Programmable Logic Controllers

PLC I/O Module Types and PLC Trainer Configuration

Basic Module Types

- Digital (discrete) output modules
  - Optical isolation provided
  - Relay, transistor or triac based
  - Transistor-based outputs may be
    - Current sourcing or
    - Current sinking
- Digital (discrete) input modules
  - Optical isolation provided
  - Diode based
    - Current sinking, sourcing or both depending on device
Relay Output Module

- Coil actuated switch closing
- AC or DC switching
  - Relay determines current carrying capacity
- More expensive relay I/O modules may have two external contacts per relay
  - Separate actuator and power supply can be connected to each relay-controlled circuit
  - Most flexible in terms of power types (AC or DC) and connections
- Less expensive relay I/O module
  - Common contact for a group (or all) outputs
### Current Sourcing Transistor Output Module

![Diagram of Current Sourcing Transistor Output Module](image)

- **CPU**
- **OUT6 Current →**
- **Actuator**
- **Positive common**
- **Power**

### Current Sinking Transistor Output Module

![Diagram of Current Sinking Transistor Output Module](image)

- **CPU**
- **OUT6 Current ←**
- **Actuator**
- **Negative common**
- **Power**
Transistor Output Modules

- PNP transistors used in current sourcing output modules
- Positive common may be shared across all (or groups of) inputs
- NPN transistors used in current sinking output modules
- Negative common may be shared across all (or groups of) inputs
- BE AWARE OF THE OUTPUT TYPE
  - Sourcing vs. Sinking
    - Power supply connections are different between the types

Current Sourcing/Sinking TRIAC Output Module

TRIAC allows current flow in either direction if triac’s gate contact is energized. Power supply polarity is not important. AC is allowed. More expensive than transistor-based modules.
Current Sinking Optoisolated Input Module

Current Sourcing Optoisolated Input Module
Sinking/Sourcing Optoisolated Input Module

Micrologix 1100 controller

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Output Terminal Block</td>
</tr>
<tr>
<td>2</td>
<td>Battery Connector</td>
</tr>
<tr>
<td>3</td>
<td>Bus Connector Interface to Expansion I/O</td>
</tr>
<tr>
<td>4</td>
<td>Battery</td>
</tr>
<tr>
<td>5</td>
<td>Input Terminal Block</td>
</tr>
<tr>
<td>6</td>
<td>LCD Display</td>
</tr>
<tr>
<td>7</td>
<td>LCD Display Keypad (ESC, OK, Up, Down, Left, Right)</td>
</tr>
<tr>
<td>8</td>
<td>Status LEDs</td>
</tr>
<tr>
<td>9</td>
<td>Memory Module Port Cover(1) or Memory Module(2)</td>
</tr>
<tr>
<td>10</td>
<td>DIN Rail Latches</td>
</tr>
<tr>
<td>11</td>
<td>RS-232/485 Communication Port (Channel 0, isolated)</td>
</tr>
<tr>
<td>12</td>
<td>Ethernet Port (Channel 1)</td>
</tr>
</tbody>
</table>
Controller Wiring

- **1763-L16BWA**
  - 120V AC input power
  - (6) 24 Vdc inputs
  - (4) high-speed 24 Vdc inputs
  - (6) relay outputs
  - (2) voltage inputs 0-10Vdc (Not used on the trainer)

![Diagram of Controller Wiring](image)

Trainer Wiring

*(sink/source input module)*

- All inputs (I/0-I/9) have similar wiring.
- I/0-I/2 have a normally open momentary pushbutton
- I/3-I/5 have a normally closed momentary pushbutton
- I/6-I/9 have toggle switches attached to the input

![Diagram of Trainer Wiring](image)
**Trainer Wiring**

(relay output module)

![Diagram of trainer wiring]

- AC power
- All outputs have similar wiring.

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**MicroLogix™ Analog Input/Output Module (1762-IF2OF2)**

- 1a upper panel mounting tab
- 1b lower panel mounting tab
- 2 power diagnostic LED
- 3 module door with terminal identification label
- 4 bus connector with male pins
- 5 bus connector cover
- 6 flat ribbon cable with bus connector (female)
- 7 terminal block
- 8 DIN rail latch
- 9 pull loop
- 10 input type selector switch
Input Type Selection

• Select the input type, current or voltage, using the switch located on the modules circuit board and the input type/range selection bits in the Configuration Data File.

• You can access the switch through the ventilation slots on the top of the module.
  – Switch 1 controls channel 0;
  – switch 2 controls channel 1.

• The factory default setting for both switch 1 and switch 2 is Current. Switch positions are shown below.

Output Type Selection

• The output type selection, current or voltage, is made by wiring to the appropriate terminals, Iout or Vout, and by the type/range selection bits in the Configuration Data File.

Terminal Block Layout
Input Data File

**Input Data File**

<table>
<thead>
<tr>
<th>Raw/Proportional Format</th>
<th>Scaled-for-PID Format</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bit Position</td>
<td>Bit Position</td>
</tr>
<tr>
<td>W</td>
<td>H</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>0</td>
</tr>
</tbody>
</table>

- For each module, slot x, words 0 and 1 contain the analog values of the inputs.
- The module can be configured to use either raw/proportional data or scaled-for-PID data.

**Status Bits**

- **SIx** = General status bits for input channels 0 and 1.
- **SOx** = General status bits for output channels 0 and 1. This bit is set when an error (over- or under-range) exists for that channel, or there is a general module hardware error.
- **OIX** = Over-range flag bits for input channels 0 and 1.
- **O0x** = Over-range flag bits for output channels 0 and 1. These bits can be used in the control program for error detection.
- **UIx** = Under-range flag bits for input channels 0 and 1.
- **U0x** = Under-range flag bits for output channels 0 and 1. These bits can be used in the control program for error detection.
## Output Data File

For each module, slot x, words 0 and 1 contain the channel output data.

### Raw/Proportional Format

<table>
<thead>
<tr>
<th>Word</th>
<th>Bit Position</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0</td>
</tr>
<tr>
<td>0</td>
<td>Channel 0 Data 0 to 32,760</td>
</tr>
<tr>
<td>1</td>
<td>Channel 1 Data 0 to 32,760</td>
</tr>
</tbody>
</table>

### Scaled-for-PID Format

<table>
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<tbody>
<tr>
<td></td>
<td>15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0</td>
</tr>
<tr>
<td>0</td>
<td>Channel 0 Data 0 to 16,380</td>
</tr>
<tr>
<td>1</td>
<td>Channel 1 Data 0 to 16,380</td>
</tr>
</tbody>
</table>