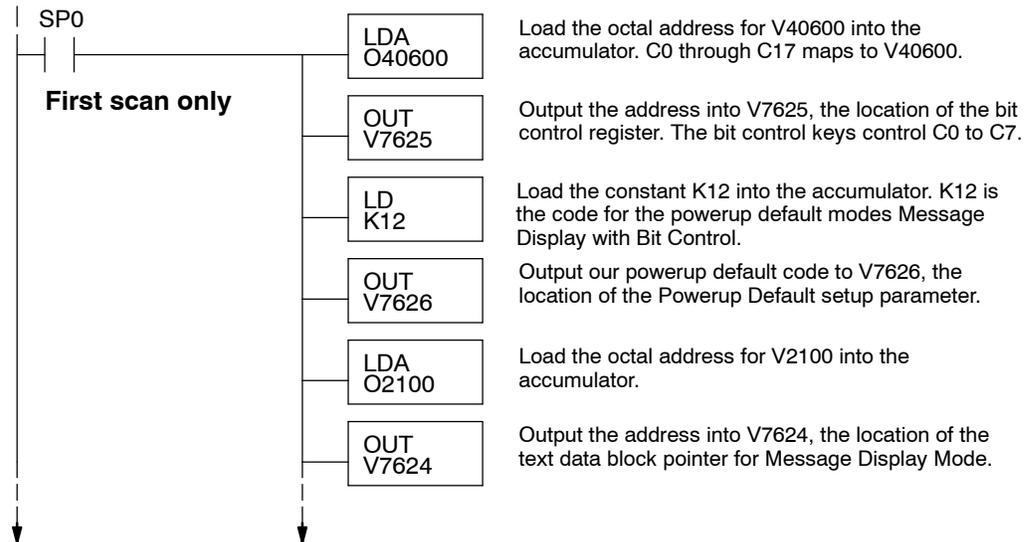
The ladder program has no means of forcing the display into Message Display Mode, nor the keypad into Bit Control Mode. However, these modes may be selected from the keypad, as well as programmed as the powerup default. The program creates the display output with ACON and MOVMC instructions. Load the program below, and place the CPU in run mode. Then power cycle the CPU, and it should enter Bit Control and Message Display Modes. Watch the bottom line of the display respond as you press each Bit Control key.

NOTE: This example contains certain instructions including LDLBL, DLBL, ACON, and MOVMC which are discussed in detail in Chapter 4. Refer to the the section "Using the ASCII Constant (ACON) Instruction" for more information.



a:\bitctrl2.prj

Setup Parameters for Bit Control and Message Mode

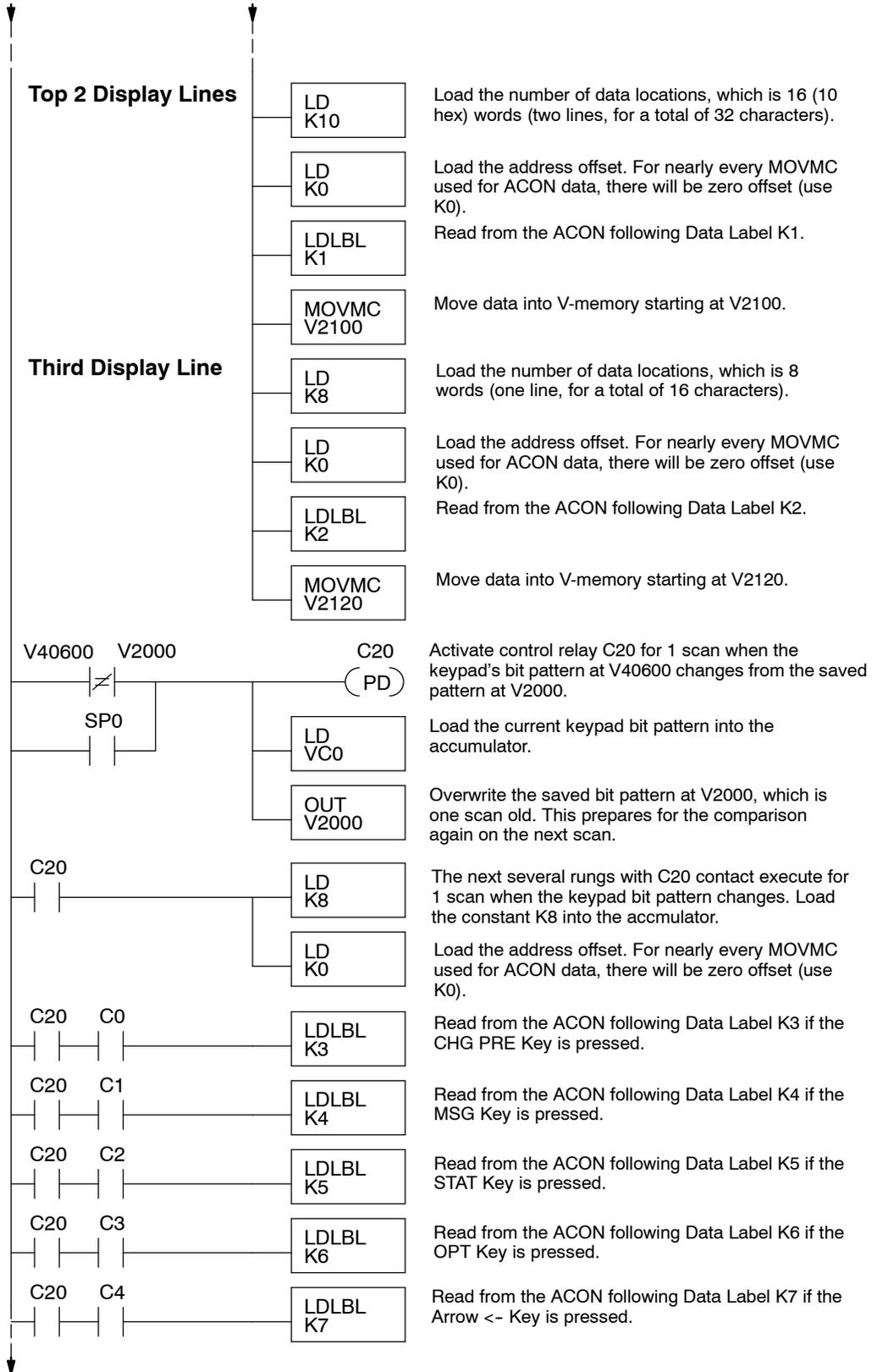


Bit Control Mode

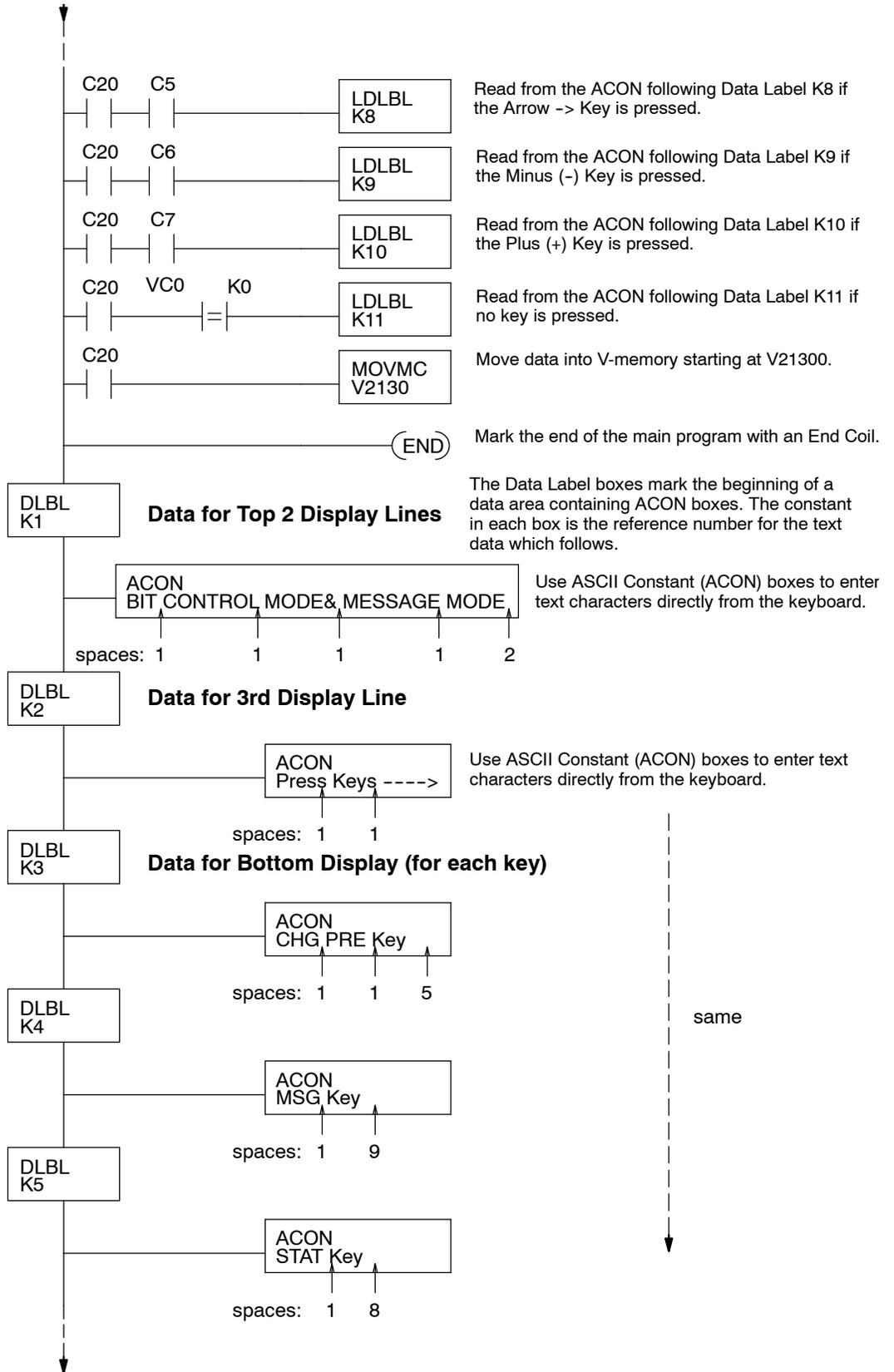
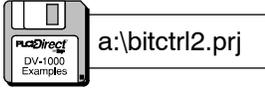
(continued)



a:\bitctrl2.prj



(continued)



Bit Control Mode

(continued)



a:\bitctrl2.prj

Bit Control Mode

DLBL K6

Data for Bottom Display (for each key), cont'd

ACON OPT Key

Use ASCII Constant (ACON) boxes to enter text characters directly from the keyboard.

spaces: 1 9

DLBL K7

ACON Arrow <- Key

spaces: 1 1 4

DLBL K8

ACON Arrow -> Key

spaces: 1 1 4

DLBL K9

ACON Minus (-) Key

spaces: 1 1 3

DLBL K10

ACON Plus (+) Key

spaces: 1 1 4

DLBL K11

ACON (no key pressed)

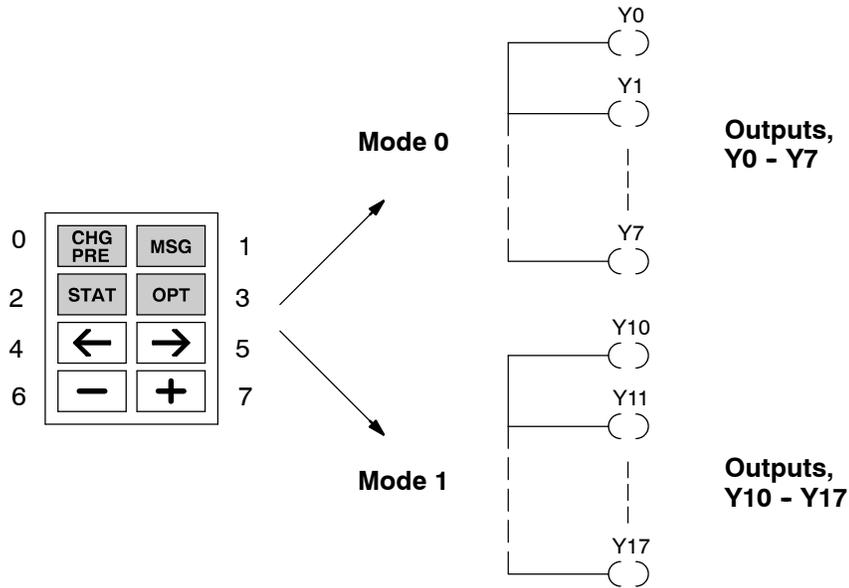
spaces: 1 1

same



Multiplexed Bit Control

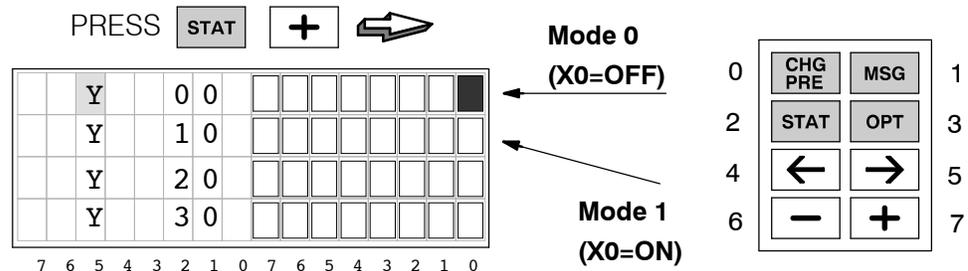
In some applications you may need bit control of more than 8 bits from the keypad. Using ladder logic, you can share (multiplex) the bit control keys among multiple outputs. Refer to the drawing below. For example, when the machine is in "Mode 0" the keypad's bit control maps to outputs Y0 through Y7. During "Mode 1" the keypad controls Y10 through Y17. In this way, eight keys are multiplexed among sixteen output points.



NOTE: The operator must be informed as to which mode is active before and during keypad use for bit control. One method is to use ladder logic to send a message to the DV-1000 display indicating which outputs are under bit control.

In this example, we will use the state of discrete input X0 to indicate the mode of the machine. X0 = OFF is Mode 0, and X0 = ON is Mode 1. The ladder logic program on the following page maps the bit control keys to control relay contacts C0 through C7 (see setup rung). The main program then uses X0 in conjunction with the control relays to control either the first or second bank of Y output points.

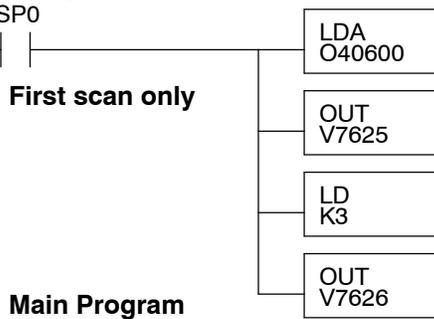
Load the example program in the CPU and place the CPU in Run Mode. You can use Status Display Mode to see the program work. Press the **Status** Key followed by the **Plus (+)** Key to view the status of Y output points. Then place the keypad in Bit Control Mode by pressing the **Options** Key and selecting Bit Control from the menu. When the status display returns, you can change between Mode 0 and Mode 1 using a discrete input at X0. Then observe the corresponding group of Y outputs.





a:\bitctrl3.prj

Setup Parameters for Bit Control



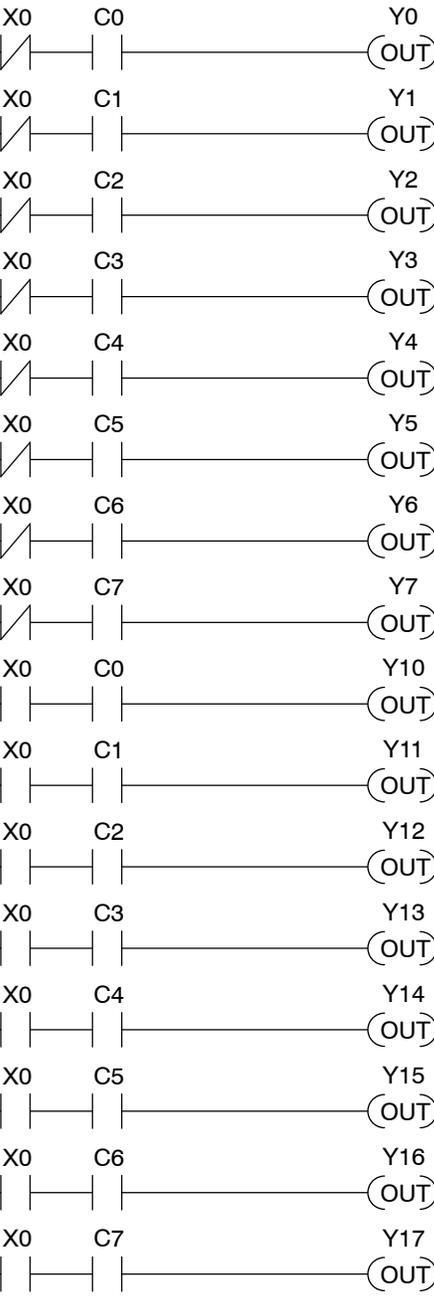
Load the octal address for V40600 into the accumulator. C0 through C17 maps to V40600.

Output the address into V7625, the location of the bit control register. The bit control keys control C0 to C7.

Load the constant K3 into the accumulator. K3 is the code for the powerup default mode Status Display Mode.

Output our powerup default code to V7626, the location of the powerup default setup parameter.

Main Program



When X0 is OFF, the machine is in Mode 0. In this mode we map the bit control keys to control outputs Y0 through Y7. **Note:** If using DL105 be sure CPU is initialized to make X0 operational.

SAME

When X0 is ON, the machine is in Mode 1. In this mode we map the bit control keys to outputs Y10 through Y17.

SAME

Chapter Summary

Summary of Key Points

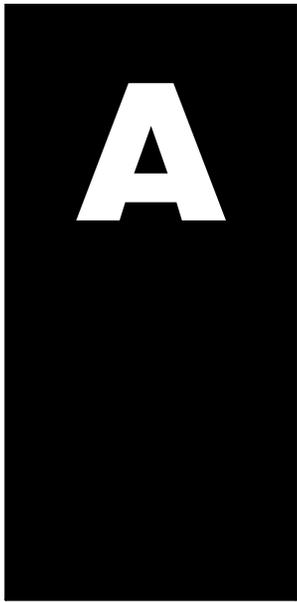
Now we have covered Bit Control Mode and demonstrated how to turn on specific I/O bits using the keypad.

We may summarize some of the key points we have learned about Bit Control Mode in this chapter:

- Bit Control Mode only applies to the keypad. The display can be in any one of the other three modes during Bit Control.
- The keypad operates as normally open, momentary switches during bit control.
- Only the lower eight bits of V-memory locations may be directly addressed by bit control.
- After selecting a V-memory location for bit control, do not use its upper eight bits (the DV-1000 overwrites these while updating the whole V-memory word).
- If ladder logic contains an output point that references the same address as the bit controlled register, a conflict exists. The PLC scan will overwrite the keypad request.

Now you have the necessary information to install and use your DV-1000!

Troubleshooting Guide



A

In This Appendix. . . .
— Troubleshooting Guide

Troubleshooting Guide

One or more example programs in this manual do not operate properly. What's wrong?

Check for the following possible causes:

- Most of the example programs include first scan rungs using SP0 contacts. The CPU needs to make a program-to-run mode transition in order for these rungs to execute. Use **DirectSOFT** to do this.
- The program may require an external input such as X0 or X1. Check the system configuration requirements listed for the example to work.
- The DL430 CPU does not support some instructions such as MOVMC and ACON boxes which occur in the examples. The DL130 and DL230 do not support pointer variables (type P).

When pressing some of the keys on the DV-1000, a display message appears that says "Setup Error, Check Value in V(xxxx)". How can I eliminate these error messages?

For most of the DV-1000 modes, two or three PLC V-memory locations must be loaded with setup parameters. The range of V-memory set aside for this purpose is described in Chapter 3. If you have manually entered these parameters at one time, they now may have become corrupted for one of several possible reasons. We recommend imbedding parameter setup data in ladder logic (first scan rung only). See Chapter 3 for more on this topic.

Using Change Preset Mode I attempt to change timer or counter presets. However, the timer or counter preset does not actually change when the PLC program is running. What's wrong?

The most likely problem is that the counter or timer box in the ladder program has a constant Kxxxx selected as a preset. You will need to edit the timer or counter box to instead reference a V-memory location for the preset. The Change Preset function cannot change an instruction box's constant. Please see the examples in Chapter 6.

I can't get the numeric data in Message Display mode to put numbers on the screen.

Potential sources of this problem are:

- The numeric setup parameter at V7623 may not be pointing to the area of V-memory where the value resides.
- The text data may be masking the number(s) if its ASCII codes are 20 hex or greater in text positions corresponding to numeric positions where you want the numbers to appear.
- The display is not in Message Display Mode.

Why does Change Preset keypad entries take so long to respond and update the display?

The delay you are seeing is due to communication time between the DV-1000 and the CPU. If screen updates lag behind, it can cause you to overshoot the desired value. For best results, pause a second between key strokes.

In ladder logic I change the text or numeric pointer to point to a second block of data. However, the DV-1000 only reads the original data block. Why is that?

The DV-1000 only reads the setup parameter table just after powerup. If you want to change the display data, you'll need to move new data into the original text and/or numeric data blocks. An example in Chapter 4 shows the ladder logic required to do this.

I am not able to change preset values, even though I have entered the correct password (or the password is disabled). What's wrong?

See if the number(s) you are trying to edit are hex numbers. Remember, Change Preset Mode only works for BCD numbers (0000 to 9999). Also, make sure the switch on the front of your CPU is not in the "Run" position (use "Term").

The ACON (ASCII Constant) instruction box will only accept two characters, while the examples in the manual show many more characters. What's the problem?

You are probably using a Hand-held Programmer to enter ladder logic. This is ok, but the extended ACON box functionality you are expecting is provided by the PC-based *DirectSOFT* programming software. The Hand-held Programmer accesses the CPU's standard ACON box function, which accepts two characters. This is described in Chapter 4.

The keypad seems to be locked up. When I press keys the display does not change. Why is that?

There can be two different causes of this problem:

- It may be that the DV-1000 is in Bit Control Mode. This temporarily changes the keypad functionality. Press the **Clear** Key followed by the **Enter** Key to exit Bit Control Mode.
- The DV-1000 setup parameters may be invalid, thereby confusing DV-1000 firmware. This is most likely if your CPU is new and its setup parameter locations for the DV-1000 have never been programmed. Follow the instructions in Chapter 2 to initialize the CPU scratchpad memory, which places zeros in all these setup parameter locations.

When I use a LDD instruction to load text data (ASCII codes), the display output swaps the position of the two pairs of characters. Why?

This is normal. The reason behind this effect, along with an example, is shown in the section in Chapter 4, titled "Loading Text Using the LDD and OUTD Instructions".

The display backlight is on, but no characters ever appear on the display for any of the modes.

This condition occurs when the DV-1000 is connected to the second communications port on a DL240 that is configured incorrectly. Using *DirectSOFT*, select the **PLC** menu, then **Setup**, then **Secondary Port**. Set the port for 9600 baud, 8 data bits, 1 stop bit, odd parity.

When I view the contents of the setup parameter locations, the setup pointer values are wrong. It seems something is overwriting the setup data which the ladder program writes on the first scan.

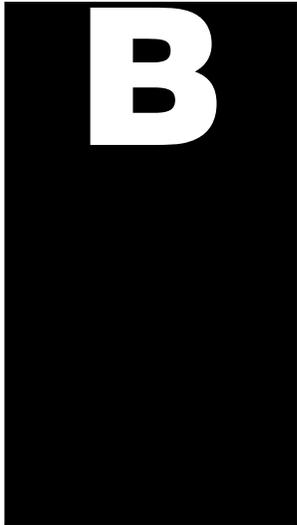
Remember that the LDA instruction which loads octal addresses in the setup program converts the octal numbers to hex numbers. It's likely that the values you see are the correct hex representations of the octal addresses.

When the DV-1000 powers up, the only thing it does is display the error message "E320 TIME OUT". The keypad also does not work. What is the problem?

The message you see is generated by the DV-1000. It is unable to establish communications with the CPU. Check the following to find the source of the problem:

- The communications cable may be faulty. Inspect the contacts for dust, etc., or change cables.
- If you have made a custom cable, it may be that the cable pinouts are reversed (the RJ12 connector on one end is installed upside down). Pin 1 of one end should connect to pin 6 of the opposite end! Refer to the custom cable drawing in Chapter 2.

Reference Data

A large, bold, white letter 'B' is centered within a black rectangular box in the top right corner of the page.

In This Appendix. . . .

- Setup Parameter Tables
- ASCII Table

Setup Parameter Tables

The following table includes all the setup parameters for the various modes of the DV-1000.

PLC CPU V-memory Locations	DV-1000 Parameter Description	Operational Mode	See Chapter Number
V7620	Change Preset Values Pointer	CHG PRE	6
V7621	Change Preset Titles Pointer	CHG PRE	6
V7622	Change Preset Block Size	CHG PRE	6
V7623	Numeric Message Pointer	MSG	4
V7624	Text Messages Pointer	MSG	4
V7625	Bit Control Pointer	BIT CNTRL	7
V7626	Powerup Operational Mode	Power-up Default	3
V7627	Change Preset Value Password	CHG PRE	6
V7720*	Titled Timer Preset Value Pointer	CHG PRE	6
V7721*	Titled Counter Preset Value Pointer	CHG PRE	6
V7722*, High byte	Titled Timer Preset Block Size	CHG PRE	6
Low byte	Titled Counter Preset Block Size	CHG PRE	6

*DL130 and DL230 CPUs use different memory locations here: V7640 instead of V7720, V7641 instead of V7721, and V7642 instead of V7722.

The next table repeats the setup parameter list, but gives the valid address range for each CPU type and the data type for each setup parameter.

PLC CPU V-memory Locations	DV-1000 Parameter Description	Data Type	DL130 DL230 Ranges	DL240, Ranges	DL250 DL350 DL430 Ranges	DL440 Ranges	DL450 Ranges
V7620	Change Preset Values Pointer	Octal	V2000 to V2377, V4000 to V4177	V2000 to V4377	V1400 to V7377	V1400 to V7377, V10000 - V17777	V1400 to V7377, V10000 - V37777
V7621	Change Preset Titles Pointer	Octal	V2000 to V2377, V4000 to V4177	V2000 to V4377	V1400 to V7377	V1400 to V7377, V10000- V17777	V1400 to V7377, V10000- V37777
V7622	Change Preset Block Size	BCD	1 - 16	1 - 16	1 - 32	1 - 32	1 - 32
V7623	Numeric Message Pointer	Octal	V2000 to V2377, V4000 to V4177	V2000 to V4377	V1400 to V7377	V1400 to V7377, V10000- V17777	V1400 to V7377, V10000- V37777
V7624	Text Message Pointer	Octal	V0000 to V2377, V4000 to V4177	V2000 to V4377	V1400 to V7377	V1400 to V7377, V10000- V17777	V1400 to V7377, V10000- V37777
V7625	Bit Control Pointer	Octal	X, Y, or C V-mem. locations	X, Y, or C V-mem. locations	X, Y, GX, or C V-mem. locations	X, Y, GX, or C V-mem. locations	X, Y, GX, or C V-mem. locations
V7626	Power-up Operational Mode	BCD	0, 1, 2, 12, 3	0, 1, 2, 12, 3	0, 1, 2, 12, 3	0, 1, 2, 12, 3	0, 1, 2, 12, 3
V7627	Change Preset Value Password	BCD	0000 to 9999	0000 to 9999	0000 to 9999	0000 to 9999	0000 to 9999
V7720*	Titled Timer Preset Value Pointer	Octal	-	V2000 to V4377	V1400 to V7377	V1400 to V7377, V10000- V17777	V1400 to V7377, V10000- V37777
V7721*	Titled Counter Preset Value Pointer	Octal	-	V2000 to V4377	V1400 to V7377	V1400 to V7377, V10000- V17777	V1400 to V7377, V10000- V37777
V7722*, High byte	Titled Timer Preset Block Size	BCD	-	1 to 99	1 to 99	1 to 99	1 to 99
V7722*, Low byte	Titled Counter Preset Block Size	BCD	-	1 to 99	1 to 99	1 to 99	1 to 99

*DL130 and DL230 CPUs use memory locations V7640 thru V7642 here.

ASCII Table

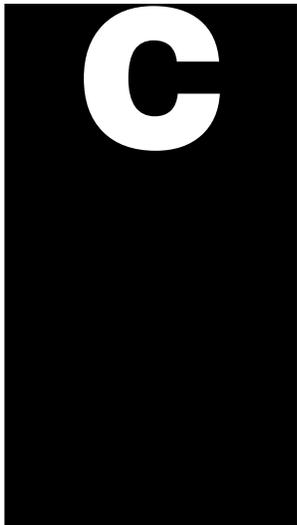
There are several versions of the ASCII character codes for various computer platforms and output devices. The following table lists the ASCII characters supported by the *DirectVIEW™* 1000.

Reference Data

HEX	ASCII	HEX	ASCII	HEX	ASCII	HEX	ASCII	HEX	ASCII	HEX	ASCII	HEX	ASCII	HEX	ASCII
00	--	20		40	@	60	'	80	--	A0	--	C0	--	E0	□
01	--	21	!	41	A	61	a	81	--	A1	□	C1	--	E1	ä
02	--	22	"	42	B	62	b	82	--	A2		C2	--	E2	□
03	--	23	#	43	C	63	c	83	--	A3		C3	--	E3	□
04	--	24	\$	44	D	64	d	84	--	A4		C4	--	E4	□
05	--	25	%	45	E	65	e	85	--	A5	■	C5	--	E5	□
06	--	26	&	46	F	66	f	86	--	A6	--	C6	--	E6	?
07	--	27	'	47	G	67	g	87	--	A7	--	C7	--	E7	q
08	--	28	(	48	H	68	h	88	--	A8	--	C8	--	E8	--
09	--	29	)	49	I	69	i	89	--	A9	--	C9	--	E9	--
0A	--	2a	*	4A	J	6A	j	8A	--	AA	--	CA	--	EA	?
0B	--	2B	+	4B	K	6B	k	8B	--	AB	--	CB	--	EB	x
0C	--	2C	,	4C	L	6C	l	8C	--	AC	--	CC	--	EC	--
0D	--	2D	-	4D	M	6D	m	8D	--	AD	--	CD	--	ED	--
0E	--	2E	.	4E	N	6E	n	8E	--	AE	--	CE	--	EE	π
0F	--	2F	/	4F	O	6F	o	8F	--	AF	--	CF	--	EF	ö
10	--	30	0	50	P	70	p	90	--	B0	—	D0	--	F0	p
11	--	31	1	51	Q	71	q	91	--	B1	--	D1	--	F1	q
12	--	32	2	52	R	72	r	92	--	B2	--	D2	--	F2	?
13	--	33	3	53	S	73	s	93	--	B3	--	D3	--	F3	
14	--	34	4	54	T	74	t	94	--	B4	l	D4	--	F4	□
15	--	35	5	55	U	75	u	95	--	B5	--	D5	--	F5	ü
16	--	36	6	56	V	76	v	96	--	B6	--	D6	--	F6	□
17	--	37	7	57	W	77	w	97	--	B7	--	D7	--	F7	
18	--	38	8	58	X	78	x	98	--	B8	--	D8	--	F8	x
19	--	39	9	59	Y	79	y	99	--	B9	--	D9	--	F9	u
1A	--	3A	:	5A	Z	7A	z	9A	--	BA		DA	--	FA	--
1B	--	3B	;	5B	[	7B	{	9B	--	BB	--	DB	□	FB	--
1C	--	3C	<	5C	--	7C	|	9C	--	BC	--	DC	--	FC	--
1D	--	3D	=	5D	]	7D	}	9D	--	BD	--	DD	--	FD	
1E	--	3E	>	5E	^	7E		9E	--	BE	--	DE	--	FE	--
1F	--	3F	?	5F	_	7F		9F	--	BF	--	DF	□	FF	■

NOTE: If any of the non-useable characters noted as -- are used for the messages or titles in the DV-1000, the character will not display.

DV-1000 Worksheets

A large, bold, white capital letter 'C' is centered within a solid black rectangular box in the top right corner of the page.

In This Appendix. . . .

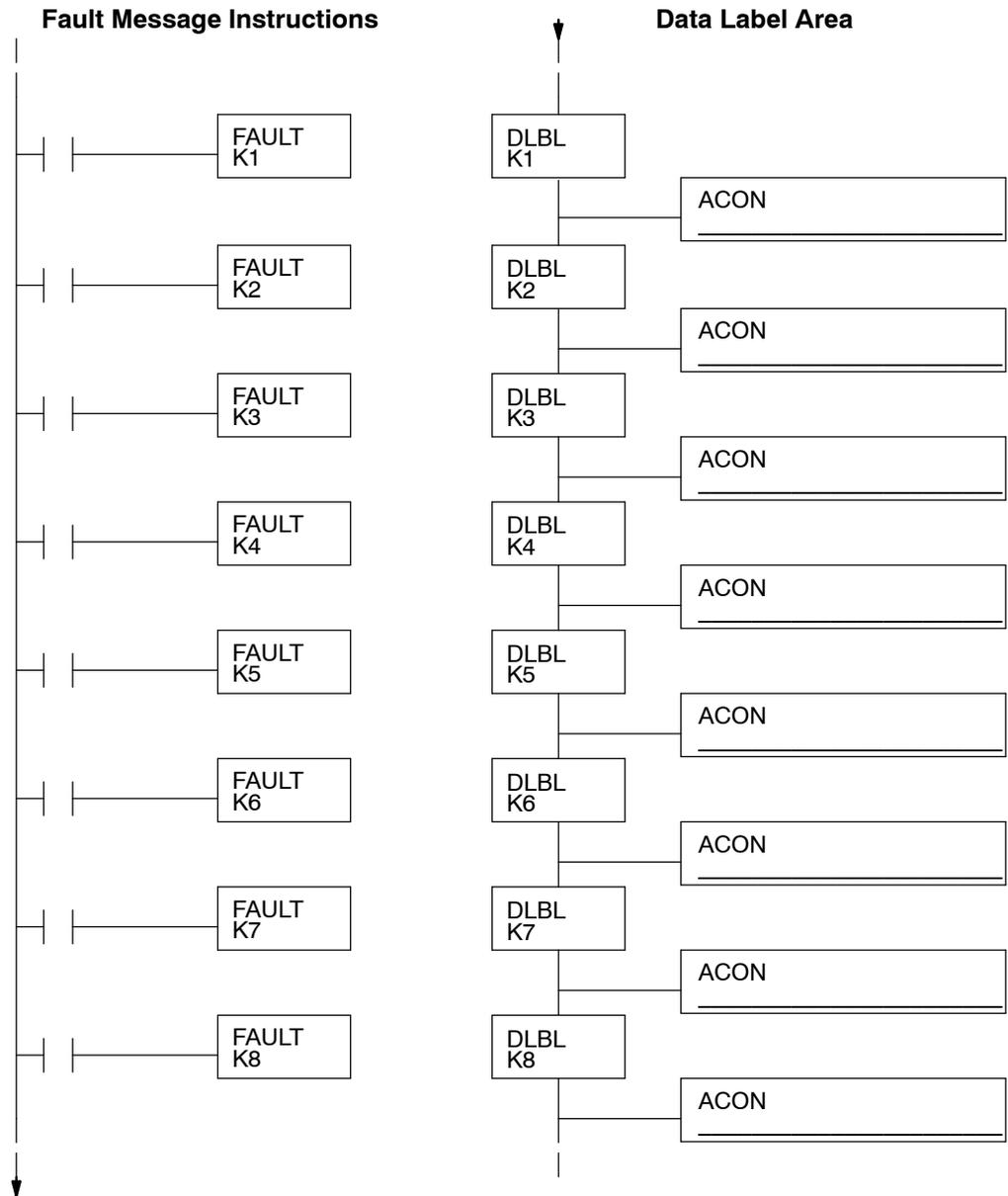
- Message Display Worksheets
- Change Preset Worksheets

Message Display Worksheets

Fault Messages

The Fault Instruction can output up to 23 characters. We recommend limiting it to 15 characters so the text fits within the DV-1000's top line. The following worksheet shows ladder program segments. On the left are the Fault boxes (yours may be spread throughout your program, and use different permissive contact arrangements). On the right are the corresponding data labels and ACON boxes. Each active Fault box can cause the message in the corresponding ACON Box to be displayed. Remember that the maximum number of Data Labels is 64, and the Data Label numbers are hexadecimal.

DV-1000 Worksheets



**Display Output
Grids**

The following display grids are for general-purpose message display planning.

**Numeric
Output**

Numeric Data Starting Address = V _____

	3		2		1		0
	7		6		5		4
	13		12		11		10
	17		16		15		14

**Text
Output**

Text Data Starting Address = V _____

0	1	2	3	4	5	6	7
10	11	12	13	14	15	16	17
20	21	22	23	24	25	26	27
30	31	32	33	34	35	36	37

**Numeric
Output**

Numeric Data Starting Address = V _____

	3		2		1		0
	7		6		5		4
	13		12		11		10
	17		16		15		14

**Text
Output**

Text Data Starting Address = V _____

0	1	2	3	4	5	6	7
10	11	12	13	14	15	16	17
20	21	22	23	24	25	26	27
30	31	32	33	34	35	36	37

Index

A

ACON Instruction, 4-25 to 4-31
ASCII Table, Appendix B

B

Bit Control Mode
 Debugging applications, 1-15, 7-9 to 7-10
 Message display coordination, 7-11 to 7-14
 Multiplexed bit control, 7-15
 Overview, 7-2 to 7-3
 Quick Tour, 1-13
 Setup parameters, 7-4
 Toggle function, 7-17

C

Change Preset Mode
 Accessing preset variables, 6-8
 Buffered preset values, 6-31
 Combination titles, 6-25 to 6-27
 Controlling a process, 1-15
 Individual default user titles, 6-22 to 6-24
 Operator's Guide, 6-32 to 6-33
 Overview, 6-2 to 6-4
 Password, 6-28 to 6-29
 Preset title lists, 6-6 to 6-7
 Quick Tour, 1-12
 Setup parameters, 6-4 to 6-7
 Timer and counter presets, 6-10 to 6-12, 6-30
 Titles available, 6-3
 User-titled presets, 6-14 to 6-24
 User-titled text, 6-19 to 6-22
Communication cables, 1-5, 2-7 to 2-8

D

Display, 1-5, 1-6 to 1-8

E

Error message, 4-4 to 4-7
 Overview, 4-2
Example programs. *See* Program examples

F

Fault message, 4-4 to 4-7
 Overview, 4-2
Frequently Asked Questions, 1-16 to 1-17

I

Installation
 Mounting Location, 2-5
 Panel Mounting, 2-6
 PLC Selection, 2-4

K

Keypad, 1-5, 1-6 to 1-8
 Bit control function, 7-3, 7-6 to 7-7

L

LDD instruction, Used for text output, 4-17 to 4-18

M

Message Display Mode

- ACON instruction, 4-25 to 4-31
- Bar graphs, 4-49 to 4-56
- Bit control coordination, 7-11 to 7-14
- Blinking text, 4-38 to 4-40
- Combining numbers and next, 4-19 to 4-24
- Display positions, 4-18 to 4-19
- Dynamic text, 4-36 to 4-37
- Embedded time and date, 4-44 to 4-48
- How to display numbers, 4-13 to 4-14
- How to display text, 4-15 to 4-16
- How user messages work, 4-9, 4-20
- Monitoring a process, 1-15
- Multiple displays, 4-32 to 4-35
- Overview, 4-2 to 4-4
- Polarity sign for numeric output, 4-41 to 4-43
- Quick Tour, 1-11
- Scrolling display, 4-57 to 4-61
- Setup parameters, 4-10 to 4-12, 4-22 to 4-23
- System messages, 4-5 to 4-8
- Unmasking numeric positions, 4-23

O

Operator Interface

- Design Basics, 1-14 to 1-15
- Role of DV-1000, 1-2
- Using single or dual DV-1000s, 2-2 to 2-3

Operator's Guide to Change Preset Mode, 6-32 to 6-33

OUTD instruction, Used for text output, 4-17 to 4-18

P

Password, 6-28 to 6-29

Powerup default operational mode, 3-9 to 3-11

Presets. *See* Change Preset Mode

Program examples

- Bar graphs, 4-49 to 4-56
- Bit control toggle, 7-17
- Bit control with message display, 7-11 to 7-14
- Blinking text, 4-38 to 4-40
- Diskette, 1-5
- Dynamic text, 4-36 to 4-37
- Embedded decimal point, 4-62
- Embedded time and date, 4-44 to 4-48
- Installation, 2-9
- Loading, 2-10
- Multiple displays, 4-32 to 4-35
- Multiplexed bit control, 7-15
- Polarity sign for numeric output, 4-41 to 4-43
- Scrolling display, 4-57 to 4-61
- System requirements, 4-4
- Timer and counter presets, 6-10 to 6-13
- User-titled presets, 6-14 to 6-24

S

Setup parameters

- Bit control mode, 7-4
- Change preset mode, 6-4 to 6-7
- Definitions, 3-4 to 3-5
- General, 1-9
- How to enter, 3-7
- Loading address pointers, 3-8
- Message display mode, 4-10 to 4-12, 4-22 to 4-24
- Overview, 3-2 to 3-3
- Powerup default mode, 3-9 to 3-11

Specifications, 1-18

Status Display Mode

- Address selection, 5-4
- Bookmark, 5-6
- Data type selection, 5-5
- Monitoring a process, 1-15
- Overview, 5-2
- Quick Tour, 1-10

TTimer and counter presets, 6-10 to 6-13, 6-30
