3

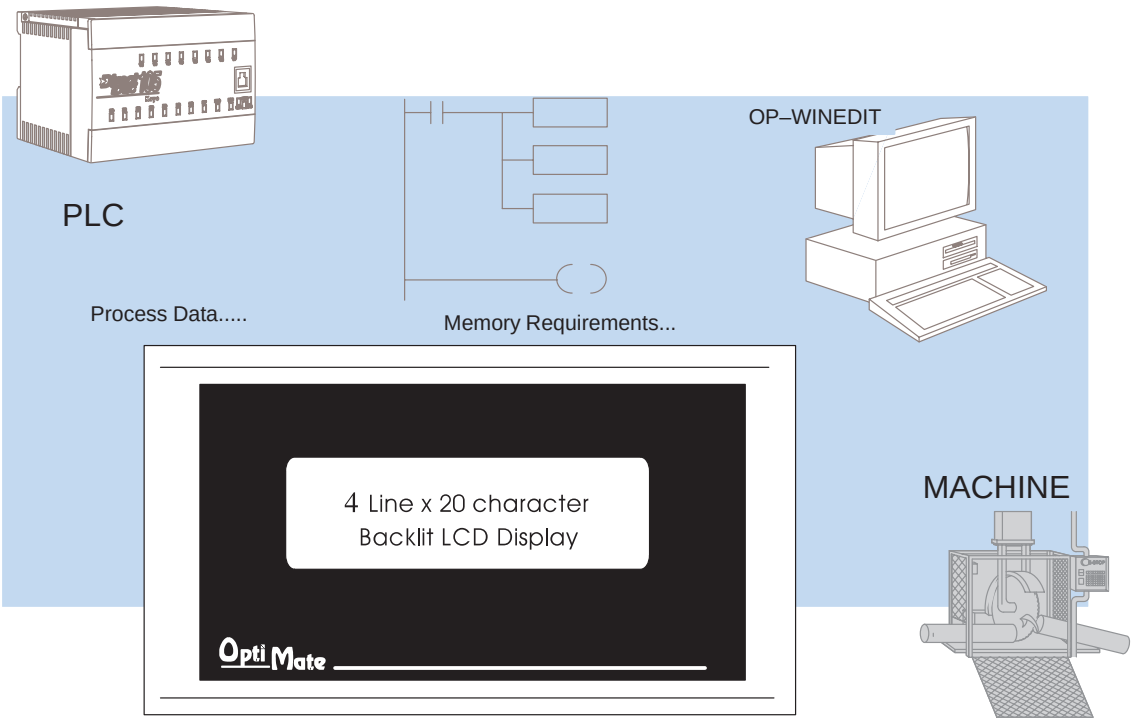
Understanding the Features

In This Chapter. . . .

Learning the Features

In this section, the subject of how to use the OP–440 features is described. The details for using messages are covered. We recommend that you study this chapter before attempting to configure and use the OP-panel. As you proceed through this chapter, relate the topics discussed with how your operator panel may be implemented. The concepts discussed in this chapter are applicable to all PLCs.

- PLC Registers
- Message Operations
- User Memory Overview



PLC Registers

Register Overview The OP400 panels communicate to the PLC through user defined PLC data registers. The starting or “Base” register is assigned during panel configuration and automatically occupies 12 consecutive 16-bit data registers. In this manual the registers are identified as M+0, M+1, M+2, thru M+11.

OP–440 Panel PLC Register Map

PLC Register	Register Function
M+0	Top line message selection
M+1	Second line message selection
M+2	Third line message selection
M+3	Bottom line message selection
M+4	Top line data
M+5	Top line data 2 (for long BCD and floating point numbers)
M+6	Second line data
M+7	Second line data 2 (for long BCD and floating point numbers)
M+8	Third line data
M+9	Third line data 2 (for long BCD and floating point numbers)
M+10	Bottom line data
M+11	Bottom line data 2 (for long BCD and floating point numbers)

Register Definition The following describes the function of each of the registers shown in the table.

- **Register M+0** – When a number from 1 to 160 is placed in this register, the predefined message associated with that number will be displayed on the **top** line of the LCD display.
- **Register M+1** – When a number from 1 to 160 is placed in this register, the predefined message associated with that number will be displayed on the **second** line of the LCD display.
- **Register M+2** – When a number from 1 to 160 is placed in this register, the predefined message associated with that number will be displayed on the **third** line of the LCD display.
- **Register M+3** – When a number from 1 to 160 is placed in this register, the predefined message associated with that number will be displayed on the **bottom** line of the LCD display.
- **Register M+4** – This contains numeric data associated with the **top** line display (this is described in more detail later).
- **Register M+5** – **Top** line, this is used for long BCD and floating point data only.
- **Register M+6** – This contains numeric data associated with the **second** line display (this is described in more detail later).
- **Register M+7** – **Second** line, this is used for long BCD and floating point data only.
- **Register M+8** – This contains numeric data associated with the **third** line display (this is described in more detail later).
- **Register M+9** – **Third** line, this is used for long BCD and floating point data only.
- **Register M+10** – This contains numeric data associated with the **bottom** line display (this is described in more detail later).
- **Register M+11** – **Bottom** line, this is used for long BCD and floating point data only.

Messages

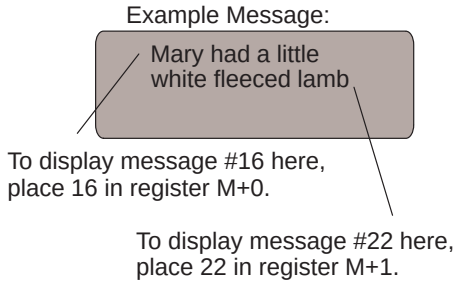
Displaying Messages on the LCD Screen

Through the OP–WINEDIT software, up to 160 predefined messages can be entered and stored in the OP–440. These messages can be 20 characters long and can include a field for the display of numeric data.

Any predefined message can be displayed on any of the four message lines. The messages entered during configuration are numbered 1 thru 160. To display a particular predefined message on the display, simply place that message's number in the message selection register.

For example, let's assume that we have defined message #16 as "Mary had a little" and message #22 as "white fleeced lamb". If we wanted to put these two lines on the top and second lines respectively, we would simply need to put the number 16 in register M+0 and 22 in register M+1.

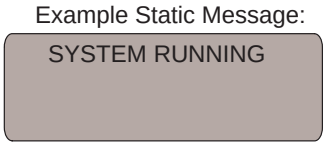
If any number other than 1 thru 160 is placed in a message selection register, the associated line will not change.



There are two types of messages which may be displayed on this panel, **Static** and **Dynamic** messages.

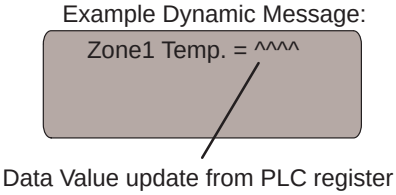
Static Messages

Static messages are text displays which have *no* embedded data. The static messages may be displayed when an event or condition becomes true. You enter the messages during configuration.



Dynamic Messages

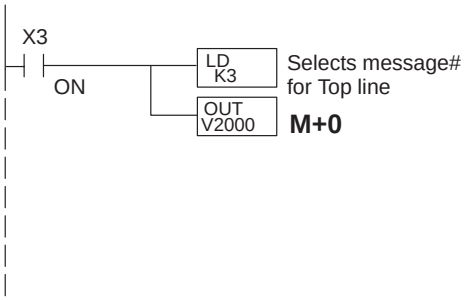
Dynamic messages are text messages which include embedded data. These messages are used to present the operator with important PLC data. This data is information which helps the operator closely monitor and control the machine or process.



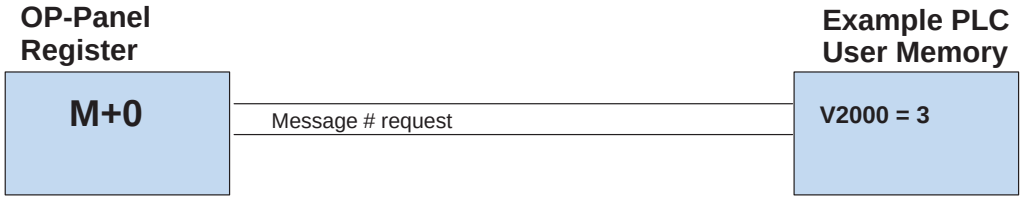
Displaying Messages

The logic required to display the configured message is quite simple. Simply put the message number (1–160) in the memory location that corresponds to the line on which you want the message displayed. The figure below demonstrates an example of a Static message.

Static Message Operation



In this example, if the PLC's input signal X3 is ON, the 16 bit integer (K3) value is placed in Word register V2000 (M+0), selecting message #3 to be displayed on the top line.



Static Display

Description

All supported CPUs use the first OP-panel register for displaying a top line static message.

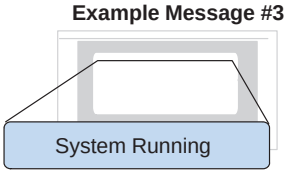
Your ladder logic program must sequence the message being displayed by placing an integer value (1–160) in register M+0. For second line static messages use register M+1 for message selection. Use M+2 for third line static messages and M+3 for bottom line static messages.

The OP-panel operating system automatically updates the latest messages according to values placed in the highlighted registers.

Top Line Static Message

Register	Value	Function
M+0	**3**	Top line message selection
M+1		Second line message selection
M+2		Third line message selection
M+3		Bottom line message selection
M+4		Top line data
M+5		Top line data 2
M+6		Second line data
M+7		Second line data 2
M+8		Third line data
M+9		Third line data 2
M+10		Bottom line data
M+11		Bottom line data 2

Example Message #3



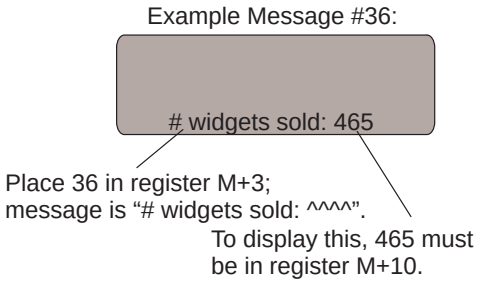
Dynamic Message Operation

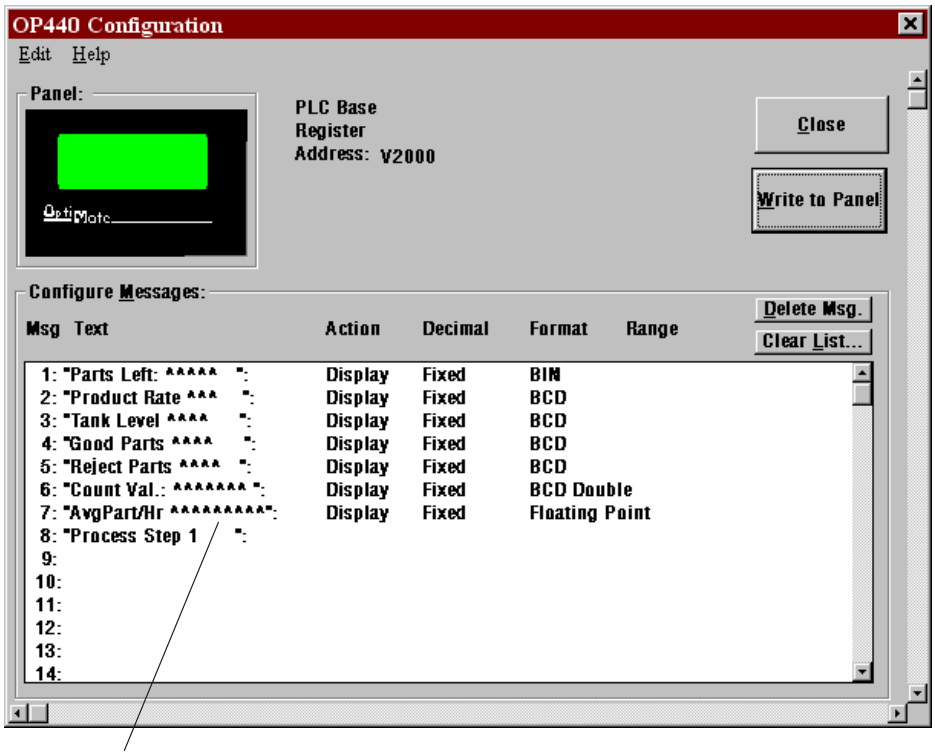
You may program message numbers 1–160 to be used as dynamic messages. One numeric field per line is allowed. Dynamic messages may be displayed on any of the display lines. The maximum number of digits which may be displayed is five if binary data format is used or eight if BCD is used when using a single 16–bit register. The largest number that can be displayed is 99,999,999 when using 32–bit format, and this must be done using BCD. The figure below shows an OP–WINEDIT screen for programming dynamic messages.

Enter the message text and place the caret (^) symbol(s) depending on the number of digits you would like to display. The value range which may be displayed is 0–65,535 integer or 0–99999999 BCD. Choose binary, BCD, or BCD double format and fixed point decimal placement. When choosing the data format for ***Direct***Logic PLCs use BCD format, and with Allen-Bradley PLCs use binary.

For dynamic messages which require fixed decimal point placement within the value, you must use the OP–WINEDIT to perform parameter placement type. For fixed position decimal points you must enter the decimal directly into the message text, such as Zone1 Temp = ^^**.**^^.

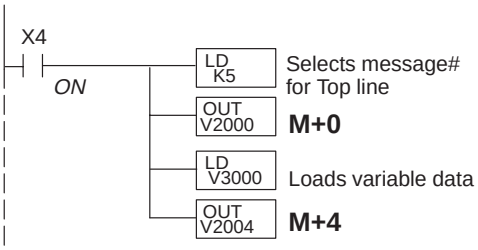
For example, let's say message #36 is "# widgets sold: ^^^". Let's also say that 465 widgets have been sold today. To display the current number of widgets sold on the bottom line of the display, you would place 36 in register M+3 and 465 in register M+10. The bottom line would then display: "# widgets sold: 465".



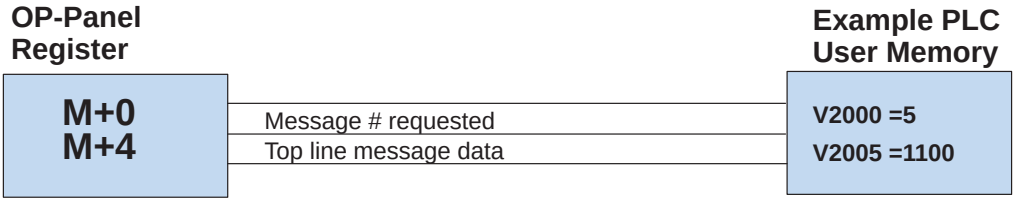


Examples of dynamic messages. Notice the caret (^) symbols, which is where data will be when the message is displayed.

Dynamic Message Top Line

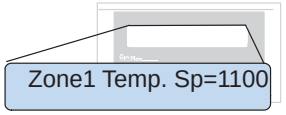


In this example, if the PLC's input signal X4 is ON, the 16 bit integer (K5) value is placed in Word register V2000 (M+0) selecting message #5 to be displayed on the top line. The data value in register V3000 (let's say 1100) is moved into V2004 (M+4), which is embedded in the top line message. The top line data value will update as long as X4 is enabled (ON).



Remember, your ladder logic program must select the message being displayed by placing an integer value between 1 and 160 (message #) in register M+0. The embedded data for the top line message is controlled by loading a 16 bit value into register M+4.

Example Message #5

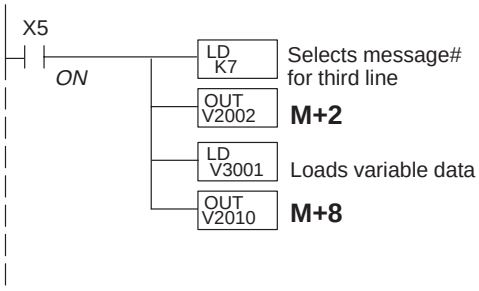


The highlighted registers M+0 and M+4 in this figure result in displaying this top-line dynamic message.

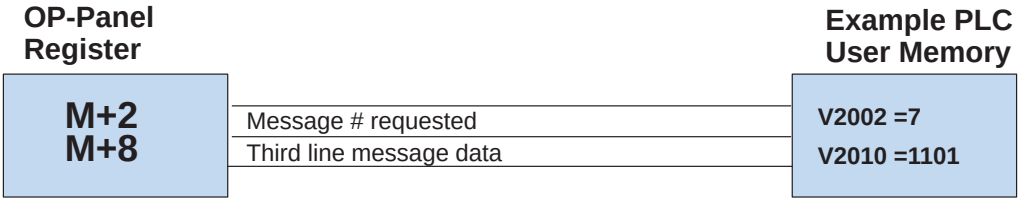
Top Line Dynamic Message

Register	Value	Function
M+0	**5**	Top line message selection
M+1		Second line message selection
M+2		Third line message selection
M+3		Bottom line message selection
M+4	**1100**	Top line data
M+5		Top line data 2
M+6		Second line data
M+7		Second line data 2
M+8		Third line data
M+9		Third line data 2
M+10		Bottom line data
M+11		Bottom line data 2

Dynamic Message Third Line

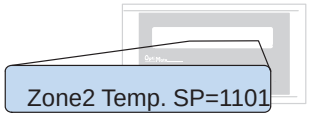


In this example, if the PLC's X5 input signal is ON, the 16 bit integer (K7) value is placed in Word register V2002 (M+2) requesting message #7 to be displayed on the third line. The data value in register V3001 (let's say 1101) is moved into V2010 (M+8), which is embedded in the third line message. The third line data value will update as long as X5 is enabled (ON).



Remember, your ladder logic program must select the third line message being displayed by placing an integer value between 1 and 160 (message #) in register M+2.

Example Message #7



The highlighted registers shown in this figure results in displaying this third-line dynamic message.

Third Line Dynamic Message

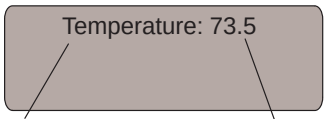
Register	Value	Function
M+0		Top line message selection
M+1		Second line message selection
M+2	**7**	Third line message selection
M+3		Bottom line message selection
M+4		Top line data
M+5		Top line data 2
M+6		Second line data
M+7		Second line data 2
M+8	**1101**	Third line data
M+9		Third line data 2
M+10		Bottom line data
M+11		Bottom line data 2

Displaying Data With a Decimal Point

The OP–440 panel allows you to display fixed point numbers, which are numeric values that have a known decimal point placement and are simply handled as integer values within the PLC program. The only time you see an actual decimal point is on the LCD display. An example of a fixed point number is a program that uses temperature as a control variable, and within the program all temperatures are scaled in tenths of a degree. The values are integer, so a temperature of 73.5 degrees would be 735 in a data register. For the convenience of the operator, you would want the LCD display to include the decimal.

Fixed point numbers are handled by simply placing a decimal point or period in the message field during configuration. For example, let's say you want to display the message "Temperature: 73.5" on the top line, and the message is #47. Enter message #47 as "Temperature:^^^**.**^" during configuration.

Example Message #47:



Place 47 in register M+0;
message is "Temperature: ^^^.^"

To display this, 735 must be in register M+4.

Displaying BCD and Binary Numbers

Normally, numeric values to be displayed are values contained in one 16-bit register. One 16-bit register will handle values between 0 and 65535 in binary form, or between 0 and 9999 in BCD form. For these type numbers, register M+4 is used for the numeric value for the top line, M+6 for the second line, M+8 for the third line, and M+10 is used for the bottom line.

BCD and Binary Numbers Display

Register	Value	Function
M+0		Top line message selection
M+1		Second line message selection
M+2		Third line message selection
M+3		Bottom line message selection
M+4		Top line data
M+5		Top line data 2
M+6		Second line data
M+7		Second line data 2
M+8		Third line data
M+9		Third line data 2
M+10		Bottom line data
M+11		Bottom line data 2

Displaying BCD Double Numbers

The OP–440 will handle large numeric numbers. If you select the option **BCD Double** when the display message is being defined, your display can handle numbers between 0 and 99,999,999. The panel will use data in the register pair M+4 and M+5 for the top line, M+6 and M+7 for the second line, M+8 and M+9 for the third line, and use M+10 and M+11 for the bottom line. **The data must be in BCD.**

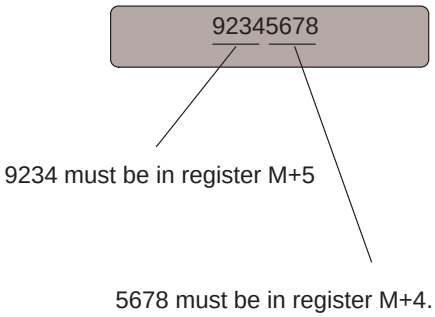
BCD Double Numbers Display

Register	Value	Function
M+0		Top line message selection
M+1		Second line message selection
M+2		Third line message selection
M+3		Bottom line message selection
M+4		Top line data
M+5		Top line data 2
M+6		Second line data
M+7		Second line data 2
M+8		Third line data
M+9		Third line data 2
M+10		Bottom line data
M+11		Bottom line data 2

When placing a BCD double number in the display registers, the first register numerically in the sequence of two registers (M+4, M+6, M+8 or M+10) will contain the four least significant digits of the number. The second register in the sequence (M+5, M+7, M+9 or M+11) contains the data for the four most significant digits of the BCD double number.

For example, to display the number 92345678 on the top line of the display, the top line data registers, M+4 and M+5, must contain 5678 and 9234 respectively.

Example: BCD Double



Displaying Floating Point Numbers

The OP–440 has the capability to display Floating Point (or Real) numbers if you select the option **Float** when the display message is being defined in the OP–WINEDIT software.

Floating point numbers can only be used with the D2–250, D3–350, and D4–450 CPUs since they are the only compatible CPUs that support the IEEE 32-bit floating point number format, which is where the floating point numbers are stored. They always occupy two 16-bit register locations regardless of the size of the number. See the PLC User Manual for more information on the IEEE 32-bit floating point number format.

An IEEE 32-bit floating point number has a range of –3.402823E+38 to +3.402823E+38. The OP–440 will be able to display any number within that range. The panel always uses the format ±X.XXE±XX to display the numbers.

The panel does not have the ability to display all the significant digits of a floating point number, it only displays the first three significant digits. The OP–440 truncates the remaining digits so you always see the true number. The two examples below show the data contained in the PLC registers and the corresponding value displayed on the panel in its format. Notice how the data is truncated.

The configuration of a floating point number message is similar to any other message. First, you select the message number, then you type in the text using nine caret symbols (^) as a place holder for each of the nine floating point number symbols. Next, select the **Float** option for the data format.

Example: Floating Point Numbers

PLC Registers	OP–440 Display
12301.789	+123E+04
123.96783	+123E+02

Let's say you wanted to configure message #58 to display a floating point number. In the OP–WINEDIT software, select OP–440 as the module type, and then select message #58 with the mouse. Type in the following message: "Float Pt ^^^^^^^^^" and select floating point as the message format.

To display a number , simply move it into the desired display line data registers and load the appropriate message number into the corresponding line message selection register. For example, if you display the number 632.15 in message #58, it will be displayed as "Float Pt # +632E+02".

Memory Mapping Process

Each OP–440 is assigned 192 bits of PLC user memory which will be used as the OP-panel database. The ladder logic program must access this assigned OP-panel memory. Let's take a closer look at this user memory and how it relates to the OP-panel features.

OP Base Register Memory Definition

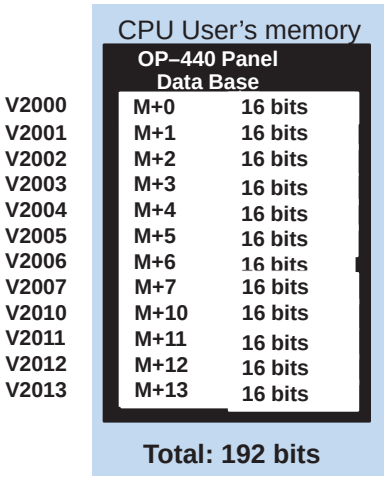
As discussed earlier, regardless of which PLC product you are using the base registers address M+0 through M+11 are formatted the same. In this manual, when the terms M+0 through M+11 are used, this identifies which base register(s) are affected for the topic being covered.

Base Address Manual Reference		Function Description
M+0	=	Top line message selection
M+1	=	Second line message selection
M+2	=	Third line message selection
M+3	=	Bottom line message selection
M+4	=	Top line data
M+5	=	Top line data 2
M+6	=	Second line data
M+7	=	Second line data 2
M+8	=	Third line data
M+9	=	Third line data 2
M+10	=	Bottom line data
M+11	=	Bottom line data 2

Operator Panel Base Memory

PLC user memory is assigned to each panel with the OP–WINEDIT configuration software. For new OP-panels and add-on applications, the programmer must define twelve 16 bit registers for PLC interface. Below is a figure showing memory layout for DL05, DL105, DL205, D3–350, and DL405 PLC's and uses V2000–V2013 for the OP–440 panel. See the next page for other PLC product memory usage examples.

You must reserve 192 bits (twelve 16-bit registers or twenty-four 8-bit registers) which are used to process data between the panel and your PLC. You must configure the **Base** register for the OP-panel. This base register address is stored in the OP-panel program.



OP-Panel User Memory

Let's examine the different address conventions for ***Direct***LOGIC and Allen-Bradley. For example, the ***Direct***LOGIC address references are **octal**, and the Allen-Bradley is **decimal**. The ***Direct***LOGIC DL05/DL105/DL205/D3–350/DL405 OP-panel address uses V-memory registers which are 16-bit registers. The DL305 family uses reference assignments with 8-bit registers. This means that the DL305 will require twenty-four 8 bit registers for data handling. The Allen-Bradley memory is defined with a reference **(Nx)** which represents the memory area and **(:n)** which defines the word within the memory area. Please refer to the appropriate CPU User manual for the PLC product you are using.

DirectLOGIC DL05/DL105/DL205/D3–350/DL405

Example Address		Function
V2000	**M+0**	Top line message selection
V2001	**M+1**	Second line message selection
V2002	**M+2**	Third line message selection
V2003	**M+3**	Bottom line message selection
V2004	**M+4**	Top line data
V2005	**M+5**	Top line data 2
V2006	**M+6**	Second line data
V2007	**M+7**	Second line data 2
V2010	**M+8**	Third line data
V2011	**M+9**	Third line data 2
V2012	**M+10**	Bottom line data
V2013	**M+11**	Bottom line data 2

DirectLOGIC DL305 (DL330 and DL340)

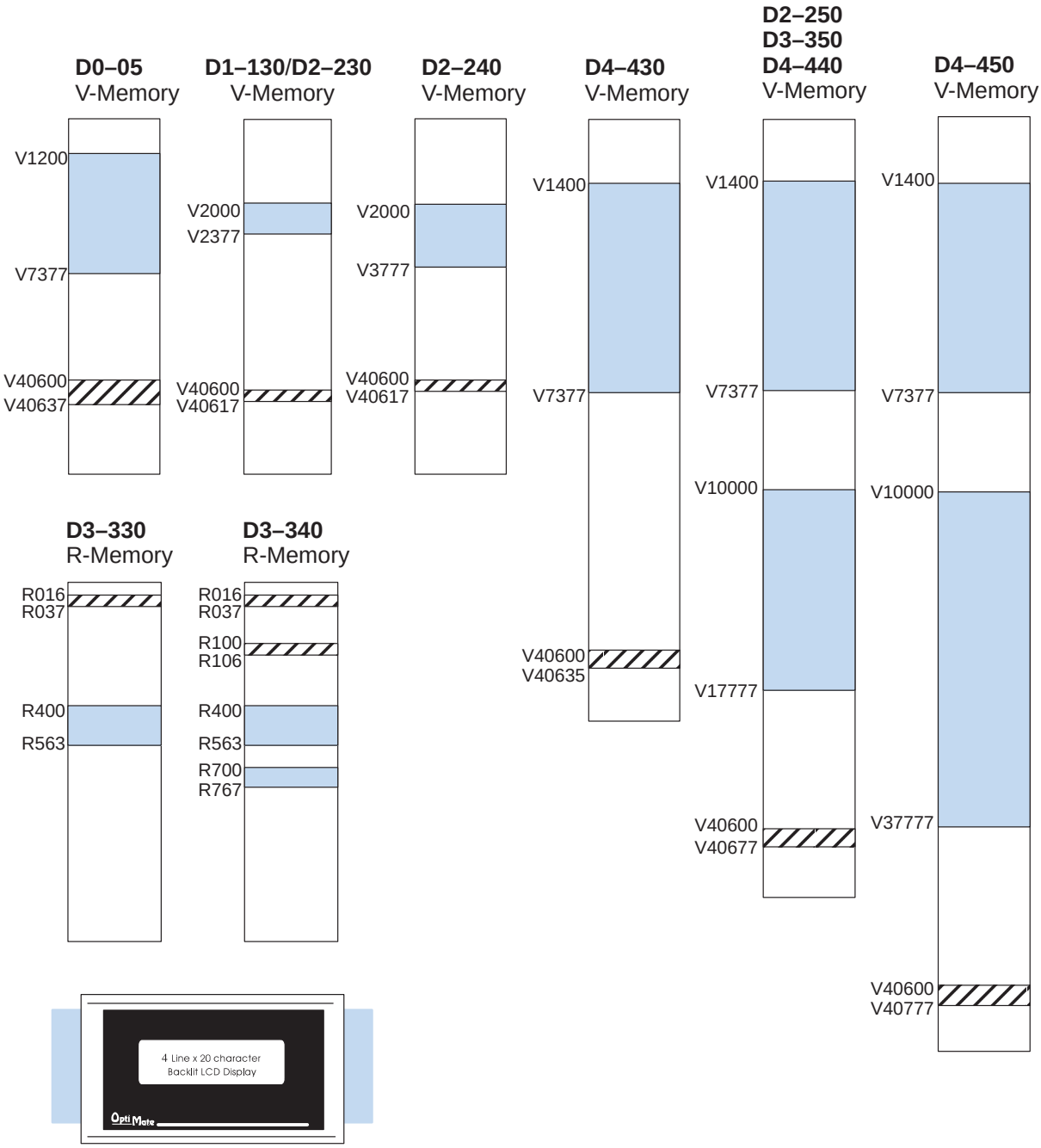
Example Address		Function
R400/R401	**M+0**	Top line message selection
R402/R403	**M+1**	Second line message selection
R404/R405	**M+2**	Third line message selection
R406/R407	**M+3**	Bottom line message selection
R410/R411	**M+4**	Top line data
R412/R413	**M+5**	Top line data 2
R414/R415	**M+6**	Second line data
R416/R417	**M+7**	Second line data 2
R420/R421	**M+8**	Third line data
R422/R423	**M+9**	Third line data 2
R424/R425	**M+10**	Bottom line data
R426/R427	**M+11**	Bottom line data 2

OP Panel User Memory (Cont.)

Allen-Bradley SLC 5/03, 5/04 and Micrologix

Example Address		Function
N7:0	**M+0**	Top line message selection
N7:1	**M+1**	Second line message selection
N7:2	**M+2**	Third line message selection
N7:3	**M+3**	Bottom line message selection
N7:4	**M+4**	Top line data
N7:5	**M+5**	Top line data 2
N7:6	**M+6**	Second line data
N7:7	**M+7**	Second line data 2
N7:8	**M+8**	Third line data
N7:9	**M+9**	Third line data 2
N7:10	**M+10**	Bottom line data
N7:11	**M+11**	Bottom line data 2

*Direct*LOGIC **User Memory Overview**



User Data Space available for OP-panels

Internal Relay Memory

DirectLOGIC PLCs use octal addressing, as indicated by the shaded areas.