

Photoelectric Sensors — Through-Beam, Reflex, Polarised Reflex, Diffuse and Background Suppression Compared

cBallast Technical Sourcing · Photoelectric sensors · issued 2026-10-03 · cballast.com/documents/photoelectric-sensing-modes-explained

Choosing a photoelectric sensing mode by range, target and environment: through-beam emitter/receiver pairs, polarised retro-reflex against shiny targets, plain diffuse, background suppression and laser variants, mapped to the OsiSense XUB/XUK/XUX ranges in stock.

The five modes

Through-beam — separate emitter and receiver, target breaks the beam. Longest range (tens of metres), best dirt reserve, immune to target colour and finish; costs two devices and two cable runs. Stocked across bodies: Ø18 barrel sets (XU2S18 pair, 8 m, stainless XU2N18 pair), compact XUK (emitter + receiver, 30 m class) and large XUX (receiver, 40 m class); laser versions reach 25 m with millimetre beams (XUK2LA emitter/receiver).

Retro-reflex (polarised) — one device plus a corner-cube reflector; the polarising filter stops shiny targets faking the reflector. The workhorse for conveyors: Ø18 (XU9M18 230 V AC, stainless XU9N18), M18-barrel XUB9 (metal, PNP NO), XUK9/XUX9 compacts (XUK9, 5 m class, XUX9, 11 m class); laser reflex to 12 m (XUK9LA). Reflective tape for curved surfaces: XUZB11 1 m roll.

Diffuse — the sensor sees light scattered off the target itself. One device, no reflector, shortest ranges, and sensitive to colour/background. Stocked in every body: M18 XUB5/XUB4 (metal PNP NO), compact XUK5 (PNP NO), miniature M8 (XUAH, PNP NO), stainless Ø18 (XU5N18).

Background suppression (BGS) — a diffuse sensor with triangulating optics that ignores anything beyond its cut-off: dark target against a bright wall, done. Laser BGS for precision (XUK8LA, 0–310 mm window); time-of-flight distance versions output analogue (XUK8TAE1 0–10 V, 4–20 mA).

Fork and frame — emitter and receiver factory-aligned in one housing for labels, small parts and web edges: optical forks (XUVR 30×30, laser XUYFAL 95×15, IR XUYFAN 95×15), frames (XUVF 30×30, 2 mm objects, XUVA 120×120) and the transparent-object reflex specialist (XUMTAPCN).

Decision table

Situation | Mode |
Long range, dirty air, any target | Through-beam |
Conveyor presence, one-side wiring | Polarised reflex |
Shiny/metallic targets | Polarised reflex or through-beam (never plain reflex) |
Close target against near background | Background suppression |
Clear bottles/film | Transparent-object reflex |
Labels, webs, small parts | Fork/frame |
No reflector possible, forgiving scene | Diffuse |

Practice notes

Excess gain: choose a mode/range so the sensor runs well inside its curve — dust and misalignment then cost margin, not function.

Multimode bodies: the XU*0 universal versions (XUK0, PNP/NPN selectable, relay-output XUK0ARC multi-voltage) cover mixed spares inventories with one article.

Outputs and wiring mirror inductives — PNP/NPN, NO/NC, M8/M12 or cable; see the connector reference.

Alignment: mount rigid, align at maximum signal (most bodies indicate), then back off sensitivity from the edge; slit masks (XUZMSH20 2×6.4 mm) tame beams for precision gaps.

Safety is different: object detection here is control, not protection — personnel protection needs Type 4 light curtains (see the light-curtain guide).

Part numbers and designations are those of the original manufacturers and are given for identification. cBallast is an independent supplier. © cBallast 2026 · cballast.com