Choosing PNP vs NPN and NO vs NC
Basic electrical wiring in typical automation sensor applications

PNP or NPN? How does the sensor provide its signal to the controller?

<table>
<thead>
<tr>
<th>PNP (sourcing)</th>
<th>VS</th>
<th>NPN (sinking)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensor delivers (sources) positive 24V DC to the load or input</td>
<td>+ Load</td>
<td>Sensor connects (sinks) Negative or 0V DC common to the load or input</td>
</tr>
</tbody>
</table>

Benefits and Info
- More widely stocked in North America and European component suppliers
- More commonly used in North American and European automation equipment

Gotchas
- Sensors are more vulnerable to short circuit states
- Sensor vs PLC perspective: Ambiguity
  - Sensor: Sourcing
  - PLC: Sinking

Why NO or NC? Selecting the state of the unpowered device.

<table>
<thead>
<tr>
<th>Normally Open (NO, N/O)</th>
<th>VS</th>
<th>Normally Closed (NC, N/C)</th>
<th>VS</th>
<th>Complimentary (NO+NC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensor provides signal when target is present</td>
<td>+</td>
<td>Sensor provides signal when target is absent</td>
<td>-</td>
<td>Sensor provides both signals when target is absent or present</td>
</tr>
<tr>
<td>Typically pin 4 of sensor (BK)</td>
<td>-</td>
<td>Typically pin 2 of sensor (WH)</td>
<td>-</td>
<td>Provides status on sensor presence</td>
</tr>
<tr>
<td>Most common usage for automation sensors</td>
<td>+</td>
<td>Broken wire detection</td>
<td>+</td>
<td>Used for logic decisions made later, can require more wiring and inputs</td>
</tr>
<tr>
<td>Positive detection (signal with target)</td>
<td></td>
<td>Negative detection (signal when target missing)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Gotchas
- Can be software designed to be normally closed in PLC logic
- No signal if target present but broken wire (signal can’t pass broken wire)
- False detection if short circuit

- Can be designed around with PLC logic
- False detection of target if broken wire (looks like target present)

- Provides status on sensor presence
- Used for logic decisions made later, can require more wiring and inputs

- Some vendors offer sensors with normally closed on pin 4 (BK)
- Requires 4-wire cable