

# Control System Basics – Open Collectors

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In the fourth installment of this five-part series, Jon Titus explores the basic elements of a control system. In previous installments, Jon has covered [relays](#), [sink vs. source control](#) and [PNP vs. NPN logic](#). Check back next month for the final installment.

**Q:** It looks like NPN and PNP sensors each provide an “open” collector contact. Is this what “open collector” means in data sheets?

**A:** Yes, but the topic needs a thorough explanation. You already learned that PNP transistors can source current and that NPN transistors can sink current. In both cases, the load—LEDs in Figures 10 and 11—connects to the collector of the transistor. The NPN open-collector devices are more common for reasons that go beyond the scope of this answer. That said, though, engineers like open-collector NPN circuits because they almost always connect to a known voltage; ground or 0 volts.

Open-collector PNP current source can provide a wide range of voltages depending on the manufacturer. Suppose you have newer controllers that have open-collector PNP current sources with a 24V output. But you must drive 12V relays in older apparatus. You can't power the relays with a 24V source. On the other hand if you specify equipment with open-collector NPN current sinks, you could provide a 12V power supply and use the sinks to control a direct connection to ground.

As an aside, in the early years of transistor-transistor-logic (TTL) circuits, IC manufacturers produced many devices with NPN open-collector outputs. This arrangement let designers connect many outputs to a “bus” signal. A pullup resistor to +5V placed the bus in a logic-1 state. But any open-collector device on the bus could connect the bus to ground, thus a logic-0. The open-collector ICs also could provide current sinks of up to 40 mA for LEDs, numeric displays, small indicator lamps, and reed relays. For the most part logic devices with three-state outputs (logic-0, logic-1, and high-impedance) have supplanted open-collector devices in modern designs, but you can still buy open-collector logic ICs.

We hope you enjoyed the fourth installment. Check back next month where Jon will explain isolation in his Control System Basics series. Be sure to read the previous installments:

- [Relays Explained](#)
- [Sink vs. Source Control](#)
- [PNP vs. NPN Logic](#)