Inductive Proximity Sensors — Barrel Sizes, Sensing Range, PNP vs NPN and Flush Mounting

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How sensing range follows barrel size (M8 through M30), what flush versus non-flush mounting costs in range, the PNP/NPN and NO/NC wiring decision, reading Turck and Telemecanique type codes, target-material correction factors, and when a capacitive sensor is the right tool instead.

Range is set by the barrel — and the mounting

An inductive sensor's nominal range Sn scales with coil diameter, so the thread size on the drawing already fixes what is achievable. Typical standard-range figures, flush-mountable types:

Barrel | Flush Sn (typ.) | Non-flush / extended | Stocked example |

Ø6.5 / M8 | 1.5 mm | 2–4 mm | Telemecanique XS106 Ø6.5 smooth barrel |

M12 | 2 mm | 4–8 mm | Turck BI2-M12-AP6X, XS2 M12 at 8 mm |

M18 | 5 mm | 8–12 mm | M18 types across Turck and Telemecanique |

M30 | 10 mm | 15–20 mm | Turck BI10-M30-AP6X, BI15-M30-AP6X |

Turck's prefix states it directly: the digit after BI or NI is the range in millimetres, so a BI10-M30 and BI15-M30 differ exactly as their names say. Flush-mountable (BI, shielded) sensors sit level in steel at the cost of range; non-flush (NI, unshielded) buy range back but need free space around the face. The trailing AP6X group on the stocked Turck units reads: 3-wire DC, PNP output, normally open.

Wiring: the thirty-second version

3-wire DC: brown +, blue " , black signal. PNP switches the signal wire up to + (the European default; loads sit between black and "); NPN switches it down to " (common in Asian-built machines). A PLC input card is built for one or the other — match the card, not habit.

NO vs NC is chosen in the reference, not the wiring; fail-safe detection circuits often want NC so a cut cable reads as "object lost".

2-wire types wire in series with the load like a switch and leak a small off-state current — fine for contactors, marginal for high-impedance electronic inputs.

Target material matters: ranges are rated on mild steel. Stainless, brass, aluminium and copper reduce the effective distance progressively (copper to roughly a third) unless the sensor is a factor-1 type — Turck's UPROX family, e.g. the stocked NI4-M12 UPROX3, reads all metals at the same distance.

When inductive is the wrong physics

Inductive sensors see metal only. Plastics, liquids, grain and level detection through a tank wall belong to capacitive types — same barrel formats, adjustable sensitivity, like the stocked Turck BC5-M18 capacitive. Some 860 proximity-sensor line items are quotable across Turck, Telemecanique and others — the fastest route to the right replacement is the full code off the old sensor's laser marking plus the cable or connector (M8/M12 quick-disconnect) detail, answered with a quotation within 24 hours.

Frequently asked questions
What do PNP and NPN actually mean on a sensor?The output transistor's polarity: PNP sources current from + down through the load (signal wire goes high when detecting); NPN sinks it to " (signal goes low). The PLC input type dictates the choice — most European cards expect PNP.Why does my M12 sensor only detect at 1 mm when it is rated 2 mm?Rated range assumes a standard mild-steel target of defined size; smaller targets, non-ferrous metals and worn mounting alignment all shave distance. Working practice is to operate at no more than about 80 % of Sn.Can I mount a non-flush sensor level with the bracket face?No — unshielded types need the free zone around the face the datasheet specifies, or the bracket itself triggers them; countersunk mounting is what flush-rated (shielded) versions are for.What is a factor-1 (UPROX) sensor?An inductive design whose sensing distance is the same for every metal — steel, stainless, aluminium, brass — removing the correction-factor derating and doubling as protection against target-material changes on the line.How do I choose between capacitive and inductive for level detection?Liquid or bulk-solid level is capacitive territory (it senses any material with sufficient dielectric), inductive is metal-only. Capacitive units carry a sensitivity trimmer to tune out the tank wall.

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