# Applying Ladder Logic

General Concepts

Memory Mapping

The OP-1212 uses memory mapping in order to link itself to a PLC. Memory mapping is a technique that maps the memory of the OP-1212 to the memory of the PLC. During initial configuration, the beginning address must be selected in the PLC memory where the mapping process will start. By knowing where the data of the specific panel is mapped, this data can be moved, changed or monitored using ladder logic.
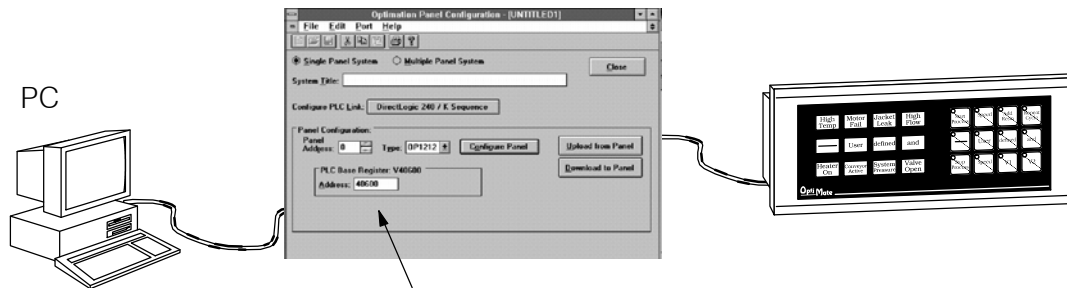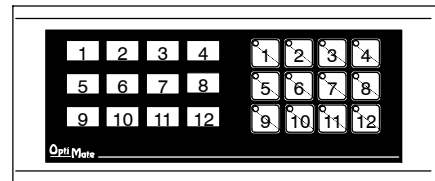
PC

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

*Direct*LOGIC
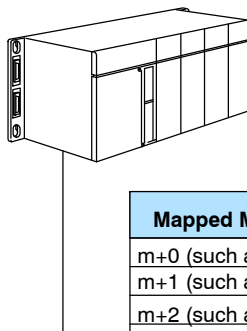
Mapping Assignments

Mapped Memory Location	Function
m+0 (such as V40600) C0–C17	Indicator Lamps ON/OFF
m+1 (such as V40601) C20–C37	Indicator Lamps Flash Control
m+2 (such as V40602) C40–C57	Button LEDs ON/OFF
m+3 (such as V40603) C60–C77	Button LEDs Flash Control
m+4 (such as V40604) C100–C117	Button ON/OFF Status
m+5 (such as V40605) C120–C137	Force Pushbuttons Data & Comnd

The pushbuttons and lamps are numbered left to right starting in the upper left corner of their respective area.

Allen-Bradley
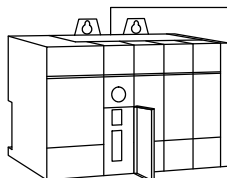
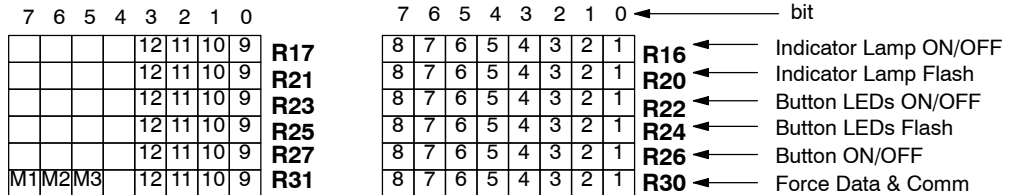| Mapped Memory Location	Function
m+0 (such as N7: 0/0–0/15)	Indicator Lamps ON/OFF
m+1 (such as N7: 1/0–1/15)	Indicator Lamps Flash Control
m+2 (such as N7: 2/0–2/15)	Button LEDs ON/OFF
m+3 (such as N7: 3/0–3/15)	Button LEDs Flash Control
m+4 (such as N7: 4/0–4/15)	Button ON/OFF Status
m+5 (such as N7: 5/0–5/15)	Force Pushbuttons Data & Comnd

Addressing Conventions

Before going into ladder logic programming, it is good to take a moment to review and compare the addressing conventions used by Automation*Direct* and Allen-Bradley.

DirectLOGIC **Memory –** A typical address within a *Direct*LOGIC PLC is Vxxxx, such as V40600 for *Direct*LOGIC PLCs (DL05, DL06, DL105, DL205, DL350 and DL405 families) and Rxx, such as R16 for the DL305 family. The V-memory in the *Direct*LOGIC PLCs is divided into 16-bit registers, and the R-memory in the DL305 is divided into 8-bit registers. Refer to your individual User Manuals for complete memory information. The two diagrams below shows how the OP-1212 could be mapped during configuration. In this example, V40600 and R16 have been chosen as starting registers to map the OP-1212 to the PLC, but it could actually be any available user or internal relay memory areas as long as they are consecutive:
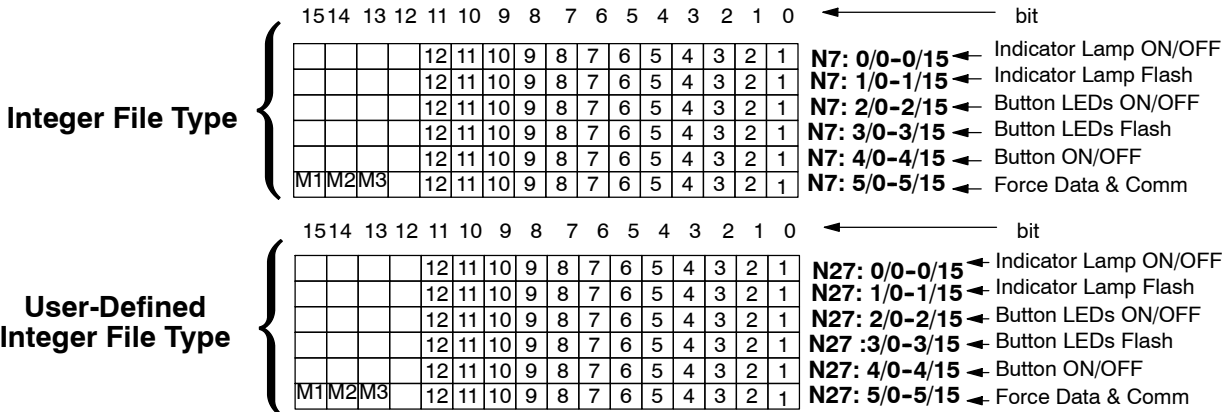
DL05, DL06, DL105, DL205 or DL405

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	← bit	
				12	11	10	9	8	7	6	5	4	3	2	1	**V40600** ←	Indicator Lamp ON/OFF
				12	11	10	9	8	7	6	5	4	3	2	1	**V40601** ←	Indicator Lamp Flash
				12	11	10	9	8	7	6	5	4	3	2	1	**V40602** ←	Button LEDs ON/OFF
				12	11	10	9	8	7	6	5	4	3	2	1	**V40603** ←	Button LEDs Flash
				12	11	10	9	8	7	6	5	4	3	2	1	**V40604** ←	Button ON/OFF
M1	M2	M3		12	11	10	9	8	7	6	5	4	3	2	1	**V40605** ←	Force Data & Comm

DL305

7	6	5	4	3	2	1	0		
				12	11	10	9	**R17**	
				12	11	10	9	**R21**	
				12	11	10	9	**R23**	
				12	11	10	9	**R25**	
				12	11	10	9	**R27**	
M1	M2	M3		12	11	10	9	**R31**	

7	6	5	4	3	2	1	0		← bit	
8	7	6	5	4	3	2	1	**R16** ←	Indicator Lamp ON/OFF
8	7	6	5	4	3	2	1	**R20** ←	Indicator Lamp Flash
8	7	6	5	4	3	2	1	**R22** ←	Button LEDs ON/OFF
8	7	6	5	4	3	2	1	**R24** ←	Button LEDs Flash
8	7	6	5	4	3	2	1	**R26** ←	Button ON/OFF
8	7	6	5	4	3	2	1	**R30** ←	Force Data & Comm

After the address has been selected and mapped, it will allow the ladder logic to treat pushbuttons as contacts and Lamps, and LEDs as coils. The following table is an example of the control relay correlation for *Direct*LOGIC PLCs to the OP-1212 when the address is configured for V40600. Use the work sheet in **Appendix A** for your application.

Device	Lamp ON/OFF	Lamp Flash	Button LED ON/OFF	Button LED Flash	Button Status	Force Function
1	C0	C20	C40	C60	C100	C120
2	C1	C21	C41	C61	C101	C121
3	C2	C22	C42	C62	C102	C122
4	C3	C23	C43	C63	C103	C123
5	C4	C24	C44	C64	C104	C124
6	C5	C25	C45	C65	C105	C125
7	C6	C26	C46	C66	C106	C126
8	C7	C27	C47	C67	C107	C127
9	C10	C30	C50	C70	C110	C130
10	C11	C31	C51	C71	C111	C131
11	C12	C32	C52	C72	C112	C132
12	C13	C33	C53	C73	C113	C133
M3						C135
M2						C136
M1						C137

Allen-Bradley Memory–A typical address for Allen-Bradley might be N7:0/0 or N27:0/0. The OP-1212 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, it must be defined in the Allen-Bradley memory map before configuring the panel.* Below diagrams show how 16-bit integer files could be used to map the pushbuttons to the Allen-Bradley PLC.

Integer File Type

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	← bit

				12	11	10	9	8	7	6	5	4	3	2	1	**N7: 0/0–0/15** ← Indicator Lamp ON/OFF
				12	11	10	9	8	7	6	5	4	3	2	1	**N7: 1/0–1/15** ← Indicator Lamp Flash
				12	11	10	9	8	7	6	5	4	3	2	1	**N7: 2/0–2/15** ← Button LEDs ON/OFF
				12	11	10	9	8	7	6	5	4	3	2	1	**N7: 3/0–3/15** ← Button LEDs Flash
				12	11	10	9	8	7	6	5	4	3	2	1	**N7: 4/0–4/15** ← Button ON/OFF
M1	M2	M3		12	11	10	9	8	7	6	5	4	3	2	1	**N7: 5/0–5/15** ← Force Data & Comm

User-Defined Integer File Type

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	← bit

				12	11	10	9	8	7	6	5	4	3	2	1	**N27: 0/0–0/15** ← Indicator Lamp ON/OFF
				12	11	10	9	8	7	6	5	4	3	2	1	**N27: 1/0–1/15** ← Indicator Lamp Flash
				12	11	10	9	8	7	6	5	4	3	2	1	**N27: 2/0–2/15** ← Button LEDs ON/OFF
				12	11	10	9	8	7	6	5	4	3	2	1	**N27 :3/0–3/15** ← Button LEDs Flash
				12	11	10	9	8	7	6	5	4	3	2	1	**N27: 4/0–4/15** ← Button ON/OFF
M1	M2	M3		12	11	10	9	8	7	6	5	4	3	2	1	**N27: 5/0–5/15** ← Force Data & Comm

After the address has been selected and mapped, it will allow the ladder logic to treat pushbuttons as contacts and Lamps, and LEDs as coils. The following table is an example of the control relay correlation for the SLC or Micrologix to the OP-1212 when the address is configured for N7:0. Use the work sheet in **Appendix A** for your application.

Device	Lamp ON/OFF	Lamp Flash	Button LED ON/OFF	Button LED Flash	Button Status	Force Function
1	N7:0/0	N7:1/0	N72/0	N7:3/0	N7:4/0	N7:5/0
2	N7:0/1	N7:1/1	N7:2/1	N7:3/1	N7:4/1	N7:5/1
3	N7:0/2	N7:1/2	N7:2/2	N7:3/2	N7:4/2	N7:5/2
4	N7:0/3	N7:1/3	N7:2/3	N7:3/3	N7:4/3	N7:5/3
5	N7:0/4	N7:1/4	N7:2/4	N7:3/4	N7:4/4	N7:5/4
6	N7:0/5	N7:1/5	N7:2/5	N7:3/5	N7:4/5	N7:5/5
7	N7:0/6	N7:1/6	N7:2/6	N7:3/6	N7:4/6	N7:5/6
8	N7:0/7	N7:1/7	N7:2/7	N7:3/7	N7:4/7	N7:5/7
9	N7:0/8	N7:1/8	N7:2/8	N7:3/8	N7:4/8	N7:5/8
10	N7:0/9	N7:1/9	N7:2/9	N7:3/9	N7:4/9	N7:5/9
11	N7:0/10	N7:1/10	N7:2/10	N7:3/10	N7:4/10	N7:5/10
12	N7:0/11	N7:1/11	N7:2/11	N7:3/11	N7:4/11	N7:5/11
M3						N7:5/13
M2						N7:5/14
M1						N7:5/15

Three Different Ways to Use the Panel

Depending on the type of CPU and the number of OP-1212 functions selected, there are three different ways to interface your ladder logic with the panel.

Bit-of-Word

Internal Relays

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.

Method 1: Bit-of-Word *Direct*LOGIC 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 in the DL05, DL06, DL250, DL350 and DL450 *Direct*LOGIC PLCs and SLC 5/03 and 5/04 Allen-Bradley PLCs. Below is a rung of logic that shows how a *Direct*LOGIC PLC might use the status of bit 3 to control a process connected to Y12. This function will be covered in more detail further on the next page for *Direct*LOGIC PLCs. **Refer to page 31 for Allen-Bradley.**

```
        V2004.3  Pushbutton 4      Y12
        ─┤ ├──              ──(OUT)──
```
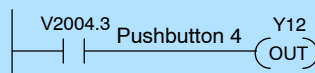
Method 2: Internal Relays (All Options Used)

This method is only available for Automation*Direct* programmable controllers. If you are already familiar with *Direct*LOGIC PLCs, then you know about internal relays. These relays, by PLC design, are mapped to certain bits in reserved memory areas. These relays can be mapped during configuration with OP–WINEDIT by mapping directly to the control relay reserved memory area. **Only use this method if *all of the functions are going to be used* in the panel; otherwise it will consume internal relays unnecessarily.** Using this method automatically consumes 96 internal relays. In the example below, one of the mapped pushbuttons is used to control the output Y12. **Refer to Pages 24–25.**

```
        C103  Pushbutton 4      Y12
        ─┤ ├──            ──(OUT)──
```

**Method 3: Remapping (Selected Options)**

A better way to make use of internal relays when you are not using all of the OP-1212 functions is to use a process of "remapping". With this technique the panel is mapped to the user memory (such as V2000), then maps part of the user memory only to those relays actually needed to be used. The example below shows ladder logic necessary to use a pushbutton. It maps V2004 to V40604 and consumes only 16 relays. The point is–it uses only the relays necessary for the option you have selected. More examples will be in the following pages. **By convention, in this manual, syntax of the form V2000:V40600 is used to refer to memory locations that have been mapped together**. **Refer to Pages 26–30 for ladder logic examples.**
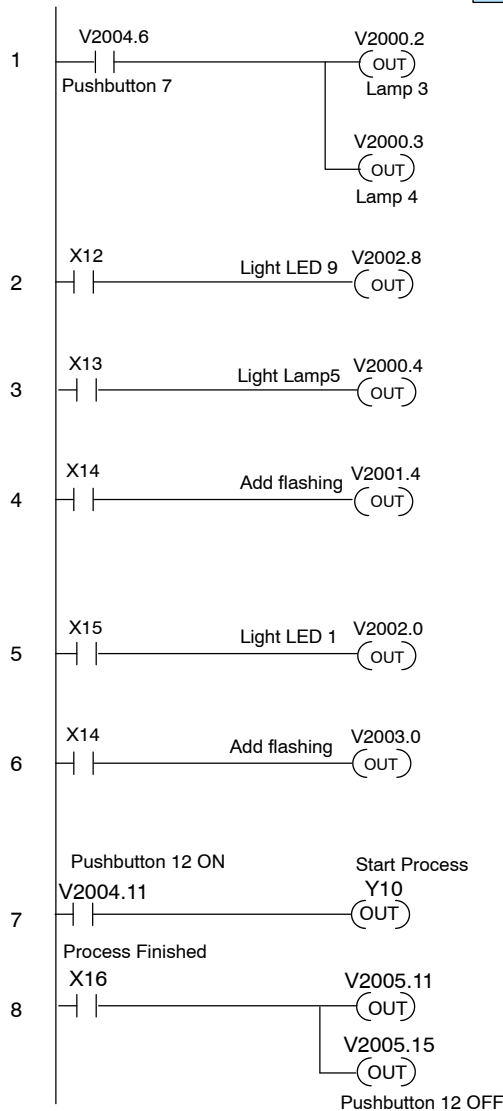
```
        SP1                    ┌─────────┐
        ─┤ ├──────────────────│ LD      │
                              │ V2004   │
                              └─────────┘
                              ┌─────────┐
                              │ OUT     │
                              │ V40604  │
                              └─────────┘
        C103   Pushbutton 4      Y10
        ─┤ ├──               ──(OUT)──
```
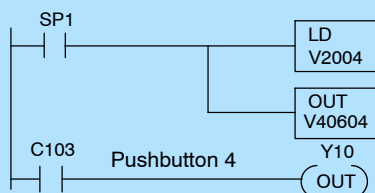
Using Bit–of–Word with the OP–1212

Using Ladder Logic

*Diredt*LOGIC PLCs (DL05, DL06, DL250, DL350 and DL450) all use the bit-of-word instructions. (Refer to your particular PLC user guide). The example program shown below uses a base register address of **V2000** to map the status of the pushbuttons, lamps, and LEDs. The ladder logic example provides a simple use for all of the panel features. If you are unfamiliar with any of the panel features, please refer to *Understanding the OP-1212 Panel*. The table shows which bits the program sets.
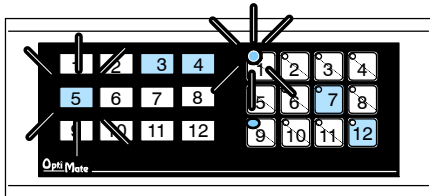
																	device number
				12	11	10	9	8	7	6	5	4	3	2	1	←	device number
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	← bit

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	Register	
0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	**V2000**	Indicator Lamp ON/OFF
0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	**V2001**	Indicator Lamp Flash
0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	**V2002**	Button LEDs ON/OFF
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	**V2003**	Button LEDs Flash
0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	**V2004**	Button ON/OFF
1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	**V2005**	Force Data & Comm

Rung 1 – Pushbuttons and Lamps
When pushbutton 7 is activated Lamps 3 and 4 turn ON.

Rung 1:
V2004.6 (Pushbutton 7) → V2000.2 OUT (Lamp 3)
→ V2000.3 OUT (Lamp 4)

Rung 2 – LEDs
When contact X12 is ON, LED 9 turns ON
NOTE: Panel must be in LED Separation mode and pushbutton configured as momentary.

Rung 2:
X12 → Light LED 9 — V2002.8 OUT

Rung 3:
X13 → Light Lamp5 — V2000.4 OUT

Rung 4:
X14 → Add flashing — V2001.4 OUT

Rungs 3 and 4 –Flashing Lamps
To flash a Lamp, it must first be turned ON. When contact X13 is activated Lamp 5 will turn ON and when contact X14 is activated the Lamp will flash.

Rung 5:
X15 → Light LED 1 — V2002.0 OUT

Rung 6:
X14 → Add flashing — V2003.0 OUT

Rungs 5 and 6 – Flashing LEDs
To flash an LED, it must first be turned ON. When contact X15 is activated, LED 1 will turn ON and when contact X14 is activated the LED will flash.
NOTE: Panel must be in LED Separation mode and pushbutton configured as momentary.

Rung 7:
Pushbutton 12 ON — V2004.11 → Start Process Y10 OUT

Rung 8:
Process Finished — X16 → V2005.11 OUT
→ V2005.15 OUT (Pushbutton 12 OFF)

Rungs 7 and 8 – Force Function
When pushbutton 12 is pressed, process Y10 is started.When the process is completed it activates contact X16 which forces pushbutton 12 OFF.
NOTE: The pushbuttons must be configured as maintained (alternate) and the panels "Force Function" feature must be enabled.

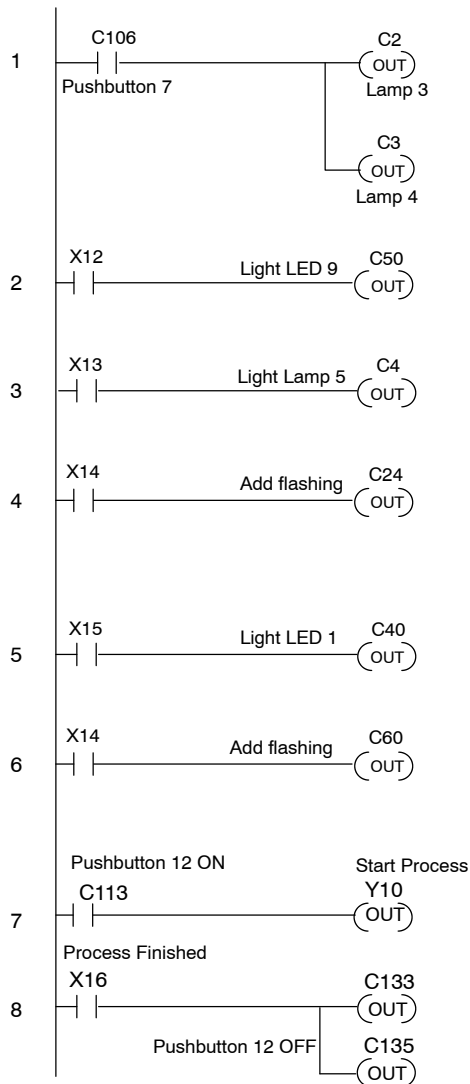# Using All Functions with *Direct*LOGIC PLCs

Using Ladder Logic

When configuring the OP-1212, a base address must be selected 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 ***Direct*LOGIC** PLCs (DL05, DL06, DL105, DL205, DL350 and DL405) start at **V40600**. Using this method, the total mapping consumes 96 internal relays, which 75 are assigned to operator functions. This method is only used when all of the OP-1212 functions are utilized. In the examples below, **V40600** has been chosen as the starting address for ***Direct*LOGIC** PLCs. *Notice that the internal control relays are numbered in octal and not decimal.*
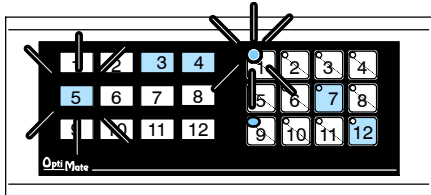
device number →	12	11	10	9	8	7	6	5	4	3	2	1		
Internal Relay →	17	16	15	14	13	12	11	10	7	6	5	4	3	2	1	0		

0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	**V40600**	Indicator Lamp ON/OFF
0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	**V40601**	Indicator Lamp Flash
0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	**V40602**	Button LEDs ON/OFF
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	**V40603**	Button LEDs Flash
0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	**V40604**	Button ON/OFF
0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	**V40605**	Force Data & Comm

Rung 1 – Pushbuttons and Lamps
When pushbutton 7 is activated Lamps 3 and 4 turn ON.

1
C106 — Pushbutton 7
C2 (OUT) — Lamp 3
C3 (OUT) — Lamp 4

Rung 2 – LEDs
When contact X12 is ON, LED 9 turns ON
NOTE: Panel must be in LED Separation mode and pushbutton configured as momentary.

2
X12 — Light LED 9 — C50 (OUT)

Rungs 3 and 4 –Flashing Lamps
To flash a Lamp, it must first be turned ON When contact X13 is activated Lamp 5 will turn ON and when contact X14 is activated the Lamp will flash.

3
X13 — Light Lamp 5 — C4 (OUT)

4
X14 — Add flashing — C24 (OUT)

Rungs 5 and 6 – Flashing LEDs
To flash an LED, it must first be turned ON. When contact X15 is activated, LED 1 will turn ON and when contact X14 is activated the LED will flash.
NOTE: Panel must be in LED Separation mode and pushbutton configured as momentary.

5
X15 — Light LED 1 — C40 (OUT)

6
X14 — Add flashing — C60 (OUT)

Rungs 7 and 8 – Force Function
When pushbutton 12 is pressed, process Y10 is started.When the process is completed, it activates contact X16 which forces pushbutton 12 OFF.
NOTE: The pushbuttons must be configured as maintained (alternate) and the panels "Force Function" feature must be enabled.
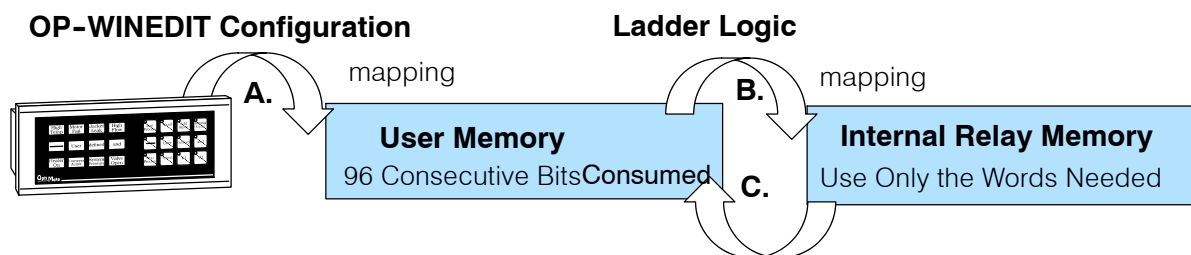
7
Pushbutton 12 ON — C113
Start Process — Y10 (OUT)

8
Process Finished — X16
C133 (OUT)
Pushbutton 12 OFF — C135 (OUT)

Using All Functions with the DL305 PLCs

Using Ladder Logic

When configuring the OP-1212, a base address must be selected 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 DL305 family start at **R16**. Using this method, the total mapping consumes 96 internal relays, of which 75 are assigned to operator functions. This method should only be used when all of the OP-1212 functions are utilized. In the examples below, **R16** has been chosen as the starting address for the DL305. *Notice that the internal control relays are numbered in octal and not decimal.*
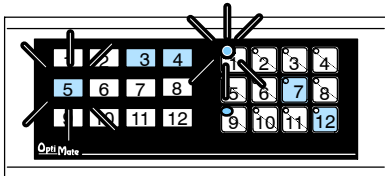
12	11	10	9						8	7	6	5	4	3	2	1		← device number
7	6	5	4	3	2	1	0		7	6	5	4	3	2	1	0		← internal relay
0	0	0	0	0	0	0	0	**R17**	0	0	0	1	1	1	0	0	**R16**	Indicator Lamp ON/OFF
0	0	0	0	0	0	0	0	**R21**	0	0	0	1	0	0	0	0	**R20**	Indicator Lamp Flash
0	0	0	0	0	0	0	1	**R23**	0	0	0	0	0	0	0	1	**R22**	Button LEDs ON/OFF
0	0	0	0	0	0	0	0	**R25**	0	0	0	0	0	0	0	1	**R24**	Button LEDs Flash
0	0	0	0	1	0	0	0	**R27**	0	1	0	0	0	0	0	0	**R26**	Button ON/OFF
0	0	1	0	1	0	0	0	**R31**	0	0	0	0	0	0	0	0	**R30**	Force Data & Comm
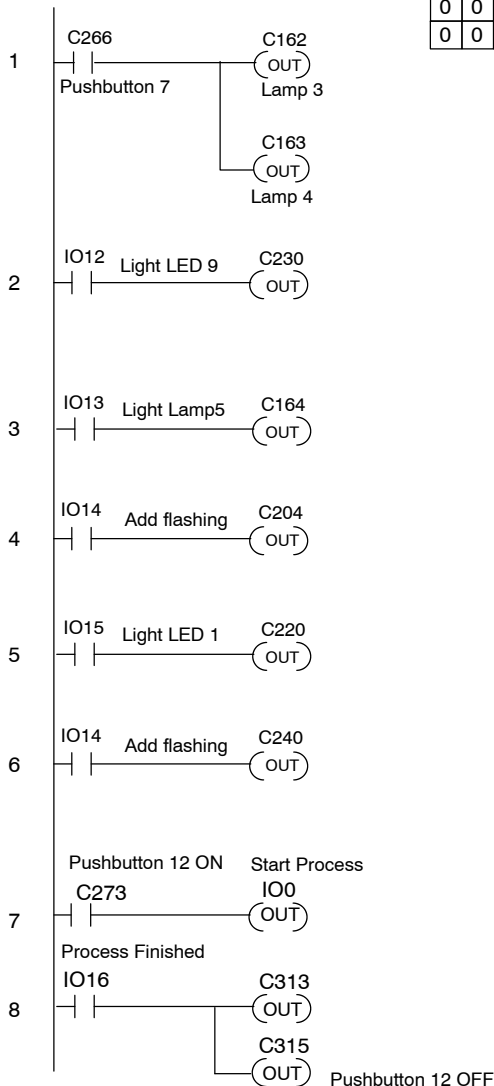
Rung 1 – Pushbuttons and Lamps
When pushbutton 7 is activated, Lamps 3 and 4 turn ON.

Rung 1:
C266 Pushbutton 7 — C162 (OUT) Lamp 3 — C163 (OUT) Lamp 4

Rung 2 – LEDs
When contact IO12 is ON, LED 9 turns ON.
NOTE: Panel must be in LED Separation mode and pushbutton configured as momentary.

Rung 2:
IO12 Light LED 9 — C230 (OUT)

Rungs 3 and 4 –Flashing Lamps
To flash a Lamp, it must first be turned ON When contact IO13 is activated Lamp 5 will turn ON and when contact IO14 is activated the Lamp will flash.

Rung 3:
IO13 Light Lamp5 — C164 (OUT)

Rung 4:
IO14 Add flashing — C204 (OUT)

Rungs 5 and 6 – Flashing LEDs
To flash an LED, it must first be turned ON. When contact IO15 is activated, LED 1 will turn ON and when contact IO14 is activated the LED will flash.
NOTE: Panel must be in LED Separation mode and pushbutton configured as momentary.

Rung 5:
IO15 Light LED 1 — C220 (OUT)

Rung 6:
IO14 Add flashing — C240 (OUT)

Rungs 7 and 8 – Force Function
When pushbutton 12 is pressed, process IO0 is started.When the process is completed, it activates contact IO16 which forces pushbutton 12 OFF.
NOTE: The pushbuttons must be configured as maintained (alternate) and the panels "Force Function" feature must be enabled.

Rung 7:
Pushbutton 12 ON C273 — Start Process IO0 (OUT)

Rung 8:
Process Finished IO16 — C313 (OUT) — C315 (OUT) Pushbutton 12 OFF

Using Selected Functions with *Direct*LOGIC PLCs (not DL305 PLCs)

Using the Remapping Process

The "remapping" process has been briefly discussed 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, the number of relays actually needed for the selected functions are consumed.

OP--WINEDIT Configuration   **Ladder Logic**

A. | mapping   B. | mapping

User Memory
96 Consecutive Bits Consumed   C.

Internal Relay Memory
Use Only the Words Needed

Using the remapping method, the panel configuration will automatically consume 96 consecutive memory bits in PLC User Memory (this occurs when the base register address is configured with OP--WINEDIT). This is indicated by the arrow A. But since User Memory doesn't provide bit control, the User Memory will need to be remapped with Internal Relay Memory. By remapping between User Memory and Internal Relay Memory, the Relay Memory needed will be consumed. There are two directions in which the ladder logic can be programmed to do the remapping between User Memory and Internal Relay Memory:

For using the Pushbutton Status to control outputs, write ladder logic to map User Memory to Internal Relay Memory (arrow B). This affects the User Memory in the **m+4** location.

For controlling all other functions of the panel, write the ladder logic to map Internal Relay Memory to User Memory (arrow C). This affects the User Memory in locations **m+0** through **m+3** and **m+5**.

The two relay ladder examples of remapping below demonstrate the two types of remapping that can be used with this technique. Assume that V2000 was used as the base register address:

Example of User Memory being mapped to Internal Relay Memory

m+4 = V2004

remapping = V2004:40604

SP1
LD
V2004

OUT
V40604
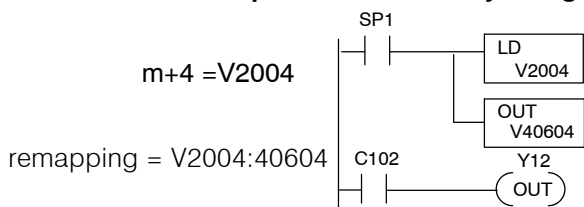
C102
Y12
(OUT)

Here we are using SP1 to map V2004 to V40604. This consumes 16 relay bits, 12 of which are tied to the 12 pushbuttons of the panel. By pressing Pushbutton 3, you affect the status of the third relay in V40604 which is C102. In turn, C102 will control output Y12.
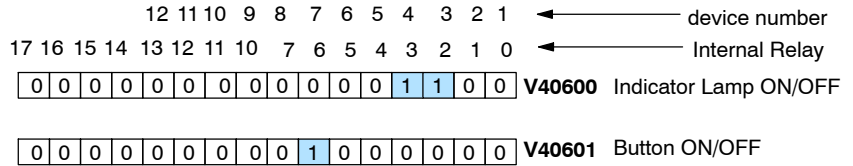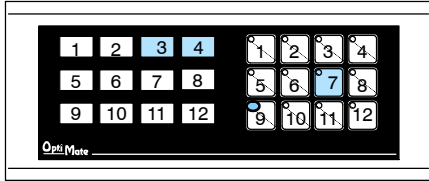
Example of Internal Relay Memory being mapped to User Memory

m = V2000

remapping = V40600:V2000

SP1
LD
V40600

OUT
V2000
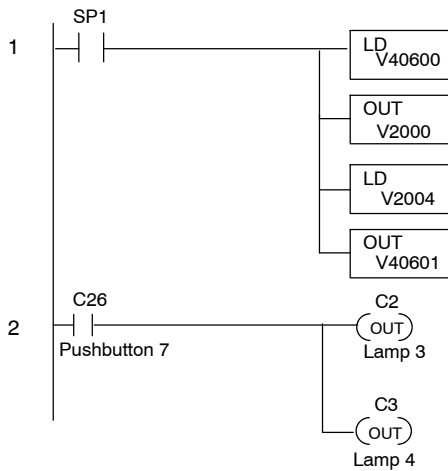
X12 Light Lamp 3 C2
(OUT)
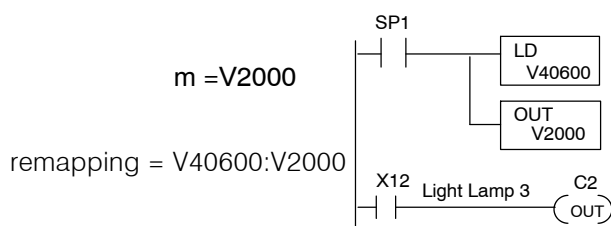
Here we are using SP1 to map V40600 to V2000. This consumes 16 relay bits, 12 of which are tied to the 12 Lamps of the panel. When a relay is ON, its corresponding Lamp is ON. By turning ON X12 with our ladder logic, we can thus turn on the Lamp corresponding to C2. C2 is bit 2 of the V40600 word and is tied to Lamp 3 through the mapping process. See your PLC User Manual for relay number assignments

Using Ladder Logic with *Direct*LOGIC PLCs

In the following examples, user memory will be remapped to internal relay memory. The internal relays of *Direct*LOGIC PLCs (DL05, DL06, DL105, DL205, DL350 and DL405) start at V40600. In the examples below, **V2000** has been used as the base address for a *Direct*LOGIC PLC, then **SP1** (always ON relay) is used in the ladder logic to perform the remapping. When using **SP1**, the remapping is performed on each scan, otherwise **m+0** and **m+1** would not be updated.
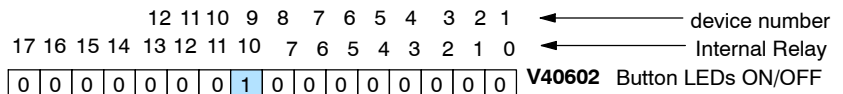
```
              12 11 10  9  8  7  6  5  4  3  2  1  ◄──── device number
           17 16 15 14 13 12 11 10  7  6  5  4  3  2  1  0  ◄──── Internal Relay
           0  0  0  0  0  0  0  0  0  0  0  0  1  1  0  0  V40600  Indicator Lamp ON/OFF

           0  0  0  0  0  0  0  0  0  0  1  0  0  0  0  0  V40601  Button ON/OFF
```

MAPPING PUSHBUTTONS AND LAMPS

Rung 1

SP1 — LD V40600 / OUT V2000 / LD V2004 / OUT V40601

Rung 1 – Mapping User Memory to Internal Relays
The first steps remap the Internal Relay Memory to User Memory for the lamps to function. The second step remaps the User Memory to the Internal Relay Memory for the operation of the pushbuttons.

Rung 2

C26 (Pushbutton 7) — C2 OUT (Lamp 3) / C3 OUT (Lamp 4)

Rung 2 – Pushbuttons and Lamps
When pushbutton 7 is activated Lamps 3 and 4 turn ON.

MAPPING LEDS

```
              12 11 10  9  8  7  6  5  4  3  2  1  ◄──── device number
           17 16 15 14 13 12 11 10  7  6  5  4  3  2  1  0  ◄──── Internal Relay
           0  0  0  0  0  0  0  1  0  0  0  0  0  0  0  0  V40602  Button LEDs ON/OFF
```
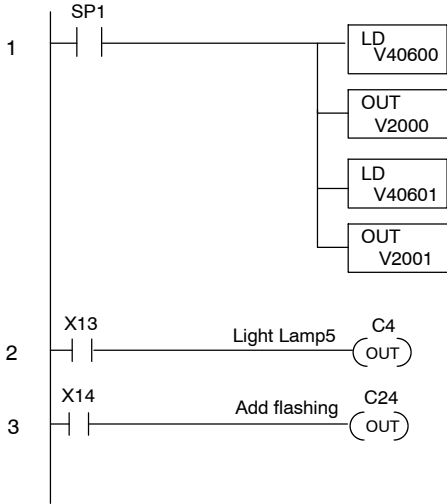
Rung 1

SP1 — LD V40602 / OUT V2002

Rung 1 – Mapping Internal Relays to User Memory
This step remaps the Internal Relay Memory to User Memory for the LEDs to function.

Rung 2 – LEDs
When contact X12 is ON, LED 9 turns ON
NOTE: Panel must be in LED Separation mode and pushbutton configured as momentary.

Rung 2

X12 — Light LED 9 — C50 OUT
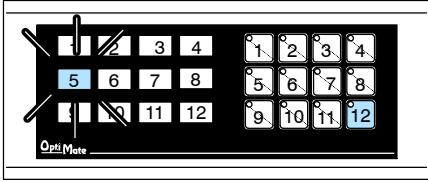
	12	11	10	9	8	7	6	5	4	3	2	1		device number
17	16	15	14	13	12	11	10		7	6	5	4	3	2	1	0		Internal Relay
0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	**V40600**	Indicator Lamp ON/OFF
0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	**V40601**	Indicator Lamp Flash

MAPPING LAMPS AND FLASH FEATURE

Rung 1 – Mapping Internal Relays to User Memory
This step remaps the Internal Relay Memory to User Memory for the Lamps and their flashing feature. These steps will be the same except for the address location for the LED flash option.

Rungs 2 and 3 –Flashing Lamps and LEDs
To flash a Lamp or LED, it must first be turned ON When contact X13 is activated, Lamp 5 will turn ON and when contact X14 is activated the Lamp will flash. These steps are the same for the LED flash option with the exception of the internal relay number.
NOTE: Panel must be in LED Separation mode and pushbutton configured as momentary.

MAPPING PUSHBUTTONS AND FORCE FUNCTION FEATURE

	12	11	10	9	8	7	6	5	4	3	2	1		device number
17	16	15	14	13	12	11	10		7	6	5	4	3	2	1	0		Internal Relay
0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	**V40602**	Button ON/OFF
0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	**V40603**	Force Data & Comm
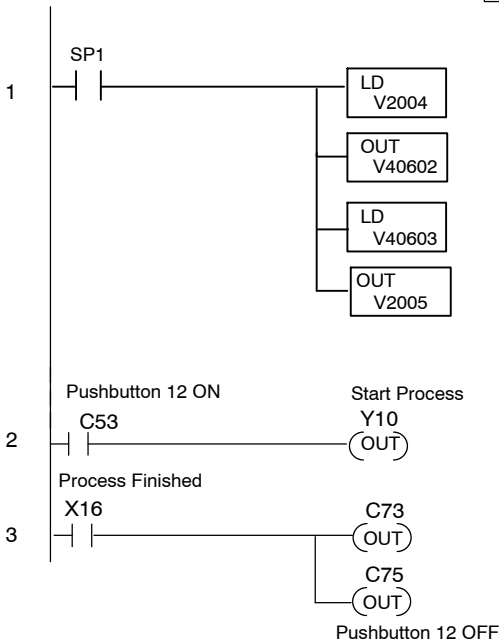
Rung 1 – Mapping User Memory to Internal Relays
These steps remap the User Memory to Internal Relay Memory for the Force Function feature. The first step maps the pushbutton control and the second step maps the Force Function feature.
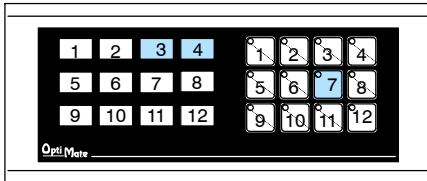
Rungs 2 and 3 - Force Function
When pushbutton 12 is pressed, process Y10 is started.When the process is completed it activates contact X16 which forces pushbutton 12 OFF.
NOTE: The pushbuttons must be configured as maintained (alternate) and the panels "Force Function" feature must be enabled.
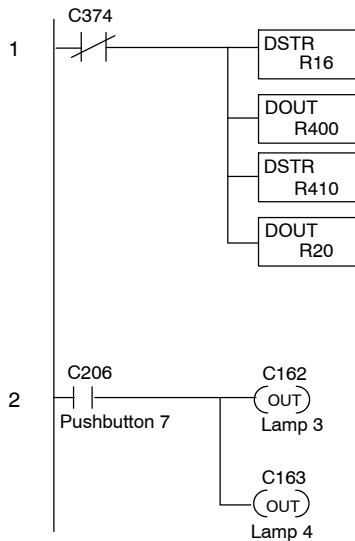
Using Ladder Logic with the DL305

In the following examples, user memory will be remapped to internal relay memory in order to use the pushbutton status to control outputs. The internal relays of the DL305 family start at R16. In the examples below, **R400** has been chosen as the base address for the DL305, then used normally closed **C374** in the ladder logic to map it to **R16**. Using **normally closed C374,** the remapping is performed on each scan, otherwise **m+0** and **m+1** would not be updated.

				12	11	10	9		8	7	6	5	4	3	2	1	← device number
7	6	5	4	3	2	1	0		7	6	5	4	3	2	1	0	← internal relay number

0	0	0	0	0	0	0	0	**R17**	0	0	0	0	1	1	0	0	**R16** Indicator Light ON/OFF

0	0	0	0	0	0	0	0	**R21**	0	1	0	0	0	0	0	0	**R20** Button ON/OFF

MAPPING PUSHBUTTONS AND LAMPS

1

C374
─┤/├─
DSTR R16
DOUT R400
DSTR R410
DOUT R20

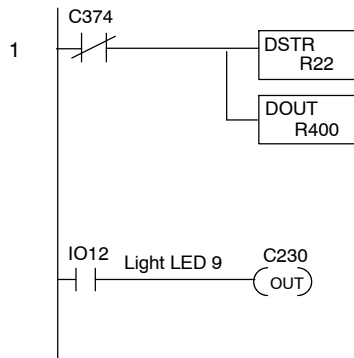**Rung 1 – Mapping User Memory to Internal Relays**
The first steps remap the Internal Relay Memory to User Memory for the lamps to function. The second step remaps the User Memory to the Internal Relay Memory for the operation of the pushbuttons.

2

C206
─┤ ├─
Pushbutton 7

C162
(OUT)
Lamp 3

C163
(OUT)
Lamp 4

Rung 2 – Pushbuttons and Lamps
When pushbutton 7 is activated Lamps 3 and 4 turn ON.

MAPPING LEDS

				12	11	10	9		8	7	6	5	4	3	2	1	← device number
7	6	5	4	3	2	1	0		7	6	5	4	3	2	1	0	← internal relay number

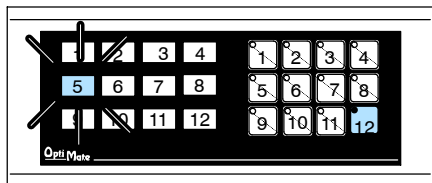| 0	0	0	0	0	0	0	1	**R23**	0	0	0	0	0	0	0	0	**R22** Button LEDs ON/OFF

1

C374
─┤/├─
DSTR R22
DOUT R400

Rung 1 – Mapping Internal Relays to User Memory
This step remaps the Internal Relay Memory to User Memory for the LEDs to function.
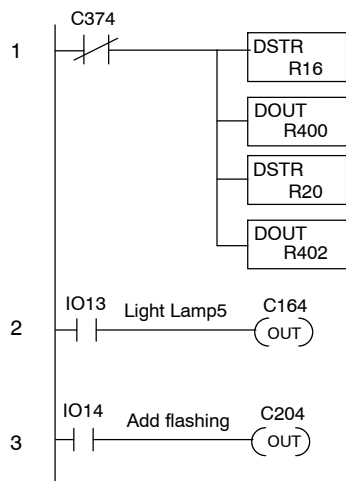
IO12
─┤ ├─
Light LED 9

C230
(OUT)

Rung 2 – LEDs
When contact IO12 is ON, LED 9 turns ON
NOTE: Panel must be in LED Separation mode and pushbutton configured as momentary.

					12 11 10 9				8 7 6 5 4 3 2 1 ◄ device number								
7	6	5	4	3	2	1	0		7	6	5	4	3	2	1	0	◄ internal relay number
0	0	0	0	0	0	0	0	**R17**	0	0	0	1	0	0	0	0	**R16** Indicator Lamp ON/OFF
0	0	0	0	0	0	0	0	**R21**	0	0	0	1	0	0	0	0	**R20** Indicator Lamp Flash

MAPPING LAMPS AND FLASH FEATURE

Ladder Logic

Rung 1

1. C374 — DSTR R16, DOUT R400, DSTR R20, DOUT R402

Rung 2 — IO13 Light Lamp5 — C164 (OUT)

Rung 3 — IO14 Add flashing — C204 (OUT)

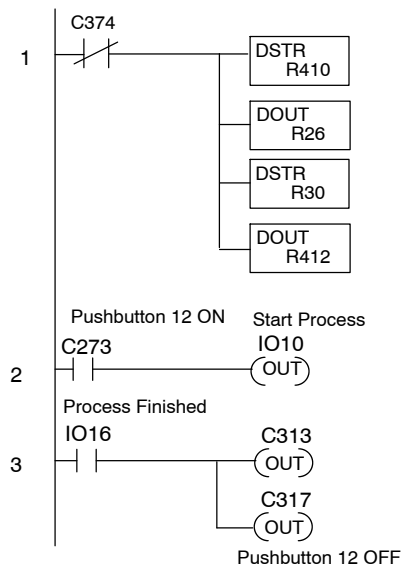### Rung 1 - Mapping Internal Relays to User Memory
This step remaps the Internal Relay Memory to User Memory for the Lamps and their flashing feature. These steps will be the same except for the address location for the LED flash option.

Rungs 2 and 3 - Flashing Lamps and LEDs
To flash a Lamp or LED, it must be first turned ON. When contact IO13 is activated Lamp 5 will turn ON and when contact IO14 is activated the Lamp will flash. These steps are the same for the LED flash option with the exception of the internal relay number.
NOTE: Panel must be in LED Separation mode and pushbutton configured as momentary.

MAPPING PUSHBUTTONS AND FORCE FUNCTION FEATURE

					12 11 10 9				8 7 6 5 4 3 2 1 ◄ device number								
7	6	5	4	3	2	1	0		7	6	5	4	3	2	1	0	◄ internal relay
0	0	0	0	1	0	0	0	**R27**	0	0	0	0	0	0	0	0	**R26** Button ON/OFF
1	0	0	0	1	0	0	0	**R31**	0	0	0	0	0	0	0	0	**R30** Force Data & Comm

Ladder Logic

Rung 1

1. C374 — DSTR R410, DOUT R26, DSTR R30, DOUT R412

Rung 2 — Pushbutton 12 ON — C273 — Start Process IO10 (OUT)

Rung 3 — Process Finished — IO16 — C313 (OUT), C317 (OUT) Pushbutton 12 OFF

Rung 1 - Mapping User Memory to Internal Relays
The first step remaps the User Memory to the Internal Relay Memory for the pushbuttons. The second step remaps the User Memory to the Internal Relay Memory for the operation of the Force Function feature.

Rungs 2 and 3 - Force Function
When pushbutton 12 is pressed, process IO10 is started. When the process is completed it activates contact IO16 which forces pushbutton 12 OFF.
NOTE: The pushbuttons must be configured as maintained (alternate) and the panels "Force Function" feature must be enabled.

Using the OP-1212 with an Allen-Bradley PLC

Using Ladder Logic with Allen–Bradley PLC

Integer type of files can be mapped for the Allen-Bradley PLC when being used with the OP-1212. In the examples below, integer file registers starting at base address **N7:0** have been mapped. If you need more information on any of the features of the panel, refer to ***Understanding the OP-1212 Panel*** in this manual.
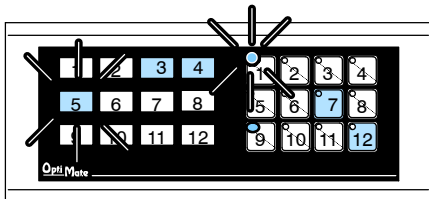
device number	12	11	10	9	8	7	6	5	4	3	2	1		
bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0		
0 0 0 0 0 0 0 0 0 0 0 1 1 1 0 0	**N7:0**	Indicator Lamp ON/OFF
0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0	**N7:1**	Indicator Lamp Flash
0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 1	**N7:2**	Button LEDs ON/OFF
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1	**N7:3**	Button LEDs Flash
0 0 0 0 1 0 0 0 0 1 0 0 0 0 0 0	**N7:4**	Button ON/OFF
1 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0	**N7:5**	Force Data & Comm
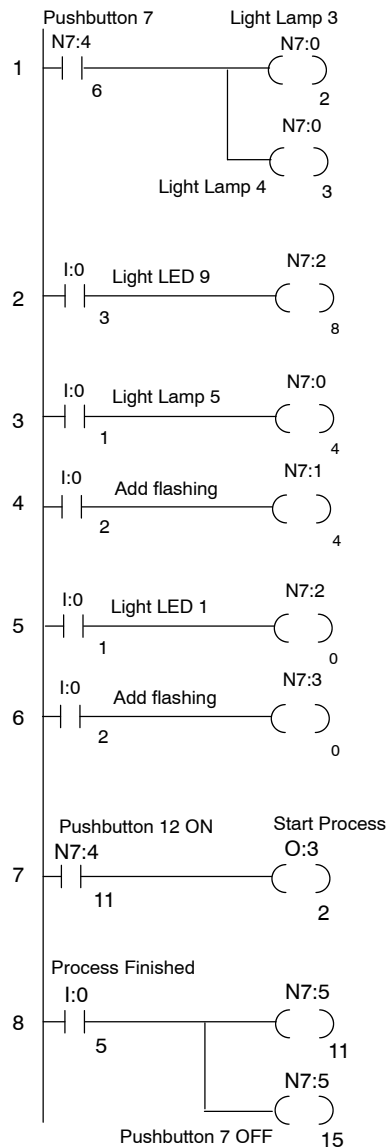
Rung 1 – Pushbuttons and Lamps
When pushbutton 7 is activated Lamps 3 and 4 turn ON.
Also, the LED in pushbutton 7 will turn ON if LED Separation is disabled and the pushbutton is configured as maintained.

Pushbutton 7 — N7:4 / 6
Light Lamp 3 — N7:0 / 2
Light Lamp 4 — N7:0 / 3
Rung 1

Rung 2 – LEDs
When contact I:0/3 is ON, LED 9 turns ON
NOTE: Panel must be in LED Separation mode and pushbutton configured as momentary.

I:0 / 3 — Light LED 9 — N7:2 / 8
Rung 2

Rungs 3 and 4 –Flashing Lamps
To flash a Lamp, it must be first turned ON When contact I:0/1 is activated Lamp 5 will turn ON and when contact I:0/2 is activated the Lamp will flash.

I:0 / 1 — Light Lamp 5 — N7:0 / 4
Rung 3
I:0 / 2 — Add flashing — N7:1 / 4
Rung 4

Rungs 5 and 6 – Flashing LEDs
To flash a LED, it must be first turned ON When contact I:0/1 is activated LED 1 will turn ON and when contact I:0/2 is activated the LED will flash.
NOTE: Panel must be in LED Separation mode and pushbutton configured as momentary.

I:0 / 1 — Light LED 1 — N7:2 / 0
Rung 5
I:0 / 2 — Add flashing — N7:3 / 0
Rung 6

Rungs 7 and 8 – Force Function
When pushbutton 12 is pressed, process O:3/2 is started.When the process is completed it activates contact I:0/5 which forces pushbutton 12 OFF.
NOTE: The pushbuttons must be configured as maintained (alternate) and the panels "Force Function" feature must be enabled.

Pushbutton 12 ON — N7:4 / 11
Start Process — O:3 / 2
Rung 7

Process Finished — I:0 / 5
N7:5 / 11
Pushbutton 7 OFF — N7:5 / 15
Rung 8