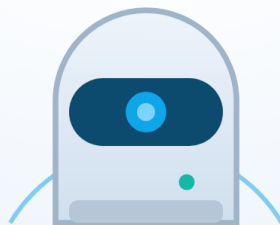


Sensorium™ Zone Awareness — User & Operation Manual

Operation, configuration, and maintenance of the Sensorium™ Zone Awareness sensor — a proximity / presence alerting sensor. Read the Safety chapter before any use.

`sensorium-safety-zone-manual` · Revision Draft (Preliminary) · 2026-07-18 · Status:
PRELIMINARY

PRELIMINARY. This manual describes intended functionality and operating procedures. Values marked ‡ are proposed engineering placeholders confirmed in the datasheet; they are not final and must not be relied upon for a safety decision. This device is an **alerting sensor, not a certified safety device**, and must not be used to provide a machine-safety function — see §1.4.



SENSORIUM™

Sensorium™ SafeZone

Sensorium™ SafeZone — proximity / zone-presence alerting sensor.

Figure FIG-001 — Sensorium™ Zone Awareness, the proximity / presence alerting sensor of the Sensorium™ Sense layer.

1. Safety

WARNING — Read before operating. The Sensorium™ Zone Awareness sensor is deployed around **hazardous, moving machinery**, but it is an **alerting sensor only** — it does **not** stop machinery and does **not** protect personnel. Relying on this device as a safeguard could result in **death or serious injury**. Only qualified personnel may install, configure, commission, or maintain it, and only under a documented machine risk assessment. If you have not read and understood this chapter, do not proceed.

This chapter defines the hazard symbols and signal words used throughout the manual, the intended use and limits of the device, the residual risks that remain after installation, and who is permitted to work on the system.

SAFETY SYMBOLS & SIGNAL WORDS



DANGER

risk of death / serious injury



WARNING

could cause injury



CAUTION

minor injury / equipment



NOTICE

property / operation

Standard signal words used throughout this document; observe all safety notices.

Figure FIG-002 — Signal words (DANGER / WARNING / CAUTION / NOTICE) and the hazard pictograms used in this manual.

1.1 Signal words

Signal words appear before the hazard they describe, never after. They are used with the following, fixed meanings:

SIGNAL WORD	MEANING
DANGER	Indicates a hazardous situation which, if not avoided, will result in death or serious injury.
WARNING	Indicates a hazardous situation which, if not avoided, could result in death or serious injury.
CAUTION	Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.
NOTICE	Addresses practices not related to personal injury — property or equipment damage , data loss, or degraded monitoring function.

NOTICE. This is an alerting device, not a safeguard, so no procedure in this manual is flagged **DANGER** (a "will result in death" hazard implies the device itself provides protection, which it does not). Hazards arising from **mis-reliance** on the device are flagged **WARNING**; the **DANGER** row is retained above only to define the term.

1.2 Intended use

The Sensorium™ Zone Awareness sensor is a networked sensing device intended to:

- Detect the presence of personnel and objects within a defined region around hazardous machinery, using **60 GHz FMCW mmWave radar**† (radar was chosen because it detects presence through airborne dust, smoke, and changing light; the device does **not** use LiDAR or vision AI).
- Discriminate configured **warning zones** (outer) and **alert zones** (inner) in real time.
- Drive a **local audible/visual output** (≤ 200 ms†) for immediate on-site awareness **and** raise a notification through the Gateway and dashboard (≤ 2 s†) when a zone is entered (see the datasheet §3 for these response times and their conditions).

The device is intended for **fixed, indoor/industrial installation** near machinery or hazardous areas for which a **documented risk assessment** has determined that area monitoring and alerting is a useful supplementary measure. It is the **externally-powered (24 V DC) variant** of the Sensorium™ sensor-node platform — the radar front-end draws more than a coin cell can supply, so the unit is line-powered. It operates as part of the 5Tech ecosystem: it connects **wirelessly** to the **Sensorium™ Gateway** over Bluetooth Low Energy, which relays events to the **5Tech Platform** (monitoring, automation, and AI-assisted reporting).

WARNING — Not a safeguard. The Zone Awareness sensor is an **alerting aid**, not a protective device. It does **not** stop machinery and does **not** replace primary machine guarding — fixed guards, interlocked movable guards, emergency-stop circuits, or the machine's own safety-rated control system. It may only ever be used **in addition to**, never instead of, the safeguards required by the machine's risk assessment.

1.3 Reasonably foreseeable misuse — do NOT

WARNING. The following uses can give a false sense of protection and lead to serious injury:

- Do **not** use the device as a **means of protection** against a machine hazard; it only alerts.
- Do **not** treat its alert as a machine stop — it does not stop machinery, and personnel must not enter a hazard relying on it to react.
- Do **not** use its response time to compute a safety distance (ISO 13855) — it provides no safety function (§1.4, §6).
- Do **not** rely on it where required detection cannot be guaranteed — see residual risks (§1.5).
- Do **not** modify, defeat, bypass, or reconfigure zones to suppress an alert in order to keep production running.
- Do **not** operate with an obstructed, heavily soiled radome, or with metal placed close to it (see §7).
- Do **not** install, aim, or configure the device outside the conditions established by the documented risk assessment.

1.4 Not a certified safety device

NOTICE. The Zone Awareness sensor is an **alerting sensor**. It has **not** been assessed or certified as a machine-safety component, and it carries **no** functional-safety rating. **Do not treat it as a safety component** or use it to provide a machine-safety function. The protection required for your application must be provided by the machine's own safeguards as determined by its risk assessment; the Zone Awareness sensor may be added only as a supplementary alerting aid. No certification is currently held; the intended certification programme is listed in the datasheet §9.

1.5 Residual risks

Even when correctly installed, configured, and maintained, the following residual risks remain. The machine risk assessment must account for each:

RESIDUAL RISK	NATURE
Occlusion / blind sectors	Objects, fixtures, or other equipment can shadow part of the radar field; a person within a shadowed sector may not be detected. See FIG-005.
Detection limits	Detection of very small, low-reflectivity, or fast-moving objects/persons is not guaranteed; the detection range, coverage, minimum detectable target, and max target speed are given in the datasheet §3.1.
Radome contamination / metal	Heavy build-up on the radome, or metal placed close to it, can reduce or defeat radar detection (a light dust film is tolerated).
No stopping action	The device does not stop the machine; it only raises an alert. Machinery keeps moving unless stopped by its own safeguards, and a person can reach the hazard regardless of the alert.
Fail-silent loss of function	Power loss, loss of the BLE link to the Gateway, radome contamination, misalignment, or an internal fault can stop alerts being raised. The device is fail-silent — it simply stops alerting rather than commanding a safe state — so the machine must never depend on it for a safe state. A dedicated fault output (normally energised, de-energises on fault/power loss) lets a downstream annunciator detect loss of the sensor (datasheet §3.2).
Reconfiguration	Incorrect zone geometry or parameter changes can silently reduce detection and alerting.

1.6 Qualified personnel

WARNING. Installation, wiring, configuration, commissioning, and maintenance of this device may be performed **only by qualified personnel** — persons who, by training and experience, are competent in the machine's safety requirements and the applicable regulations, who are authorized for the task, and who are working under the machine's documented risk assessment. Operators may only observe indications and follow the operating procedures in §5. Zone configuration (§6) and validation are **not** operator tasks.

1.7 Before you put the device into service

1. Confirm a **documented risk assessment** exists for the machine and that the machine's own safeguards provide the required protection independently of this device.

2. Confirm the installation, zone geometry, and mounting were performed and signed off by qualified personnel per the installation guide (see §2, related documents).
 3. Confirm **commissioning validation** (§5.1) has been completed and recorded, including a verified alert test on the actual machine.
 4. Confirm the device is in its **normal / ready** indication (§4) before relying on its alerts.
-

2. About this manual

Scope. This manual covers day-to-day operation, zone-configuration concepts, routine maintenance, and troubleshooting of the Sensorium™ Zone Awareness sensor. It does **not** cover mechanical installation and wiring (see the installation guide) or full technical specifications (see the datasheet).

Audience. Qualified machine-safety personnel, integrators, and trained operators, as distinguished in §1.6. Sections that are restricted to qualified personnel are marked.

Conventions.

- Signal words (DANGER / WARNING / CAUTION / NOTICE) are used as defined in §1.1.
- Procedures are numbered, one action per step, in the imperative voice. A step's warning precedes the step; the expected result follows it.
- Values shown as ‡ are proposed and confirmed in the datasheet; they are not final.

Related documents.

- **Datasheet:** [datasheets/sensorium-safety-zone-datasheet/](#) — full specifications (§9 links here).
 - **Installation guide:** [installation/sensorium-safety-zone-installation/](#) — mounting, wiring, commissioning.
 - **Gateway manual:** [manuals/sensorium-gateway-manual/](#) — the aggregation hub this device connects to.
 - **5Tech Platform** — monitoring, automation, and AI-assisted reporting, where events are reviewed and actioned.
-

3. Product overview & theory of operation

The Sensorium™ Zone Awareness sensor is the **Sense**-layer proximity / presence alerting sensor of the Sensorium™ family. It watches a defined area around hazardous machinery and reports zone entry so personnel can be alerted.

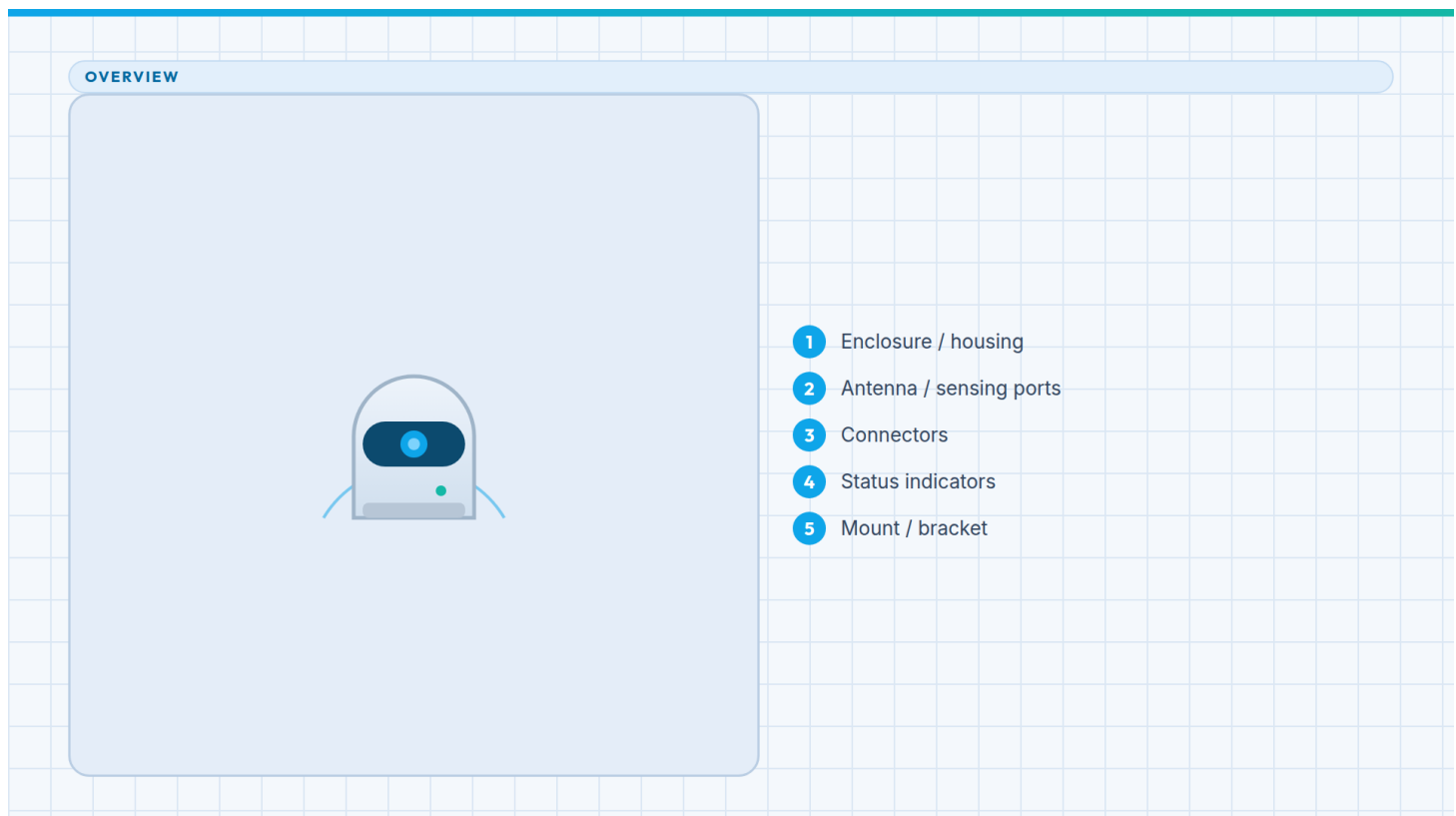


Figure FIG-003 — External features: mmWave radar radome, status LEDs, connector face (power + outputs), and mount.

How it works, at operator depth:

1. The **mmWave radar front-end** (60 GHz FMCW[†]) builds a picture of presence and movement in the area surrounding the sensor, seeing through airborne dust, smoke, and darkness (no LiDAR, no vision AI).
2. Detections are filtered to distinguish personnel and objects from the static machine environment, reducing nuisance and missed events.
3. Detections are compared against the **configured zones**: an outer **warning zone** and an inner **alert zone** (§6, FIG-005).
4. On zone entry the device **directly drives its local audible/visual output** (≤ 200 ms[†]) for immediate on-site awareness, **and** signals the **Sensorium™ Gateway** over BLE, which relays the event to the **5Tech Platform** for a dashboard notification (≤ 2 s[†]). Response times and their conditions are in the datasheet §3.

The device is **externally powered from 24 V DC** and its uplink to the Gateway is **wireless (BLE)** — the only wired connections are power and the local alert / fault outputs. It **senses and alerts**

only. It does **not** stop the machine: stopping a hazard remains the job of the machine's own safeguards. The Platform and Gateway provide monitoring, logging, and alerting around those safeguards.

4. Controls & indicators

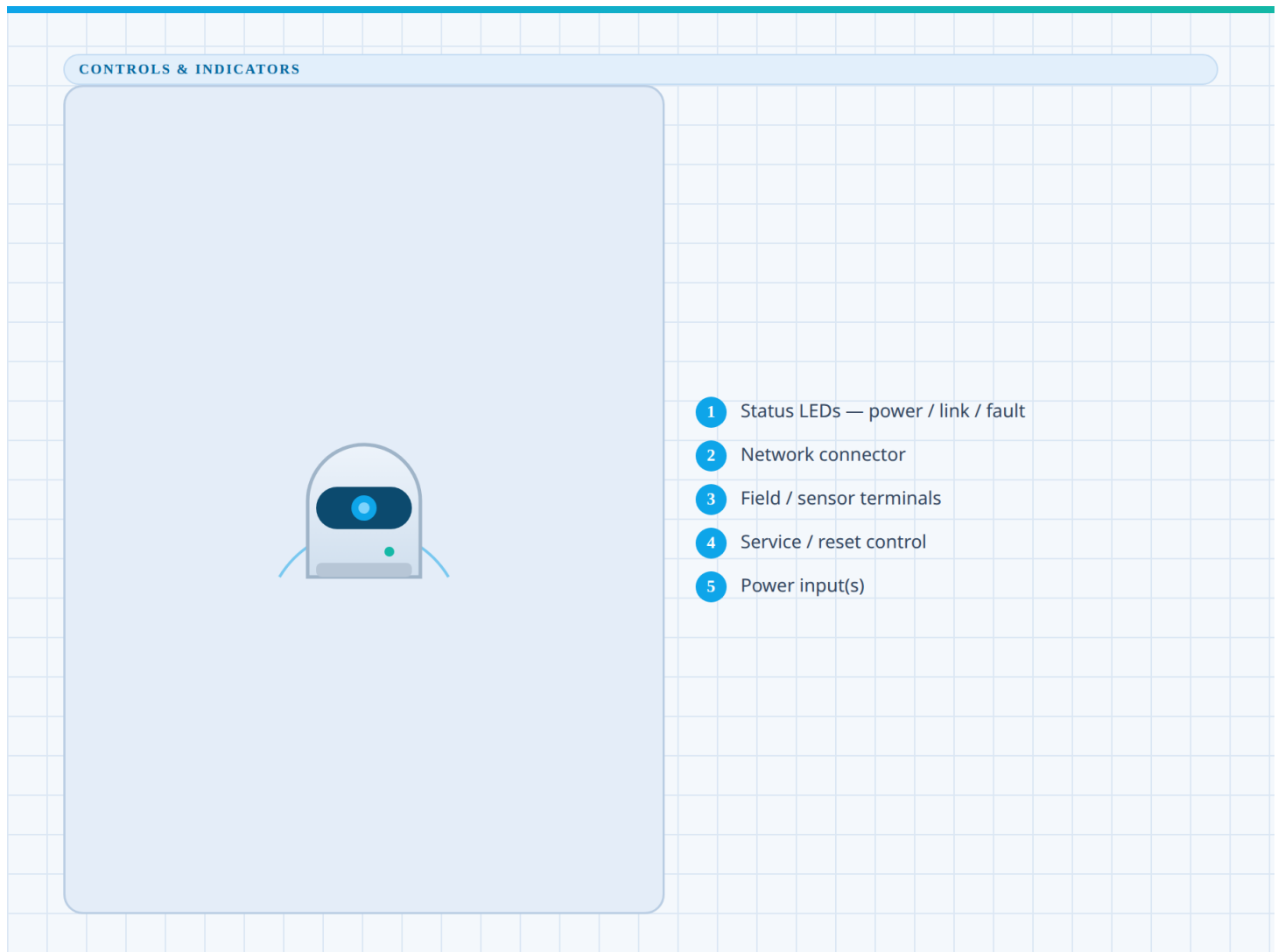


Figure FIG-004 — Connector face and status-LED array: power, Gateway link, and health / detection indicators.

The device is configured over the network via the 5Tech Platform; local controls are minimal. The uplink to the Gateway is **wireless (BLE via an internal antenna)** — there is **no** wired network connector. Exact controls, connectors, and LED behaviour are ‡ pending final hardware and are shown here as intended.

CONTROL / INDICATOR	FUNCTION	STATES
Power indicator	Shows the device is powered from 24 V DC	Off = no power · Steady = powered‡
Health / ready indicator	Shows the device is operating normally and monitoring	Steady = ready‡
Detection indicator	Shows a zone is currently occupied / triggered	Off = clear · On/blink = warning- or alert-zone entry‡
Fault indicator	Shows a fault that may stop alerts being raised	Off = no fault · On/blink = fault (see §8)‡
Gateway link (BLE) indicator	Shows the wireless link to the Sensorium™ Gateway	Off = no link · Steady = linked‡
Power connector	Supplies 24 V DC device power — power only, not a data link	Sealed connector‡
Local alert output connector	Drives the local audible/visual annunciator	Sealed connector‡
Fault output connector	Normally-energised fault signal; de-energises on fault/power loss (§1.5)	Sealed connector‡
Service / reset access	Qualified-personnel service function	‡ — not an operator control

NOTICE. The exact colours, blink patterns, and their precise meanings will be confirmed against final hardware. Do not infer safety state from an indicator whose meaning is ‡; confirm status in the 5Tech Platform.

5. Operation

Normal operation is largely automatic once the device is commissioned. The procedures below are for **trained operators**, except §5.1 which is a **qualified-personnel** task.

5.1 Commissioning validation (qualified personnel only)

WARNING. Zones and alert response must be validated on the **actual machine** before the device is put into service. An unvalidated system may fail to raise an alert when a zone is entered — and remember the device never stops the machine and must not be relied on as protection.

1. Confirm the machine risk assessment and installation sign-off are on file (§1.7).
2. Verify the device shows a **ready** indication (§4) and appears healthy in the 5Tech Platform.
3. Using the Platform, confirm the configured **warning** and **alert** zone geometry matches the approved design (§6, FIG-005).
4. With the machine in a controlled test state, enter the **warning zone** with a suitable test piece and verify the expected **alert** is raised. *Expected result: the local output activates and the Platform logs a warning-zone event.*
5. With the machine in a controlled test state, enter the **alert zone** with a suitable test piece and verify the expected **high-priority alert** is raised. *Expected result: the local output activates (high-priority) and the Platform logs an alert-zone event.*
6. Confirm the warning- and alert-zone sizes suit the site: the local output asserts within ≤ 200 ms† and the Platform notification within ≤ 2 s‡ of detection (datasheet §3), and personnel have adequate time to react to the **awareness** these provide. *Note: these are annunciation latencies for awareness only. They must not be used to compute a safety distance under ISO 13855 — the device provides no safety function (§1.4).*
7. Record the validation results and sign off before putting the device into service.

5.2 Daily start-of-shift check (operator)

1. Visually inspect the radome for obstruction, heavy soiling, or damage (§7). *If obstructed, heavily soiled, or damaged, stop and follow §7 / §8 — do not run production.*
2. Confirm the device shows a **ready** indication (§4) with **no fault** indicator active.
3. In the 5Tech Platform, confirm the device is **online** and reporting healthy.
4. Verify no persons or obstructions are left inside the configured zones. *Expected result: device ready, zones clear, no faults — machine may be enabled per site procedure.*

5.3 Normal running (operator)

1. Keep the configured zones clear except for intended access.
2. Treat any **warning-zone alert** as an instruction to stop approaching and clear the zone.
3. Treat any **alert-zone alert** as a signal to stop work and clear the zone immediately — do not attempt to suppress it. *Expected result: the alert is acknowledged and the zone is cleared per site procedure; the machine is stopped by its own safeguards where required.*

5.4 Responding to a zone alert (operator)

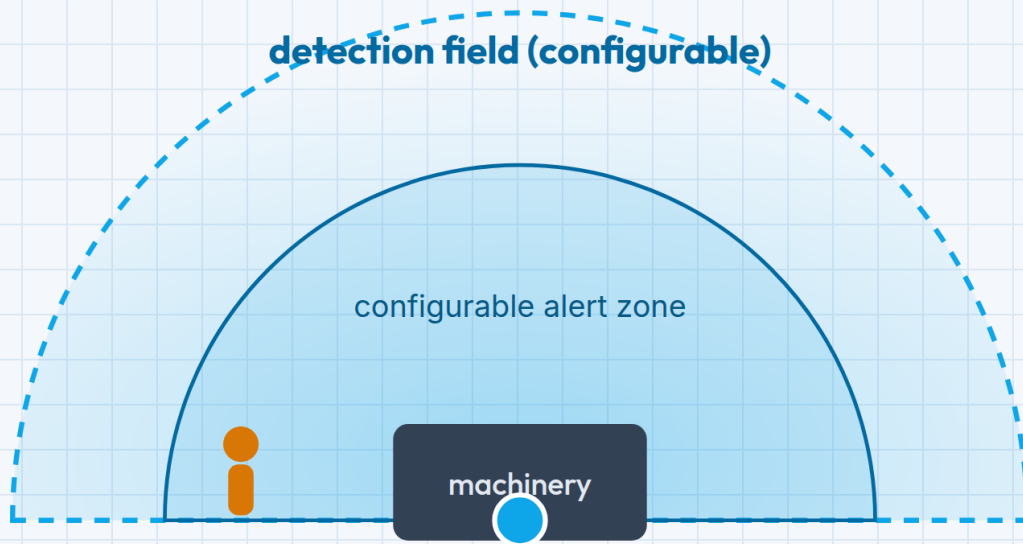
WARNING. Do not enter a machine's hazard area in response to an alert until the machine is in a verified safe state per the machine's own lock-out / safe-access procedure. The Zone Awareness sensor does not stop the machine and does not guarantee the machine cannot move.

1. Identify what entered the zone (person or object) using the Platform event and local indication.
2. Once it is safe to do so, clear the person or object from the zone.
3. Confirm the device returns to a **ready, zones-clear** state (§4).
4. Restart the machine only per the site's authorized restart procedure. *Expected result: device ready and clear before restart.*

6. Configuration

WARNING — Qualified personnel only. Zone geometry and detection parameters are **detection-relevant**. Incorrect configuration can silently reduce or defeat detection and alerting. Configuration and any change to it must be performed by qualified personnel under the machine risk assessment, followed by re-validation (§5.1), and recorded under change control.

Configuration is performed through the **5Tech Platform**, which distributes settings to the device via the Gateway over BLE. Parameter names, ranges, and defaults are **‡** pending final firmware.



Top-down plan — sensor near machinery with configurable warning & alert zones; zone entry raises an alert (not a certified machine)

Figure FIG-005 — Top-down plan: radar detection field with configurable warning and alert zones around a machine.

Concepts:

- **Coverage area** — the device senses within a defined region around its mounting point (see the datasheet §3.1 for range and field of view). Coverage is **not** guaranteed in sectors that are physically **occluded** by the machine, fixtures, or other equipment; occluded sectors must be identified and handled by the risk assessment (FIG-005).
- **Warning zone** — the outer region whose entry raises a lower-priority **alert** (local output plus Platform notification) to deter approach before the alert zone is reached.
- **Alert zone** — the inner region whose entry raises a **high-priority alert**. Size the zones so that the awareness they provide is useful for the site.

NOTICE — zone sizing. The device's response times are **local output ≤ 200 ms†** and **Platform annunciation ≤ 2 s†** (datasheet §3). These are **awareness** latencies only. They must **not** be used to compute a protective safety distance (ISO 13855) — this device

provides no safety function, and the machine's own safeguards remain responsible for protection.

To change a configuration (qualified personnel):

1. Confirm a change is authorized under the machine's change-control and risk-assessment process.
 2. In the 5Tech Platform, open the device's zone configuration and record the current settings.
 3. Apply the approved change to the warning and/or alert zone geometry or parameters.
 4. Verify the device accepts the change and remains healthy.
 5. Re-run the commissioning validation (§5.1), including a live alert test.
 6. Record the change, the validation result, and the sign-off before returning to production.
-

7. Maintenance

WARNING. Before maintenance, place the machine and the surrounding area in a verified safe state per the machine's lock-out procedure. The device raises **no alerts** while it is being cleaned, inspected, or serviced. After any maintenance, re-verify the device is ready and, where alignment or configuration may have changed, re-validate (§5.1).

MAINTENANCE POINTS



- 1 Sealing gasket — inspect / replace
- 2 Sensing window — clean per schedule
- 3 Fasteners — check torque
- 4 Firmware — apply OTA updates
- 5 Filter / vent — inspect

Figure FIG-006 — Maintenance points: radar radome, seals, and mount — cleaning and inspection access.

Keeping the radome clear and the mount secure is essential to reliable detection and alerting. A light dust film is tolerated by the radar, but heavy build-up, moisture films, or metal placed near the radome degrade detection.

INTERVAL	TASK	NOTES
Start of shift	Visually inspect the radome for obstruction, heavy soiling, or damage	Do not rely on the device if obstructed or damaged (§5.2)
‡	Clean the radome	Soft, lint-free cloth; no abrasives or solvents; approved cleaning agent ‡
‡	Inspect connector seals and gaskets for integrity	Replace if damaged; part numbers ‡
‡	Verify mounting is secure and alignment/aim is unchanged	Re-validate zones if alignment changed (§5.1)
‡	Confirm firmware is current via the 5Tech Platform	Apply updates only under change control
As needed	Functional alert test on the actual machine	Per site procedure; record results

To clean a radome:

1. Place the machine and area in a verified safe state; the device raises no alerts during cleaning.
2. Gently remove loose dust from the radome.
3. Wipe the radome with a soft, lint-free cloth using light pressure. *Do not use abrasives, solvents, or high-pressure spray; the cleaning agent is ‡. Do not place metal objects against the radome.*
4. Confirm the radome is clear and unmarked.
5. Restore the device, confirm a **ready** indication (§4), and return to service per site procedure.

NOTICE. There are no user-serviceable internal parts. Do not open the enclosure; doing so can compromise sealing and detection and voids warranty (§10). Refer internal service to 5Tech.

8. Troubleshooting

WARNING. While any fault that may stop alerts being raised is present, do not rely on the device for awareness and follow the machine's own safe-state procedure. Do not defeat or

bypass the device to keep production running.

Behaviours below are indicative; exact indications and remedies are ‡ pending final hardware.

SYMPTOM	POSSIBLE CAUSE	ACTION
No power indication	No 24 V DC supply / connector issue	Verify power per installation guide; if unresolved, contact qualified personnel
Device offline in Platform	Wireless BLE link to Gateway lost	Confirm the device is powered and within BLE range of the Gateway; confirm the Gateway is online
Fault indicator active / fault output de-energised	Internal fault, misalignment, or radome fault	Place machine in safe state; inspect radome/mount; consult Platform diagnostics ‡
Frequent nuisance alerts	Zones too large, radome contamination, or reflective clutter	Clean the radome (§7); qualified personnel review zone geometry (§6) and re-validate
Suspected missed detection	Occlusion, radome contamination, misalignment, or detection limit	Stop relying on it immediately; place machine in safe state; escalate to qualified personnel and re-validate
Configuration change won't apply	Authorization / connectivity	Confirm change control and Platform connectivity; do not force

WARNING. If you suspect the device has **failed to detect** a person or object when it should have, stop relying on its alerts immediately, place the machine in a safe state, and escalate to qualified personnel before returning the machine to production.

9. Specifications

Full technical specifications — mechanical, electrical, radar/sensing, interface, environmental, response timing, and compliance — are maintained in the **datasheet** to avoid duplication and drift:

- **Datasheet:** [datasheets/sensorium-safety-zone-datasheet/](#)

Summary orientation only (all exact values live in the datasheet, and unconfirmed values there are ‡):

ASPECT	SUMMARY	WHERE TO CONFIRM
Sensing	60 GHz FMCW mmWave radar‡ (no LiDAR, no vision AI)	Datasheet · §3.1
Function	Personnel/object detection; warning & alert zones; local + Platform alerting	Datasheet · §1.2
Response	Local output ≤ 200 ms‡; Platform annunciation ≤ 2 s‡	Datasheet · §3
Interfaces	Wireless BLE uplink to the Gateway; 24 V DC power; local alert + fault outputs	Datasheet · §7
Power	Externally powered 24 V DC; 3 W typ‡ / 6 W max‡	Datasheet · §6
Environmental / ingress	IP65‡ (IEC 60529); -20 °C to +55 °C‡	Datasheet · §8
Certification	No certification currently held; not a safety-rated device	Datasheet · §9, §1.4

NOTICE. Do not use this summary for a safety-distance or compliance decision. Use the confirmed values in the datasheet and your machine risk assessment, and remember the device does not provide a safety function — it only alerts.

10. Warranty & support

Warranty terms are ‡ and will be published with the product release. Opening the enclosure, modifying the device, or operating it outside its documented conditions voids the warranty and may compromise detection and alerting (§7).

Support and service

- **5Tech** — Automation & Informatics, Vancouver, BC, Canada.
- **General enquiries:** info@5tech.ca
- **Service:** Refer all internal service and repair to 5Tech; there are no user-serviceable internal parts. Service contacts and RMA procedure are ‡.

Figures

ID	TITLE	FILE	ASPECT	PURPOSE
FIG-001	Industrial Hero Render	renders/hero_sensorium_safety_zone.png	16:9	Manual cover / hero
FIG-002	Safety Symbols & Signal Words	figures/safety_symbols.png	4:3	Hazard symbols and signal words for the safety chapter
FIG-003	Product Overview	figures/product_overview_callout.png	16:9	Identify external features and the radar radome
FIG-004	Controls & Indicators	figures/controls_and_indicators.png	4:3	Identify controls, connectors, and status LEDs
FIG-005	Detection Coverage & Alert Zones	diagrams/detection_coverage_360.png	4:3	Configure radar coverage and warning/alert zones
FIG-006	Maintenance Points	figures/maintenance_points.png	4:3	Locate the radome and maintenance points

This manual is preliminary and subject to change. The Safety chapter (§1) requires review by the Industrial Customer and CTO review seats before release. See [revision.md](#) for change control, [references.md](#) for sources, and [figures.json](#) / [image_prompts.md](#) for the figure index. Web publication target: </resources/manuals/safety-zone>.