

Architectural & Engineering Specification for

Microwave outdoor intrusion detection sensor

Purpose of document

This document is intended to provide performance specifications and operational requirements for the MPS-4100 Microwave Protection Sensor. It is written in a generic format without referring to the system by name or by specific identifiers. This specification may be copied verbatim to form a generic procurement specification for a microwave intrusion detection system.

Classification of equipment

The MPS-4100 is a volumetric electromagnetic field sensor employing microwave radar technology for outdoor perimeter intrusion detection.

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1.0 General performance specifications

1.1 System description

The system shall be a modular, bi-static, microwave, outdoor intrusion detection sensor based on microwave radar technology. The detection field shall be formed by radio frequency (RF) signals, in the X-band, carried between a transmitter and a receiver. The RF signals shall form an invisible electromagnetic detection field that can detect the presence of an intruder crossing it.

A transmitter shall create the RF signals that form the detection field. A receiver shall house the necessary electronics to monitor the detection field and to raise an alarm when an intruder enters the field. The transmitter and receiver shall be powered individually, as a standalone unit, with the option of powering the transmitter from the receiver.

1.2 System technology

1.2.1 Microwave

The system shall operate in the X-band of the electromagnetic spectrum at a frequency of 10.525 ± 0.025 GHz, with Class A2 modulation at one of six (6) selectable frequencies. The transmitter shall incorporate a dielectric resonant oscillator for increased stability over temperature ranges.

1.2.2 Electromagnetic wave

An electromagnetic wave shall be emitted by the antenna of the transmitter and received by the antenna of the receiver. The receiver shall detect changes to the wave that are caused by the presence of an intruder.

1.3 Detection properties

1.3.1 Detection sensitivity

The system shall detect moving intruders having a significant electromagnetic cross-section (e.g. humans, vehicles, and other large conductive objects) while rejecting other environmental stimuli.

1.3.2 Detection performance

1.3.2.1 Probability of detection (PD)

The probability of detecting a human intruder weighing more than 34 kg (75 lb.) walking across the detection zone at random locations shall be 95% with a 95% confidence factor.

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1.3.2.2 Velocity response

The system shall be capable of detecting human intruders moving through the detection field at various speeds regardless of the direction of motion. The user shall be able to optimize the detection of fast or slow intrusions by jumper selection on the receiver.

1.3.2.3 Crossing types

The system shall be capable of detecting human intruders who walk, crawl, roll, jump, or run through the detection field.

1.3.3 False/nuisance alarms

False and nuisance alarms are divided into the two categories listed below.

1.3.3.1 System-generated alarms (false alarms)

Alarms generated by internal electronic processes shall not occur at a rate greater than one per zone per month, averaged over the total number of zones in the system.

1.3.3.2 Environmental alarms (nuisance alarms)

The system shall operate within specifications in typical outdoor environments. The system must be installed in accordance with the manufacturer's recommendations in order to maintain the full PD for valid intruders while minimizing false alarms from the following stimuli:

- vegetation up to 8 cm (3 in.) high
- rain
- sunrise/sunset
- wind
- temperature changes
- snow
- hail
- fog
- sandstorms
- motion of nearby objects (vehicles, etc.)
- motion of underground water
- nearby radio-frequency sources
- seismic vibration
- acoustic or magnetic effects

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Before installation, the installer shall alert the customer, in writing, as to all site-specific conditions, which may contribute to an increased nuisance alarm rate. The customer shall decide whether to remedy the situation or accept the nuisance alarm sources without any further responsibility on the part of the installer or the manufacturer.

1.4 Sensor characteristics

1.4.1 Zone length

The system shall be capable of providing detection coverage at distances ranging between a minimum of 3.0 m (10 ft.) and a maximum of 183 m (600 ft.) per zone.

1.4.2 Antenna

The transmitting and receiving antennae shall be horizontal E-plane polarized. Vertical E-plane antenna polarization shall be possible by rotating the printed circuit antenna array on the transmitter and the receiver.

1.5 Performance history

1.5.1 Previous installations

The system shall have been installed in at least ten similar configurations. A list of these projects shall be available.

1.5.2 Customer references

The vendor shall submit the names and telephone numbers of at least four users who shall serve as references for the satisfactory performance of the equipment. These users shall have a minimum performance experience of one year with the equipment.

2.0 Sensor processor specifications

2.1 Processor description

The receiver shall contain the necessary electronics to perform the signal processing for the detection zone. The transmitter and receiver shall be operated as a standalone unit with independent power and data with the option of powering the transmitter from the receiver. Both the transmitter and receiver shall be installed in weatherproof enclosures and shall have built-in lightning protection on all input and output lines by way of gas discharge tubes and transient bypasses.

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2.2 Signal processor operation

2.2.1 Distributed processing

Transmitter-receiver pairs distributed along a perimeter shall provide extended range and fail-safe operation. The failure of one pair shall not affect the coverage of the remainder of the perimeter.

2.2.2 Total perimeter length

Total perimeter length shall be expandable from the 183 m (600 ft.) maximum coverage for a single zone, to an unlimited length using multiple pairs. There shall be no gap of detection between the individual zones.

2.2.3 Alarm outputs

The signal processor shall identify intrusion/fail and tamper alarms locally, at the transmitter or receiver, via dry relay or switch contacts.

2.2.3.1 Intrusion/fail alarm outputs

The following intrusion/fail alarm scenarios shall be identified by isolated and supervised relay contacts (plug-programmable n.o. or n.c. contacts) rated at 0.25 A, 30 VDC:

- an intrusion in the detection zone
- a power failure
- an internal electronic failure
- a loss of signal at the receiver

The relay shall have an adjustable latch time for intrusion alarms of between 0.5 and 2.5 seconds.

Fail alarms shall continue until the fault is corrected.

2.2.3.2 Tamper alarm outputs

An alarm caused by opening the outer enclosure of the transmitter or receiver shall be identified as a tamper alarm. Tamper alarms shall be distinctive from intrusion alarms.

The tamper alarm shall be identified by switch contacts rated at 0.25 A, 30 VDC. Tamper alarms shall continue until the fault is corrected.

The user shall be able to choose to report a tamper alarm on the transmitter in one of three ways:

- as a separate contact closure,
- as a contact closure through the receiver, or
- by turning off the transmitted power which will cause an intrusion/fail alarm at the receiver.

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The receiver shall contain four LED's to display Transmitter On, Alarm, Wrong Modulation Channel, and System Jamming.

2.2.3.1 Self-test

The system shall be capable of self-test by local and remote activation. The self-test feature shall cause a complete internal test of the system, at the sensitivity level required of the zone. The receiver shall perform all self-test processes.

Systems requiring self-test wiring to the transmitter are not acceptable.

2.2.3.2 Audio Assessment

Audio assessment of intrusion signals shall be possible through a built-in 1/8-in. phone jack on the receiver.

2.3 Environmental operating range

2.3.1 Temperature

The transmitter and receiver shall operate within specifications at temperatures between -40 and 70°C (-40 and 158°F).

2.3.2 Humidity

The transmitter and receiver shall operate within specifications at relative humidity levels between 0 and 95%, non-condensing.

2.4 Powering Requirements

The transmitter shall operate at voltages between 12 and 24 VDC, at 25 mA maximum current. The receiver shall operate at voltages between 12 and 24 VDC, at 50 mA maximum current. It shall be possible to power the transmitter from the receiver.

2.5 Reliability/maintainability

The transmitter and receiver shall have a mean time between failure (MTBF) of greater than 130,000 hours, and a mean time to replace (MTTR) of less than 30 minutes.

2.6 Physical installation criteria

2.6.1 Physical installation

The transmitter and receiver shall each be mounted on a 7.7 to 10.2 cm (3.0 to 4.0 in.) diameter metal post, with a concrete foundation. The mounting height shall be determined on site, but is typically 76 cm (30 in.). The transmitter and receiver must always be facing each other, directly. Optional wall mounts shall be available upon request.

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2.6.2 Determination of zone length

The length of the zone shall be determined by the level of security required and the physical zone boundaries on site, to a maximum zone length of 183 m (600 ft.).

2.6.3 Location of transmitter and receiver

The transmitter and receiver shall overlap each other by 4.5 m (15 ft.) from the outside boundaries of the zone to provide complete and uniform coverage.

2.6.4 Enclosures

Each transmitter and receiver shall be housed in weatherproof, all-metal enclosures that can withstand temperatures between -40° and 70° C (-40° and 158° F) and relative humidity between 0 and 95%. Each enclosure shall have a rain shield as an integral part of the enclosure, without seams, to improve water flow paths and eliminate critical ice formation areas. Each enclosure shall include hardware suitable for mounting the unit on a 10.2 cm (4.0 in.) diameter metal post.

2.7 Sensor calibration

Each detection zone shall be capable of being calibrated from its receiver without the use of special tools or voltmeters.

2.7.1 Sensitivity adjustment

Detection sensitivity for each zone shall be adjustable at the receiver using one sensitivity control. Access to the local calibration controls shall require opening the enclosure of the receiver. This action shall cause a tamper alarm to be generated.

2.7.2 LED Alignment Aid

A colored LED array on the receiver card shall indicate microwave signal strength as an aid to aligning the transmitter and the receiver. It shall be possible to disable this display after installation to conserve power.

2.7.3 Audio sideband

An audio zone monitor with an output that is proportional to the size and velocity of the intruder shall be available as a setup aid.

3.0 System installation and commissioning

The system shall be installed and commissioned in accordance with the manufacturer's recommended procedures as defined in the product's installation and setup guides.

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Prior to installation, the installer shall have completed a manufacturer's training program and be certified by the manufacturer. Alternatively, the installer shall be required to have the manufacturer, or their designate, provide qualified technical support for installation and commissioning.

Acceptance tests shall be performed in accordance with standard procedures available from the manufacturer.

4.0 System maintenance and repair

4.1 Recalibration requirements

There shall be no requirement to recalibrate the system after initial calibration.

4.2 Repair

The design shall allow modular plug-in replacement of all electronic assemblies without changing the alignment of the transmitter and the receiver.

4.3 Product support

The supplier shall warrant that the product shall be supported by spare parts and assemblies for a minimum of 10 years from the date of purchase.

5.0 Product certifications

The system shall have the specific regulatory approval for the operation of a radio-frequency-radiating device, within the country of use.

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6.0 System availability

An acceptable product that meets or exceeds this specification is MPS-4100 Microwave Protection System, available from:

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