Industrial sensing fundamentals – NPN vs PNP

Learn the basics about sourcing and sinking sensors

Mark Sippel   23 Feb 2024 | 17:12 Clock   16

Reading Time: 2 minutes

If you're confused by the terms PNP and NPN, this post will shed some light on the differences between the two. In the context of this post, they refer to the construction of a sensor's transistor and whether it has a p-type or n-type semiconductor.

When wiring a sensor, the "N" stands for "Negative" and the "P" stands for "Positive." An NPN device can switch the negative side of the circuit, while a PNP device switches the positive side.
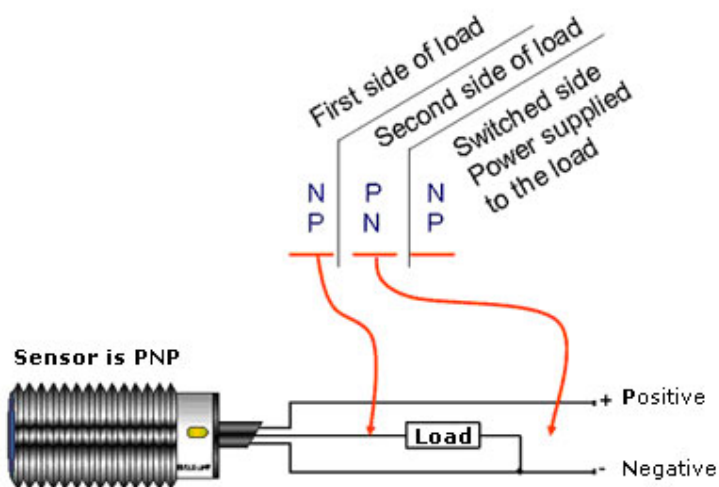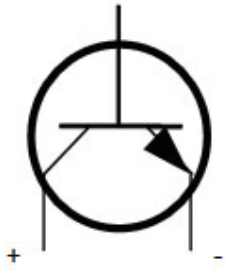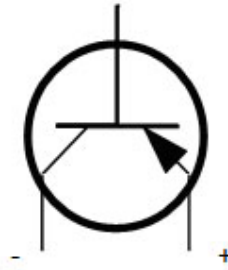

The next question to ask is, what direction do you want the current to flow?

PNP sensors are sometimes called "**sourcing** sensors" because they source positive power to the output. **NPN** sensors are sometime called "**sinking** sensors" because they sink ground to the output.
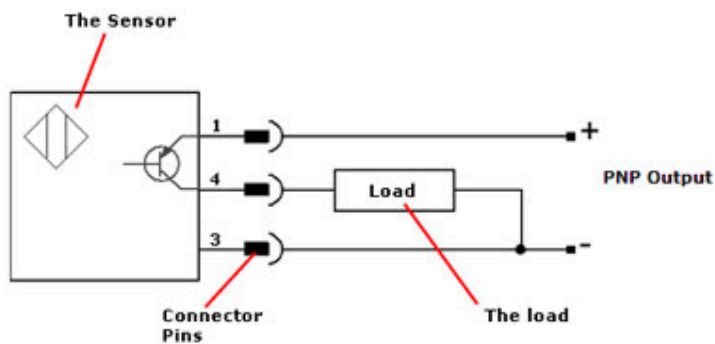
NPN
Also called **Sinking**
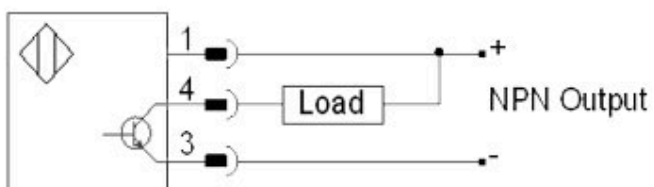
PNP
Also called **Sourcing**

+ - - +

The term "load" identifies the device the sensor powers. The load could be a lamp, pneumatic valve, relay or PLC input.

PNP 3-wire Standard Diagram

The Sensor

1 +

4 Load **PNP Output**

3 -

Connector Pins The load

NPN 3-wire Standard Diagram

1 +

4 Load NPN Output

3 -

Additional Details:

Types of Discrete Electrical Outputs – The majority of sensors used today use solid-state outputs, not mechanical relays.

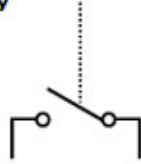|				
Today			**Yesterday**	
PNP, 3-wire			Relay	
NPN, 3-wire				
AC/DC, 2-wire				

The drawing below shows 2 wires for sensor power and 2 for the switch. Most sensors use only 3 wires because one wire does double duty, carrying both power and output signals. This is similar to a bathroom with only one line carrying water to the sink and toilet as opposed to individual lines for each.

Solid-state discrete sensors function similarly to a switch, but current only flows in one direction. Solid-state devices are reliable, economical, small, and fast. The only drawback is that you have to know the direction of the current flow. NPN and PNP are technical terms for the type of transistor used to switch the output. The type of transistor determines the direction of current flow.