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.

<table>
<thead>
<tr>
<th>Mapped Memory Location</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>m+0 (such as V40600)</td>
<td>C0-C17 Indicator Lamps ON/OFF</td>
</tr>
<tr>
<td>m+1 (such as V40601)</td>
<td>C20-C37 Indicator Lamps Flash Control</td>
</tr>
<tr>
<td>m+2 (such as V40602)</td>
<td>C40-C57 Button LEDs ON/OFF</td>
</tr>
<tr>
<td>m+3 (such as V40603)</td>
<td>C60-C77 Button LEDs Flash Control</td>
</tr>
<tr>
<td>m+4 (such as V40604)</td>
<td>C100-C117 Button ON/OFF Status</td>
</tr>
<tr>
<td>m+5 (such as V40605)</td>
<td>C120-C137 Force Pushbuttons Data &amp; Comm</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Mapped Memory Location</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>m+0 (such as N7: 0/0-0/15)</td>
<td>Indicator Lamps ON/OFF</td>
</tr>
<tr>
<td>m+1 (such as N7: 1/0-1/15)</td>
<td>Indicator Lamps Flash Control</td>
</tr>
<tr>
<td>m+2 (such as N7: 2/0-2/15)</td>
<td>Button LEDs ON/OFF</td>
</tr>
<tr>
<td>m+3 (such as N7: 3/0-3/15)</td>
<td>Button LEDs Flash Control</td>
</tr>
<tr>
<td>m+4 (such as N7: 4/0-4/15)</td>
<td>Button ON/OFF Status</td>
</tr>
<tr>
<td>m+5 (such as N7: 5/0-5/15)</td>
<td>Force Pushbuttons Data &amp; Comm</td>
</tr>
</tbody>
</table>

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

Addressing Conventions

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

**DirectLOGIC Memory** - A typical address within a DirectLOGIC PLC is Vxxxx, such as V40600 for DirectLOGIC PLCs (DL05, DL06, DL105, DL205, DL350 and DL405 families) and Rxx, such as R16 for the DL305 family. The V-memory in the DirectLOGIC 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 show 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:

![Diagram](image)

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 DirectLOGIC PLCs to the OP-1212 when the address is configured for V40600. Use the work sheet in Appendix A for your application.

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

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 worksheet in Appendix A for your application.

<table>
<thead>
<tr>
<th>Device</th>
<th>Lamp ON/OFF</th>
<th>Lamp Flash</th>
<th>Button LED ON/OFF</th>
<th>Button LED Flash</th>
<th>Button Status</th>
<th>Force Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>N7:0/0</td>
<td>N7:1/0</td>
<td>N7:2/0</td>
<td>N7:3/0</td>
<td>N7:4/0</td>
<td>N7:5/0</td>
</tr>
<tr>
<td>2</td>
<td>N7:0/1</td>
<td>N7:1/1</td>
<td>N7:2/1</td>
<td>N7:3/1</td>
<td>N7:4/1</td>
<td>N7:5/1</td>
</tr>
<tr>
<td>3</td>
<td>N7:0/2</td>
<td>N7:1/2</td>
<td>N7:2/2</td>
<td>N7:3/2</td>
<td>N7:4/2</td>
<td>N7:5/2</td>
</tr>
<tr>
<td>4</td>
<td>N7:0/3</td>
<td>N7:1/3</td>
<td>N7:2/3</td>
<td>N7:3/3</td>
<td>N7:4/3</td>
<td>N7:5/3</td>
</tr>
<tr>
<td>6</td>
<td>N7:0/5</td>
<td>N7:1/5</td>
<td>N7:2/5</td>
<td>N7:3/5</td>
<td>N7:4/5</td>
<td>N7:5/5</td>
</tr>
<tr>
<td>7</td>
<td>N7:0/6</td>
<td>N7:1/6</td>
<td>N7:2/6</td>
<td>N7:3/6</td>
<td>N7:4/6</td>
<td>N7:5/6</td>
</tr>
<tr>
<td>8</td>
<td>N7:0/7</td>
<td>N7:1/7</td>
<td>N7:2/7</td>
<td>N7:3/7</td>
<td>N7:4/7</td>
<td>N7:5/7</td>
</tr>
<tr>
<td>9</td>
<td>N7:0/8</td>
<td>N7:1/8</td>
<td>N7:2/8</td>
<td>N7:3/8</td>
<td>N7:4/8</td>
<td>N7:5/8</td>
</tr>
<tr>
<td>10</td>
<td>N7:0/9</td>
<td>N7:1/9</td>
<td>N7:2/9</td>
<td>N7:3/9</td>
<td>N7:4/9</td>
<td>N7:5/9</td>
</tr>
<tr>
<td>11</td>
<td>N7:0/10</td>
<td>N7:1/10</td>
<td>N7:2/10</td>
<td>N7:3/10</td>
<td>N7:4/10</td>
<td>N7:5/10</td>
</tr>
<tr>
<td>M3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>N7:5/13</td>
</tr>
<tr>
<td>M2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>N7:5/14</td>
</tr>
<tr>
<td>M1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>N7:5/15</td>
</tr>
</tbody>
</table>
Applying Ladder Logic

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**

*DirectLOGIC 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 *DirectLOGIC* PLCs and SLC 5/03 and 5/04 Allen-Bradley PLCs. Below is a rung of logic that shows how a *DirectLOGIC* 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 *DirectLOGIC* PLCs. Refer to page 31 for Allen-Bradley.

```
V2004.3 Pushbutton 4 Y12
```

**Method 2:**

**Internal Relays**

*(All Options Used)*

This method is only available for Automation*Direct* programmable controllers. If you are already familiar with *DirectLOGIC* 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
```

**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

C103 OUT V40604

Pushbutton 4 OUT Y10
```
Applying Ladder Logic

Using Ladder Logic

DirectLOGIC 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.

<table>
<thead>
<tr>
<th>Device Number</th>
<th>Bit 12</th>
<th>Bit 11</th>
<th>Bit 10</th>
<th>Bit 9</th>
<th>Bit 8</th>
<th>Bit 7</th>
<th>Bit 6</th>
<th>Bit 5</th>
<th>Bit 4</th>
<th>Bit 3</th>
<th>Bit 2</th>
<th>Bit 1</th>
<th>Bit 0</th>
</tr>
</thead>
<tbody>
<tr>
<td>V2000</td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
</tr>
<tr>
<td>V2001</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
<td>ON</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
</tr>
<tr>
<td>V2002</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
</tr>
<tr>
<td>V2003</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
</tr>
<tr>
<td>V2004</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
</tr>
<tr>
<td>V2005</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
</tr>
</tbody>
</table>

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

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.

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.

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.

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 DirectLOGIC 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 DirectLOGIC 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 DirectLOGIC PLCs.

Notice that the internal control relays are numbered in octal and not decimal.

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

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.

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.

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.

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 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.

![Diagram of PLC setup]

**Rung 1 - Pushbuttons and Lamps**

When pushbutton 7 is activated, Lamps 3 and 4 turn ON.

**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.

**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.

**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.

**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.
Using Selected Functions with **DirectLOGIC** PLCs (not DL305 PLCs)

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.

### Using the Remapping Process

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

<table>
<thead>
<tr>
<th>SP1</th>
<th>LD</th>
<th>V2004</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OUT</td>
<td>V40604</td>
</tr>
<tr>
<td>C102</td>
<td>Y12</td>
<td>OUT</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>SP1</th>
<th>LD</th>
<th>V40600</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OUT</td>
<td>V2000</td>
</tr>
<tr>
<td>X12</td>
<td>Light Lamp 3</td>
<td>OUT</td>
</tr>
</tbody>
</table>

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.
In the following examples, user memory will be remapped to internal relay memory. The internal relays of DirectLOGIC 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 DirectLOGIC 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 \textit{m+0} and \textit{m+1} would not be updated.

### MAPPING PUSHBUTTONS AND LAMPS

**Rung 1 - Mapping User Memory to Internal Relays**

The first step remaps 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 - Pushbuttons and Lamps**

When pushbutton 7 is activated Lamps 3 and 4 turn ON.

### MAPPING LEDS

**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

\textbf{NOTE}: Panel must be in LED Separation mode and pushbutton configured as momentary.
**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**

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.

**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 - Pushbuttons and Lamps**
When pushbutton 7 is activated Lamps 3 and 4 turn ON.

**Mapping Pushbuttons and Lamps**

**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 IO12 is ON, LED 9 turns ON
NOTE: Panel must be in LED Separation mode and pushbutton configured as momentary.
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 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

**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.
Applying Ladder Logic

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.

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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.

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.

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.

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.

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.