The difference between open collector and push pull sensors.

The difference is in **how the output drives the signal wire**.

Open collector sender

- The output is a transistor that can only **switch the signal wire to ground**. When it's off, the wire just floats. It never produces a voltage of its own.
- It needs a **pull-up resistor**, typically 1k–10k, from the signal wire to a supply. Many gauges and ECUs have one built in.
- The **receiver sets the signal voltage**. Pull up to 12V, 5V or 3.3V and the pulses swing between ground and that voltage. That makes these senders easy to interface with almost anything.
- Without a pull-up you'll see no signal, or a weak and erratic one. That's a common "dead sender" misdiagnosis.
- Most 3-wire hall-effect speed sensors work this way (supply, ground, signal).

Non-open-collector sender (push-pull or totem-pole)

- The output actively drives the wire **both high and low**, so no pull-up is needed.
- The **sender sets the high voltage**, usually its own supply or a regulated 5V.
- You can't freely choose the logic level. A 12V push-pull output fed straight into a 3.3V or 5V input needs a voltage divider or level shifter.

Other senders that aren't switching outputs at all

- **Variable reluctance (magnetic pickup):** usually 2-wire. It generates an AC sine wave whose amplitude rises with speed, so it needs signal conditioning before a digital input.
- **Resistive senders** (temperature, fuel, oil pressure) are variable resistances, not pulse outputs.

A quick way to check an unknown sender: power it and measure the signal wire with no load connected.

- If it reads near ground or floats when it should be high, it's open collector.
- If it shows a solid voltage high, it's push-pull.

Output voltage level using a selection of pull up resistors including the common values of 1k and 4.7k

The “low” level stays near **0.1–0.4V** whatever pull-up you use; that’s the transistor’s saturation voltage. What the pull-up changes is how much current the sender must sink when on, and how well the “high” level holds up under a load.

Current the sender sinks when switched on

Pull-up	12V	5V	3.3V	Resistor power at 12V
470Ω	25.5 mA	10.6 mA	7.0 mA	0.31 W
1k	**12 mA**	**5.0 mA**	**3.3 mA**	**0.14 W**
2.2k	5.5 mA	2.3 mA	1.5 mA	65 mW
4.7k	**2.6 mA**	**1.1 mA**	**0.7 mA**	**31 mW**
10k	1.2 mA	0.5 mA	0.33 mA	14 mW
22k	0.55 mA	0.23 mA	0.15 mA	6.5 mW

High level when off, driving a 10k input load

Pull-up	12V	5V	3.3V
470Ω	11.5 V	4.8 V	3.15 V
1k	**10.9 V**	**4.5 V**	**3.0 V**
2.2k	9.8 V	4.1 V	2.7 V
4.7k	**8.2 V**	**3.4 V**	**2.2 V**
10k	6.0 V	2.5 V	1.65 V
22k	3.75 V	1.6 V	1.0 V

Into a high-impedance input, such as a microcontroller pin or a CMOS gate, the high level is essentially the full pull-up voltage for any of these resistors.

Choosing a value

- **Check the sender’s maximum sink current.** Many hall sensors are rated around 10–25 mA, so 470Ω at 12V is pushing it.
- **1k** gives a stiff, noise-resistant signal. It’s good for long runs in a noisy vehicle loom or for driving a low-impedance gauge input.
- **4.7k** is the usual general-purpose choice. It draws little current and is plenty strong for a high-impedance input.
- **10k and up** only suit high-impedance inputs. They also slow the rising edges on long cables, though that rarely matters at speedo pulse rates.