OP-1224

Pushbutton Panel

Manual Number OP-1224-M

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To minimize the risk of potential safety problems, you should follow all applicable local and national codes that regulate the installation and operation of your equipment. These codes vary from area to area and usually change with time. It is your responsibility to determine which codes should be followed, and to verify that the equipment, installation, and operation is in compliance with the latest revision of these codes.

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Manual Revisions

If you contact us in reference to this manual, remember to include the revision number.

Title: OP-1224 Pushbutton Panel User Manual
Manual Number: OP-1224-M

Issue	Date	Effective Pages	Description of Changes
Original	11/95	Cover/Copyright Contents Manual Revisions 1 — 45 Index	Original Issue
Rev. A	3/96	10	Pinout diagram for OP-4CBL-1 cable showed the wrong pins tied together
Rev. B	6/98	All Various Manual Revisions	Downsize to spiral Minor changes Rev. B

EU Information

This product is manufactured in compliance with European Union (EU) Directives and carries the CE mark. The following information is provided to comply with EU documentation requirements.

NOTE: Products with CE marks perform their required functions safely and adhere to relevant standards as specified by EC directives provided they are used according to their intended purpose and that the instructions in this manual are adhered to. The protection provided by the equipment may be impaired if this equipment is used in a manner not specified in this manual. Only replacement parts supplied by **PLC***Direct* or its agents should be used. A listing of international affiliates is available at our Web site http://www.plcdirect.com

Technical Support

If you need technical assistance, please call the technical support group at **PLC***Direct (3505 Hutchinson Rd., Cumming, GA 30040, U.S.A.)* at 800-633-0405. They are available Monday through Friday from 9:00 A.M. to 6:00 P.M. Eastern Standard Time. Their Web Site address is http://www.plcdirect.com

SELV Circuits

All electrical circuits connected to the communications port receptacle are rated as Safety Extra Low Voltage (SELV).

Environmental Specifications

Operating Temperature	0° to 50° C
Storage Temperature	-20° to 70° C
Operating Humidity	95% (non-condensing)
Air Composition	No corrosive gases permitted

Preventative Maintenance and Cleaning

No preventative maintenance is required. To clean the exterior of the panel disconnect the input power and carefully wipe the panel with a cloth moistened with plain water.

External Fuse Protection for Input Power

There are no internal fuses for the input power circuits, so external circuit protection is needed to ensure the safety of service personnel and the safe operation of the equipment itself. To comply with EU specifications, the input power must be fused. Use a fuse rated at **twice** the input current rating of the panel. For example, if the panel has an input current rating of 0.5 amperes, use a fuse rated for 1 ampere.

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OP-1224 Pushbutton Panel

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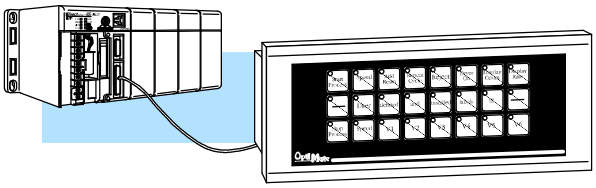
- Installing the Panel
- Configuring the Panel
- Applying Ladder Logic

Getting Started

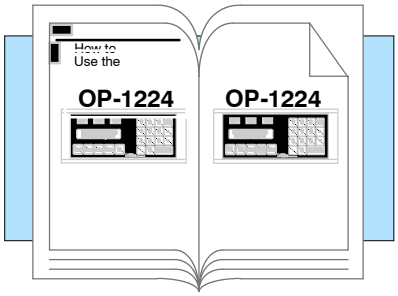
The Purpose of this Manual

This manual shows you how to install and operate your OP-1224 Pushbutton Panel. It includes wiring diagrams and power requirements, as well as the information you need for selecting the proper connecting cables.



Contents of the Manual

In this manual you will learn how to use the OPEditor configuration software (purchased separately) to configure your panel. And in the back of this manual, we will show you some simple ladder logic that demonstrates the versatility of the panel, both for PLC***Direct***™ and Allen-Bradley products.



Additional Manuals

There are several other manuals you will find helpful or necessary:

- ***Direct***SOFT™ User Manual–Shows you how to use the ***Direct***SOFT Windows software to write your ladder logic for PLC***Direct*** programmable controllers.
- Respective PLC User Manuals–Shows you the memory conventions, programming instruction sets, data or file types, communications protocol, etc.
- OP–9001–M Communications Master User Manual provides details of how to use the OP-9001 for connecting multiple OP-Panels to a single CPU.

Technical Assistance

After completely reading this manual, if you are not successful with implementing the OP-1500 or OP-1510, you may call PLC***Direct*** at (800) 633-0405, Monday through Friday from 9:00 A.M. to 6:00 P.M. Eastern Standard Time. Our technical support group will work with you in answering your application questions. If you have a comment or question about our products, services, or manuals which we provide, please fill out and return the suggestions card included with this manual.

How the OP-1224 Works

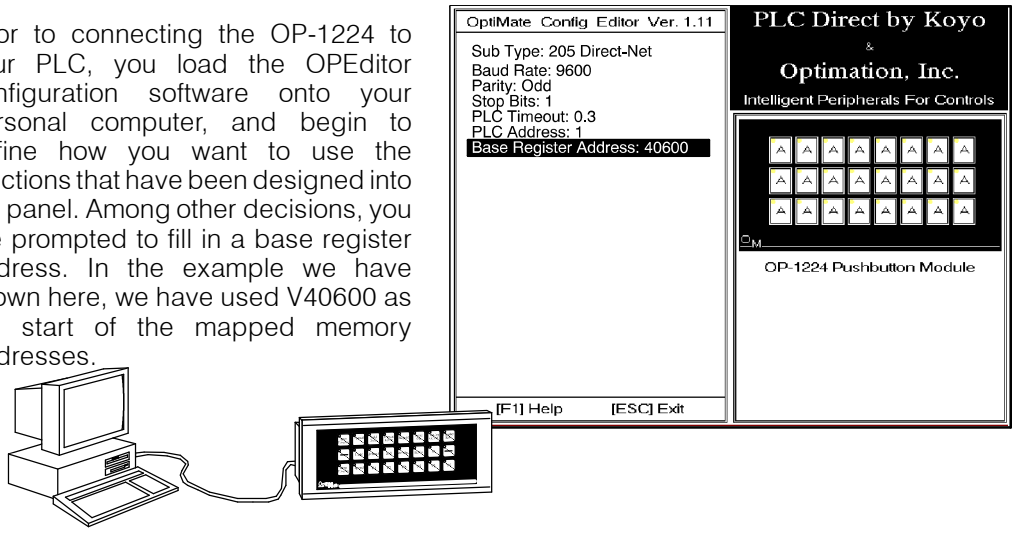
The purpose of the panel is to provide you with 24 tactile pushbuttons that can function as maintained or mometary type switches. An additional benefit of this panel is found in the LEDs that are in the upper left hand corner of each pushbutton. These LEDs can operate as indicators to reflect the status of the individual pushbutton, or they can operate independent of the pushbutton status. The LEDS can turn ON or OFF and even flash for added attention.

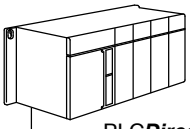
To link the pushbuttons and the LEDs to your PLC, the OP-1224 uses a process called “memory mapping”. This process ties the pushbuttons and LEDs to specific reserved areas of memory in the PLC. You can use any available memory as long as it is consecutive.

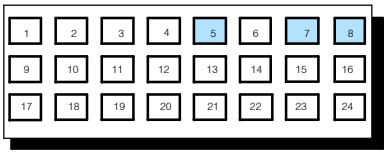
You enter these base register addresses during initial configuration using the OPEditor software. Each of the functions for the pushbuttons and LEDs are controlled by the status of their assigned bits within the memory words that you have reserved. You interface these words of memory through your ladder logic. The logic below shows how you can use the various features of the OP-1224. We’ll cover everything in detail later.

PLC*Direct*

Prior to connecting the OP-1224 to your PLC, you load the OPEditor configuration software onto your personal computer, and begin to define how you want to use the functions that have been designed into the panel. Among other decisions, you are prompted to fill in a base register address. In the example we have shown here, we have used V40600 as the start of the mapped memory addresses.

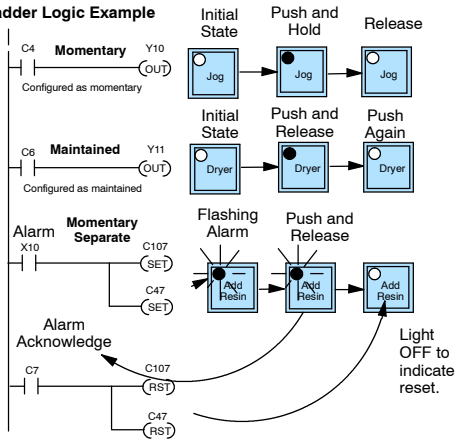






Mapped Memory Location	Function
m (such as V40600) C0-C17	Pushbuttons 1-16 ON/OFF
m+1 (such as V40601) C20-C37	Pushbuttons 17-24 ON/OFF
m+2 (such as V40602) C40-C57	LEDs 1-16 flash
m+3 (such as V40603) C60-C77	LEDs 17-24 flash
m+4 (such as V40604) C100-C117	LEDs 1-16 ON/OFF
m+5 (such as V40605) C120-C137	LEDs 17-24 ON/OFF
m+6 (such as V40606) C140-C157	Force Function Data (1-16)
m+7 (such as V40607) C160-C177	Force Function Mode/Data (17-24)

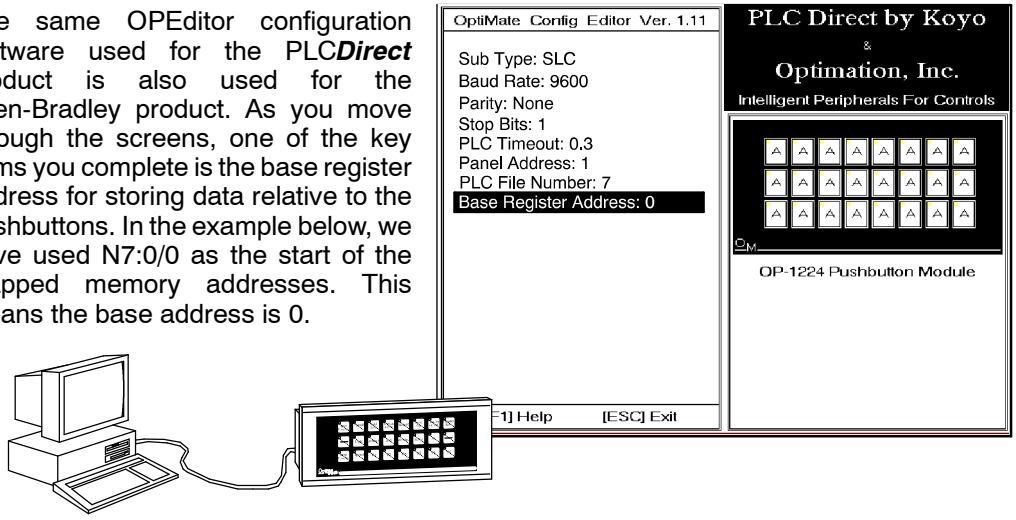
PLC*Direct* Ladder Logic Example

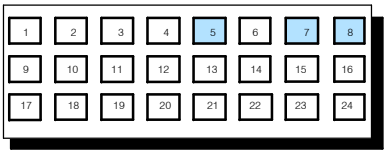


Notice in this example we are using Pushbuttons 5, 7 and 8. These are controlled by internal relays C4, C6, and C7. Your configuration software (OPEditor) allows you to operate your pushbuttons as either momentary switches or ”maintained” alternate action switches. We have made C4 a momentary switch and C6 is a maintained switch. C7 is a momentary switch but we are controlling the separate ON/OFF and flashing of Pushbutton 8 with C47 and C107 respectively.

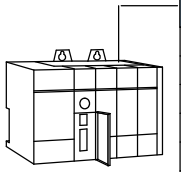
Allen-Bradley

The same OPEditor configuration software used for the PLC***Direct*** product is also used for the Allen-Bradley product. As you move through the screens, one of the key items you complete is the base register address for storing data relative to the pushbuttons. In the example below, we have used N7:0/0 as the start of the mapped memory addresses. This means the base address is 0.



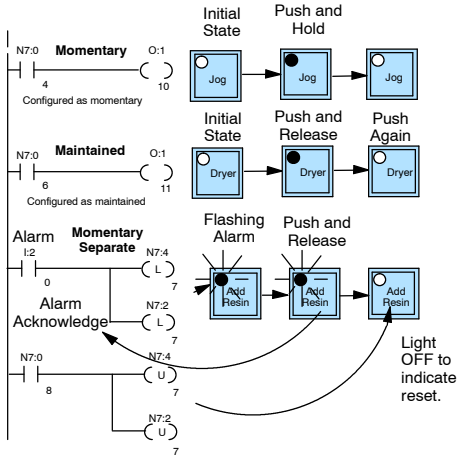


Allen-Bradley



Mapped Memory Location	Function
m (such as N7: 0/0– 0/15)	Pushbuttons 1-16 ON/OFF
m+1 (such as N7: 1/0 1/15)	Pushbuttons 17-24 ON/OFF
m+2 (such as N7: 2/0 2/15)	LEDs 1-16 flash
m+3 (such as N7: 3/0 3/15)	LEDs 17-24 flash
m+4 (such as N7: 4/0 4/15)	LEDs 1-16 ON/OFF
m+5 (such as N7: 5/0 5/15)	LEDs 17-24 ON/OFF
m+6 (such as N7: 6/0 6/15)	Force Function Data (1-16)
m+7 (such as N7: 7/0 7/15)	Force Function Mode/Data (17-24)

Allen-Bradley Ladder Logic Example

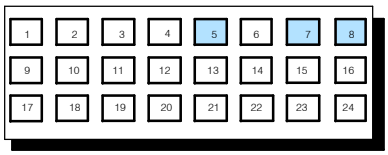


Notice in this example we are using Pushbuttons 5, 7 and 8. These are controlled by bits 4, 6 and 7 in integer file N7:0/0. Your configuration software (OPEditor) allows you to operate your pushbuttons as either momentary switches or “maintained” alternate action switches. We have made Pushbutton 5 a momentary switch and Pushbutton 7 is a maintained switch. Pushbutton 8 is a momentary switch but we are making its LED flash with N7:2/7 and controlling the LED ON/OFF separately from the button status with N7:4/7.

Using the Pushbutton Panel...5 Easy Steps

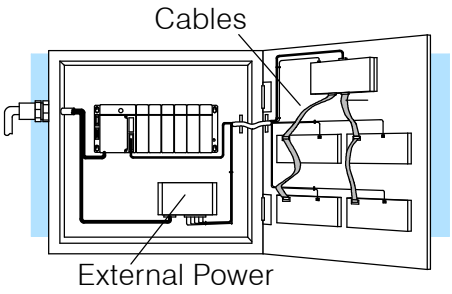
Step 1: Prepare Your Pushbutton Labels (Pages 5 - 6)

First, you need to prepare the labels for each of the pushbuttons. The labels insert into plastic sleeves behind the main cover. To access the sleeve, you merely snap loose the front bezel.



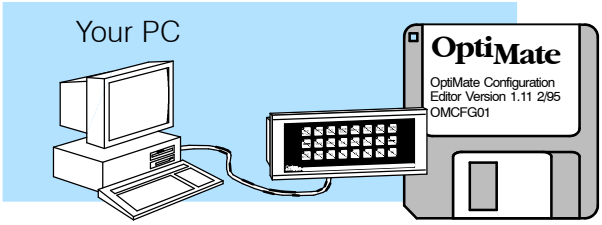
Step 2: Install the Panel (Pages 7-14)

Preparing for installation, you will want to check the individual specifications. These include dimensions, power requirements, cabling requirements, and NEMA ratings. We include information you will need for mounting; i.e. cutout dimensions, cabling requirements, components needed, etc.



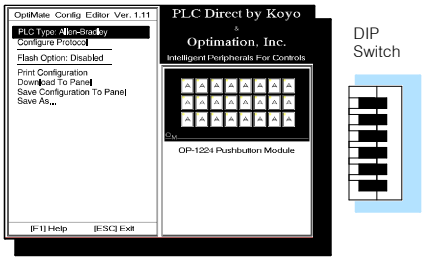
Step 3: Load the OPEditor Software (Page 15)

You need the OptiMate™ OPEditor software in order to configure your panel. At the time of publication, we have a DOS version with the introduction of a Windows version due in early 1996. This software is the same regardless of whether you are connecting to PLC***Direct*** or Allen-Bradley product.



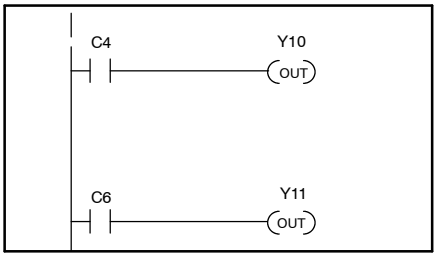
Step 4: Configure the Panel to Work with your CPU (Pages 16-20)

After setting a DIP switch on the rear of the panel and attaching the programming cable, you are ready to configure your panel. The simple and easy-to-follow screens make configuration a painless process.



Step 5: Write the Ladder Logic (Pages 21-45)

The amount of ladder logic programming knowledge you need is very basic. In most cases, you are already familiar with the elements of logic that are required. We'll give you examples in the final section of this manual, and you will see right away just how easy it is.

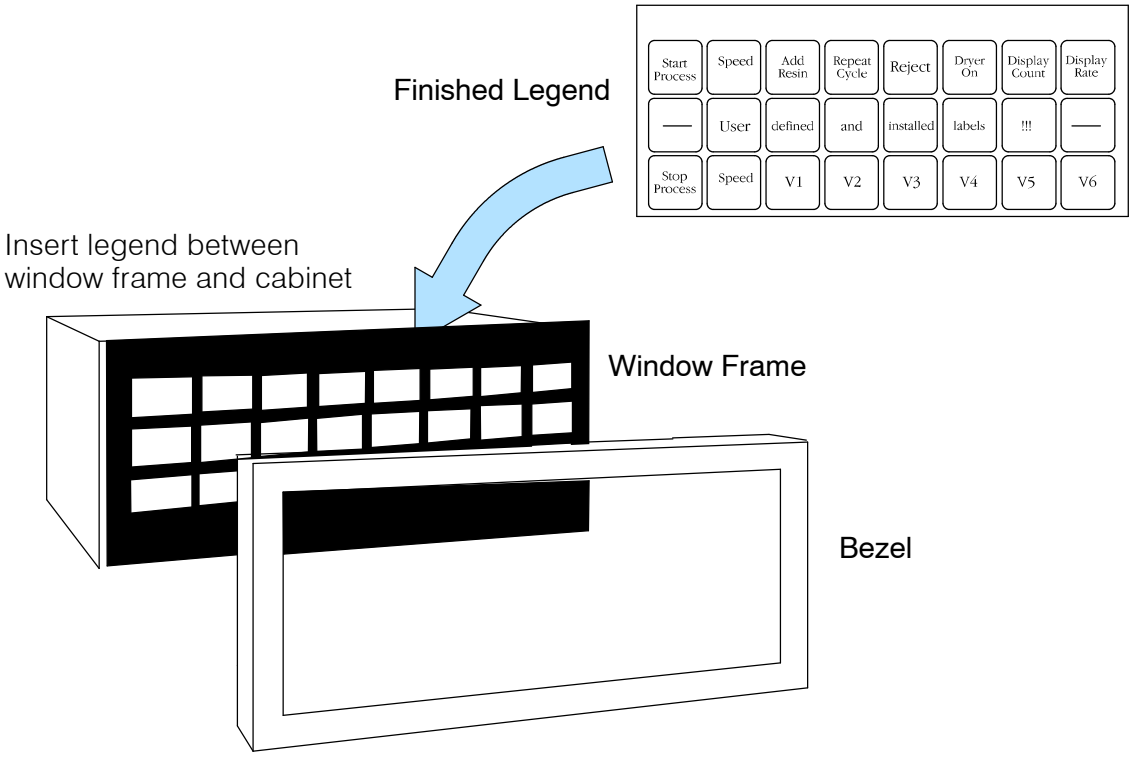


Preparing the Pushbutton Labels

Applying Text to Each Label

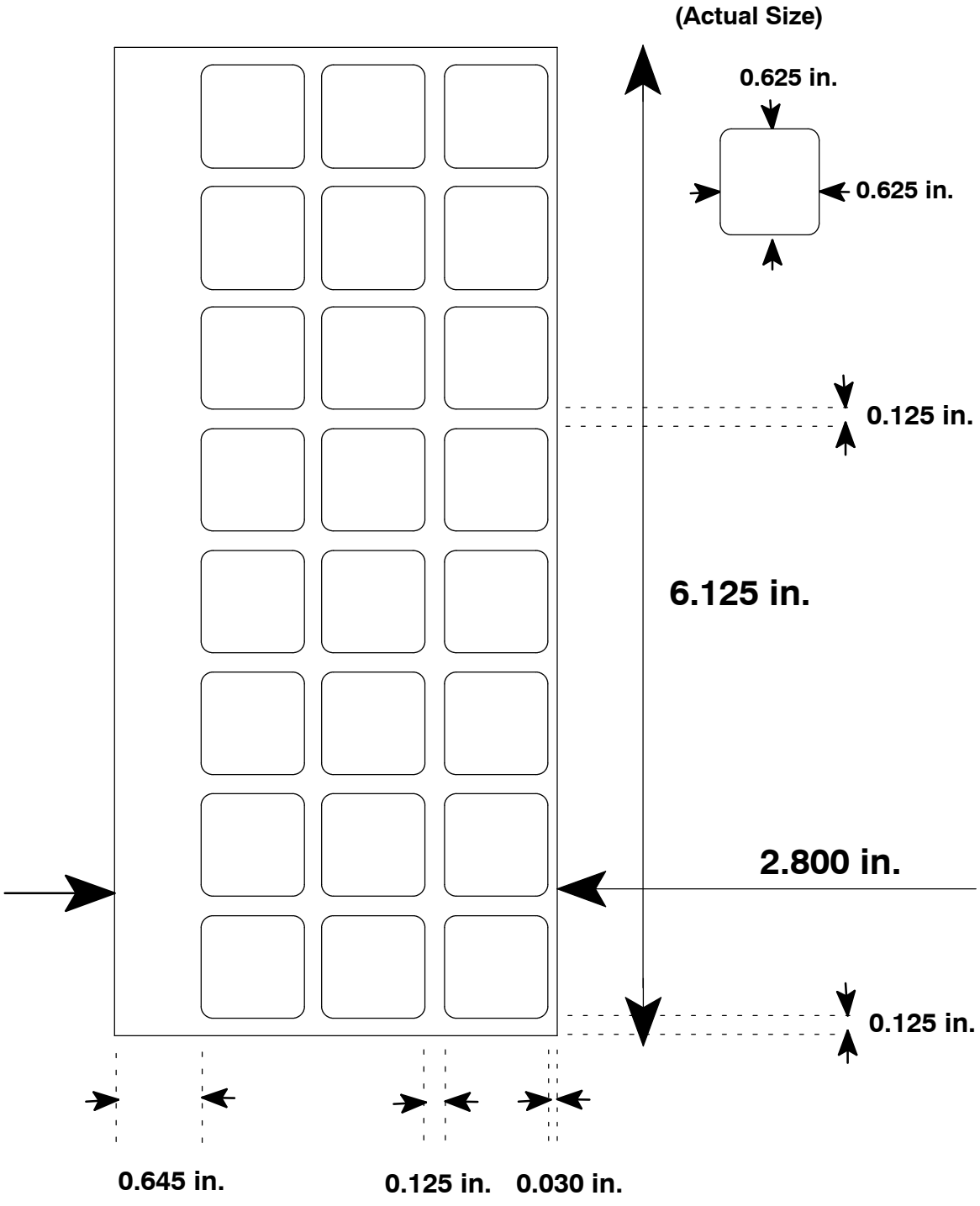
Preparing the labels for the OP-1224 panel requires you to slide a legend transparency into a pocket in the panel overlay. Use the following procedure:

1. Remove the bezel from the module by unsnapping the four tangs that hold the bezel to the module frame.
2. Create a legend transparency. There are several ways of doing this. A template is provided on the next page that gives you the available dimensions. The nicest legends result from using a computer graphics program and a laser printer to create the transparency.



3. Slide the finished legend into the pocket space between the window frame and LED bars.
4. Re-attach the bezel by snapping the bezel onto the case.

Template for Creating Labels



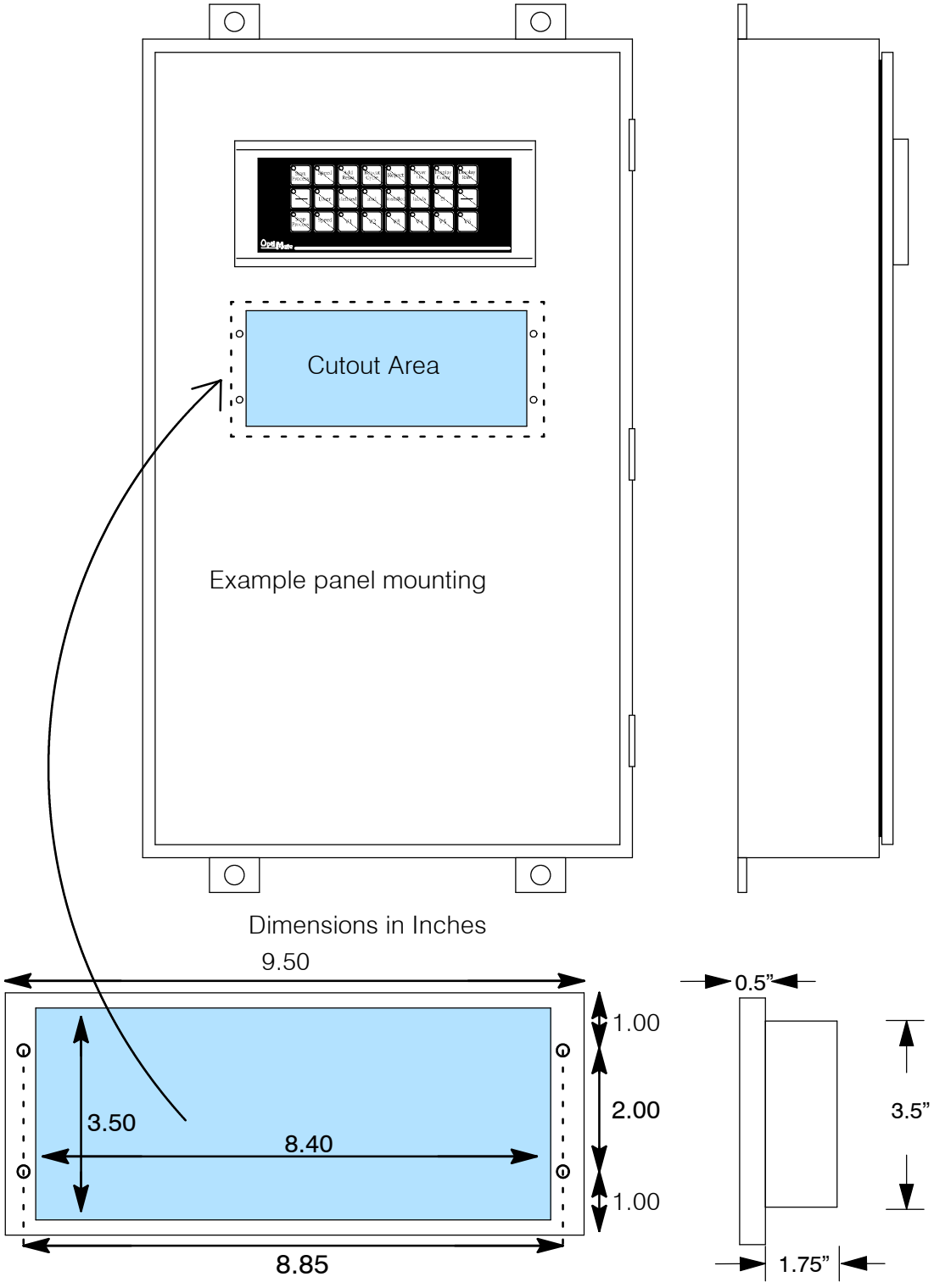
Installing the Panel

In this section, you will be given all of the information you need to install the panel. Before actually installing the OP-1224 panel, it may be helpful to examine the specifications and make sure that the requirements of your application are met.

Panel Specifications:

Physical Specifications	Weight	22 ounces
	Panel Fasteners	Four 6x32 threaded studs
	NEMA Rating	NEMA 4
Environmental Specifications	Operating Temperature	0° to 50° C
	Storage Temperature	–20° to 80° C
	Operating Humidity	5 to 95% (non-condensing)
	Air Composition	No corrosive gases permitted
Operating Specifications	Power Budget Requirement	4 VA @ 8 – 30 VDC 240 mA @ 12 VDC (all LEDs OFF) 310 mA @ 12 VDC (all LEDs ON) 120 mA @ 24 VDC (all LEDs OFF) 155 mA @ 24 VDC (all LEDs ON)
	Power Connector	Removable Terminal Block 2 position
	Absolute Maximum Voltage	32 VDC
	Diagnostics	Power On, CPU
	Communication Link	RS232 or RS422 4800, 9600 and 19200* baud 15 pin female D type connector *Only 4800 and 9600 baud will work with Allen-Bradley PLCs.

Dimensions for Mounting



Power and Cabling Requirements

What Are Your Application Needs?

Your communication cable requirements really depend on your particular application. There are two types of configuration possibilities. Point-to-point — a single operator interface connected to a CPU. Multi-drop — multiple operator interfaces connected to a CPU.

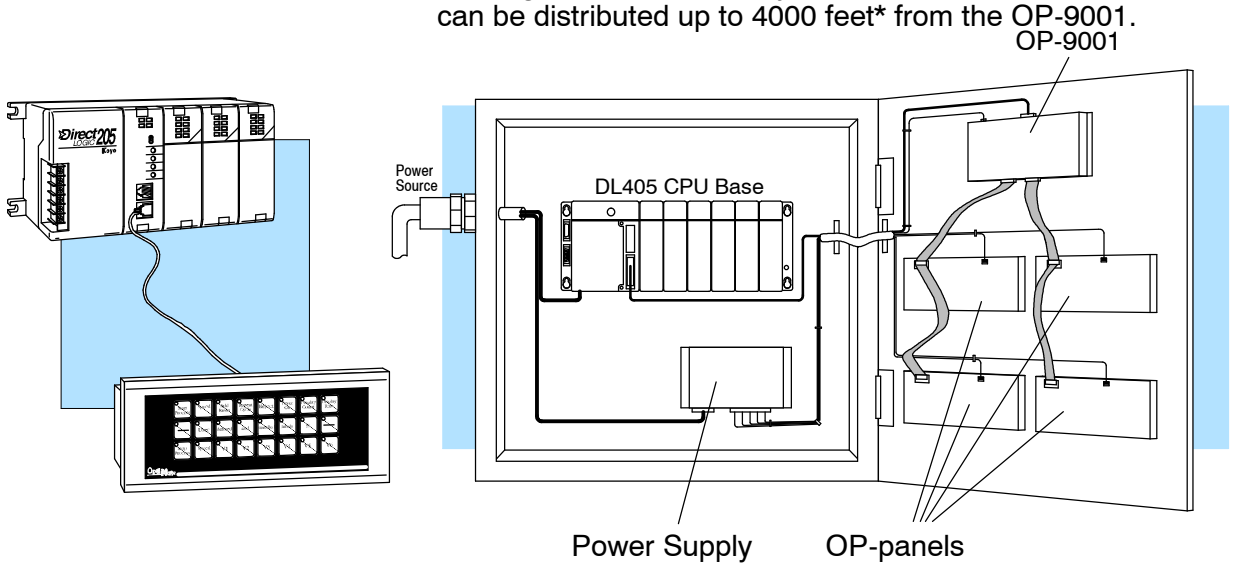
- **Point-to-Point –** If you only need one operator interface connected to one CPU, then just choose the appropriate cables from the chart on Page 13, and you're ready to go!
- **Multi-drop –** By using an OptiMate OP–9001 Communications Master, you can connect multiple Optimate units to a single CPU. Up to 31 individual units can be connected in a daisy-chain fashion to the OP–9001. Communications are via RS422 between the OP–9001 and the operator interfaces. If you use a good quality shielded cable, you can have a total distance of up to 4000 feet between the OP–9001 and the last operator interface unit in the chain. If you only have a short distance (up to 30 feet), you can use ribbon cable and easy-to-install crimp-on ribbon connectors.

1. Point-to-Point

A single cable connection from the PLC to the panel gives you access to the PLC's data registers and ladder logic.

2. Multi-drop

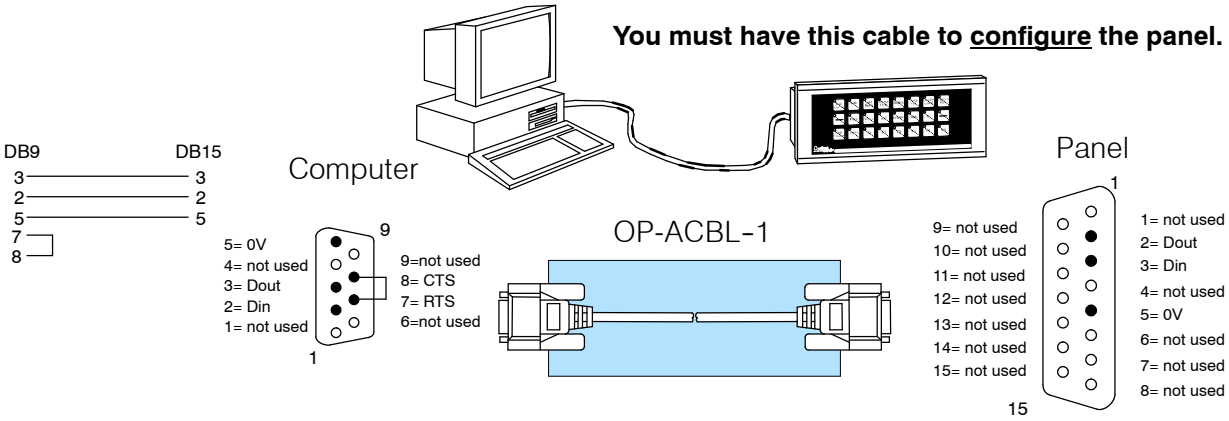
Multiple OP-panels can be interfaced to a single PLC. This requires the use of the OP-9001 Communications Master. With the Communication Master, up to 31 panels can be interfaced to a single CPU port. Each can be programmed for entirely different functions. Panels can be distributed up to 4000 feet* from the OP-9001.



NOTE: Please read and follow the cabling requirements in the OP-9001 User Manual (OP-9001-M) when using multiple panels. Failure to follow the guidelines of the User Manual may affect the integrity of the RS422 link, resulting in communication errors.

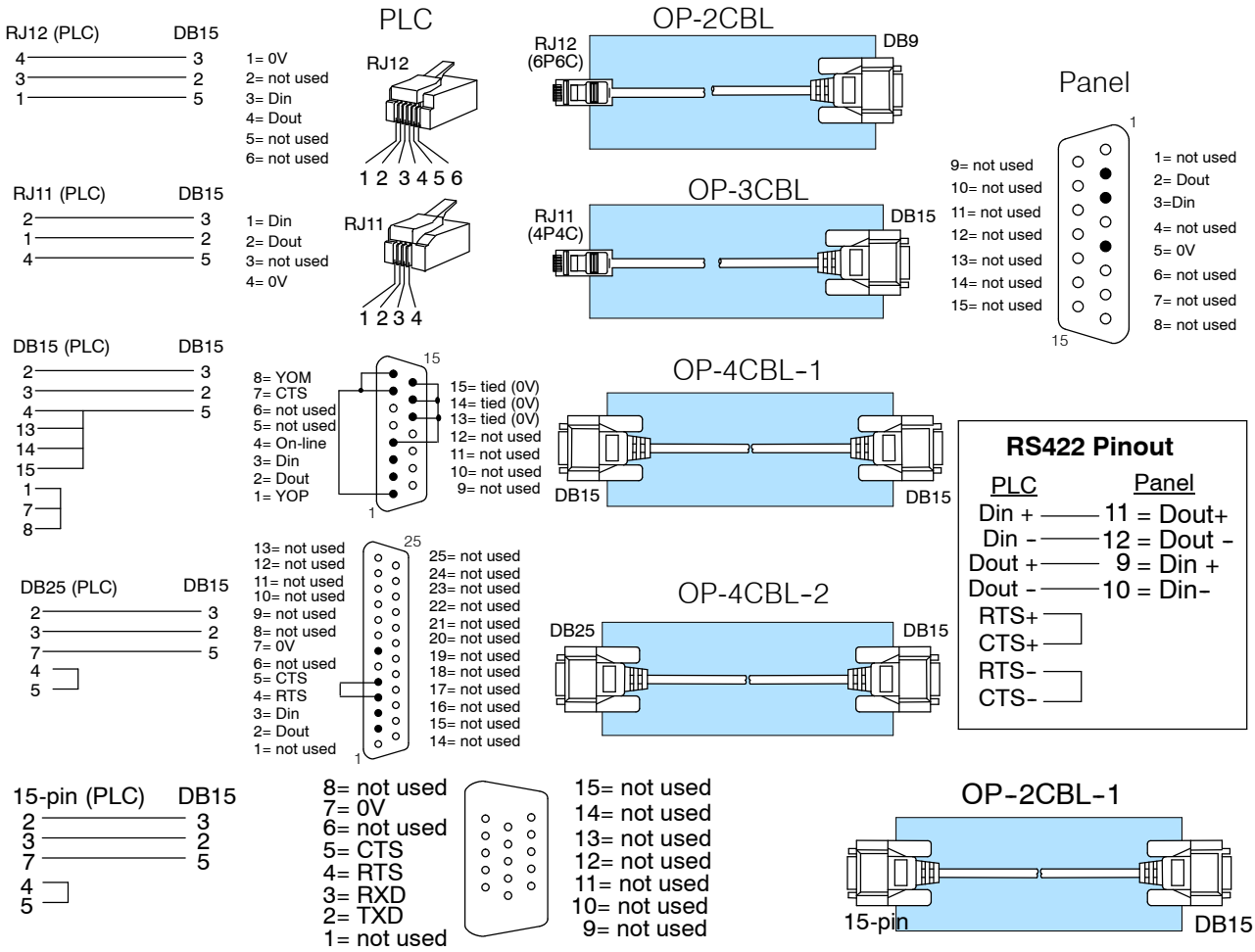
Programming Cable The OP-ACBL-1 is used to connect your OP-1224 panel to your computer for programming.

You must have this cable to <u>configure</u> the panel.



PLC to Panel Cable The OP-ACBL-1 (shown above) is also used <u>to connect Allen-Bradley SLC 5/03 and 5/04 PLCs</u> to an OP-1224 panel. Since the OP-1224 is compatible with all of the ***PLCDirect*** and compatible CPUs, your cabling requirements wll vary depending on the CPU type you are using. Refer to the table on the next page for matching the proper cable to your PLC. Pin diagrams refer to the ends of the cables and not the communication ports.

See the next page for matching your PLC to the correct cable.



Choosing the Proper Connecting Cables

OptiMate Panel Cables

Depending on which PLC you are using, you may require as many as two cables–one to connect the panel to a personal computer for configuration; and one to connect the panel to the PLC. Here are the requirements:

- **OP-ACBL-1:** *all* units require this cable for configuration. This is a 9-pin male to 15-pin male cable that connects your personal computer to the OptiMate unit. (This cable is also used to connect an OptiMate panel to the Allen-Bradley SLC-500 CPU.
- **CPU Cables:** You will also need the appropriate cable to connect your CPU to the OptiMate unit. Use the chart shown to the right to choose the correct communications cable.

OP-9001 Cable Connectors

If you're planning to use multiple panels and an OP-9001, then you'll need to build your own custom cables. Since the proper cable choice really depends on your application, we offer the following connectors.

- **OP-CMCON-1** — pack of 4 ribbon cable connectors.
- **OP-CMCON-2** — pack of 4 solder-type connectors.

For electrically noisy environments, we recommend a good shielded cable, such as Belden 9729 or equivalent. This type of cable will require the solder-type connectors. If you're going 30 feet or less, you can use ribbon cable. For ribbon cable, we recommend Belden 9L28015 or 3M 3365/15. See Page 14 for more information.

OptiMate Cables

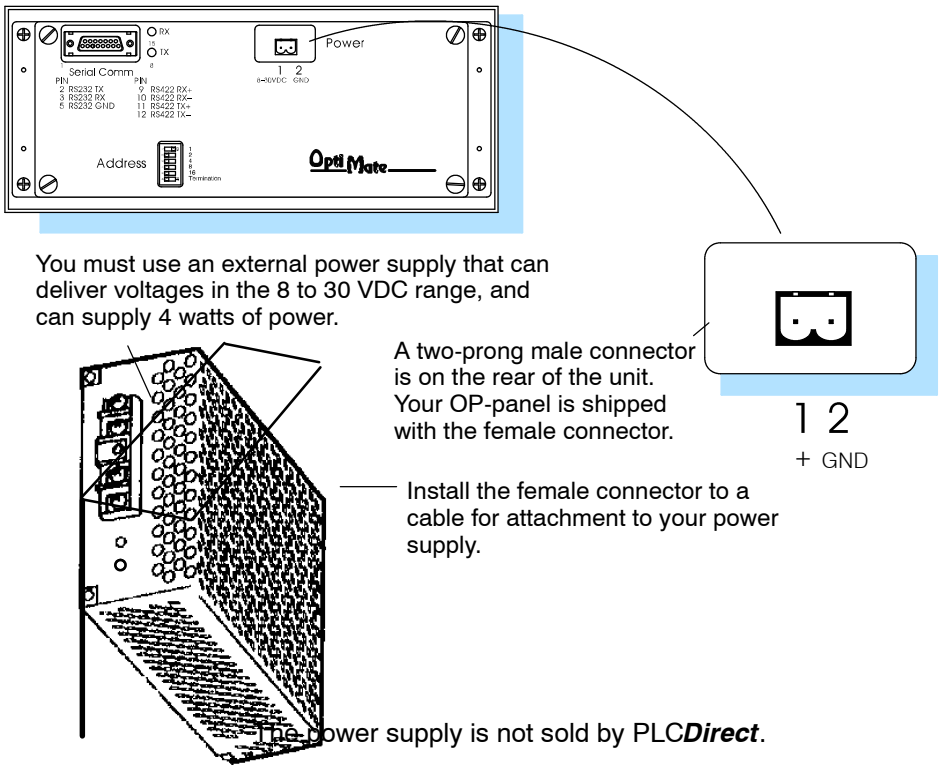
Family	CPU (or other device)	Port	Cable
DirectLOGIC™ DL105	DL130	Only port	OP-2CBL
DirectLOGIC™ DL205	DL230	One port (RJ12)	OP-2CBL
	DL240	Top port (RJ12)	OP-2CBL
		Bottom port (RJ12)	OP-2CBL
DirectLOGIC™ DL305	DL330	Requires DCU*	OP-4CBL-2
	DL330P	Requires DCU*	OP-4CBL-2
	DL340	Top port (RJ11)	OP-3CBL
	DL340	Bottom port (RJ11)	OP-3CBL
	DL350	Top port	OP-2CBL
		Bottom port	OP-4CBL-2
DirectLOGIC™ DL405***	DL430	Top port (15-pin)	OP-4CBL-1
		Bottom port (25-pin)	OP-4CBL-2
	DL440**	Top port (15-pin)	OP-4CBL-1
		Bottom port (25-pin)	OP-4CBL-2
	DL450	Phone Jack (RJ12)	OP-2CBL
		Top port (15-pin)	OP-4CBL-1
		Bottom port (25-pin)	OP-4CBL-2
	D4-DCM (module)	One port (25-pin)	OP-4CBL-2
	Slice I/O panels	One port (15-pin)	OP-4CBL-1
GE® Series 1	IC610CPU105	Requires DCU*	OP-4CBL-2
	IC610CPU106	Requires DCU*	OP-4CBL-2
TI305™ / SIMATIC® TI305™	325-07, PPX:325-07	Requires DCU*	OP-4CBL-2
	330-37, PPX:330-37	Requires DCU*	OP-4CBL-2
	325S-07 (or 325 w/ Stage Kt)	Requires DCU*	OP-4CBL-2
	330S-37, PPX:330S-37	Requires DCU*	OP-4CBL-2
	335-37, PPX:335-37	Phone Jacks (RJ11)	OP-3CBL
		If DCU is used*	OP-4CBL-2
TI405™ / SIMATIC® TI405™	425-CPU, PPX:425-CPU **	One port (15-pin)	OP-4CBL-1
	430-CPU, PPX:430-CPU	Top port (15-pin)	OP-4CBL-1
		Bottom port (25-pin)	OP-4CBL-2
	435-CPU, PPX:435-CPU **	Top port (15-pin)	OP-4CBL-1
		Bottom port (25-pin)	OP-4CBL-2
	Smart Slice™ I/O panels	One port (15-pin)	OP-4CBL-1
Allen-Bradley SLC500	5/03 5/04	Bottom port	OP-ACBL-1
Allen-Bradley	MicroLogix	Only port	OP-ACBL-2

* — requires RS232 Data Communications Unit (D3-232-DCU)
**-also DC versions

Connecting a Power Supply

Power Supply Connections

The OP-1224 panel can operate on DC voltages between 8 and 30 VDC rated at 4 watts. Connect the panel to a power supply (within the required voltage range and wattage) using the terminal block connector supplied. The connector is polarized to prevent reversing the connections. The male receptacle on the rear of the panel will only connect in one way with the female connector that is supplied with your OP-1224 panel. Pin 1 is the positive connection, while Pin 2 is the negative, or ground, connection.



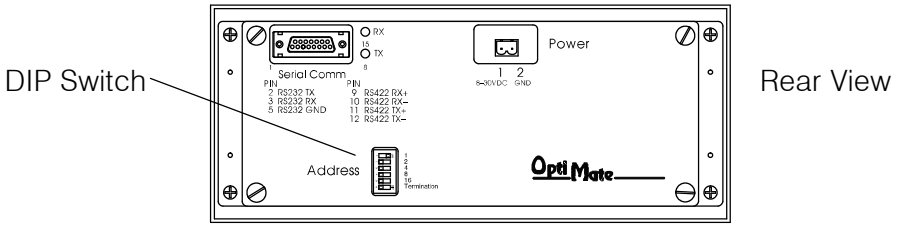
Model	Current Consumed at 12VDC	Current Consumed at 24VDC
OP-1224	0.24A (all LEDs OFF)	0.12A (all LEDs OFF)
	0.31A (all LEDs ON)	0.16A (all LEDs ON)

Connecting the Panel to your Personal Computer

Assigning an Address to the OP-1224

A 6-position DIP switch on the rear of the OP-1224 allows you to assign a hardware Aaddress to your panel. Each panel must have a unique address. You can use any address between 0 and 30 when communicating between a panel and a PLC or the OP-9001 Master Communications panel. Address 31, however, is reserved. See the note that follows.

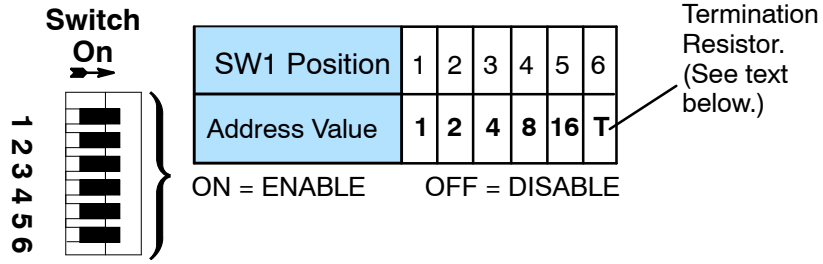
NOTE: You must use Address No. 31 when you are using the OPEditor software to download to your OP-1224 panel. No other address will work for the configuration process. In a similar manner, if you are connecting more that one OP-panel to a single CPU (through an OP-9001), then the OP-9001 needs to know which set of configuration parameters belong to which OP-panel. You do this by assigning an address in the range of 0 to 30 to each panel connected. Each panel must have a different address.



How to Set the Address

To set the address on the OP-1224, simply set the apppropriate switches on the dip switch to the desired address. The figure below shows the binary weighting of each switch position. Notice that it is in decimal format. To select address 14 for example, you would press switches 2, 3 and 4 down to the right, and switches 1, 3 and 5 to the left (2 + 4+ 8 = 14). Any address between 0 and 30 is valid for the OptiMate-to-CPU (or to OP9001) communications. Address 31, however selects the configuration mode. Use this mode when you connect your personal computer to the panel for configuration. To select address 31, turn switches 1 through 5 ON.

NOTE: Please note that when the dip switches are changed, the OP-1224 must be power cycled before the new settings will take effect.



The Termination Resistor

Switch position 6 enables or disables an internal termination resistor. The OptiMate panels communicate via an RS232 or RS422 communcations network. If you are using a single panel that will be located less than 50 feet from the CPU, then you can use RS232 and are not required to use a termination resistor (i.e. switch position 6 is turned OFF).

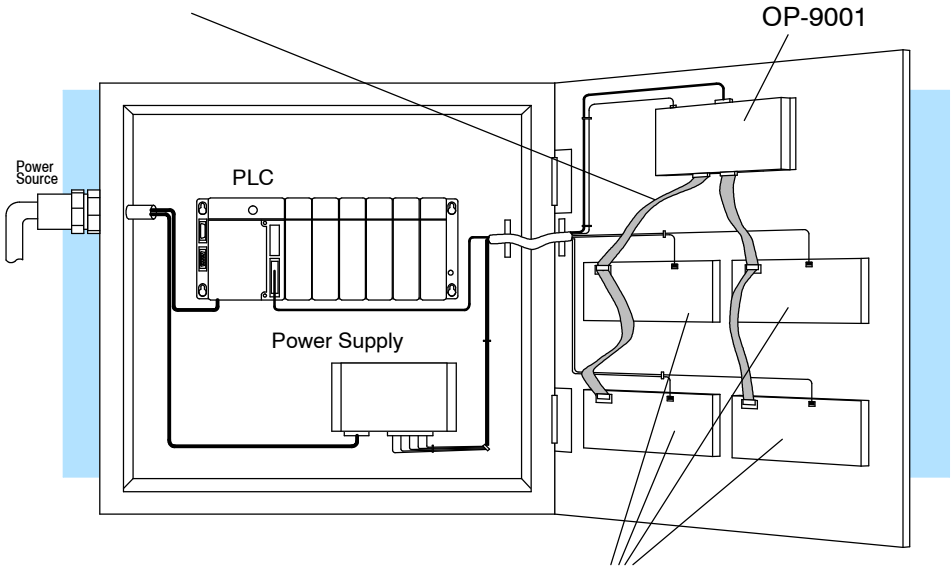
*If a panel will be located more than 50 feet from the CPU or you want to use multiple panels, you **must** use RS422.* For single panel installations, this means that switch 6 must be enabled (ON). For multi-drop installations, this means **the last panel only** must have switch 6 enabled (ON). All other panels must have switch 6 disabled (OFF). A more detailed description of multiple panel installations is given in the OP-9001-M User Manual.

Using the OP-9001 to Connect Multiple Panels

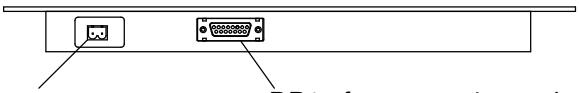
With the addition of the OP-9001 Communications Master panel, you can connect up to 31 panels per a useable CPU port of the PLC. Shown below are the connection requirements. For specifics of the OP-9001 panel itself, please refer to the Communications Master User Manual (OP-9001–M).

NOTE: The OP-9001 must be used in a multiple panel configuration.

Ribbon cable with DB15 male connectors attached.
Panels can be connected directly to the OP-9001 ports or be daisy-chained to other OP-panels.



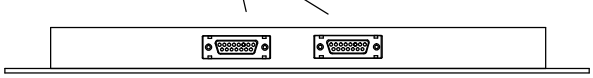
Note: Panels can be located as far away as 4000 feet from the OP-9001 when using shielded cable (Belden 9729 or equivalent). Flat ribbon connections can be used for a distance of 30 feet maximum. For ribbon cable, we recommend Belden 9L28015 or 3M 3365/15.



Power supply receptacle. Same as the one on the OP-1224. See Page 15.

DB15 for connecting to the PLC. See chart on Page 13 for selection of the proper cable.

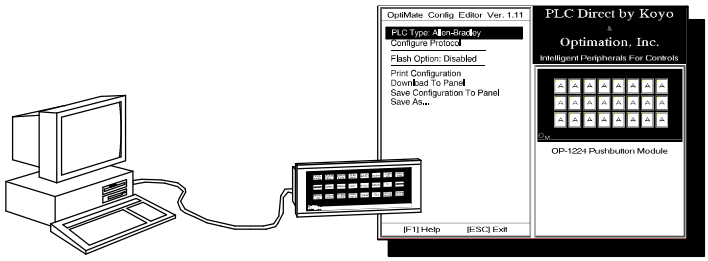
Two DB15 ports for RS422 connection to any OP-panel.



Belden 9279 Specifications	
No. twisted pairs	2
Nom. Impedance (ohms)	100
Nom. Capacitance (pF/m)	41.0
Wire Gauge (AWG)	24

Configuring the Panel with the OPEditor Software

You configure the OP-1224 by loading the OPEditor software on a personal computer and selecting the appropriate options. The setup options answer basic questions concerning your system configuration such as type of PLC being used, communications protocol, and the type of panel being used. The same software is used for all of the Optimate panels; so once you've set up one panel, you understand most of the procedures required to configure any of the other panels.



System Requirements

In order to use the OPEditor software, you must have the following components:

- IBM 386 (or better) compatible computer
- VGA or SVGA video board and color monitor
- DOS 5.0 or higher and 3 1/2" disk drive
- At least 1 meg of hard drive space and 1 meg of RAM

At the time of publication of this manual, we are providing a DOS version of the OptiMate OPEditor configuration software. In early 1996, we will have a Windows version available.

There is only one installation disk for this software. You must have a 3-1/2 inch drive in order to install it. We suggest you make a backup copy of this disk before making the installation.

How to Install

Here are the easy steps for successful installation of the software:

1. Insert the disk in the 3 1/2" floppy drive of your computer.
2. From the DOS prompt, log onto the drive where you have the disk and execute the INSTALL.EXE file. For example, if the disk is in drive A:

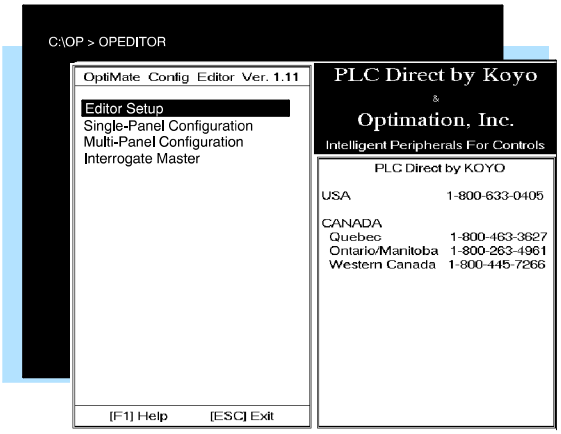
   . . . . . **A:** install press <**Return**>
3. You will be prompted to accept the default directory (C:\OP) or change it. Make the choice and press Enter.
4. The software will automatically insert files in the directory you have named. These will use about 400 kilobytes of hard drive space. You should view the OPTITEXT.WRI file to take advantage of demo files and other useful information. The main file is OPEDITOR.EXE. The other files are for fonts and configuration information. Two subdirectories are created: (1) modules, and (2) systems. These are used to store your configuration data.
5. You will automatically be returned to the DOS prompt after the files and directories have been created, and you press the Return key. Installation is now complete!

Step-by-Step Procedure

NOTE: You do not have to be connected to the OP-panel in order to design your configuration. You can save it to disk and download it to the panel later.

Step 1
Load the OPEditor and Complete the Editor Setup

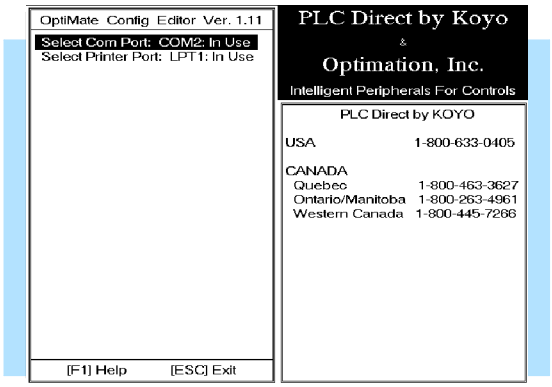
You can operate the OPEditor as a DOS program out of DOS only. Do not attempt to operate the program out of Windows. If you are in Windows, close Windows completely, change to the directory in which you have stored the OPEditor executable file (default is C:\OP), and then type the file name (OPEDITOR) from the DOS prompt.



The first configuration screen has 4 choices. You should select the first choice, **Editor Setup**.

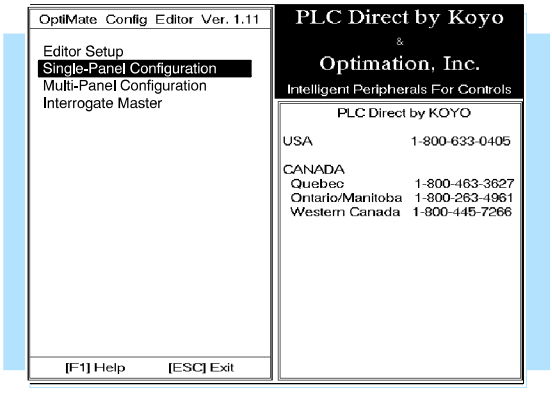
Step 2
Select the LPT and COM ports

The setup screen provides two serial port options: You must specify which of the serial ports (**COM1** or **COM2**) that you will be using when communicating with your OP-panel. The setup screen will also allow you to designate which parallel port (**LPT1** or **LPT2**) to use for printing your configuration.



Step 3
Choose from Single or Multiple Configurations

Next, you must press <**ESC**> to return to the first screen again. Here you will need to select either the **Single-Panel Configuration** or the **Multi-Panel Configuration**. For this example, we will use the "Single" choice, but the "Multi-Panel" choice follows much the same way. Refer to the OP-9001 User Manual (OP-9001-M) for instructions on how to use the OPEditor when putting together a system that uses multiple OP-panels.

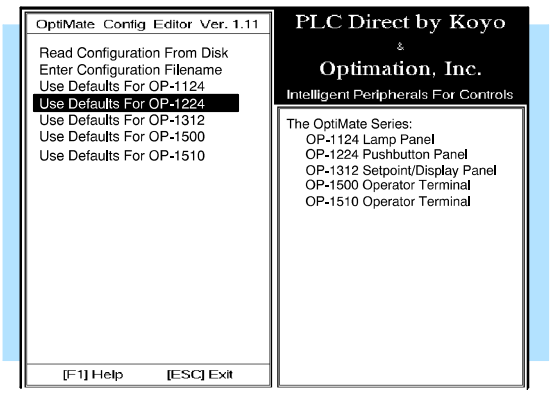


Step 4
Select the Source for your Configuration

When you select either single or multi-module installation, another menu appears that allows you to choose from the following actions:

- Read a configuration from the OP subdirectory
- Enter a path and filename of another directory for reading a configuration.
- Create a new configuration (default).

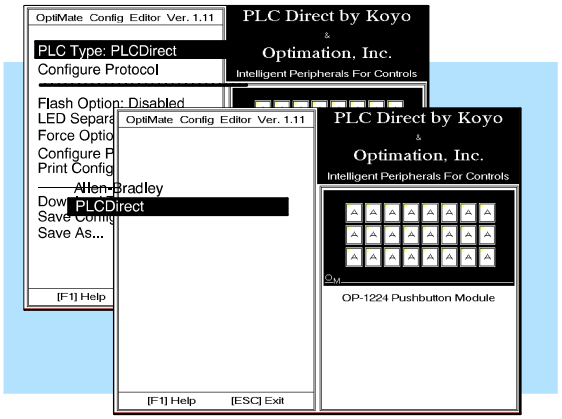
You will want to select **Use Defaults For OP-1224**, since you are creating a configuration file for the first time.



Step 5
Enter the Correct PLC Brand and Type

As soon as you make the above selection and press the <**Enter**> key, you will return to a screen that allows you to enter the type of PLC you will be using. It leads you to a second screen with two choices. Here you should select either **PLCDirect** or **Allen-Bradley**.

Press the <Enter> key to return to previous screen.



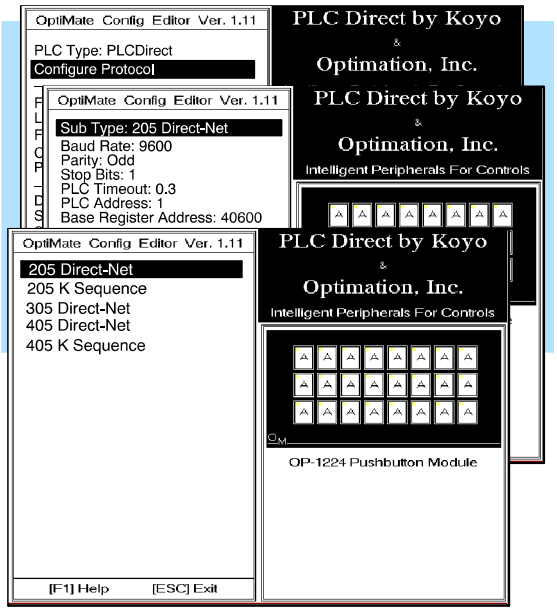
Step 6
Select Configure Protocol

Now select the second line, **Configure Protocol**.

This will take you to another screen that gives you a selection of **PLC Subtype**. The default subtype is indicated. In the example shown, the default is **205 Direct-Net**. To change this, press the <**Enter**> key.

Select the desired protocol for the CPU subtype that you are using. Refer to the appropriate CPU User Manual for the correct protocol corresponding to the communications port you are using.

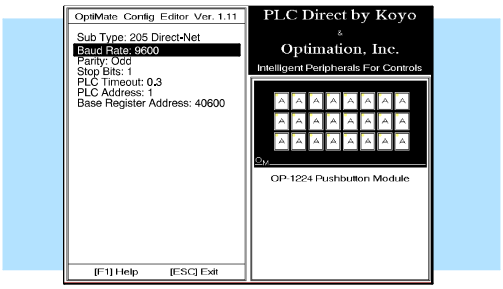
Make sure your choice here matches the CPU port into which you will actually be connected. On some models, one port is K-sequence and another may be DirectNet. On others, you may only have one protocol available.



Step 7A Complete the Communications Information

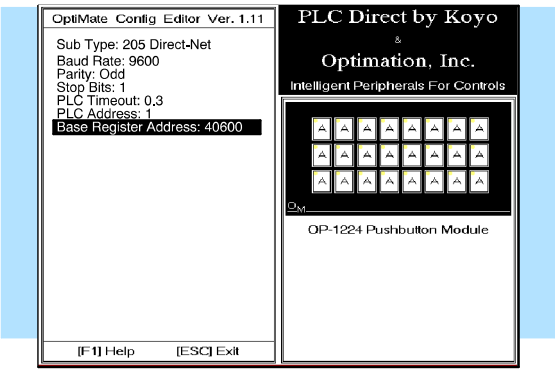
You should now be looking at a screen similar to the one shown here. If you are using a PLC***Direct*** programmable controller, check the chart below for the proper **baud rate, parity and stop bit settings**. For other PLCs, check the respective User Manuals for the proper specifications. The OP-panels will support 4800, 9600 and 19200 baud. Other baud rates of the PLCs are not supported. The table shown below only includes those baud rates that are supported by the OptiMate panels.

You also see a **PLC timeout** selection on the above screen. This means when the panel receives a communications error, it will wait a specified amount of time to receive a good transmission. If it does not receive a good transmission within this timeout period, it will acknowledge the error by flashing all of the LEDs on the panel at a 4 Hz rate. *The default is 0.3 seconds for the timeout period.* You can change this if you want–the valid range is from 0.3 seconds to 25.5 seconds.



PLC Model	Port/Baud Rates	Parity	Stop Bit
DL230/240	Top 9600	Odd	1
	Bottom (DL240 only) 1200/9600/19.2k	Odd/None	
DL330	DCU 1200/9600/19.2k	Odd/None	1
DL340	Top 1200/4800/9600/19.2k	None	1
	Bottom 1200/4800/9600/19.2k	None	
DL430/440	Top 9600	Odd	1
	Bottom 1200/9600/19.2k	Odd/None	
DL450	DB15 9600	Odd	1
	DB25 1200/4800/9600/19.2k	Odd/None	
	RJ12 1200/4800/9600/19.2k	Odd/None	

Step 7B
Select the Base Register Address and File Number

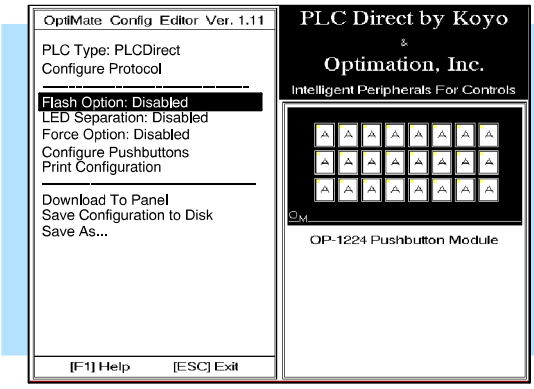


Here you need to indicate a base register address in your PLC that will be used for the mapping process. You should read the next section of this manual and make sure you understand the mapping process and how it relates to your PLC and ladder logic. Read your respective PLC User Manual for details on CPU memory types and memory available.

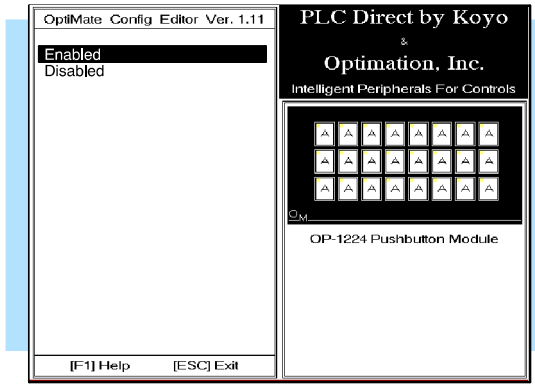
For PLC***Direct*** and compatible CPUs, you will enter a **Base Register Address**. This is the V-memory (DL205/DL405) or R-memory (DL305) location where you want to store panel data. For example, you might choose V40600. You do not enter the letter V or R. You merely enter the starting memory number (i.e. 40600).

If you chose Allen Bradley as your **PLC Type**, you must now enter the **PLC File Number** in addition to a **Base Register Address**. The panel will only recognize integer file types N7 and pre-defined user file types N9 through N255. You enter only the number and not the prefix letter N. The **Base Register Address** is any number between 0 and 255. For example, if you want the starting address N7:0, you enter a **PLC File Type: 7** and a **Base Register Address: 0**.

Step 8
Set the Flash Option



After you have completed Step 7B, press the <**Escape**> key and you will be taken back to the same screen used for Step 6. Here you can select the flashing option if you plan to have any of the LEDs flash during your ladder logic operation. Flashing can provide added emphasis to one or more LEDs that you may want to stand out from the rest. Be aware you consume less PLC memory if you don't enable the flashing feature. Default is set for no flashing.

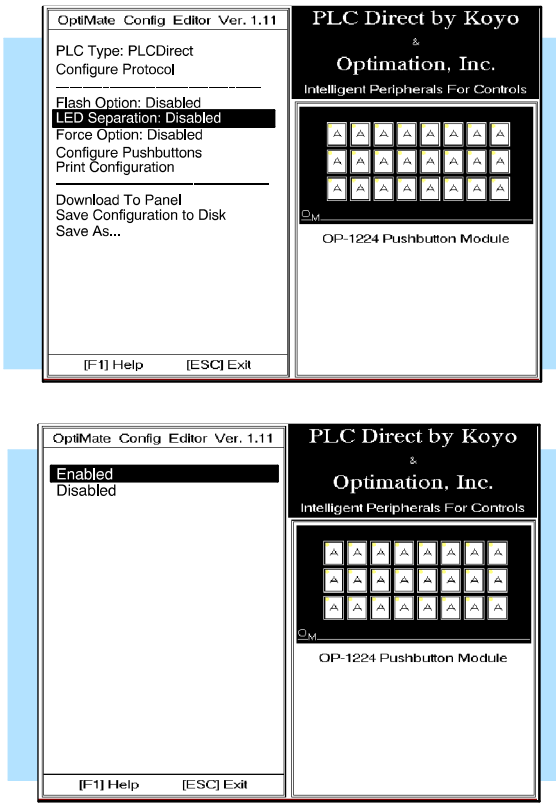


If you want to change the flashing option, position the cursor on **Flash Option:Disabled** (shown above) and then press the <**Enter**> key. The new screen (shown to the right) gives you a choice of **Enabled** or **Disabled**. Make your selection and press the <**Enter**> key again. This will return you to the original screen (top). **Note: The flash option will only work for those buttons you have configured to act as "momentary". See Step 11.**

Step 9
Set the LED Separation Option

Move the cursor down to **LED Separation**. If this function is disabled, an LED will only light when the status of its respective pushbutton is ON. If you enable this feature, the status of the LED is controlled by ladder logic independently of the pushbutton. If you enable this feature, you can still have a pushbutton LED illuminate when pushbutton is turned ON. However, you would have to use your ladder logic to check the status of the pushbutton and actually trigger the LED lighting instead of it happening automatically.

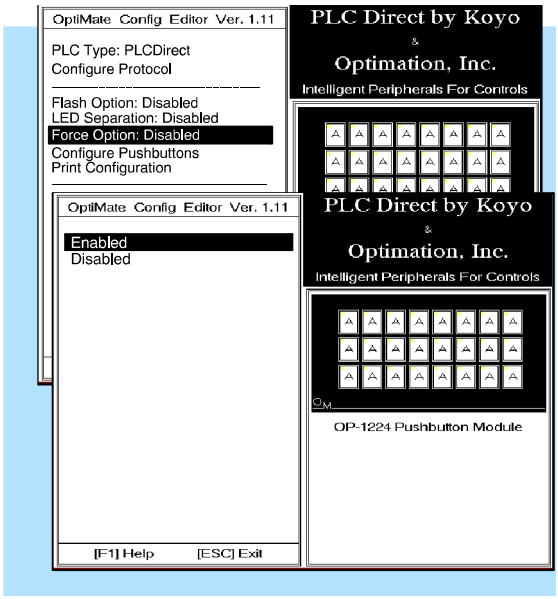
If you want to enable the separation option, position the cursor on **LED Separation:Disabled** (shown above) and then press the <**Enter**> key. The new screen (shown to the right) gives you a choice of **Enabled** or **Disabled**. Make your selection and press the <**Enter**> key again. This will return you to the original screen (top). **Note: This function is only available for those pushbuttons configured as "momentary" . See Step 11.**



Step 10
Set the Force Option

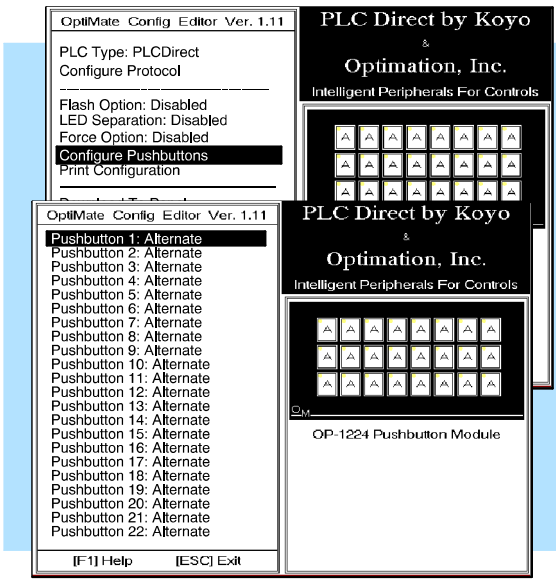
There are some applications where it may be desirable to "force" the status of a pushbutton ON or OFF with your ladder logic. For example, you might have a pushbutton configured that starts a process and you want to know when the process has been completed. In such a case, you might want the pushbutton ON when you start a process, but then have your ladder logic turn the pushbutton OFF when the process is complete.

If you want to enable this Force Option, position the cursor on **Force Option:Disabled** (shown above) and then press the <**Enter**> key. The new screen (shown to the right) gives you a choice of **Enabled** or **Disabled**. Make your selection and press the <**Enter**> key again. This will return you to the original screen (top).



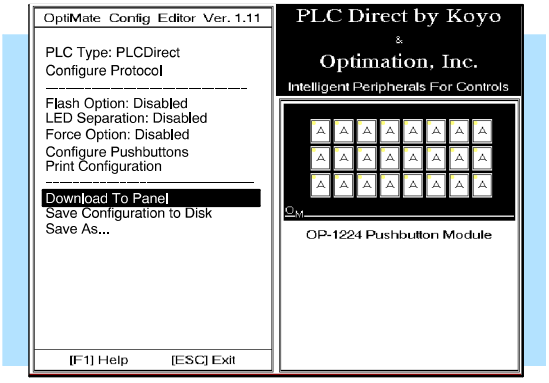
Step 11
Configure the Pushbutton Type

We mentioned earlier that your pushbuttons can operate either as momentary pushbuttons or maintained pushbuttons. **Momentary** pushbuttons only remain ON for as long as you are manually pressing on them. **Maintained** pushbuttons (also called Alternate) will change status everytime you press them, and maintain that status until you press them again. You can determine which way you want each button to operate by selecting **Alternate** or **Momentary**. Use the <**Enter**>key to change from one mode to the other. You must do this for each key. When you are finished, the button diagram will show **M**'s for all the Momentary buttons, and show **A**'s for all the Maintained (Alternate action) buttons. When finished, press <**Escape**>



Step 12
Save and Download

If you have done your configuration without being connected to the OP-panel, then you can either save it to a disk and download it to the panel later; or you can connect to the panel now, and make your download. To download, select **Download to Module** and press the <**Enter**> key. The panel will retain the configuration in its non-volatile, EEPROM memory, but you should also save it to your hard drive or a disk.

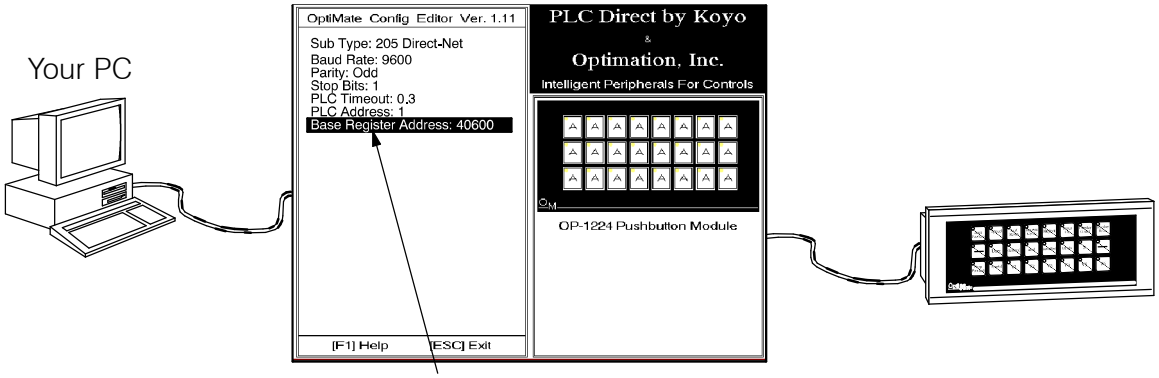


Applying Ladder Logic

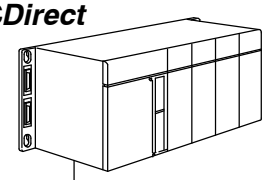
General Concepts

Memory Mapping

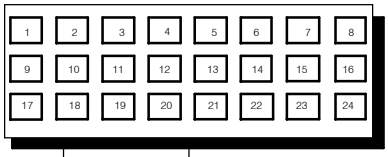
On Pages 2 and 3 of this manual, we introduced you to the basic concept of memory mapping. The OP-1224 uses memory mapping in order to link itself to a PLC. Memory mapping is a technique that maps the memory of the OP-1224 into the memory of the PLC. During initial configuration, you indicate where in the PLC memory you want to start the mapping process (See Step 7B on Page 18). By knowing where the data of the specific panel is mapped, this data can be moved, changed or monitored using ladder logic.



PLC***Direct***



During configuration, you determine the starting address for the memory mapping process.

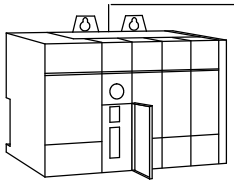


Mapping Assignments

Mapped Memory Location	Function
m (such as V40600) C0-C17	Pushbuttons 1-16 ON/OFF
m+1 (such as V40601) C20-C37	Pushbuttons 17-24 ON/OFF
m+2 (such as V40602) C40-C57	LEDs 1-16 flash
m+3 (such as V40603) C60-C77	LEDs 17-24 flash
m+4 (such as V40604) C100-C117	LEDs 1-16 ON/OFF
m+5 (such as V40605) C120-C137	LEDs 17-24 ON/OFF
m+6 (such as V40606) C140-C157	Force Function Data (1-16)
m+7 (such as V40607) C160-C177	Force Function Mode/Data (17-24)

The pushbuttons are numbered left to right starting in the upper left corner.

Allen-Bradley

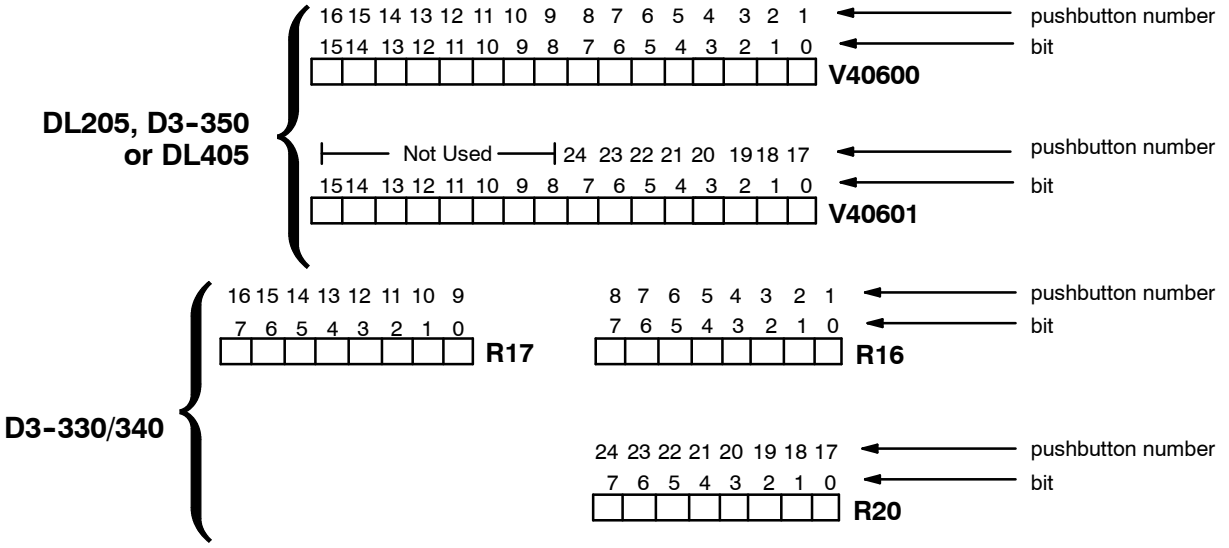


Mapped Memory Location	Function
m (such as N7: 0/0– 0/15)	Pushbuttons 1-16 ON/OFF
m+1 (such as N7: 1/0 1/15)	Pushbuttons 17-24 ON/OFF
m+2 (such as N7: 2/0 2/15)	LEDs 1-16 flash
m+3 (such as N7: 3/0 3/15)	LEDs 17-24 flash
m+4 (such as N7: 4/0 4/15)	LEDs 1-16 ON/OFF
m+5 (such as N7: 5/0 5/15)	LEDs 17-24 ON/OFF
m+6 (such as N7: 6/0 6/15)	Force Function Data (1-16)
m+7 (such as N7: 7/0 7/15)	Force Function Mode/Data (17-24)

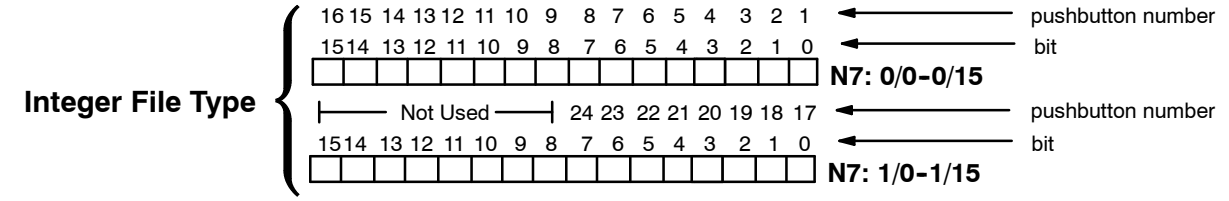
Addressing Conventions

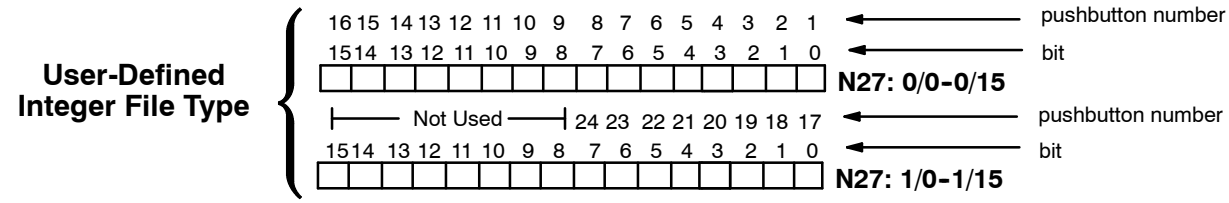
Before we jump into ladder logic programming, let's take a moment to review and compare the addressing conventions used by PLC***Direct*** and Allen-Bradley.

PLC*Direct* Memory–A typical address within a PLC***Direct*** programmable controller is Vxxxx (such as V40600 for the DL205 or DL405 families) or Rxxx (such as R16 for the DL330/340 family). The V-memory in the DL205 and DL405 is divided into 16-bit boundaries, and the R-memory in the DL330/340 is divided into 8-bit boundaries. Refer to your individual User Manuals for complete memory information. The two diagrams below show you how the lamps of the OP-1224 could be mapped during configuration. In this example, we have arbitrarily chosen V40600 and R16 as starting boundaries to map the pushbuttons to the PLC, but it could actually be any available user or internal relay memory areas as long as they are consecutive:



Allen-Bradley Memory–A typical address for Allen-Bradley might be N7:0/0 or N27:0/0. The OP-1224 will allow you to define your starting address for mapping purposes using either Allen-Bradley's integer (N7) file type or user-defined integer file types (N9–N255). *If you plan to use an integer file between N9 and N255, you must define these in the Allen-Bradley memory map before configuring the panel.* Below we have shown you how 16-bit integer files could be used to map the pushbuttons to the Allen-Bradley PLC.





Three Different Ways to Use the Panel

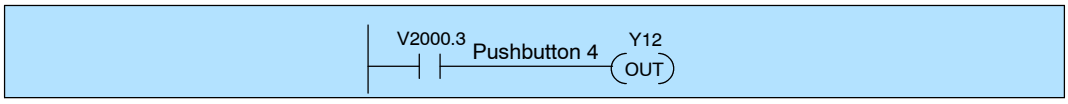
Depending on the type of CPU and the number of OP-1224 functions selected, there are three different ways to interface your ladder logic with the panel.

1. **Bit-of-Word**
2. **Internal Relays**
3. **User Memory Combined with Internal Relays**

Which of these methods is best for you depends on the make and model of the PLC you are using. Let's look at each of these three methods and discuss their relative merits.

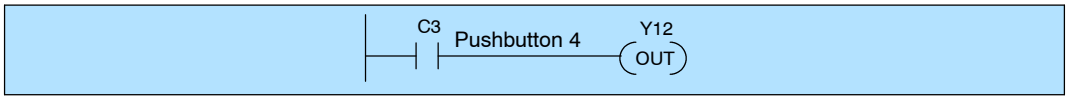
Method 1: Bit-of-Word DL250/350/450 and Allen-Bradley

The most direct way to address the individual bits with your ladder logic is to use "bit-of-word". This method is available to the DL250/350/450 (PLC***Direct***) and SLC 5/03 and 5/04 (Allen-Bradley). Below is a rung of logic that shows how the DL250/350/450 might use the status of bit 3 to control a process connected to Y12. Don't worry about understanding exactly how it works at this point. We will cover that just a few pages later. **Refer to Pages 24-28 for DL250/350/450 examples, Pages 40-47 for Allen-Bradley.**



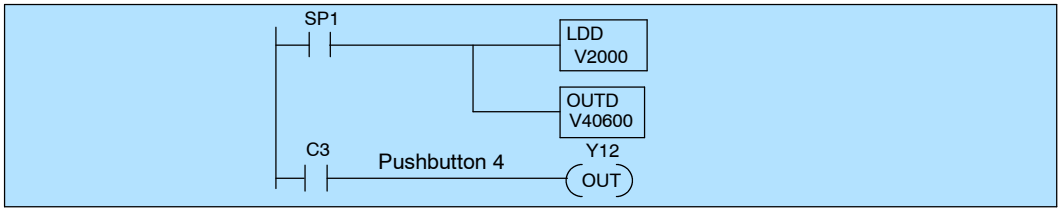
Method 2: Internal Relays (All Options Used)

This method is only available to PLC***Direct*** programmable controllers. If you are already familiar with the DL205, DL305 and DL405 PLCs, then you know about internal relays. These relays, by PLC design, are mapped to certain bits in reserved memory areas. You can make use of these relays during configuration with the OPEditor by mapping directly to the control relay reserved memory area. **This method should only be used if you plan to use all of the functions of the panel; otherwise it will consume internal relays unnecessarily.** Using this method automatically consumes 128 internal relays. In the example below, we have used one of the mapped pushbuttons to control the output Y12. **Refer to Pages 29-33.**



Method 3: Remapping (Selected Options)

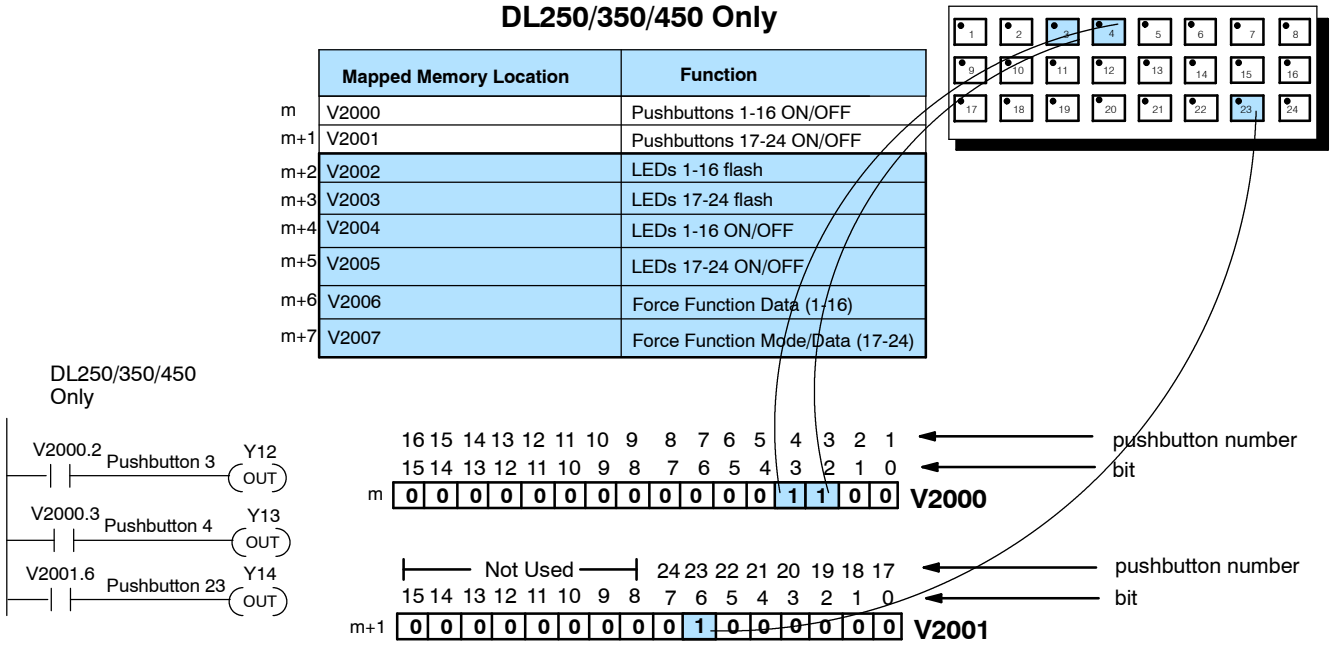
A better way to make use of internal relays when you are not using all of the OP-1224 options is to use a process of "remapping". With this technique you map your panel to user memory (such as V2000), and then map parts of your user memory only to those relays you actually need to use. The example below shows ladder logic necessary to detect when a pushbutton has been pressed. It maps V2000/V2001 to V40600/V40601 and consumes only 32 relays. The point is-it uses only the relays necessary for the option you have selected. We'll make this clearer in a moment when we give you specific ladder logic examples that use this technique. **By convention, in this manual we will use syntax of the form V2000:V40600 to refer to memory locations that have been mapped together**. **Refer to Pages 34-39 for ladder logic examples.**



Using the OP-1224 with the DL250/350/450

Using Pushbutton Status Via Ladder Logic

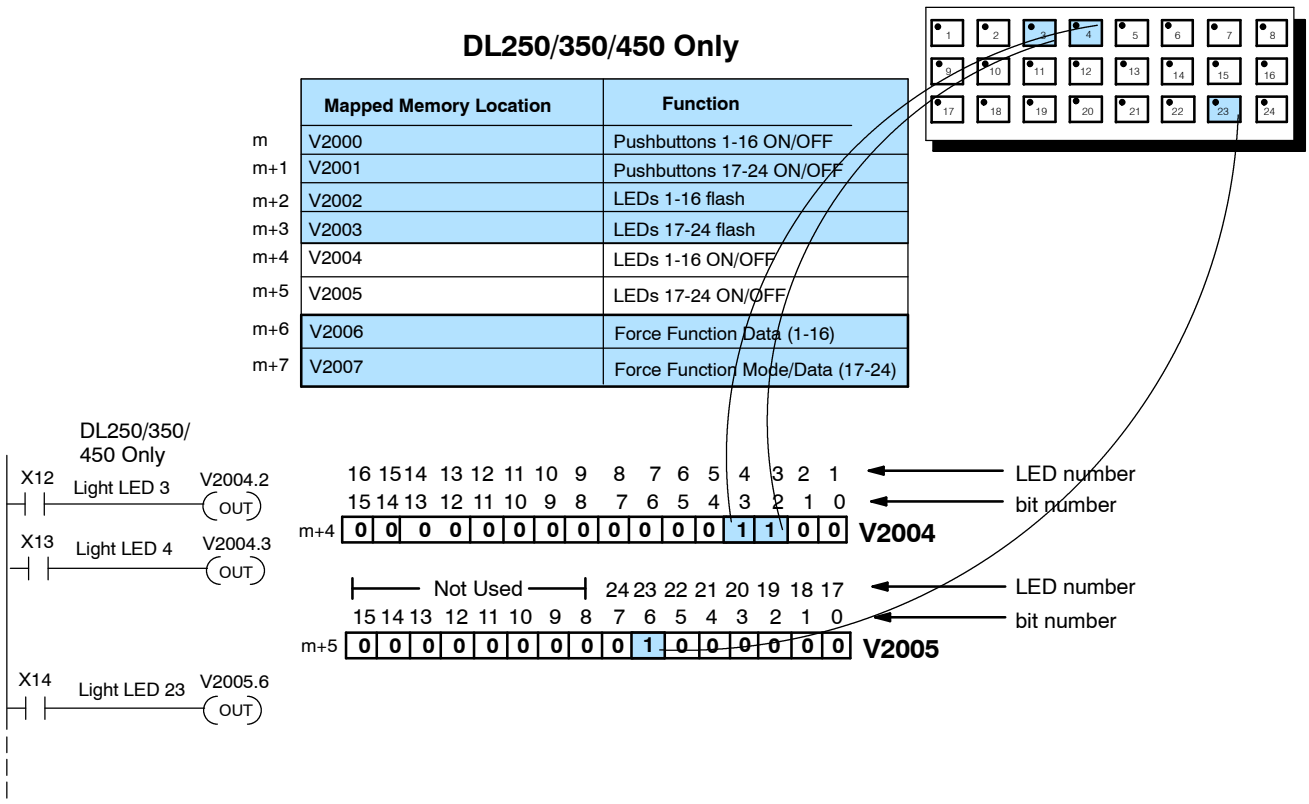
By convention we are using the letter m to refer to consecutive memory locations in the PLC. Memory locations **m** and **m+1** reflect the state of the pushbuttons. If you have the DL250/350/450, the status of the individual bits of these two words is easily determined by using the bit-of-word instruction. The example shown below uses a base register address of V2000 to map the status of the pushbuttons. When Pushbutton 3 is pressed it affects bit 2 of V2000. Likewise, Pushbutton 4 affects bit 3. Pushbutton 23 affects bit 6 of V2001.



Controlling LEDs Separately with the DL250/350/450

By default, the LED simply shows the state of the pushbutton–ON or OFF. If a pushbutton is configured for momentary operation, there are two options available for the LED. It can show the state of the pushbutton or it can be controlled independently by enabling the **LED Separation** feature. When you have enabled the LED Separation feature, the ON/OFF state of the LED is controlled only by the status of the bits in **m+4** and **m+5**. These bits can be manipulated via your ladder logic. **Remember: Any pushbutton configured for maintained (alternate action) will ignore the bits in these two words.**

In the example below, we show how the bit-of-word instruction can control LEDs 3, 4 and 23 when you have designated V2000 as the base address during configuration with your OPEditor software. X12 turns ON LED3, X13 turns ON LED4, and X14 turns ON LED23. **Remember: Independent control of the LEDs can only be accomplished if you have Enabled LED Separation during your initial configuration. (See Page 19, Step 9.)**



Adding Flashing with the DL250/350/450

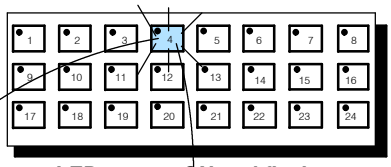
If you plan to use this feature with one or more pushbuttons, there are three things you must always remember during configuration:

1. Flashing is only available for those buttons that have been configured as **Momentary**.
2. **LED Separation** must be Enabled.
3. The **Flash Option** must be Enabled.

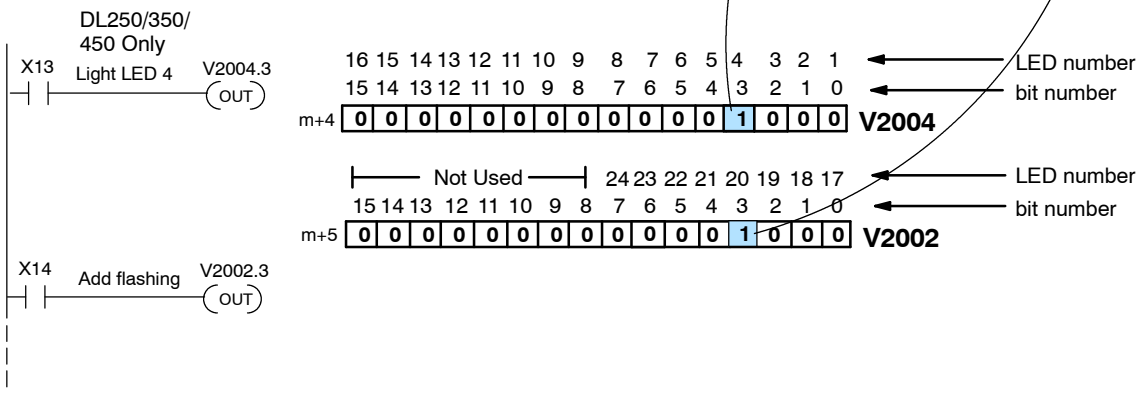
The Flashing Option is triggered through your ladder logic. On the previous page, we showed you how to turn ON an LED, this example shows you how to add flashing to an LED that has been turned ON. The flashing feature is controlled by the status of the bits in **m+2** and **m+3** memory areas. In the example below, we have begun our mapping at V2000 during the initial configuration. We are turning ON LED4 and then making it flash. Bit 3 of V2004 turns the LED ON, and bit 3 or V2002 makes it flash.

DL250/350/450 Only

	Mapped Memory Location	Function
m	V2000	Pushbuttons 1-16 ON/OFF
m+1	V2001	Pushbuttons 17-24 ON/OFF
m+2	V2002	LEDs 1-16 flash
m+3	V2003	LEDs 17-24 flash
m+4	V2004	LEDs 1-16 ON/OFF
m+5	V2005	LEDs 17-24 ON/OFF
m+6	V2006	Force Function Data (1-16)
m+7	V2007	Force Function Mode/Data (17-24)



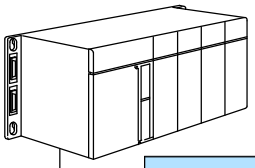
LED 4 turns ON and flashes



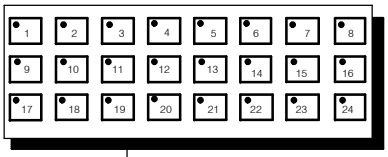
Force Function Registers

The OP-1224 has the capability to "force" a pushbutton ON or OFF through your ladder logic. If you plan to use this function, you must enable the force option during configuration. (See Page 20, Step 10.)

NOTE: The Force Function will only work for those pushbuttons that you have configured as "maintained" (alternate action). It will not work for momentary pushbuttons.



Mapping Assignments



PLC***Direct***

Mapped Memory Location	Function
m (such as V2000)	Pushbuttons 1-16 ON/OFF
m+1 (such as V2001)	Pushbuttons 17-24 ON/OFF
m+2 (such as V2002)	LEDs 1-16 flash
m+3 (such as V2003)	LEDs 17-24 flash
m+4 (such as V2004)	LEDs 1-16 ON/OFF
m+5 (such as V2005)	LEDs 17-24 ON/OFF
m+6 (such as V2006)	Force Function Data (1-16)
m+7 (such as V2007)	Force Function Mode/Data (17-24)

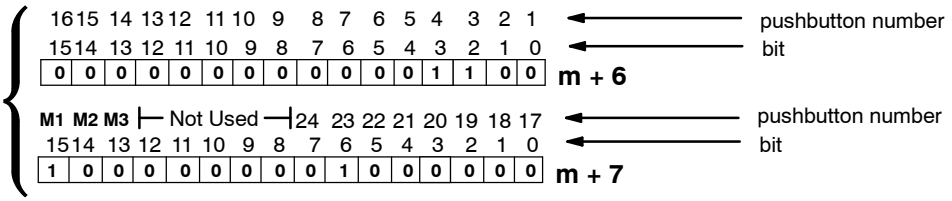
How the Memory is Used-Looking at the above memory map**, m+6** stores the forcing data for Pushbuttons 1-16 and **m+7** stores forcing data for Pushbuttons 17-24. There are three modes of the force function. These modes are controlled by the 3 most significant bits of m+7.

Mode 1 (M1)- This <u>forces all of the Pushbuttons to reflect the status</u> stored in m+6 and m+7. For example, the data shown below would force Pushbuttons 3, 4 and 23 to ON and all the others would be forced OFF. Notice that bit 15 of m +7 is set to 1 for this mode. M2 and M3 are set to 0's.

Mode 2 (M2)- This <u>forces ON only those Pushbuttons matching the bits set</u> in registers m+6 and m+7. The bits not set do not affect the status of the Pushbuttons. You would set M2 to 1 while M1 and M3 are set to 0.

Mode 3 (M3)- This <u>forces OFF only those Pushbuttons matching the bits set</u> in registers m+6 and m+7. The bits not set do not affect the status of the Pushbuttons. You would set M3 to 1, while M1 and M2 are set to 0.

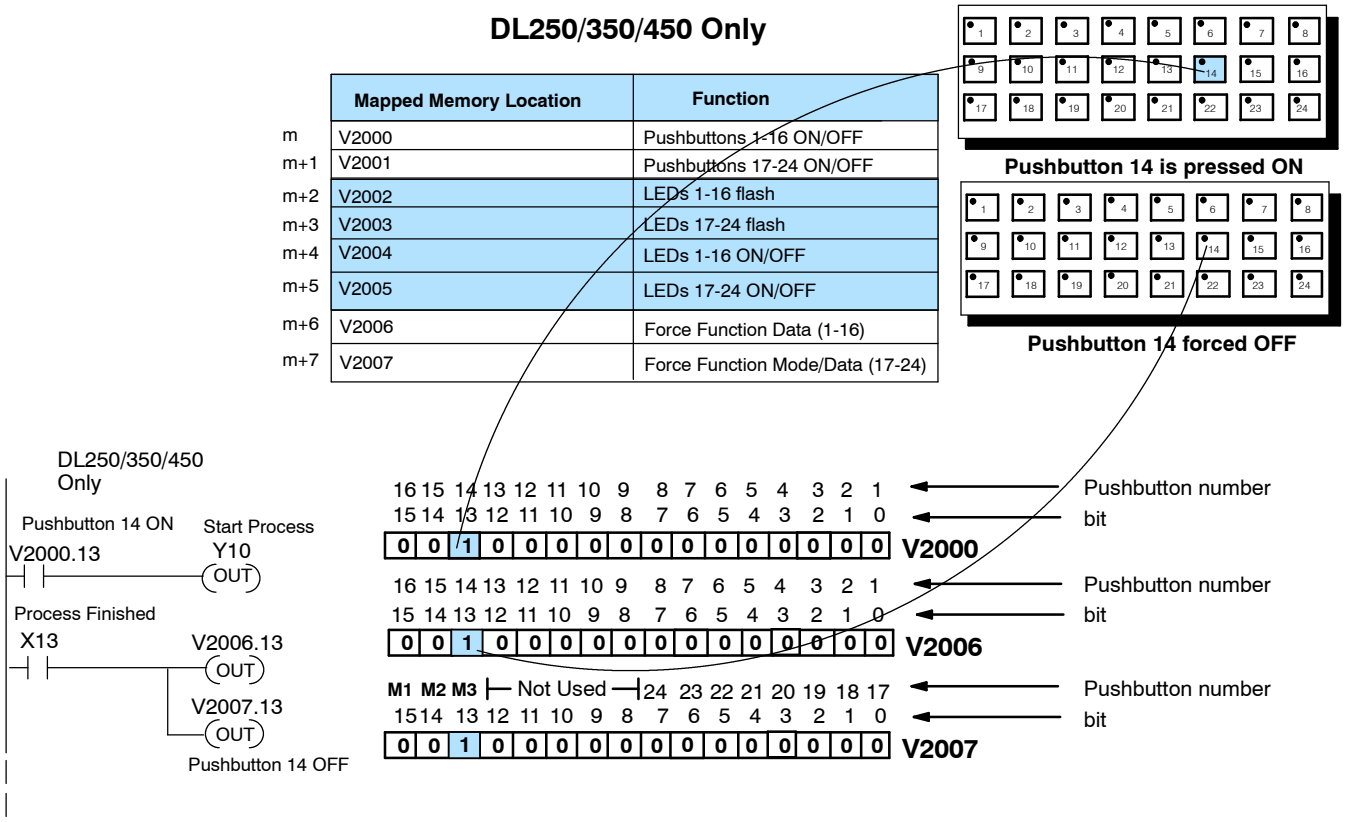
Force Function Registers



Think of forcing as a one-shot process. That is, once you have set the mode in m+7, the bit patterns in m and m+1 are changed (according to the mode selected), and then, all of the bits in m+6 and m+7 <u>are set to zero</u>. What this means is that all pushbuttons return to normal manual operation after the forcing is completed.

Forcing Pushbuttons ON/OFF with DL250/350/450

You can also use bit-of-word with the DL250/350/450 to force pushbuttons ON or OFF. Here, during configuration with the OPEditor, we have chosen V2000 as our base address for the mapping in the PLC. In this example, we are using Pushbutton 14 to start a process, and then forcing the pushbutton OFF when the process is completed. Memory location **m** (V2000 in this case) holds the bit that reflects the status of Pushbutton 14. Memory locations **m+6** and **m+7** hold the data for the forcing. Here we have chosen to use Mode 3. With this mode, whichever bits are set to 1 in m+6 and m+7, the corresponding pushbuttons will be forced to OFF. In the following example, we only set bit 13 in m+6; so only Pushbutton 14 is turned OFF.

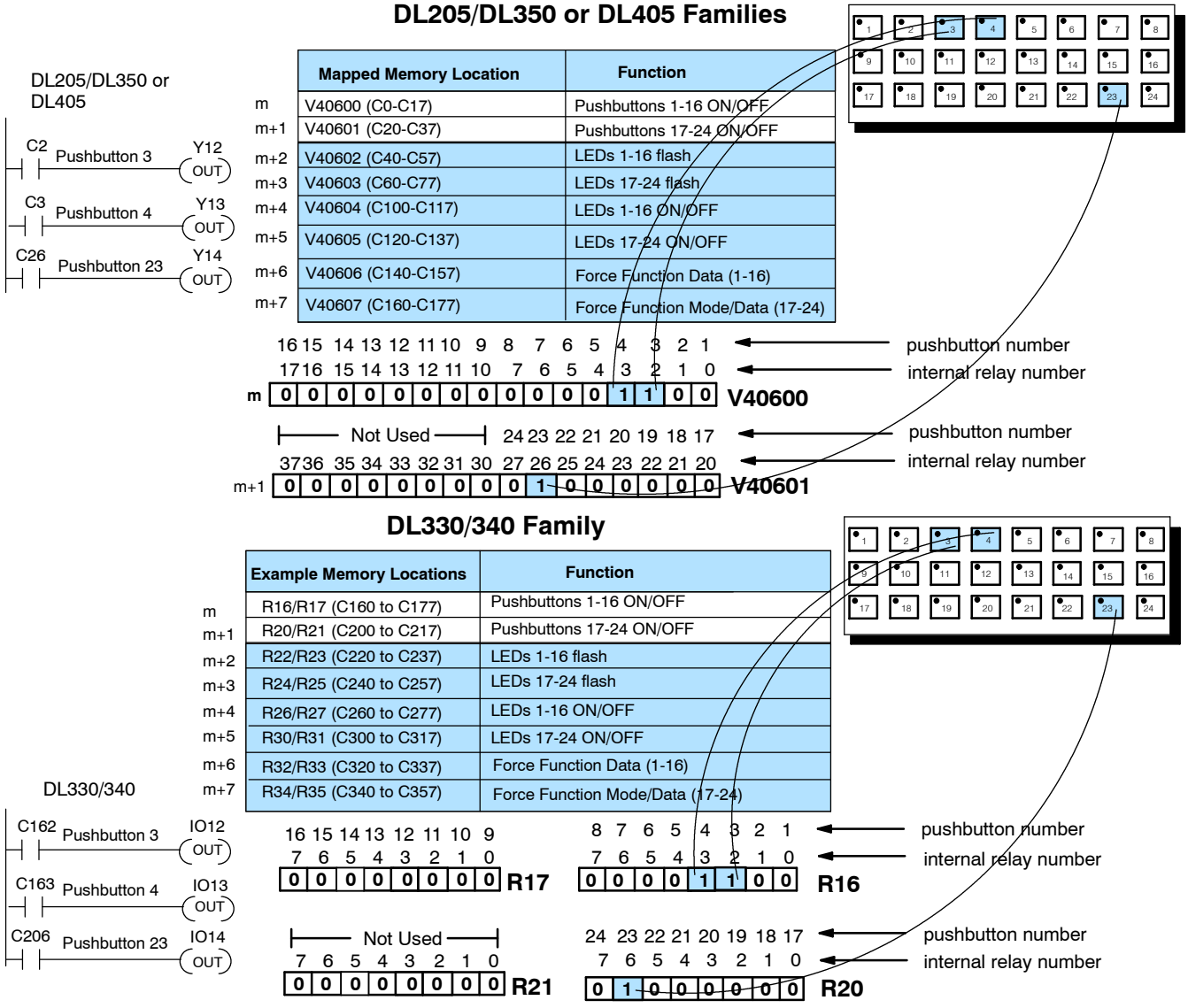


DL205/DL305/DL405 (Using All Functions)

Using Pushbutton Status Via Ladder Logic

When you configure the OP1224, you must choose a base address in the CPU. This address can be a direct mapping to the reserved memory locations that are tied to internal relays. The internal relays of the DL205 and DL405 families start at V40600 and the internal relays of the DL305 family start at R16. Using this method, the total mapping consumes 128 internal relays. You should only use this method when using all of the OP-1224 functions. In the examples below, we have chosen V40600 as the starting address for either a DL205 or DL405. We have chosen R16 as our starting address for the DL305. *Notice that the internal control relays are numbered in octal and not decimal.* In the examples below, our ladder logic is interacting with Pushbuttons 3, 4 and 23.

DL205/DL350 or DL405 Families



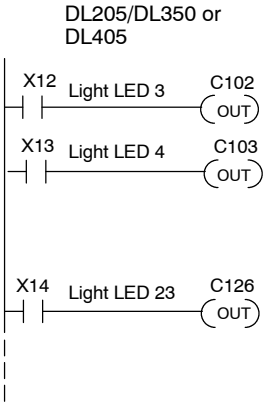
DL330/340 Family

Note: To determine the control relay number, use the register number as the first two digits and the bit number as the last digit. For example, Bit 3 of R16 is referenced as C163.

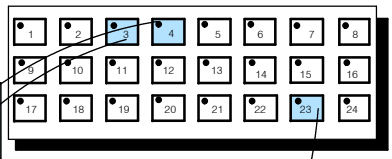
Controlling LEDs Separately

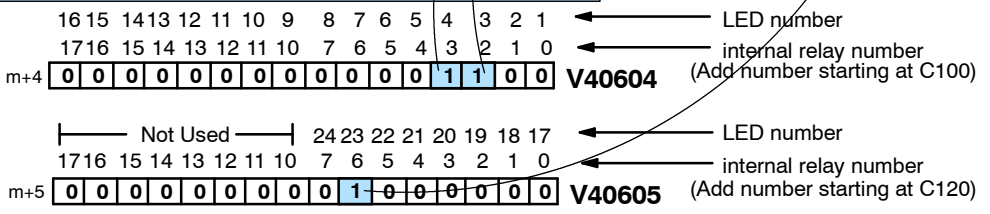
By default, the LED simply shows the state of the pushbutton–ON or OFF. If a pushbutton is configured for momentary operation, there are two options available for the LED. It can show the state of the pushbutton or it can be controlled independently by enabling the **LED Separation** feature. When you have enabled the LED Separation feature, the ON/OFF state of the LED is controlled only by the status of the bits in **m+4** and **m+5**. These bits can be manipulated via your ladder logic. In the examples below, our ladder logic is controlling LEDs 3, 4 and 23. **Remember: Any pushbutton configured for maintained (alternate action) will ignore the bits in these two words. Independent control of the LEDs can only be accomplished if you have Enabled LED Separation during your initial configuration. (See Page 19, Step 9.)**

DL205/DL350 and DL405 Family

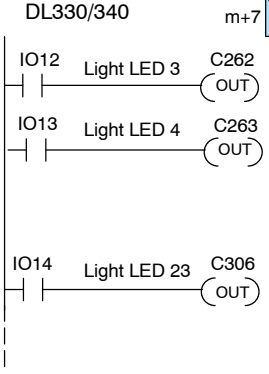


	Mapped Memory Location	Function
m	V40600 (C0-C17)	Pushbuttons 1-16 ON/OFF
m+1	V40601 (C20-C37)	Pushbuttons 17-24 ON/OFF
m+2	V40602 (C40-C57)	LEDs 1-16 flash
m+3	V40603 (C60-C77)	LEDs 17-24 flash
m+4	V40604 (C100-C117)	LEDs 1-16 ON/OFF
m+5	V40605 (C120-C137)	LEDs 17-24 ON/OFF
m+6	V40606 (C140-C157)	Force Function Data (1-16)
m+7	V40607 (C160-C177)	Force Function Mode/Data (17-24)

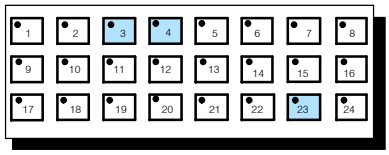


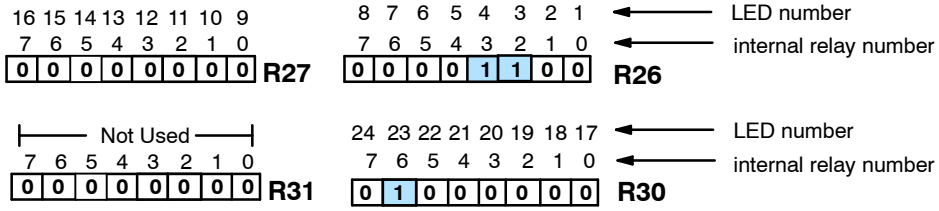


DL330/340 Family



	Example Memory Locations	Function
m	R16/R17 (C160 to C177)	Pushbuttons 1-16 ON/OFF
m+1	R20/R21 (C200 to C217)	Pushbuttons 17-24 ON/OFF
m+2	R22/R23 (C220 to C237)	LEDs 1-16 flash
m+3	R24/R25 (C240 to C257)	LEDs 17-24 flash
m+4	R26/R27 (C260 to C277)	LEDs 1-16 ON/OFF
m+5	R30/R31 (C300 to C317)	LEDs 17-24 ON/OFF
m+6	R32/R33 (C320 to C337)	Force Function Data (1-16)
m+7	R34/R35 (C340 to C357)	Force Function Mode/Data (17-24)





Note: To determine the control relay number, use the register number as the first two digits and the bit number as the last digit. For example, Bit 3 of R26 is referenced as C263.

Adding Flashing

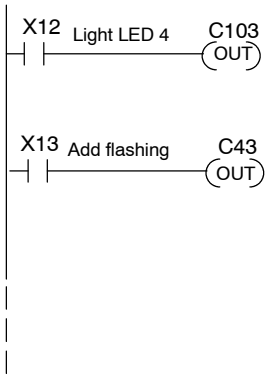
If you plan to use this feature with one or more pushbuttons, there are three things you must always remember during configuration:

1. Flashing is only available for those buttons that have been configured as **Momentary**.
2. **LED Separation** must be Enabled.
3. The **Flash Option** must be Enabled.

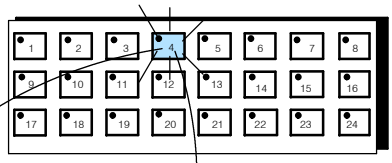
The Flashing Option option is triggered through your ladder logic. On the previous page, we showed you how to turn ON an LED, this example shows you how to add flashing to an LED that has been turned ON. The flashing feature is controlled by the status of the bits in **m+2** and **m+3** memory areas. In the example below, we have begun our mapping at V40600 during the initial configuration. We are turning ON LED4 and then making it flash. Bit 3 of **m+4** turns the LED ON, and bit 3 of **m+2** makes it flash.

DL205/DL350 or DL405 Families

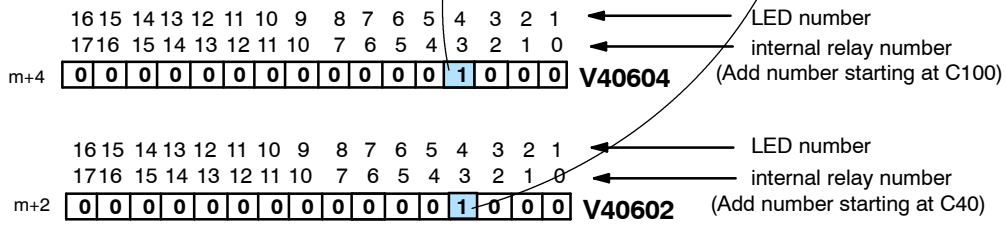
DL205/DL350 or DL405



	Mapped Memory Location	Function
m	V40600 (C0-C17)	Pushbuttons 1-16 ON/OFF
m+1	V40601 (C20-C37)	Pushbuttons 17-24 ON/OFF
m+2	V40602 (C40-C57)	LEDs 1-16 flash
m+3	V40603 (C60-C77)	LEDs 17-24 flash
m+4	V40604 (C100-C117)	LEDs 1-16 ON/OFF
m+5	V40605 (C120-C137)	LEDs 17-24 ON/OFF
m+6	V40606 (C140-C157)	Force Function Data (1-16)
m+7	V40607 (C160-C177)	Force Function Mode/Data (17-24)

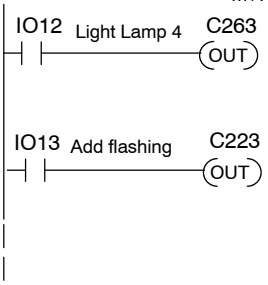


LED 4 turns ON and flashes

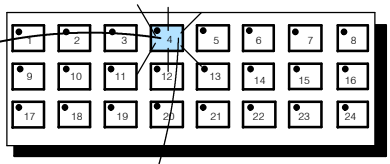


DL330/340 Family

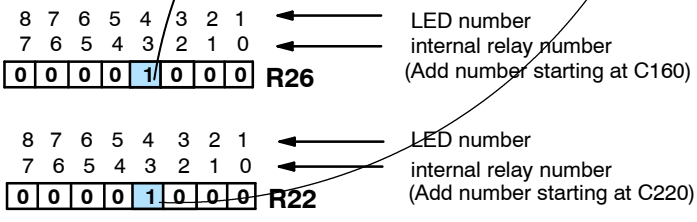
DL330/340



	Example Memory Locations	Function
m	R16/R17 (C160 to C177)	Pushbuttons 1-16 ON/OFF
m+1	R20/R21 (C200 to C217)	Pushbuttons 17-24 ON/OFF
m+2	R22/R23 (C220 to C237)	LEDs 1-16 flash
m+3	R24/R25 (C240 to C257)	LEDs 17-24 flash
m+4	R26/R27 (C260 to C277)	LEDs 1-16 ON/OFF
m+5	R30/R31 (C300 to C317)	LEDs 17-24 ON/OFF
m+6	R32/R33 (C320 to C337)	Force Function Data (1-16)
m+7	R34/R35 (C340 to C357)	Force Function Mode/Data (17-24)



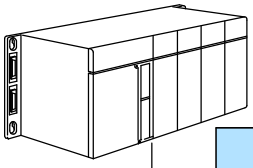
LED 4 turns ON and flashes



Force Function Registers

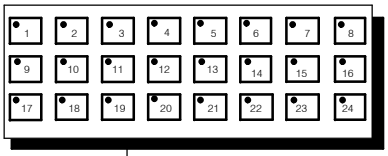
The OP-1224 has the capability to "force" a pushbutton ON or OFF through your ladder logic. If you plan to use this function, you must enable the force option during configuration. (See Page 20.)

NOTE: The Force Function will only work for those pushbuttons that you have configured as "maintained" (alternate action). It will not work for momentary pushbuttons.



PLC*Direct*

Mapping Assignments



Mapped Memory Location	Function
m (such as V40600, C0-C17)	Pushbuttons 1-16 ON/OFF
m+1 (such as V40601, C20-C37)	Pushbuttons 17-24 ON/OFF
m+2 (such as V40602, C40-C57)	LEDs 1-16 flash
m+3 (such as V40600, C60-C77)	LEDs 17-24 flash
m+4 (such as V40604, C100-C117)	LEDs 1-16 ON/OFF
m+5 (such as V40605, C120-C137)	LEDs 17-24 ON/OFF
m+6 (such as V40606, C140-C157)	Force Function Data (1-16)
m+7 (such as V40607, C160-C177)	Force Function Mode/Data (17-24)

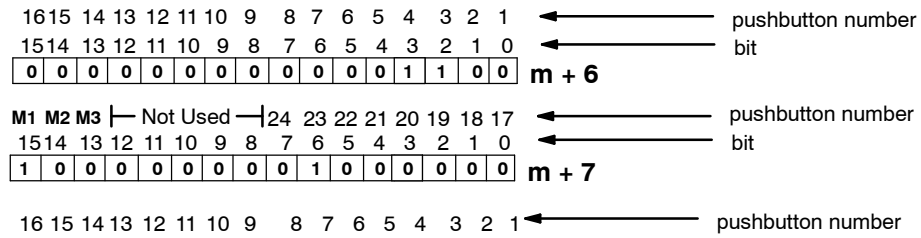
How the Memory is Used-Looking at the above memory map**, m+6** stores the forcing data for Pushbuttons 1-16 and **m+7** stores forcing data for Pushbuttons 17-24. There are three modes of the force function. These modes are controlled by the 3 most significant bits of m+7.

Mode 1 (M1)- This <u>forces all of the Pushbuttons to reflect the status</u> stored in m+6 and m+7. For example, the data shown below would force Pushbuttons 3, 4 and 23 to ON and all the others would be forced OFF. Notice that bit 15 of m +7 is set to 1 for this mode. M2 and M3 are set to 0's.

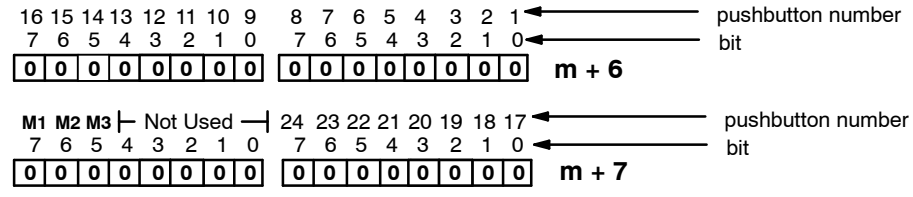
Mode 2 (M2)- This <u>forces ON only those Pushbuttons matching the bits set</u> in registers m+6 and m+7. The bits not set do not affect the status of the Pushbuttons. You would set M2 to 1 while M1 and M3 are set to 0.

Mode 3 (M3)- This <u>forces OFF only those Pushbuttons matching the bits set</u> in registers m+6 and m+7. The bits not set do not affect the status of the Pushbuttons. You would set M3 to 1 while M1 and M2 are set 0.

Force Function Registers for DL205/DL350/ DL405



Force Function Registers for DL3330/340



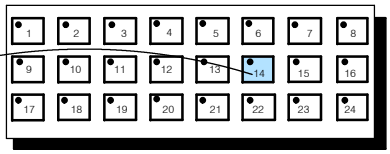
Think of forcing as a one-shot process. That is, once you have set the mode in m+7, the bit patterns in m and m+1 are changed (according to the mode selected), and then, all of the bits in m+6 and m+7 <u>are set to zero</u>. What this means is that all pushbuttons return to normal manual operation after the forcing is completed.

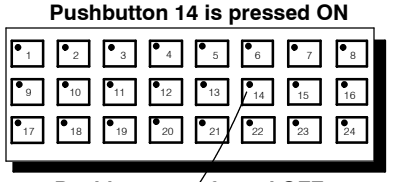
Forcing Pushbuttons ON or OFF

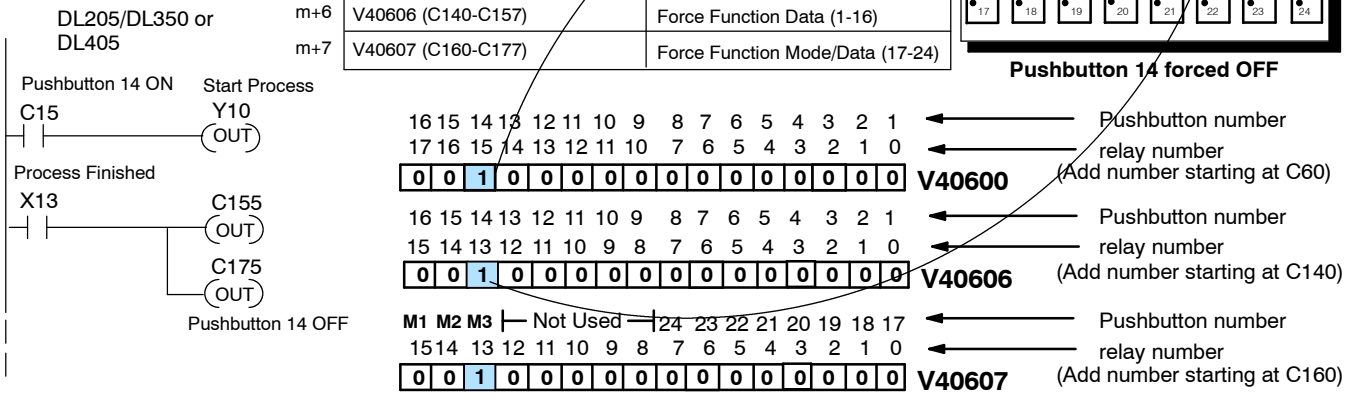
In this example, we have used Mode 3 of the Force Function to force Pushbutton 14 OFF when a process has been completed. Be sure and read Page 32 (if you haven't already done so) to learn the function of all three modes. For the DL205/DL405 example, we have used a base address of V40600. And for the DL305, we have used R16.

DL205/DL350 or DL405 Families

	Mapped Memory Location	Function
m	V40600 (C0-C17)	Pushbuttons 1-16 ON/OFF
m+1	V40601 (C20-C37)	Pushbuttons 17-24 ON/OFF
m+2	V40602 (C40-C57)	LEDs 1-16 flash
m+3	V40603 (C60-C77)	LEDs 17-24 flash
m+4	V40604 (C100-C117)	LEDs 1-16 ON/OFF
m+5	V40605 (C120-C137)	LEDs 17-24 ON/OFF
m+6	V40606 (C140-C157)	Force Function Data (1-16)
m+7	V40607 (C160-C177)	Force Function Mode/Data (17-24)

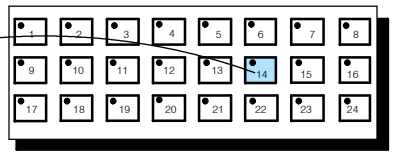


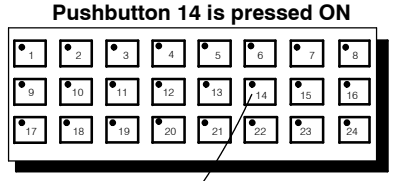


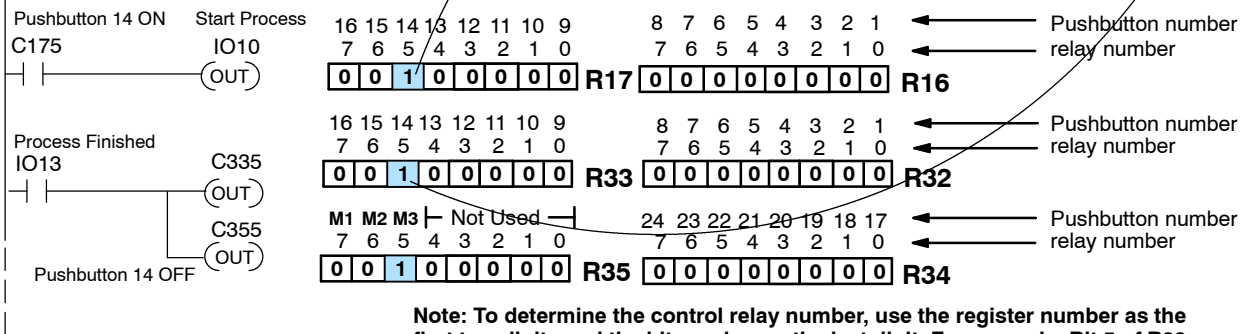


DL330/340 Family

	Example Memory Locations	Function
m	R16/R17 (C160 to C177)	Pushbuttons 1-16 ON/OFF
m+1	R20/R21 (C200 to C217)	Pushbuttons 17-24 ON/OFF
m+2	R22/R23 (C220 to C237)	LEDs 1-16 flash
m+3	R24/R25 (C240 to C257)	LEDs 17-24 flash
m+4	R26/R27 (C260 to C277)	LEDs 1-16 ON/OFF
m+5	R30/R31 (C300 to C317)	LEDs 17-24 ON/OFF
m+6	R32/R33 (C320 to C337)	Force Function Data (1-16)
m+7	R34/R35 (C340 to C357)	Force Function Mode/Data (17-24)





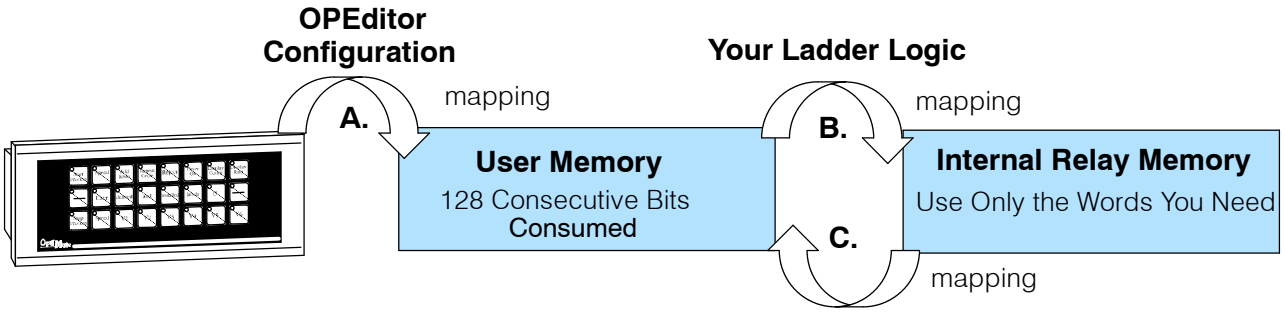


Note: To determine the control relay number, use the register number as the first two digits and the bit number as the last digit. For example, Bit 5 of R33 is referenced as C335.

DL205/DL305/DL405 (Using Selected Functions)

Using the Remapping Process

We briefly discussed the "remapping" process back on Page 23 as a method that allows you to easily manipulate individual bits to take advantage of the panels several functions. All the functions are bit-controlled. By using this method, we only consume the number of relays we actually need for the functions we select.

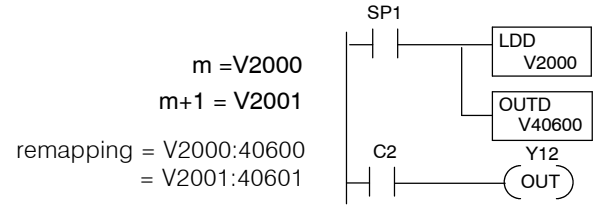


Using the remapping method, when you first indicate a base register address with your OPEditor software and download it to the panel, the panel configuration will automatically consume 128 consecutive memory bits in PLC User Memory. This is indicated by the arrow A. But since User Memory doesn't give you bit control, you need to remap the User Memory with Internal Relay Memory. By remapping between User Memory and Internal Relay Memory, you only consume the Relay Memory you need. You have two directions in which you can have your ladder logic do the remapping between User Memory and Internal Relay Memory:

1. For using the Pushbutton Status to control outputs, you will want to write ladder logic that maps User Memory to Internal Relay Memory (arrow B). This affects the User Memory in the **m** and **m+1** locations.
2. For controlling all other functions of the panel, you will want to write your ladder logic to map Internal Relay Memory to User Memory (arrow C). This affects the User Memory in locations **m+2** through **m+7**.

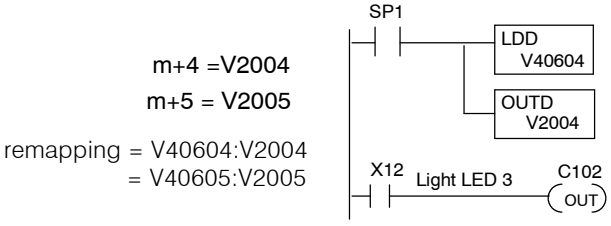
Let's look at two examples of remapping accomplished with ladder logic that demonstrate the two types of remapping that can be used with this technique. We will assume here that V2000 was used as the base register address:

Example of User Memory being mapped to Internal Relay Memory



Here we are using SP1 to map V2000/V2001 to V40600/V40601. This consumes 32 relay bits, 24 of which are tied to the 24 pushbuttons of the panel. By pressing Pushbutton 3, you affect the status of the third relay in V40600 which is C2. In turn, C2 will control output Y12.

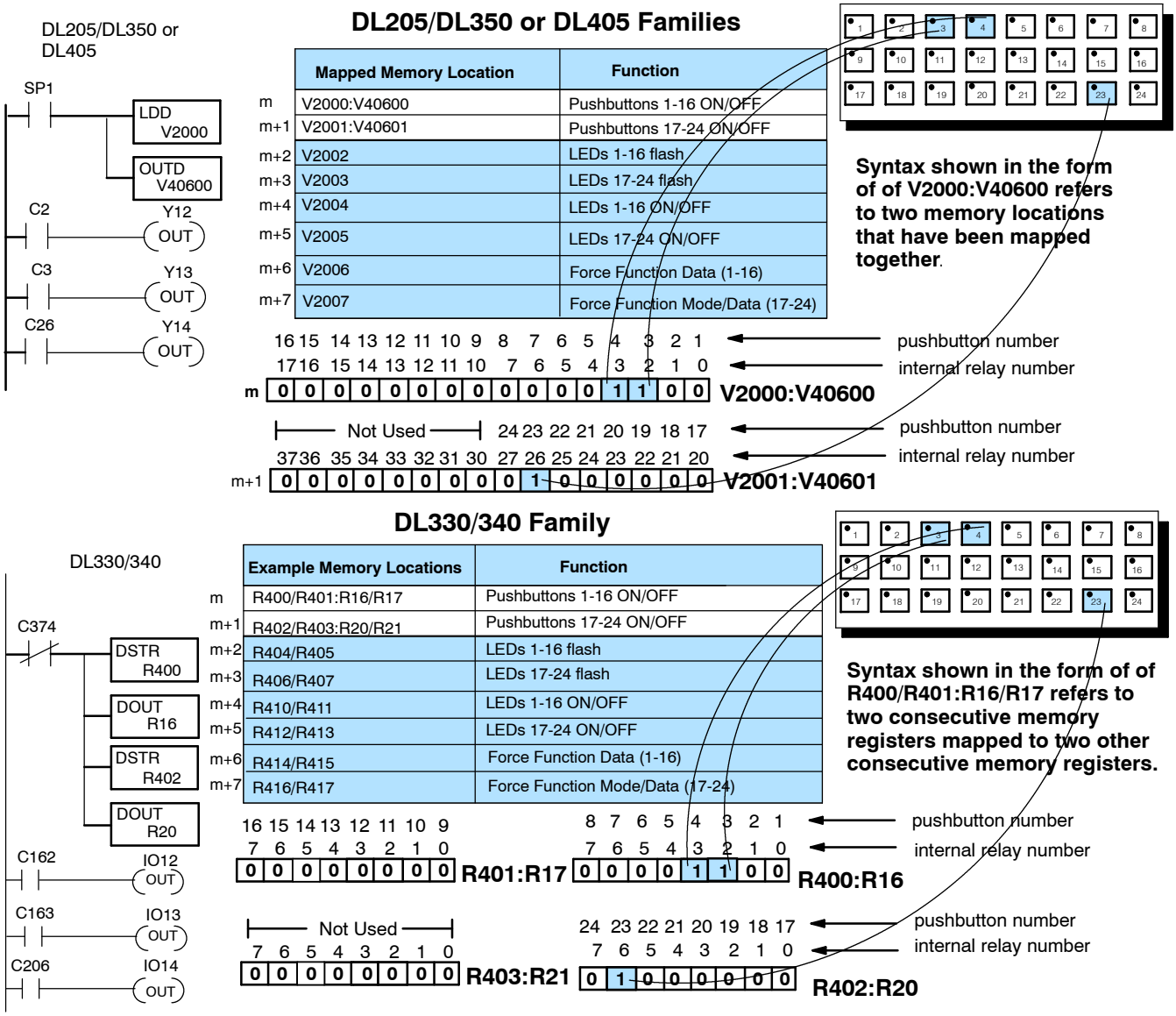
Example of Internal Relay Memory being mapped to User Memory



Here we are using SP1 to map V40604/V40605 to V2004/V2005. This consumes 32 relay bits, 24 of which are tied to the 24 LEDs of the panel. When a relay is ON, its corresponding LED is ON. By turning ON X12 with our ladder logic, we can thus turn on the LED corresponding to C102. C102 is bit 2 of the V40604 word and is tied to LED3 through the mapping process. See your PLC User Manual for relay number assignments

Using Pushbutton Status Via Ladder Logic

In this example, we are going to remap user memory to internal relay memory in order to use the the pushbutton status to control outputs. The internal relays of the DL205 and DL405 families start at V40600 and the internal relays of the DL305 family start at R16. In the examples below, we have chosen V2000 as the base address for either a DL205 or DL405 and then used SP1 (always ON relay) in our ladder logic to map it to V40600. We have chosen R400 as our base address for the DL305 and then used normally closed C374 in our ladder logic to map it to R16. Using SP1 and normally closed C374, the remapping is done every scan, otherwise m and m+1 would not be updated. In the examples below, our ladder logic is interacting with Pushbuttons 3, 4 and 23.

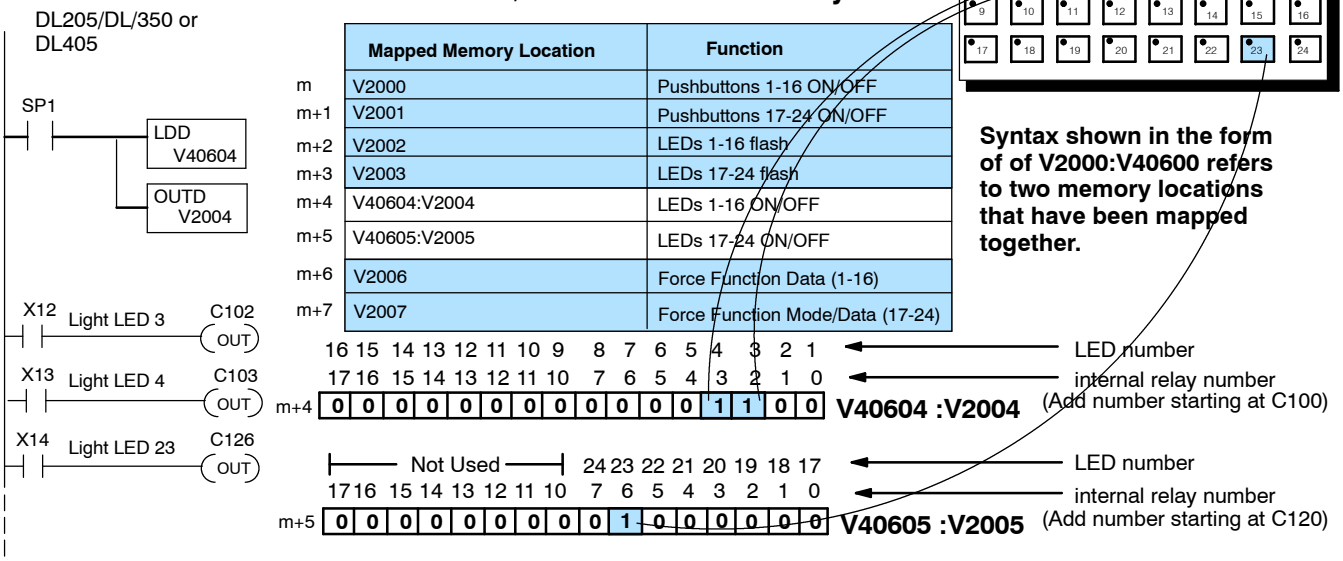


Note: To determine the control relay number, use the register number as the first two digits and the bit number as the last digit. For example, Bit 3 of R16 is referenced as C163.

Controlling LEDs Separately

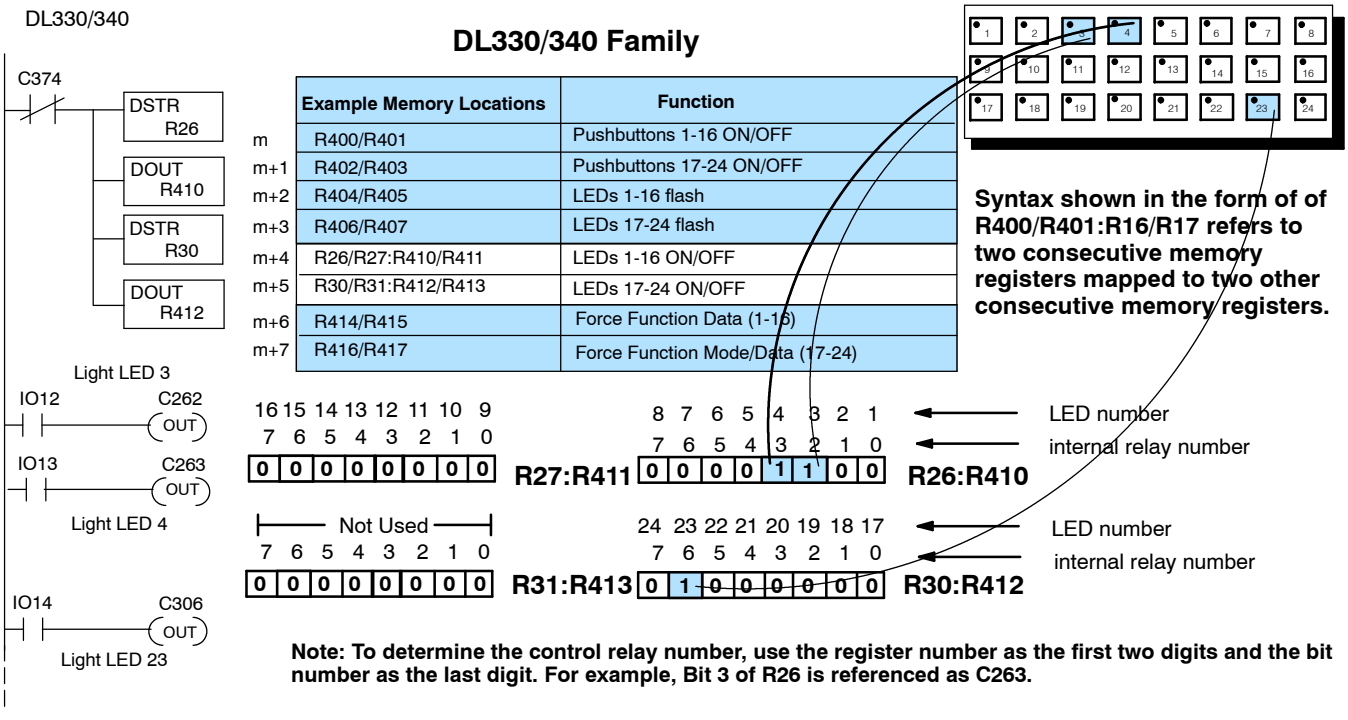
By default, the LED simply shows the state of the pushbutton–ON or OFF. If a pushbutton is configured for momentary operation, there are two options available for the LED. It can show the state of the pushbutton or it can be controlled independently by enabling the **LED Separation** feature. When you have enabled the LED Separation feature, the ON/OFF state of the LED is controlled only by the status of the bits in **m+4** and **m+5**. These bits can be manipulated via your ladder logic. In the examples below we have remapped the user memory to control relay memory to control LEDs 3, 4 and 23. **Remember: Any pushbutton configured for maintained (alternate action) will ignore the bits in these two words. Independent control of the LEDs can only be accomplished if you have Enabled LED Separation during your initial configuration. (See Page 19, Step 9.)**

DL205/DL350 or DL405 Family



Syntax shown in the form of of V2000:V40600 refers to two memory locations that have been mapped together.

DL330/340 Family



Syntax shown in the form of of R400/R401:R16/R17 refers to two consecutive memory registers mapped to two other consecutive memory registers.

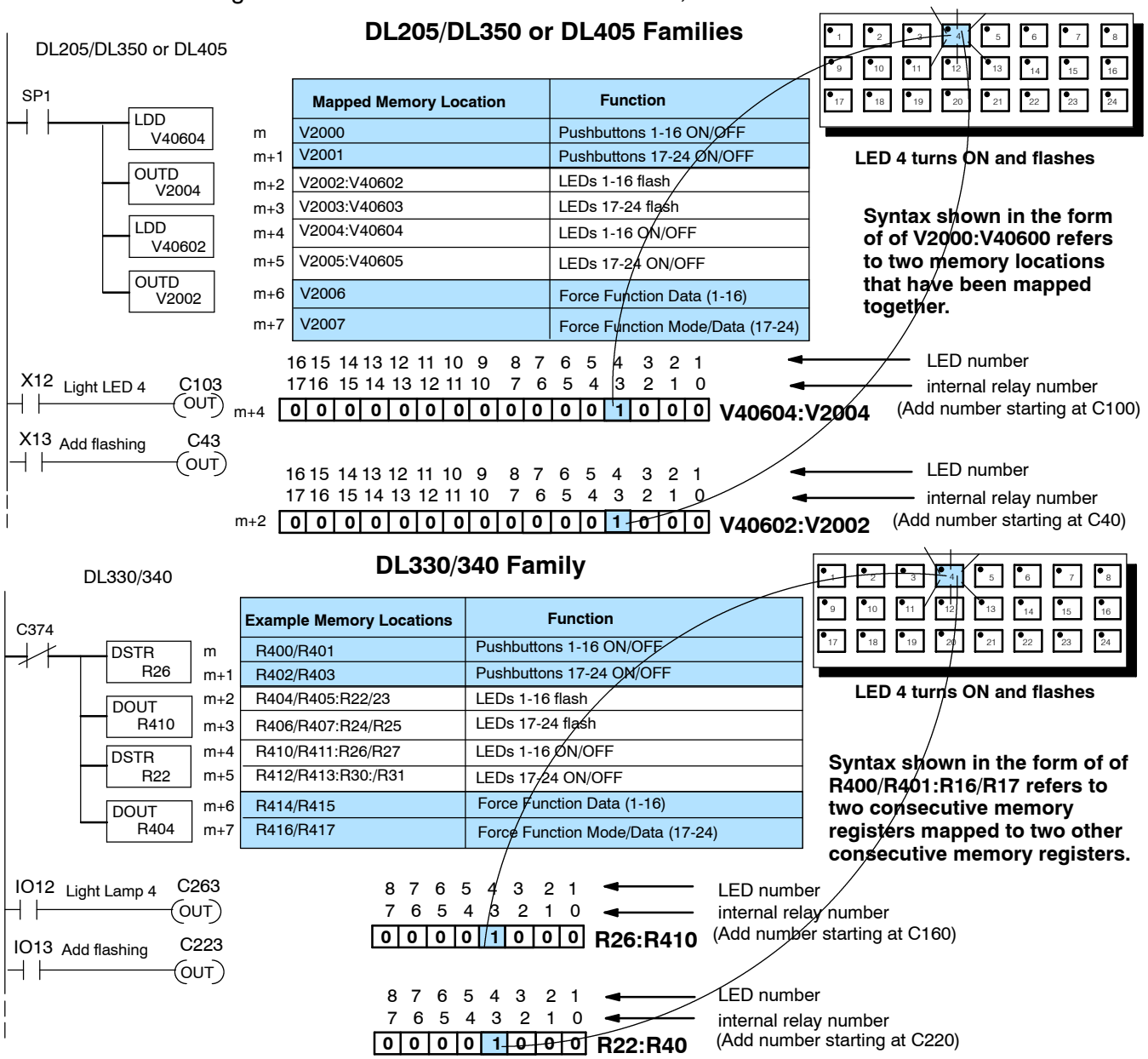
Note: To determine the control relay number, use the register number as the first two digits and the bit number as the last digit. For example, Bit 3 of R26 is referenced as C263.

Adding Flashing

If you plan to use this feature with one or more pushbuttons, there are three things you must always remember during configuration:

1. Flashing is only available for those buttons that have been configured as **Momentary**.
2. **LED Separation** must be Enabled.
3. The **Flash Option** must be Enabled.

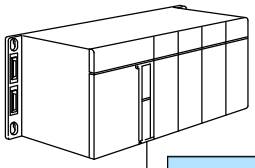
The Flashing Option is triggered through your ladder logic. On the previous page, we showed you how to turn ON an LED, this example shows you how to add flashing to an LED that has been turned ON. The flashing feature is controlled by the status of the bits in the **m+2** and **m+3** memory areas. We have mapped the user memory in these locations to internal relay memory. In the example below, we have begun our mapping at V2000 during the initial configuration. We are turning ON LED4 and then making it flash. Bit 3 of **m+4** turns the LED ON, and bit 3 of **m+2** makes it flash.



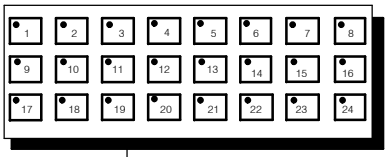
Force Function Registers

The OP-1224 has the capability to "force" a pushbutton ON or OFF through your ladder logic. If you plan to use this function, you must enable the force option during configuration. (See Page 20.)

NOTE: The Force Function will only work for those pushbuttons that you have configured as "maintained" (alternate action). It will not work for momentary pushbuttons.



PLC*Direct*



Mapping Assignments

Mapped Memory Location	Function
m (such as V40600:V2000)	Pushbuttons 1-16 ON/OFF
m+1 (such as V40601:V2001)	Pushbuttons 17-24 ON/OFF
m+2 (such as V40602:V2002)	LEDs 1-16 flash
m+3 (such as V40603:V2003)	LEDs 17-24 flash
m+4 (such as V40604:V2004)	LEDs 1-16 ON/OFF
m+5 (such as V40605:V2005)	LEDs 17-24 ON/OFF
m+6 (such as V40606:V2006)	Force Function Data (1-16)
m+7 (such as V40607:V2007)	Force Function Mode/Data (17-24)

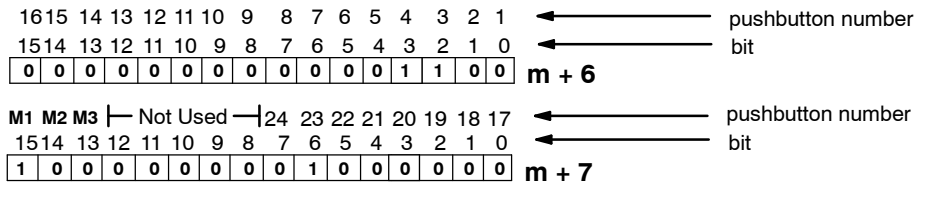
How the Memory is Used-Looking at the above memory map**, m+6** stores the forcing data for Pushbuttons 1-16 and **m+7** stores forcing data for Pushbuttons 17-24. There are three modes of the force function. These modes are controlled by the most significant bits of m+7.

Mode 1 (M1)- This forces all of the Pushbuttons to reflect the status stored in m+6 and m+7. For example, the data shown below would force Pushbuttons 3, 4 and 23 to ON and all the others would be forced OFF. Notice that bit 15 of m +7 is set to 1 for this mode. M2 and M3 are set to 0's.

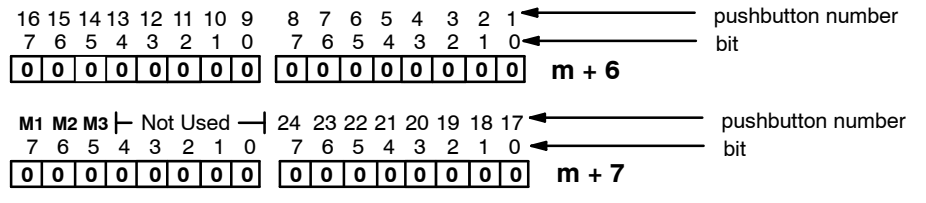
Mode 2 (M2)- This forces ON only those Pushbuttons matching the bits set in registers m+6 and m+7. The bits not set do not affect the status of the Pushbuttons. You would set M2to 1 while M1 and M3 are set to 0.

Mode 3 (M3)- This forces OFF only those Pushbuttons matching the bits set in registers m+6 and m+7. The bits not set do not affect the status of the Pushbuttons. You would set M3 to 1 while M1 amd M2 are set to 0.

Force Function Registers for DL205/DL350/ DL405



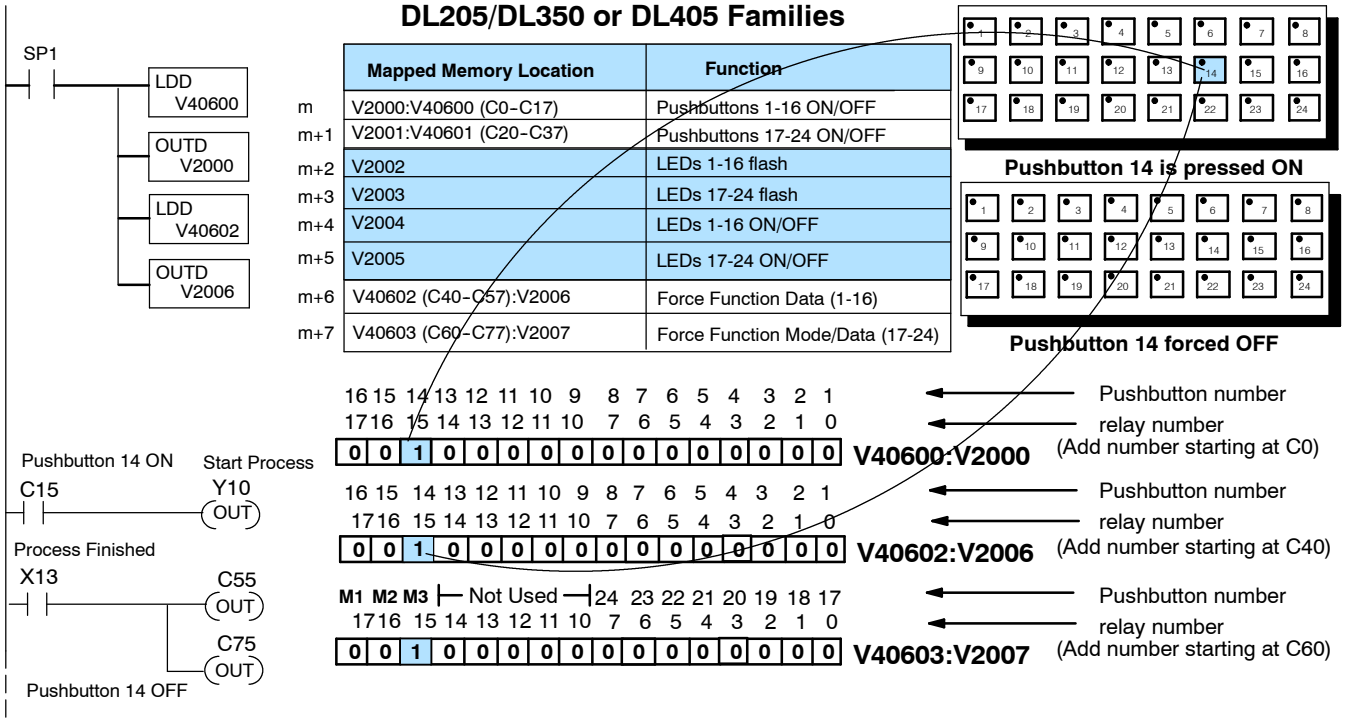
Force Function Registers for DL330/340



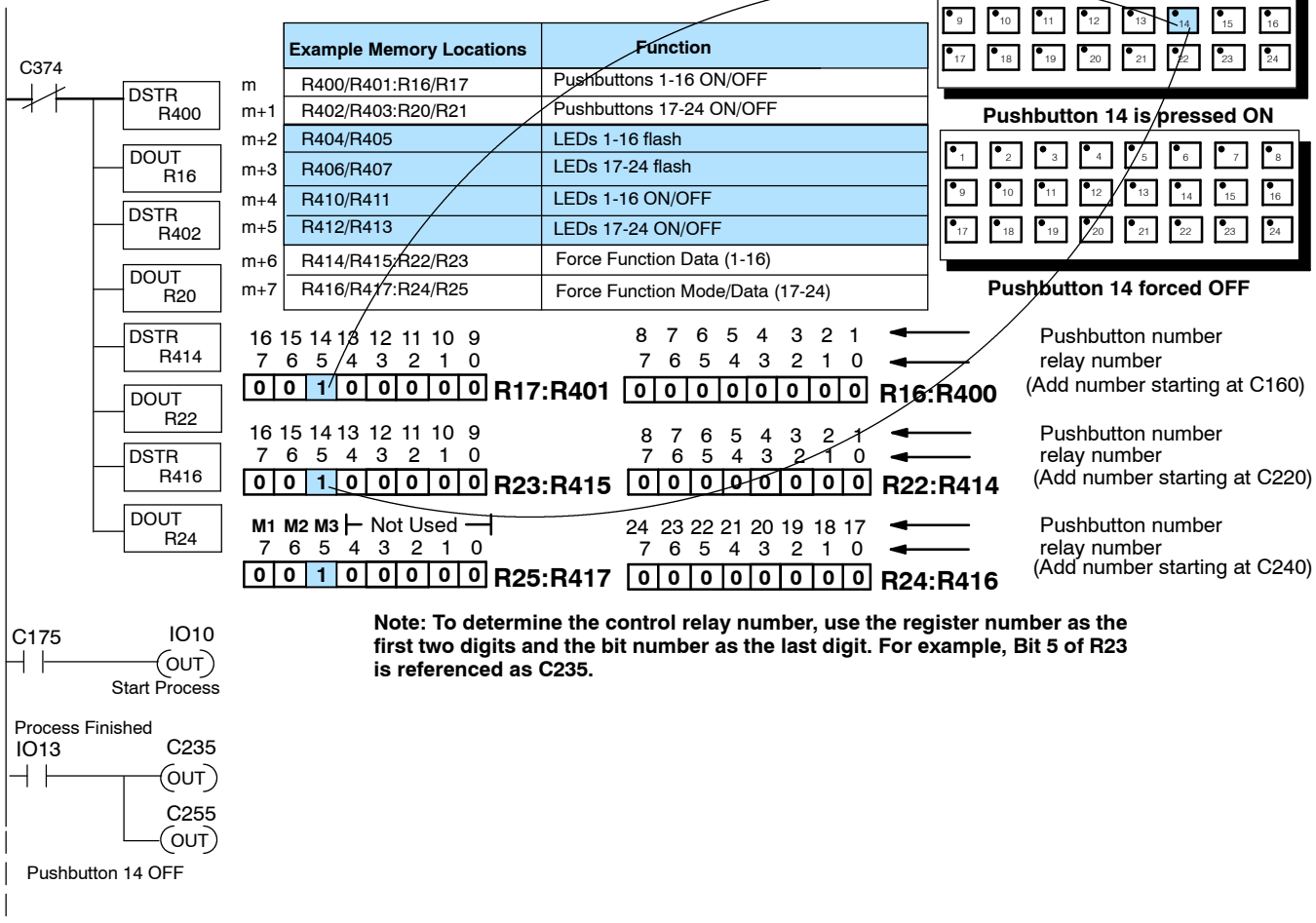
Think of forcing as a one-shot process. That is, once you have set the mode in m+7, the bit patterns in m and m+1 are changed (according to the mode selected), and then, all of the bits in m+6 and m+7 are set to zero. What this means is that all pushbuttons return to normal manual operation after the forcing is completed.

Forcing Pushbuttons ON or OFF

In this example, we have used Mode 3 of the Force Function to force Pushbutton 14 OFF when a process has been completed. Be sure and read Page 37 (if you haven't already done so) to learn the function of all three modes. For the DL205/DL405 example, we have used a base address of V40600. And for the DL305, we have used R16.



DL330/340 Family



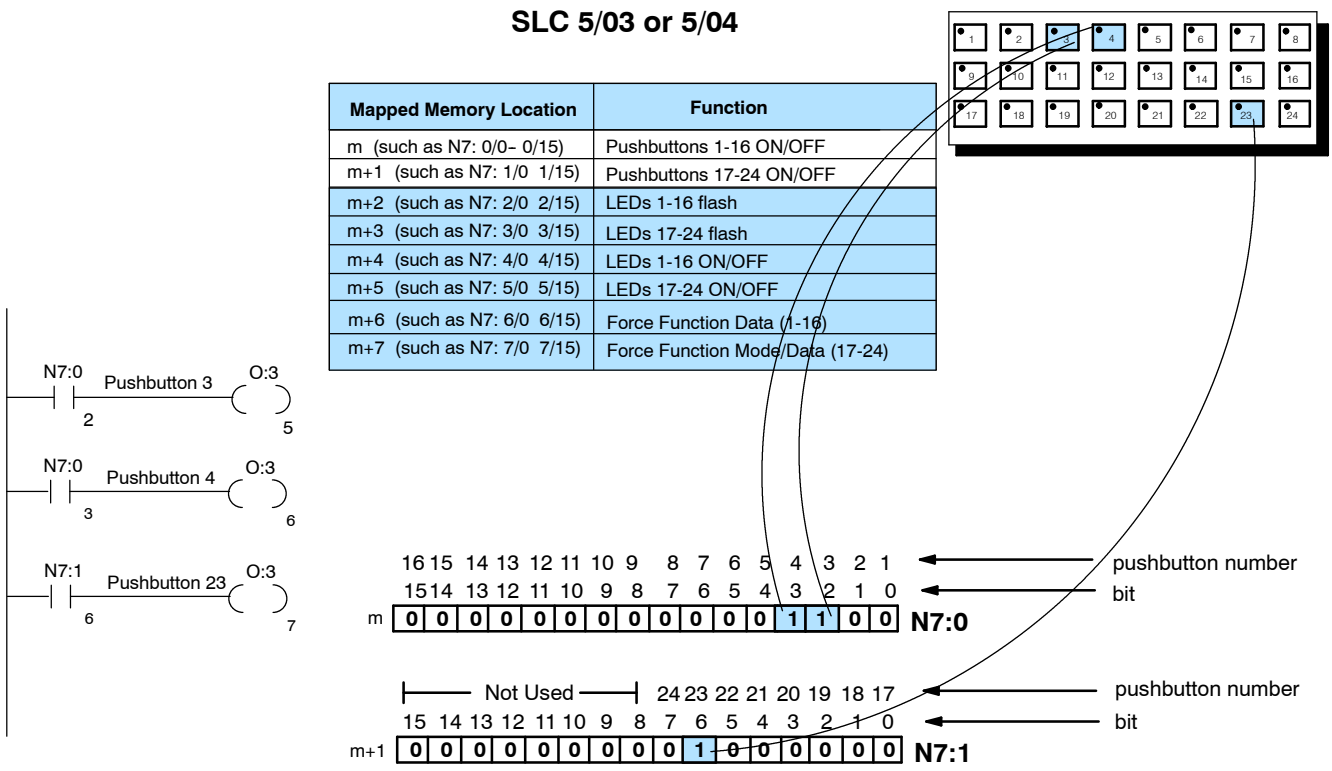
	Example Memory Locations	Function
m	R400/R401:R16/R17	Pushbuttons 1-16 ON/OFF
m+1	R402/R403:R20/R21	Pushbuttons 17-24 ON/OFF
m+2	R404/R405	LEDs 1-16 flash
m+3	R406/R407	LEDs 17-24 flash
m+4	R410/R411	LEDs 1-16 ON/OFF
m+5	R412/R413	LEDs 17-24 ON/OFF
m+6	R414/R415:R22/R23	Force Function Data (1-16)
m+7	R416/R417:R24/R25	Force Function Mode/Data (17-24)

Note: To determine the control relay number, use the register number as the first two digits and the bit number as the last digit. For example, Bit 5 of R23 is referenced as C235.

Using the OP-1224 with an Allen-Bradley PLC

Using the Pushbutton Status

As mentioned earlier, you can map integer type files for the Allen-Bradley PLC when using it with the OP1224. In the example below, we have mapped integer file registers starting at base address N7:0. We are using Pushbutton 3 to control Output 5 (O:3/5). We are using Pushbutton 4 to control Output 6 (O:3/6). And we are using Pushbutton 23 to control Output 7 (O:3/7).

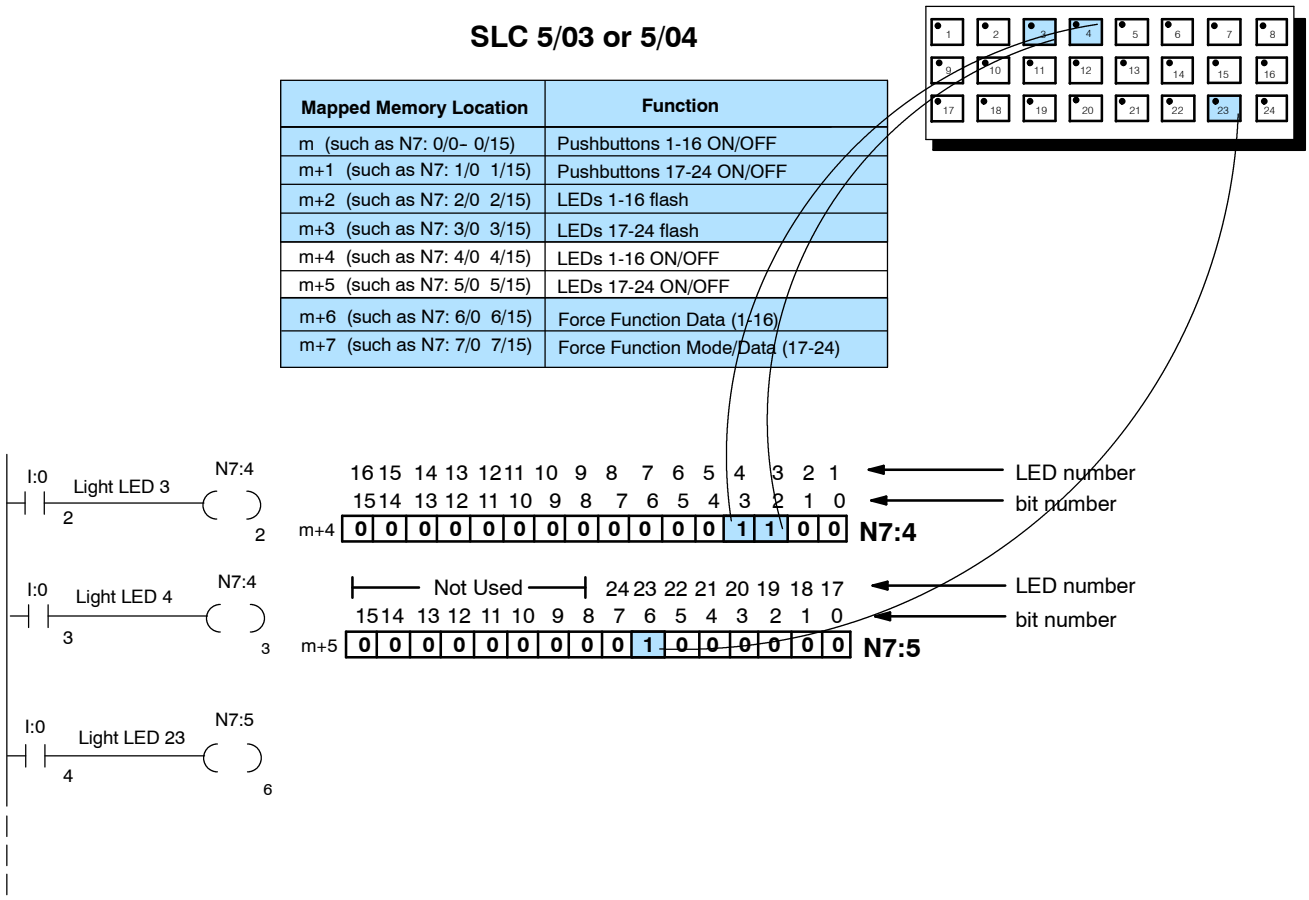


Controlling LEDs Separately

You can control the LEDs separately from the status of the pushbuttons. In the example below, we are using Allen-Bradley input type files (I:0/2, I:0/3 and I:0/4) to trigger the ON/OFF of LED3, LED4 and LED5. **Remember: Any pushbutton configured for maintained (alternate action) will ignore the bits in these two words. Independent control of the LEDs can only be accomplished if you have Enabled LED Separation during your initial configuration. (See Page 19, Step 9.)**

SLC 5/03 or 5/04

Mapped Memory Location	Function
m (such as N7: 0/0– 0/15)	Pushbuttons 1-16 ON/OFF
m+1 (such as N7: 1/0 1/15)	Pushbuttons 17-24 ON/OFF
m+2 (such as N7: 2/0 2/15)	LEDs 1-16 flash
m+3 (such as N7: 3/0 3/15)	LEDs 17-24 flash
m+4 (such as N7: 4/0 4/15)	LEDs 1-16 ON/OFF
m+5 (such as N7: 5/0 5/15)	LEDs 17-24 ON/OFF
m+6 (such as N7: 6/0 6/15)	Force Function Data (1-16)
m+7 (such as N7: 7/0 7/15)	Force Function Mode Data (17-24)



Adding Flashing

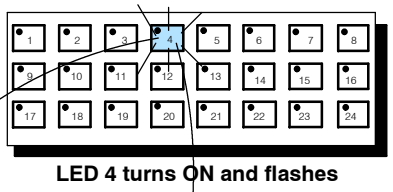
To draw extra attention to an LED that is lit, you can add flashing. If you plan to use this feature with one or more pushbuttons, there are three things you must always remember during configuration:

1. Flashing is only available for those buttons that have been configured as **Momentary**.
2. **LED Separation** must be Enabled.
3. The **Flash Option** must be Enabled.

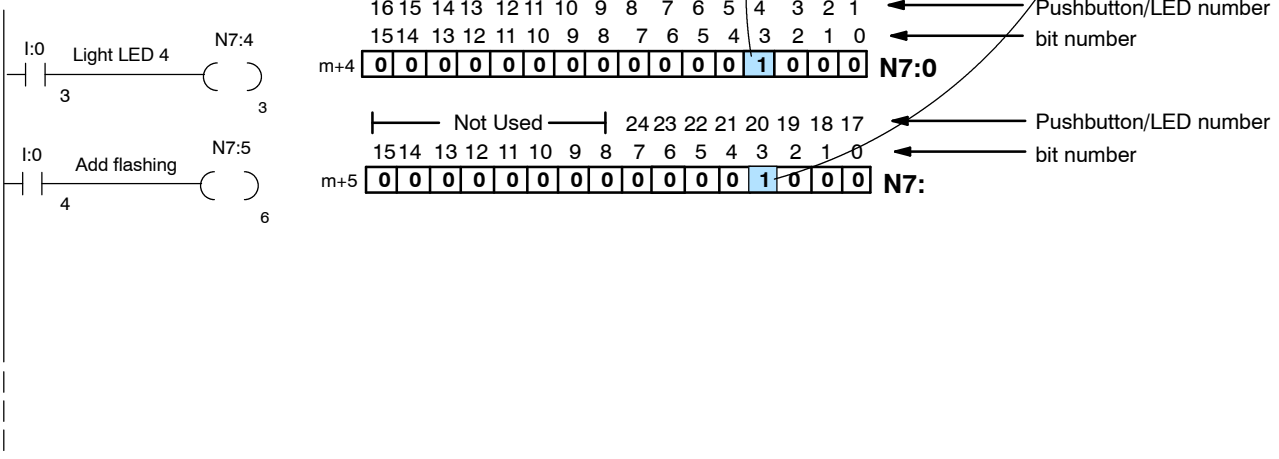
The Flashing Option is triggered through your ladder logic. On the previous page, we showed you how to turn ON an LED, this example shows you how to add flashing to an LED that has been turned ON. The flashing feature is controlled by the status of the bits in the **m+2** and **m+3** memory areas. We have mapped the user memory in these locations to internal relay memory. In the example below, we have begun our mapping at **N7:0** during the initial configuration. We are turning ON LED4 and then making it flash. Bit 3 of **m+4** turns the LED ON, and bit 3 of **m+2** makes it flash. In the example below, we are using input type files (I:0/3 and I:0/4). I:0/3 turns ON LED 4 and I:0/4 turns ON the flashing feature for that particular LED.

SLC 5/03 or 5/04

Mapped Memory Location	Function
m (such as N7: 0/0– 0/15)	Pushbuttons 1-16 ON/OFF
m+1 (such as N7: 1/0 1/15)	Pushbuttons 17-24 ON/OFF
m+2 (such as N7: 2/0 2/15)	LEDs 1-16 flash
m+3 (such as N7: 3/0 3/15)	LEDs 17-24 flash
m+4 (such as N7: 4/0 4/15)	LEDs 1-16 ON/OFF
m+5 (such as N7: 5/0 5/15)	LEDs 17-24 ON/OFF
m+6 (such as N7: 6/0 6/15)	Force Function Data (1-16)
m+7 (such as N7: 7/0 7/15)	Force Function Mode/Data (17-24)



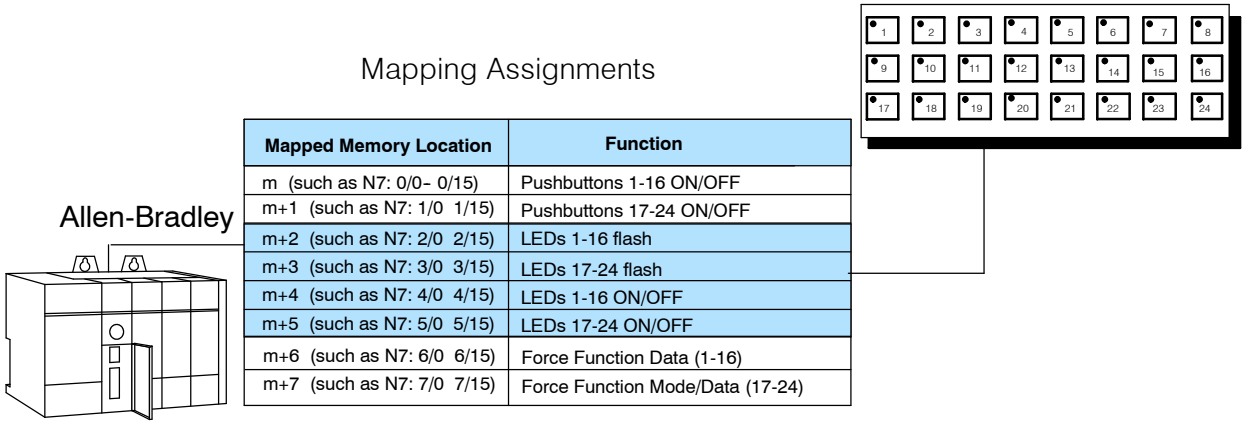
LED 4 turns ON and flashes



Force Function Registers

The OP-1224 has the capability to "force" a pushbutton ON or OFF through your ladder logic. If you plan to use this function, you must enable the force option during configuration. (See Page 24.)

NOTE: The Force Function will only work for those pushbuttons that you have configured as "maintained" (alternate action). It will not work for momentary pushbuttons.



Mapped Memory Location	Function
m (such as N7: 0/0- 0/15)	Pushbuttons 1-16 ON/OFF
m+1 (such as N7: 1/0 1/15)	Pushbuttons 17-24 ON/OFF
m+2 (such as N7: 2/0 2/15)	LEDs 1-16 flash
m+3 (such as N7: 3/0 3/15)	LEDs 17-24 flash
m+4 (such as N7: 4/0 4/15)	LEDs 1-16 ON/OFF
m+5 (such as N7: 5/0 5/15)	LEDs 17-24 ON/OFF
m+6 (such as N7: 6/0 6/15)	Force Function Data (1-16)
m+7 (such as N7: 7/0 7/15)	Force Function Mode/Data (17-24)

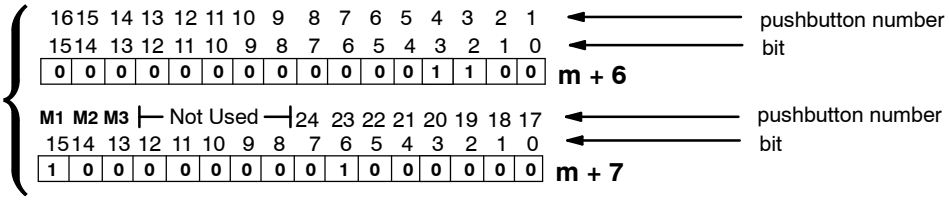
How the Memory is Used-Looking at the above memory map**, m+6** stores the forcing data for Pushbuttons 1-16 and **m+7** stores forcing data for Pushbuttons 17-24. There are three modes of the force function. These modes are controlled by the most significant bits of m+7.

Mode 1 (M1)- This forces all of the Pushbuttons to reflect the status stored in m+6 and m+7. For example, the data shown below would force Pushbuttons 3, 4 and 23 to ON and all the others would be forced OFF. Notice that bit 15 of m +7 is set to 1 for this mode. M2 and M3 are set to 0's.

Mode 2 (M2)- This forces ON only those Pushbuttons matching the bits set in registers m+6 and m+7. The bits not set do not affect the status of the Pushbuttons. You would set M2 to 1 while M1 and M3 are set to 0.

Mode 3 (M3)- This forces OFF only those Pushbuttons matching the bits set in registers m+6 and m+7. The bits not set do not affect the status of the Pushbuttons. You would set M3 to 1 while M1 amd M2 are set to 0.

Force Function Registers



Think of forcing as a one-shot process. That is, once you have set the mode in m+7, the bit patterns in m and m+1 are changed (according to the mode selected), and then, all of the bits in m+6 and m+7 are set to zero. What this means is that all pushbuttons return to normal manual operation after the forcing is completed.

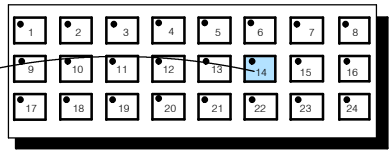
Forcing Pushbuttons ON or OFF

You can also use Allen-Bradley integer file types to force pushbuttons ON or OFF. Here we have chosen N7:0 as our base address for the mapping in the PLC. In this example, we are using Pushbutton 14 to start a process, and then forcing the pushbutton OFF when the process is completed. N7:0 holds the bit that reflects the status of Pushbutton 14. N7:6 and part of N7:7 hold the data that the force feature uses when executing one of the three selectable modes (M1, M2 or M3). These modes are selectable in the upper three bits of the mapped memory area m+7. In the example, below the mode is embedded in N7:7.

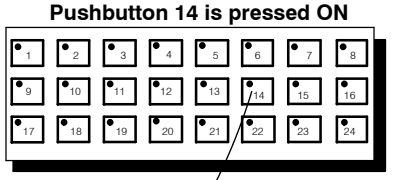
Here we have chosen to use Mode 3. Mode 3 looks at N7:6, and whichever bits are set to 1 , the corresponding pushbuttons are forced OFF. Since we set the 13th bit of N7:7 (corresponding to LED14), the OP-1224 will force LED14 OFF.

SLC 5/03 or 5/04

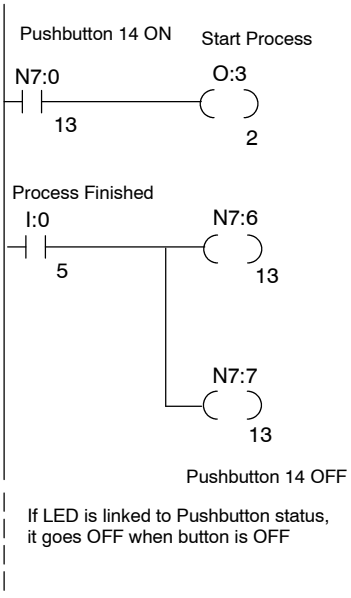
Mapped Memory Location	Function
m (such as N7: 0/0– 0/15)	Pushbuttons 1-16 ON/OFF
m+1 (such as N7: 1/0 1/15)	Pushbuttons 17-24 ON/OFF
m+2 (such as N7: 2/0 2/15)	LEDs 1-16 flash
m+3 (such as N7: 3/0 3/15)	LEDs 17-24 flash
m+4 (such as N7: 4/0 4/15)	LEDs 1-16 ON/OFF
m+5 (such as N7: 5/0 5/15)	LEDs 17-24 ON/OFF
m+6 (such as N7: 6/0 6/15)	Force Function Data (1-16)
m+7 (such as N7: 7/0 7/15)	Force Function Mode/Data (17-24)

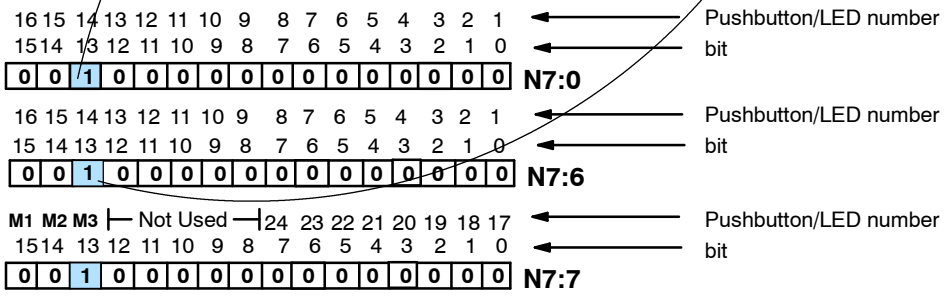


Pushbutton 14 is pressed ON



Pushbutton 14 forced OFF





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