

Understanding the Features

In This Chapter. . . .

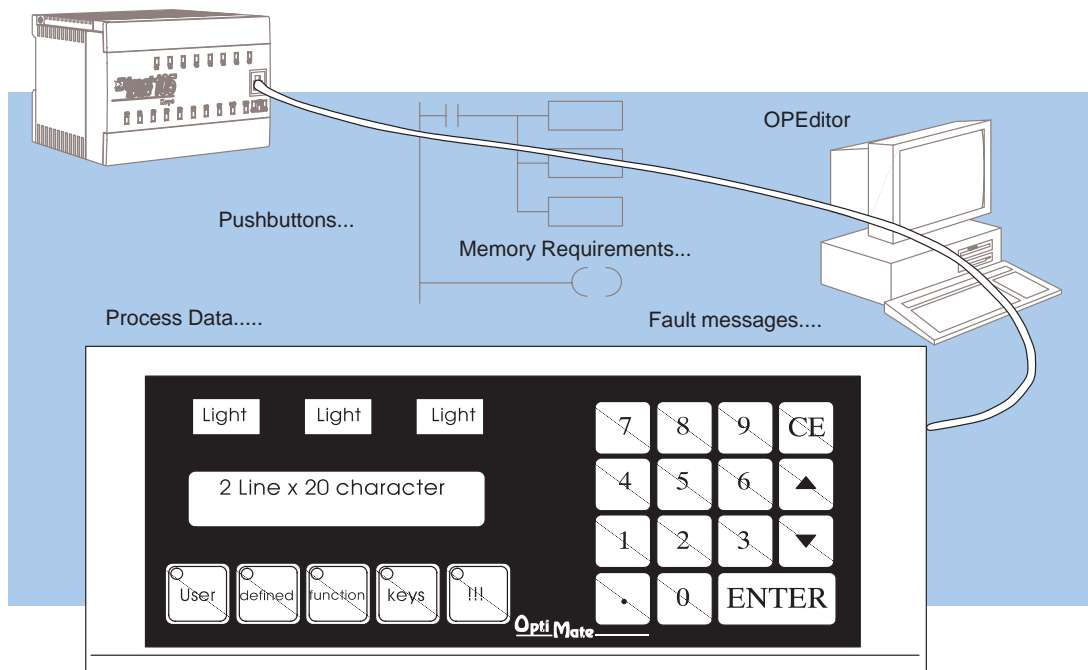
- Learning the Features
 - Status and Control Registers
 - Message and Menu Operations
 - Displaying Messages
 - Menu Operations (OP-1510 Only)
 - Pushbuttons and Lamps
 - Memory Mapping Process
 - *Direct*LOGIC User Memory Overview
 - Mapping Operation
 - Mapping Example (DL105/DL205/DL350/DL405)
 - Mapping Example (DL330/DL340)
-

Learning the Features

In this section, the subject of how to use both the OP- 1500 and OP-1510 features is described. The details for using pushbuttons, lamps, messages, and menu operations are covered. We recommend that you study this chapter before attempting to configure and use the various OP-panel features. As you proceed through this chapter, relate the topics discussed with how your Operator panel may be implemented. The ladder logic structure presented in this chapter may be applied to most PLC products which are used with the OptiMate OP-1500 and OP-1510 units.

Regardless of which PLC product is being implemented the concepts discussed in this chapter are applicable. For training purposes, the following figures use small example programs which display **Direct**LOGIC instruction elements and address references. Once again this section is showing concepts for using the panel features. For complete **Direct**LOGIC examples and other PLC solutions such as Allen-Bradley, please refer to Application Examples in this manual's Appendix. Let's now study the various features available.

- Message and Menu Operations
- Memory Mapping Process
- Controlling the Lamps
- Using the Pushbuttons
- Static Messages
- Dynamic Messages
- Interactive Messages
- Menu Messages



Status and Control Registers

Status and Control Register Overview

The OP-panels communicate to the PLC through user defined PLC data registers. The starting or “Base” register is assigned during panel configuration and automatically occupies eight consecutive 16-bit data registers. In this manual the registers are identified as m+0, M+1, m+2, thru m+7. Each OptiMate panel which is connected to the PLC maintains separate Status and Control registers within the PLC. These registers (m+6, m+7) contain information to monitor and control individual OP-panel functions and features. Shown in the figure below, base registers m+6 and m+7 **must have** bit level access by the user control program. That means Status and Control **word** register memory (OP-panel Base registers) must be mapped to user memory bit registers. These bit registers are referred to as Internal Control Relays such as C0, C1, etc.

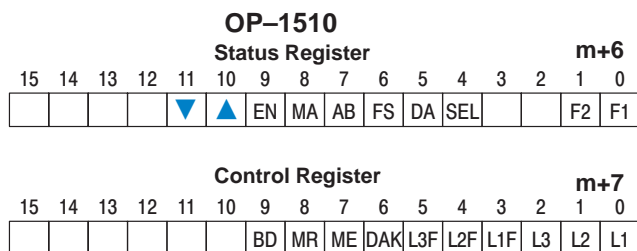
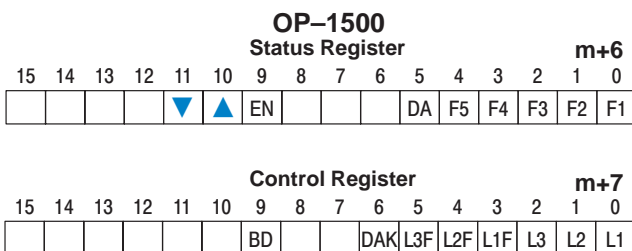


TIP: Depending on which CPU is used and the Base memory which is assigned, the Status and Control registers *may not* require the mapping process.

Bit Level Access

Once again, the Status and Control bits are monitored and manipulated by the PLC ladder logic. For discrete operations such as pushbuttons and lamps, the registers m+6 and m+7 bits are accessed by the PLC control program. The figure below shows the fixed definition of the Status and Control register bits. These bits are labeled F1 (pushbutton 1), F2 (pushbutton 2), for example. The bits and associated labels are described on the following page. First examine the figure below to begin understanding the OP-panel registers and functions. You must structure your ladder logic program to coordinate OP-panel functions asynchronously. This means the operations are triggered successively—not by a clock, but by the completion of an operation.

Register	Function
m+0	Top line message selection
m+1	Bottom line message selection
m+2	Top line data/menu function
m+3	Decimal point, top line
m+4	Bottom line data
m+5	Decimal point, bottom line
m+6	Status register
m+7	Control register



Status and Control Register Definition The Status register (m+6) and Control register (m+7) are used for data exchange between the OP-panel and PLC program. The figure below shows the individual bits within each data register. The function of the Status and Control register bits are described below.

Register	Function
m+0	Top line message selection
m+1	Bottom line message selection
m+2	Top line data/menu function
m+3	Decimal point, top line
m+4	Bottom line data
m+5	Decimal point, bottom line
m+6	Status register
m+7	Control register

Status Register (m+6):

F1–F5 – Are the status function for the OP-panel definable pushbuttons. These bits are set to 1 (ON) when the button is active. (F3–F5 OP–1500 only)

DA – Data Available is for data entry operations. The DA is set to 1 when new data has been entered, and ENTER key has been pressed.

SEL – Set to 1 when SELECT key is pressed. (OP–1510 only)

FS – Function Select. Indicates that a function has been selected through use of the menu tree. The function number will be held in register *m+2*. (OP–1510 only)

AB – Abort. Set to 1 when button pressed. (OP–1510 only)

MA – Menu Active. Set to 1 when menu button is pressed . Cleared when ME bit is reset. (OP–1510 only)

EN, ▲, ▼ – Numeric keypads Enter, Up arrow, and Down arrow button status. These status bits are set to 1 (ON) when button is active.

Control Register (m+7):

L1–L3 – Lamp ON/OFF control for each of the three annunciators. Set to 1 (ON) to turn the lamp on.

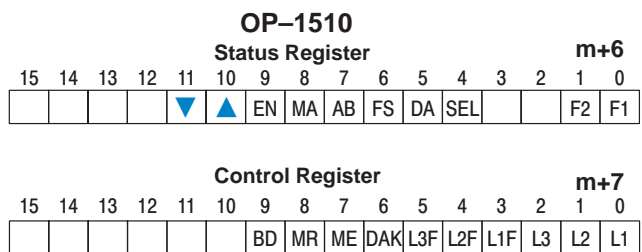
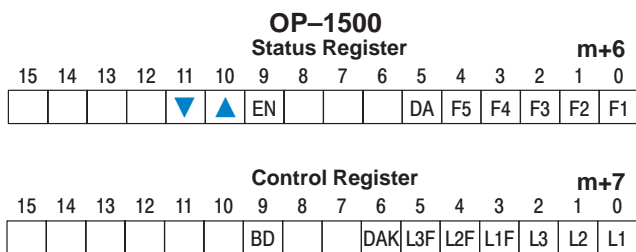
L1F–L3F – Lamp Flash control for each of the three annunciators. To flash the lamp set Lamp and Lamp Flash bits both to 1 (ON).

DAK – Data Acknowledge bit is used to clear the DA bit. When set the OP-panel will clear the DA bit and allow new data entry. This bit must be cleared after the DA bit is cleared.

ME – Menu Enable. Must be set for menu operation use. Your PLC control program should clear this bit when a menu function is selected.

MR – Menu Return. If set will return to same point in menu tree as when function was started. If reset, function complete will not return to the menu.

BD– Buzzer Disable. If set to 1 buzzer does not beep when buttons are pressed.



Message and Menu Operations

Operator Panel

Three primary categories, Static, Dynamic, and Interactive messages identify the different message types. The following pages provide an overview of these message types. Let's first study a few generic examples to describe the concepts of Message and Menu Operations.

Messages

As mentioned in earlier chapters, the LCD display supports two message lines with 20 characters each. Messages which may be displayed on either the TOP or BOTTOM display lines. These message types are referred to as **Static**, **Dynamic** and **Interactive**. The message type and operator control features are defined while using the OP-WINEDIT configuration software. Let's have a closer look at the different messages supported by the OP-1500 and OP-1510.

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 using the OPEditor software during configuration.

Example Static Message:

SYSTEM RUNNING

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/or control the machine or process.

Example Dynamic Message:

Zone1 Temp SP: ^^^^

Data Value update from PLC register

Interactive Messages

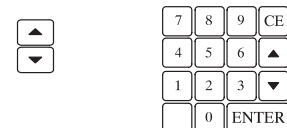
An Interactive message is commonly used for prompting the operator for data entry. You will use this type of message for changing values which are stored in the PLC registers. These values are items such as setpoints, upper and lower limits etc...

Interactive messages may be configured to enter data using either the arrow UP/DOWN keys or NUMERIC KEYPAD.

Interactive Message:

Enter New Temp. = ^^^^

Data Value entered by Operator

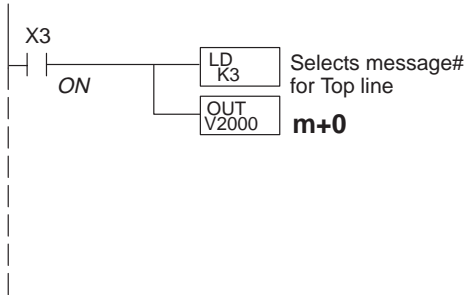


TIP: While configuring Static messages the operator control parameters *do not* need to be changed in the OPEditor. The message operator control parameters default for **Display Only**.

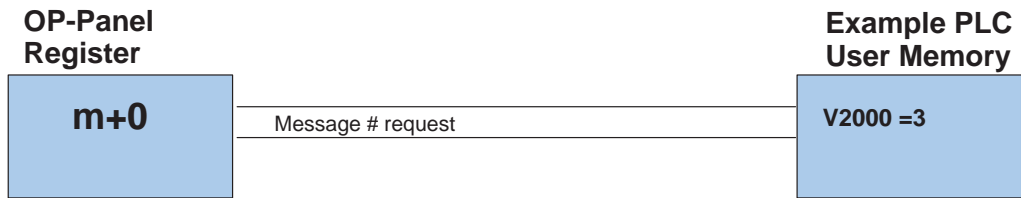
Displaying Messages

The logic required to display the configured message is quite simple. You need only put the message number (1–160) in memory location **m+0** for the top line message or **m+1** for the bottom line message. 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.



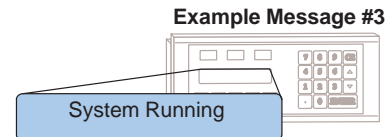
Static Display

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 Bottom line Static messages use register m+1 for message selection. The OP-panel operating system automatically updates the latest Top and Bottom line 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		Bottom line message selection
m+2		Top line data/menu function
m+3		Decimal point, top line
m+4		Bottom line data
m+5		Decimal point, bottom line
m+6		Status register
m+7		Control register



Dynamic Message Operation

Dynamic displays are text messages which include embedded data. These messages present the operator with important PLC data. The following paragraphs describe how to program Dynamic messages.

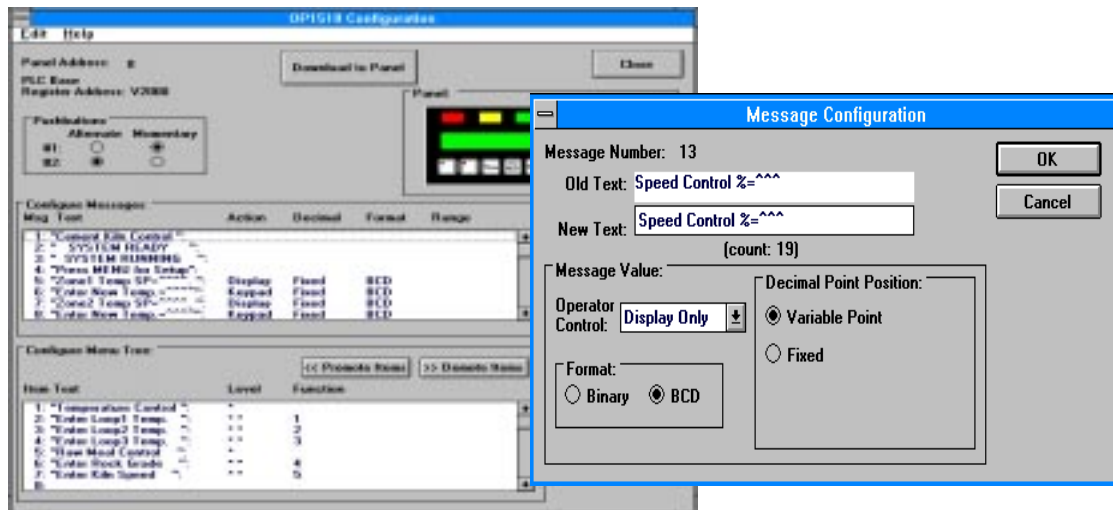
You may program message numbers 1–160 to be used as dynamic messages. Dynamic messages may be displayed on either the top or bottom display lines. The maximum number of digits which may be displayed is five (if binary data format or four if BCD). The figure below demonstrates the OPEditor screens for programming a Dynamic message.

Use the OPEditor to configure Dynamic messages. Enter the message text and place the caret (^) symbol(s) depending on number of digits you would like to display. The value range which may be displayed is 0–65,535 integer or 0–9999 BCD (Binary Coded Decimal). Choose binary or BCD format and decimal placement of either Variable Point or Fixed position. When choosing the data format for **DirectLogic** PLCs use BCD format, and with Allen-Bradley PLCs use Binary.

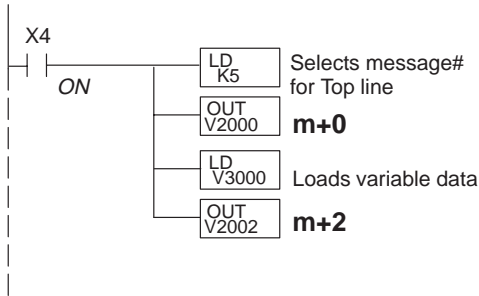
For Dynamic messages which require decimal point placement within the value, you must use the OPEditor to perform parameter placement type. For fixed position decimal points you must enter the decimal directly into the message text, such as Zone1 Temp SP= ^.^.

For displaying Variable Point numbers in a Dynamic message, the decimal is controlled with base register m+3. The m+3 values are controlled within the PLC program.

TIP: For Dynamic messages, you must configure the data format and decimal point characteristics. During configuration use the caret ^ symbol to mark the data position and length. The Operator Control parameter must also be changed to match the type and format of the data which is displayed.

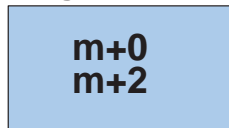


Dynamic Message Top Line

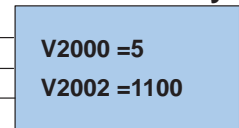


In this example, if the PLC's input signal X4 is ON, the 16 bit integer (K5) value is placed in Word register V2000 (m+0) selecting message #5 to be displayed on the top line. The data value in register V3000 is moved into V2002 (m+2) such as 1100, which is embedded in the top line message. The Top line data value will be update as long as X4 is enabled (ON).

OP-Panel Register



Example PLC User Memory



Description

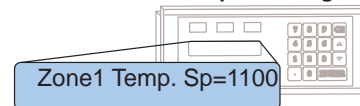
Regardless of which PLC product you are using, the following concept applies to top-line Dynamic messages.

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+2**. The highlighted registers in this figure result in displaying this top-line Dynamic message.

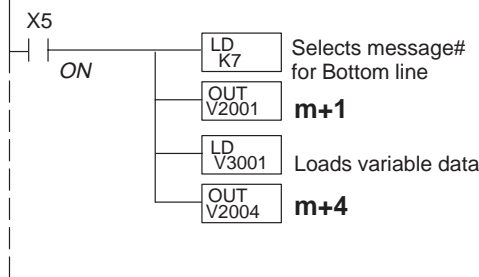
Top Line Dynamic Message

Register	Value	Function
m+0	5	Top line message selection
m+1		Bottom line message selection
m+2	1100	Top line data/menu function
m+3		Decimal point, top line
m+4		Bottom line data
m+5		Decimal point, bottom line
m+6		Status register
m+7		Control register

Example Message #5

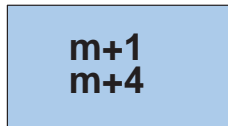


Dynamic Message Bottom Line



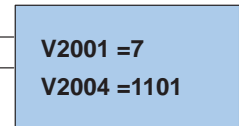
In this example, if the PLC's X5 input signal is ON, the 16 bit integer (K7) value is placed in Word register V2001 (m+1) requesting message #7 to be displayed on the bottom line. The data value in register V3001 is moved into V2004 (m+2) such as 1101, which is embedded in the top line message. The Bottom line data value will update as long as X5 is enabled (ON).

OP-Panel Register



Message # requested

Example PLC User Memory



Description

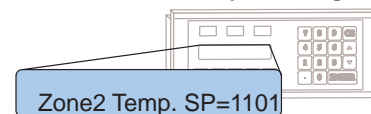
Regardless of which PLC product you are using, the following concept applies when using bottom line Dynamic messages.

Your ladder logic program must select the bottom line message being displayed by placing an integer value between 1 and 160 (message #) in register **m+1**. The highlighted register shown in this figure results in displaying this bottom-line Dynamic message.

Bottom Line Dynamic Message

Register	Value	Function
m+0		Top line message selection
m+1	7	Bottom line message selection
m+2		Top line data/menu function
m+3		Decimal point, top line
m+4	1101	Bottom line data
m+5		Decimal point, bottom line
m+6		Status register
m+7		Control register

Example Message #7



Interactive Message Operations

An Interactive message is a text display which requires operator data entry. Use these messages to enter or change values which are stored in PLC registers. Five digits may be entered in a 16-bit register using binary data format. When the interactive message is displayed the operator will be required to enter data. Check the proper PLC product user manual to verify which data formats are supported. Depending on which PLC product is used, the data format will be either binary or BCD(Binary Coded Decimal). For example, with **DirectLogic** PLCs the BCD format is commonly used, and Allen-Bradley PLCs commonly use binary. The figure below describes the requirements for configuring an Interactive message.

Interactive messages are configured within the OPEditor Message Configuration screen. An interactive message requires that you define the **Operator Control** (Numeric keypad or Arrow keys), **Format** (Binary or BCD), and **Decimal Point Position** (Fixed or Variable Point). If your interactive message requires decimal points, you must choose the operator control decimal point type. There are two types of decimal point placement which are Variable Point and Fixed placement. For **Display Only** variable point data, your control program should examine the integer value 1 through 4 in m+3 for top line, m+5 for bottom line, which will determine the place locator for decimal point. For Variable decimal points *do not* enter the decimal within the message, but enter an extra caret ^ symbol in addition to the number of digits. The variable point is then controlled by the PLC using the top and bottom line decimal point registers (m+3, m+5). For fixed decimal entries the decimal point is entered directly into the Interactive message text.

TIP: For Interactive messages, you must configure the Operator Control (arrow Up/Down or Numeric keypad), select the data format (Binary or BCD) and decimal point characteristics (fixed or floating). While configuring the Interactive message, use the caret (^) symbol for each numeric digit required within the text message.



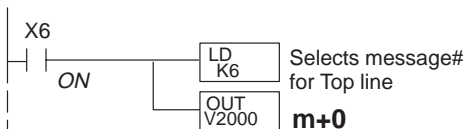
Numeric keypad Entry

When an Interactive message value is entered and you press the Enter key, the value will be placed in OP-panel data register, and the Status register DA (Data Available) will be set. The DA bit will remain on until a new message is placed in register m+0 or m+1, or until the DAK (Data Acknowledge) control bit is set.

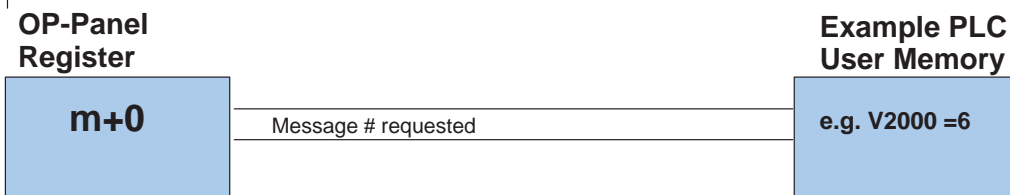
Arrow Adjustment Entry

Arrow adjust is commonly used when minimum and maximum setpoint ranges are required or setpoint value requires only minor adjustment. The arrow adjustments are only possible using the Arrow UP/DOWN Keys. As you press the up and down arrow keys the numeric value will increment and decrement respectively, one count at a time. When the adjustment is complete and you press the Enter key, the value will be placed in data register m+2 or m+4 (top or bottom line data) for display, and the DA status bit is set. The DA bit will be set until a new message is displayed or the DAK control bit is set.

Interactive Message Top Line



In this example, if the PLC's X6 input signal is ON, the 16-bit integer (K6) value is placed in Word register V2000 (m+0) requesting message #6 to be displayed on the top line.



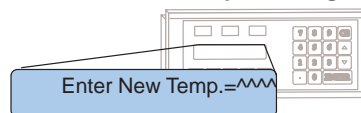
Description

Regardless of which PLC product you are using, the following concept applies when using top-line Interactive messages. Your ladder logic program must select the top line message being displayed by placing an integer value between 1 and 160 (message #) in register **m+0**. The highlighted register shown in this figure results in displaying this Top Line Interactive message.

Top Line Interactive Message

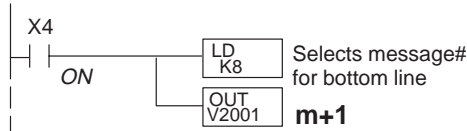
Register	Value	Function
m+0	6	Top line message selection
m+1		Bottom line message selection
m+2		Top line data/menu function
m+3		Decimal point, top line
m+4		Bottom line data
m+5		Decimal point, bottom line
m+6		Status register
m+7		Control register

Example Message #6



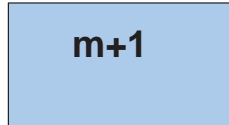
WARNING: With the OP-1510, if an Interactive menu message is selected, you may press the Clear/Abort key to escape the data entry process. In the case you *do not* enter new data, but press the ENTER key, the OP-panel will automatically load zeros into the data entry buffer.

Interactive Message Bottom Line



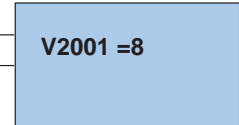
In this example, if the PLC X4 input signal is ON, the constant K8 16-bit integer value is placed in Word register V2001 (m+1) requesting message #8 to be displayed on the bottom line.

OP-Panel Register



Message # requested

Example PLC User Memory



Description

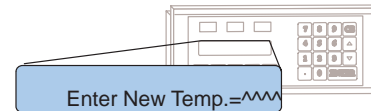
Regardless of which PLC product you are using, the following concept applies when using bottom line Dynamic messages.

Your ladder logic program must select the bottom line message being displayed by placing an integer value between 1 and 160 (message #) in register **m+1**. The highlighted register shown in this figure results in displaying this bottom line Interactive message.

Bottom Line Interactive Message

Register Value	Function
m+0	Top line message selection
m+1	8 Bottom line message selection
m+2	Top line data/menu function
m+3	Decimal point, top line
m+4	Bottom line data
m+5	Decimal point, bottom line
m+6	Status register
m+7	Control register

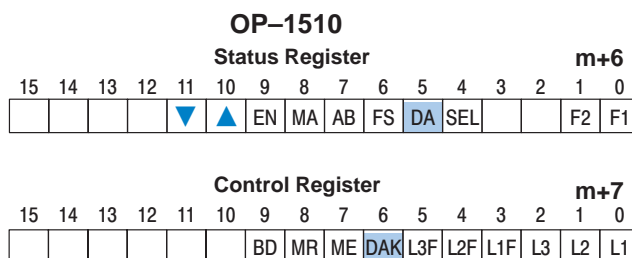
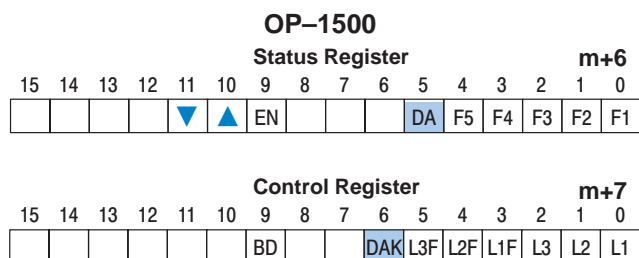
Example Message #8



Status and Control Bits used with Interactive Messages

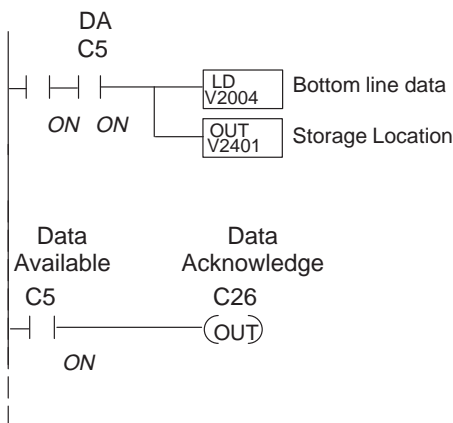
The circled registers in the figure below are required when using an **Interactive message**. As described in earlier chapters, the Interactive messages pass data values between the OP-panel and the PLC. The data exchange is coordinated with the **Data Available (DA)** and **Data Acknowledge (DAK)** bits.

Register	Function
m+0	Top line message selection
m+1	Bottom line message selection
m+2	Top line data/menu function
m+3	Decimal point, top line
m+4	Bottom line data
m+5	Decimal point, bottom line
m+6	Status register
m+7	Control register



Using the Data Available and Data Acknowledge Bits

The **DA** (Data Available) register, bit number 5 of the Status word, is controlled by the OP- 1500 and OP- 1510 operating system. This bit is turned on after the operator has entered a numeric value and pressed the ENTER key. Your ladder logic should monitor the DA bit to trigger the storage of the entered data. Use the DA bit to turn ON the Data Acknowledge (**DAK**) bit within your control program. The DAK bit is confirmation to the OP-panel from the PLC which completes handling the Interactive message.



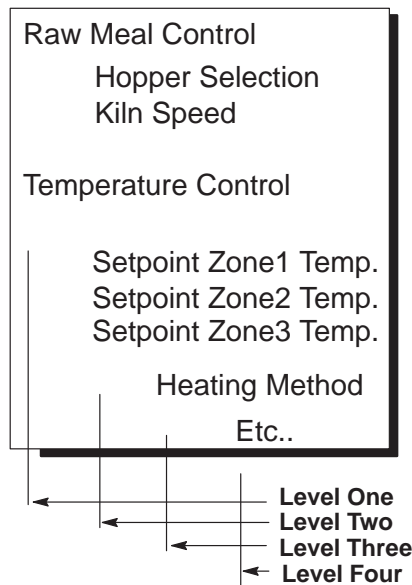
In this example, C5 represents the Data Available bit. When C5 is ON then C26 Control relay is energized.

- * Status Register (m+6) = V40600: C0 – C17
- * Control Register (m+7) = V40601: C20 – C37

Menu and Sub-Menus (OP-1510 Only)

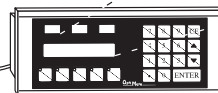
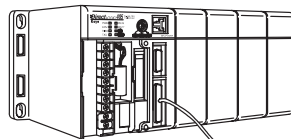
The OP- 1510 supports Menu and Sub-Menu functions to select and change register values in your PLC. You may have up to four levels of Menu/Sub-Menu functions. Plan your Menu structure according to your operator interface requirements. You should structure the menu tree to allow operator access to information which is most often used, and the sub-menu operations accordingly.

Your Menu Plan



You configure your menu and sub-menu items using the OPWINEDIT software. Each menu item is assigned an Item Level (1-4) as well as type which determines if the menu message selects a sub-menu or function. Menu items which are configured as Functions allow the operator to select and perform user defined interaction. Use the OP-WINEDIT on-line help for more details on how to configure a menu functions.

PLC



Meal Hopper (1-3) : 1
Arrow UP/DOWN =

Menu Items

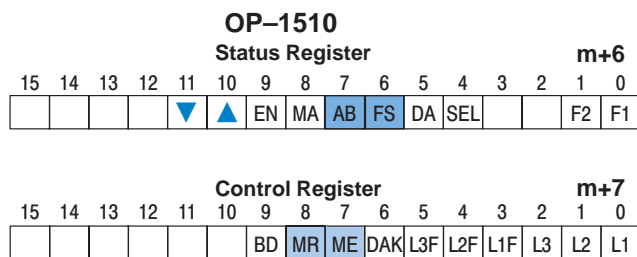
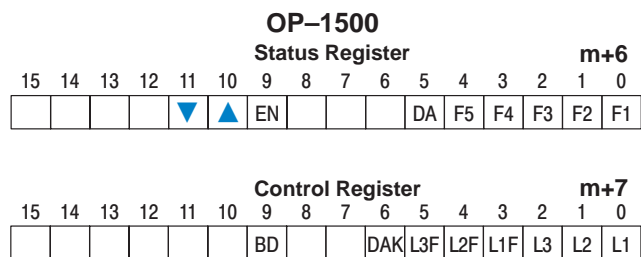
Configure your menu and sub-menu items using the OP-WINEDIT software. Each item number must have an Item Level (1-4) as well as Item Type which determines whether the menu message is a sub-menu or function. Menu items which are configured as functions allow the operator to SELECT and initiate interactive operator actions.

Your ladder logic program controls the Menu Enable (**ME**), and Menu Return (**MR**), bit 7 and 8 of Control word m+7, to help coordinate these menu functions. The following pages help provide a clear understanding of the Status and Control bits which are affected while using the **Menu/Sub-Menu** functions.

Menu Operation

The OP-1510 has four additional bit functions (**AB**, **FS**, **MR**, and **ME**) which are defined within the status and control registers. These are not available with the OP-1500. The **Clear/Abort** key on the panel energizes the **AB** flag, and you can use your ladder logic to have it trigger any type of action, such as abort a function. The **FS** bit is set when you select a function via the menu. The **ME** bit enables the menu so that when you press the **Menu** key, it will display the menu. Otherwise, if you push the Menu key, nothing will be displayed. If you reset the **ME** bit to zero (0), the menu is disabled and you can perform functions or enter values, depending on how you have written your ladder logic. When the **Menu Return (MR)** bit is energized (ON) with the ME bit also energized (ON), you will be *returned* to the menu or sub-menu which was displayed, when completing the function select process by entering data and pressing the Enter key. If you do not use the **MR** bit, the OP-1510 will not automatically return into the menu.

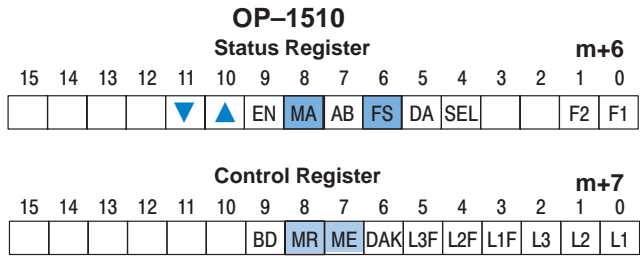
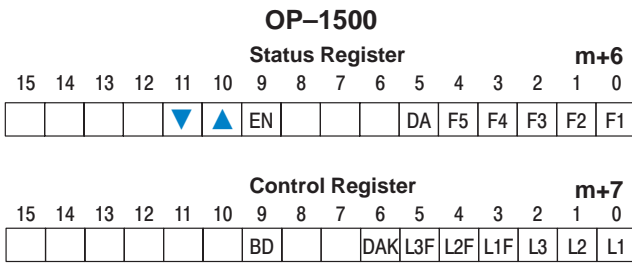
Register	Function
m+0	Top line message selection
m+1	Bottom line message selection
m+2	Top line data/menu function
m+3	Decimal point, top line
m+4	Bottom line data
m+5	Decimal point, bottom line
m+6	Status register
m+7	Control register



Using the Menu bits

Your ladder logic program must energize the **ME** (Menu Enable) bit within the Control register. When the ME bit is ON the operator may use the Menu, Clear/Abort and Select keys located on the OP-1510. With the ME enabled, you may view and SELECT the configured menus being displayed by the OP-panel. Use the arrow Up/Down keys to scroll the configured menus. While the ME bit is energized the register m+2 maintains the Menu function number. If a particular function is chosen with the **Select** key, the OP panel energizes the **Function Select (FS)** bit in Status register (m+6). When your program sees the FS bit set, it should decode the function number placed into register (m+2), clear the ME bit and execute the selected function.

Register	Function
m+0	Top line message selection
m+1	Bottom line message selection
m+2	Top line data/menu function
m+3	Decimal point, top line
m+4	Bottom line data
m+5	Decimal point, bottom line
m+6	Status register
m+7	Control register



Using Menu and Function Select bits

If the Menu Enable bit is ON and the Select key is pressed, the Function Select bit is set (FS=1) which enables the proper data entry (function) to operate. The ME bit should be set OFF until the function is complete. The interactive menu operation is performed using the DA and DAK bits as mentioned on the previous page. This bit-handling operation is asynchronous and requires your ladder logic to coordinate Menu Enable and Function Select tasks. After completing the operation you must set the ME bit ON, to begin the next menu function. Examples provided later will help you better understand these operations.

Pushbuttons and Lamps

The OP-1500 and OP-1510 both contain user-defined pushbuttons and lamps. Pushbuttons may be used to begin events or tasks within the PLC, such as start/stop control. The following pages describe concepts of how to monitor and control the pushbuttons and lamps on your OP-panel.

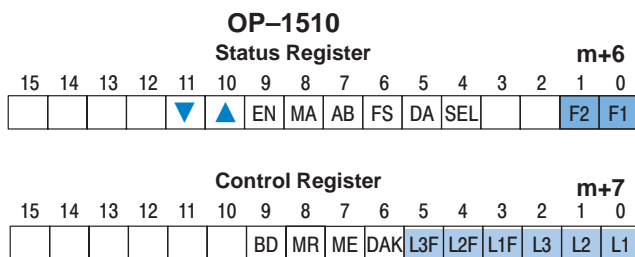
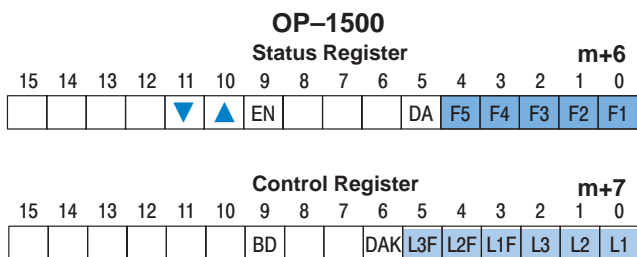
Pushbutton Operation

The OP-panel pushbutton inputs are monitored for ON/OFF conditions in your PLC ladder logic program. From a practical point of view we need to control and monitor the bits in the status and control registers on an individual basis. The OP-1500 pushbuttons are assigned to the *first five bits* of the **Status Register (m+6)**. The OP-1510 has two pushbuttons and are defined as the *first two bits* within the **Status Register (m+6)**. Examine the highlighted Status bits below which show each user definable pushbutton.

Lamp Operation

The lamps on both of the OP-panels may be user defined to display status or condition of any operation being controlled within the PLC. The lamp usage may differ from application to application. Concepts of programming and using the individual lamps and flash features are shown below. The green, yellow and red lamps on both panels are controlled by the *first six bits* of the Control Register (m+7). The first control register bits (L1, L2, and L3), are used to illuminate the individual lamps ON/OFF status. The next three bits (L1F, L2F, and L3F) control the flashing option for each of the three lamps. In an actual application, the lamp bit must be turned on before the lamp flash bit is energized.

Register	Function
m+0	Top line message selection
m+1	Bottom line message selection
m+2	Top line data/menu function
m+3	Decimal point, top line
m+4	Bottom line data
m+5	Decimal point, bottom line
m+6	Status register
m+7	Control register

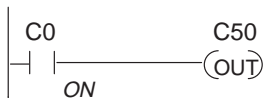




NOTE: In the following examples we assume that the OP-panel is configured with a base register of **DirectLOGIC** address V2000. In this case, Status register m+6 is V2006 which we will assume has been mapped to V40600, the **DirectLogic** internal Control Relay memory. Mapping details are discussed later in this chapters.

Pushbutton Example

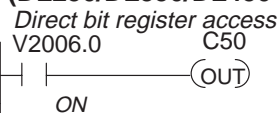
The pushbutton example shown here is using **DirectLOGIC** PLC address references. The equivalent instructions for *other* PLC products supported are demonstrated in the "Application Examples" located in Appendices B–D of this manual.



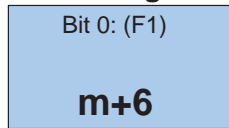
In this example, C0 represents the pushbutton No.1 (F1) via the mapping process. When pushbutton No.1 is pressed C0 is true and Coil C50 is energized.

* Status Register (m+6) = V40600: C0 – C17

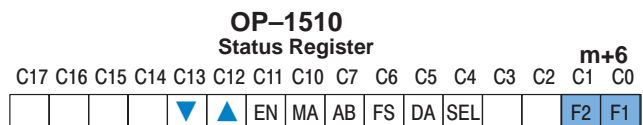
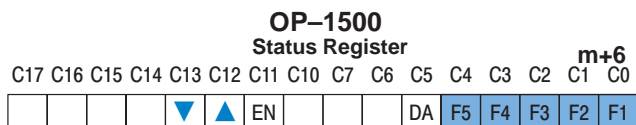
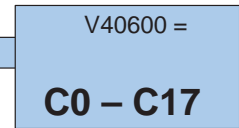
(DL250/DL350/DL450 Only)



Status Register



PLC Program User Memory



Pushbuttons Using Direct Access to Status Register bits

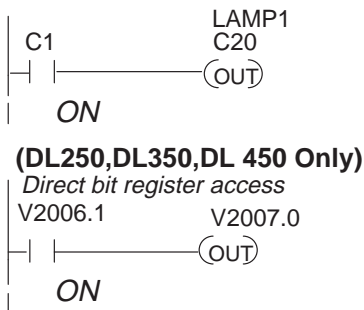
The **DirectLogic** DL250/DL350/DL450 CPUs and the Allen–Bradley SLC 5/03 and 5/04 support instructions which provide individual status bits access. This is called **Bit-of-Word** capability. For example, in the figure above, the ladder logic for the DL250/DL350/DL450 monitors the first bit of the Status word directly. Once again, our example assumes that we configured the OP-panel with a starting base address of V2000. If you were using an OP-1510, only bits 0 and 1 would be available for user-defined pushbuttons, since it only has two user-defined pushbuttons.

Pushbutton LEDs

There are LEDs located on each of the user defined pushbuttons. These LEDs indicate the pushbutton status condition is ON or OFF. You may choose the pushbutton type while configuring your OP-panel(s). There are two different operator controls, alternate or momentary, which will determine the LED response when the pushbuttons are pressed. In the case of an alternating configured pushbutton, the LED will toggle ON and OFF each time the pushbutton is pressed. With momentary configured pushbuttons the LED is ON only as long as the pushbutton is being pressed. The concept of momentary and alternating are used according to each PLC application.

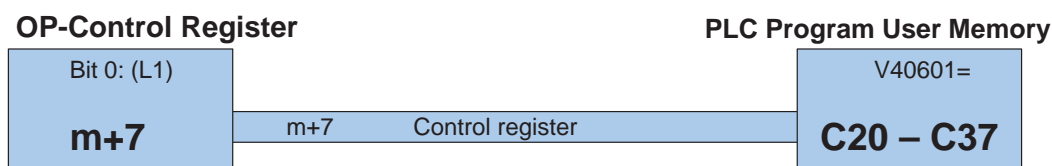
Lamp Example

The lamp examples shown here are using **Direct**LOGIC PLC address references. The equivalent instructions for *other* PLC products supported are demonstrated in the "Application Examples" located in Appendices B–D of this manual.

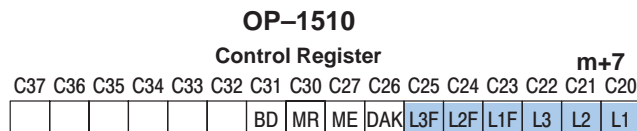
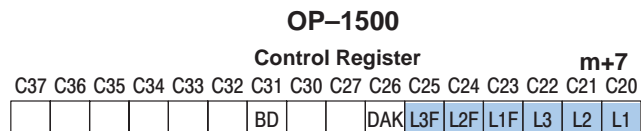


In this example, C1 represents the pushbutton No.2 (F2) via the mapping process. When *alternating* pushbutton No.2 is pressed internal Control Relay C20 is true and via mapping process Control register Bit 0 (L1 Green Lamp) is energized.

* Control Register (m+7) = V40601: C20 – C37



All lamps may be controlled using the concept shown above. You may use the Lamp Flash option by controlling the appropriate Flash bit via the ladder logic program. The example figure below demonstrates how to use the Control register Flash bits (L1F, L2F, and L3F).



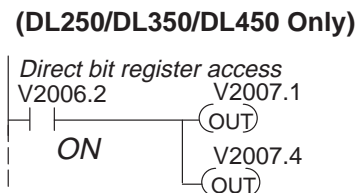
Lamp Flash

The lamp flash examples shown here are using **Direct**LOGIC PLC address references. The equivalent instructions for *other* PLC products supported are demonstrated in the "Application Examples" appendices located in this manual.



In this example, C2 represents the pushbutton No.3 (F3) via the mapping process. When *alternating* pushbutton No.3 is pressed internal Control Relay C21 and C24 are energized ON. This process manipulates Control register bit 1 and bit 4 which controls yellow lamp and flashing.

* Control Register (m+7) = V40601: C20–C37



Memory Mapping Process

Each OP-1500 or OP-1510 are assigned 128 bits of PLC user memory which will be used as the OP-panel(s) 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

Regardless of which PLC product you are using, the base registers address m+0 through m+7 are formatted the same. In this manual, when the terms m+0 through m+7 are used, this identifies which base register(s) are effected for the topic being covered. Study the figure below to begin understanding the register layout for both OP-panels.

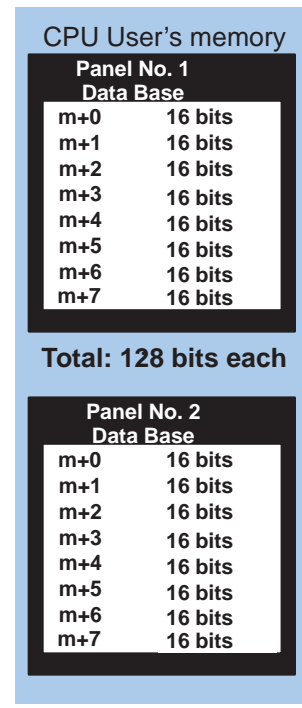
Base Address Manual Reference	Function Description
m+0 =	Top line message selection
m+1 =	Bottom line message selection
m+2 =	Top line data / menu function (OP- 1510)
m+3 =	Decimal point, top line
m+4 =	Bottom line data
m+5 =	Decimal point, bottom line
m+6 =	Status register
m+7 =	Control register

Operator Panel Base Memory

PLC user memory is assigned to each panel with the OPEditor configuration software. For new OP-panels and add-on applications the programmer must define eight 16 bit registers for PLC interface. Below is a figure showing memory layout for **Direct**LOGIC DL105,DL205,DL405 PLC's and uses V2000-V2007 for OP-panel No.1 and V2010-V2017 for OP-panel No.2. See the next page for other PLC product memory usage examples.

You must reserve 128 bits (eight 16-bit registers or sixteen 8-bit registers) which are used to process data between the Operator panel and your PLC. You must configure the **Base** register for each OP-panel using the OPEditor configuration software. This base register address is stored in the OP-panel program.

If more than one OP-panel is connected to a single CPU, you must assign a **separate** memory area for **each** OP-panel. The Base addresses assigned to each panel must not overlap. You may connect up to 31 Operator panels to a OP-9001 Communications Master, which is referred to as a multi-panel application. You must choose unused memory registers for each OP-panel within your PLC application to ensure proper data communication.



V2000
V2001
V2002
V2003
V2004
V2005
V2006
V2006

V2010
V2011
V2012
V2013
V2014
V2015
V2016
V2017

OP-Panel User Memory

Let's examine the different address conventions for PLC *Direct* and Allen-Bradley. For example, the PLC *Direct* address references are **octal**, and the Allen-Bradley is **decimal**. The *Direct* LOGIC DL105/L205/DL350/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 sixteen 8 bit registers for data handling. The Allen-Bradley memory is defined with a reference which (**Nx**) 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 within your automation system.

Direct LOGIC DL105/DL205/DL350/DL405

Example Address		Function
V2000	m+0	Top line message selection
V2001	m+1	Bottom line message selection
V2002	m+2	Top line data/menu function
V2003	m+3	Decimal point, top line
V2004	m+4	Bottom line data
V2005	m+5	Decimal point, bottom line
V2006	m+6	Status register
V2007	m+7	Control register

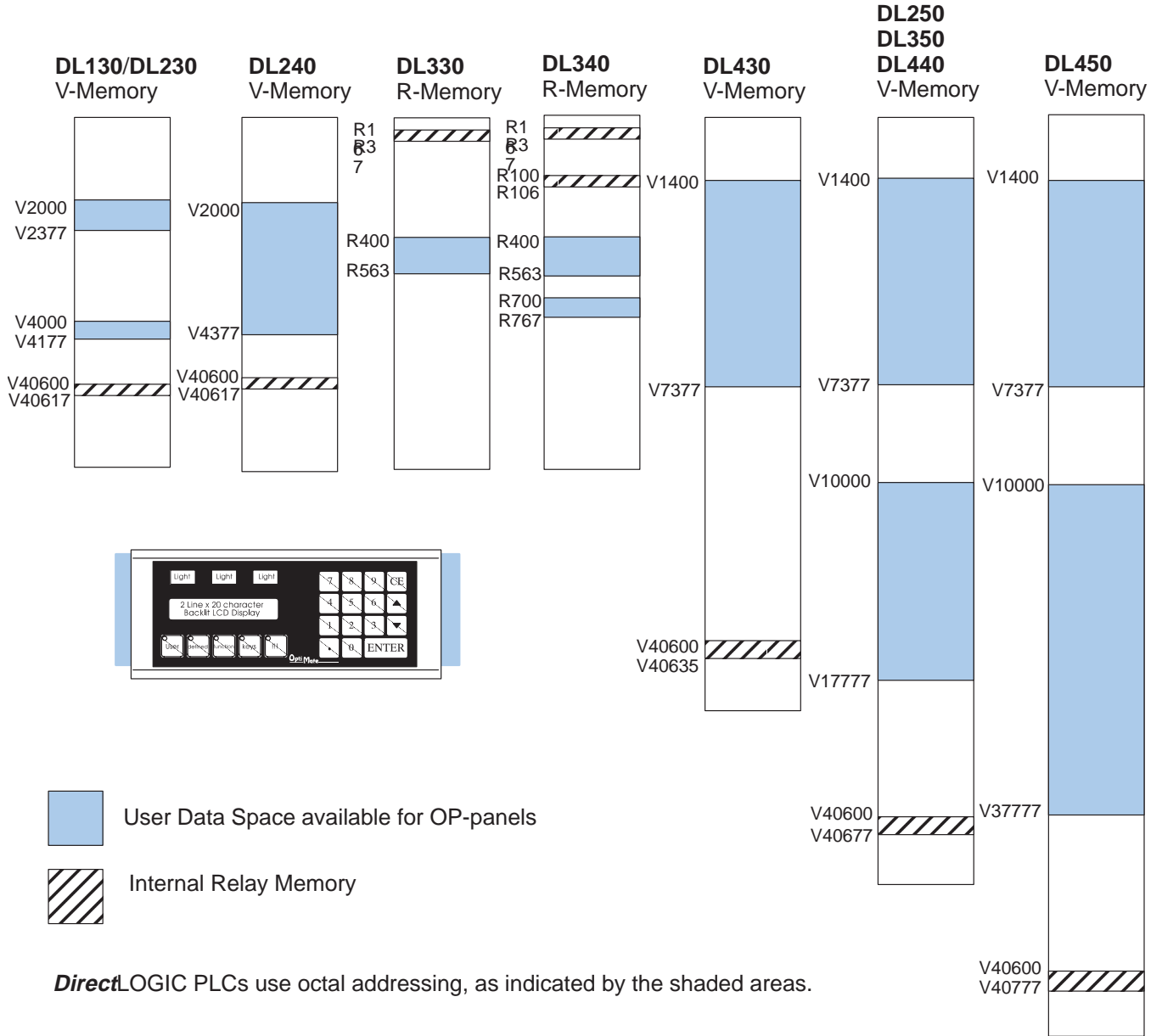
Direct LOGIC DL305 (DL330/DL340 only)

Example Address		Function
R400/R401	m+0	Top line message selection
R402/R403	m+1	Bottom line message selection
R404/R405	m+2	Top line data/menu function
R406/R407	m+3	Decimal point, top line
R410/R411	m+4	Bottom line data
R412/R413	m+5	Decimal point, bottom line
R414/R415	m+6	Status register
R416/R417	m+7	Control register

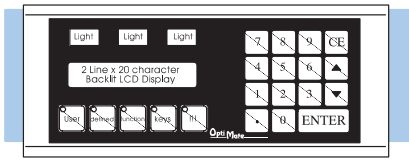
Allen-Bradley SLC 500

Example Address		Function
N7:0	m+0	Top line message selection
N7:1	m+1	Bottom line message selection
N7:2	m+2	Top line data/menu function
N7:3	m+3	Decimal point, top line
N7:4	m+4	Bottom line data
N7:5	m+5	Decimal point, bottom line
N7:6	m+6	Status register
N7:7	m+7	Control register

DirectLOGIC User Memory Overview



Understanding the Features



NOTE: The OPEditor shows a maximum of V41777 for possible base register addresses. This higher number was placed there to account for future product plans. Currently, the highest V-memory address available for mapping is V40777. Keep in mind that you must choose an available *base register address* that allows the proper number of bits upward to map the entire configuration. The OP-1500 and OP-1510 each require 128 bits to be mapped.

Mapping Operation

We explained in previous sections the PLC and OP-panel must exchange data on a *bit-level* basis. For **Direct**LOGIC controllers, the OP-panel **Status register** (m+6) and **Control register** (m+7) must be mapped into internal control relays such as C0,C1, etc. This allows *direct access* to the Status and Control bit registers. You must execute mapping every CPU scan in order to update data between the OP-panel and PLC.

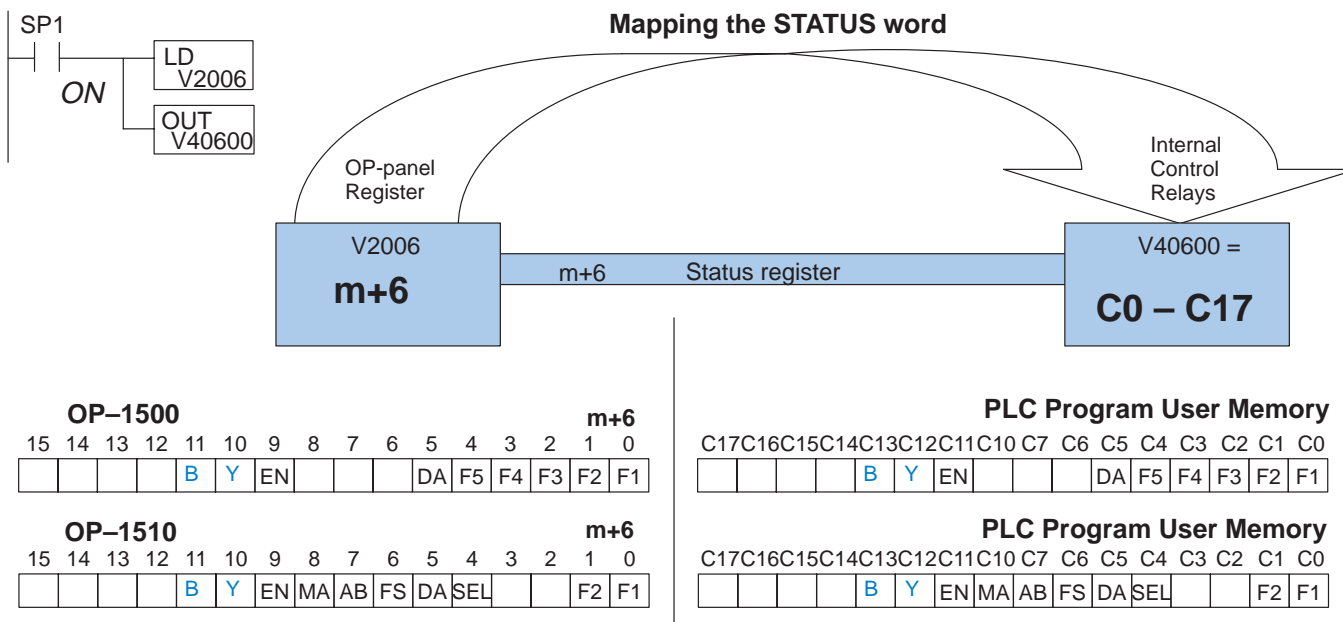
The following examples assume the OP-panel starting Base-Register (m+0) is assigned to word register V2000. For example, the DL105, DL205, DL350, and DL405 CPUs have internal control relays starting at register V40600. They are designated as C0, C1, etc. Mapping updates Status and Control data (m+6 and m+7) into appropriate base registers V2006 and V2007 each PLC scan.

Mapping Example (DL105, DL205, DL350, and DL405)

DL105, DL205, DL350, and DL405

This figure demonstrates how the OP-panel Status word is mapped to ladder program user memory for bit manipulation. In this figure, notice the sixteen bits in the STATUS register are loaded into the Internal Control Relays C0–C17. These control relays are used within the ladder logic program for monitoring pushbuttons and coordinating data entry control.

SP1 (always ON) maps OP register V2006 to V40600:C0–C17.



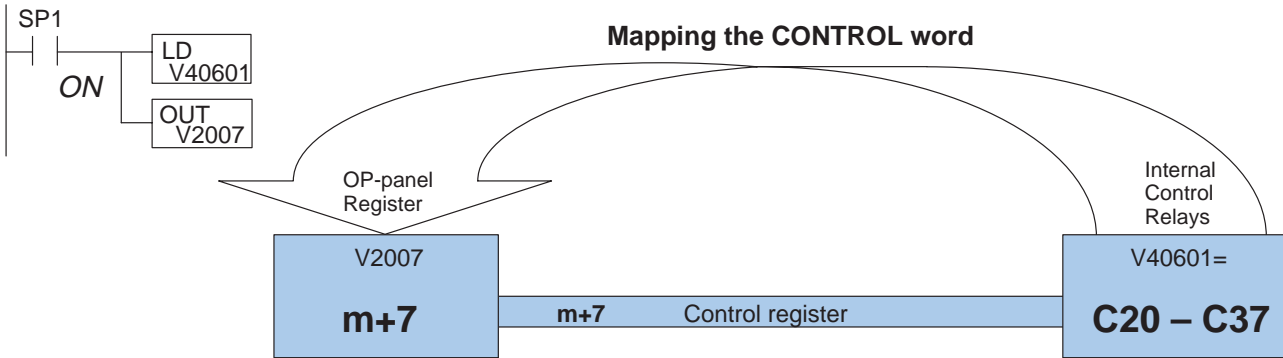
DirectLOGIC PLCs : Status and Control Registers (m+6, m+7) are required to be mapped to Internal Control Relay memory. For example, the register V40600 = C0–C17 (m+6) Status, and V40601 = C20–C37 (m+7) the Control register.

Understanding the Features

DL105, DL205, DL350, and DL405

This figure demonstrates how the internal control relay memory, for bit manipulation, is mapped into the OP-panel Control word. In this figure, notice Control Relays C20 through C37 are loaded into the OP-panel CONTROL register address m+7. The control word operates the annunciator lamps, flashing control and menu/data entry operations.

SP1 (always ON) maps data bits V40601:C20 –C37 to OP-panel Base register V2007.



OP-1500

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0		
									BD		DAK	L3F	L2F	L1F	L3	L2	L1

OP-1510

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0			
									BD	MR	ME	DAK	L3F	L2F	L1F	L3	L2	L1

PLC Program User Memory

C37	C36	C35	C34	C33	C32	C31	C30	C27	C26	C25	C24	C23	C22	C21	C20				
										BD	MR	ME	DAK	L3F	L2F	L1F	L3	L2	L1

PLC Program User Memory

C37	C36	C35	C34	C33	C32	C31	C30	C27	C26	C25	C24	C23	C22	C21	C20				
										BD	MR	ME	DAK	L3F	L2F	L1F	L3	L2	L1

Mapping Example (DL330/DL340)

DL305 Family

Let's look at mapping the DL330/DL340 PLC belonging to the DL305 family. Unlike the DL105, DL205, DL350, and DL405 mapping examples described on the previous pages, the DL305 uses 8-bit words. It therefore takes two words for each mapped memory location, because each mapped memory location needs sixteen consecutive bits, on one data word. We will assume that R400 was used as the base register address and we want the mapping to start at R16 for the **Status register** and R20 for the **Control register**.

DL305 Only

This figure demonstrates how the OP-panel Status word is mapped to ladder program user memory for bit manipulation. In this figure, notice the two 8-bit STATUS registers (m+6) are loaded into the Internal Control Relays R16 – R17. These control relays are used within the ladder logic program for monitoring pushbuttons, and coordinating data entry control.

Not C374 (always ON after first scan) maps OP register R414/R415 to R16/R17.

