Architectural & Engineering Specification for a Hatch Intrusion Detection System for Steel Hatches

1 Introduction

This document details the performance specifications and operational requirements for the HatchSecure hatch mounted intrusion detection system. It is written in a generic format with no reference to the equipment name, manufacturer, or supplier.

These specifications may be copied in their entirety to form a generic Procurement Specification.

2 System Description

2.1 General

The system shall be an electronic hatch intrusion detector comprising impact sensor, tilt sensor, sustained attack sensor and light sensor, directly attached to the hatch lid or base mechanically and connected back to the controller via a network.

The system shall be capable of detecting intruders cutting, drilling, grinding, gross attack and thermic lance cutting of the hatch.

The system shall be capable of discriminating between intruder generated events and those generated by the environment.

2.2 Construction

2.2.1 Hatch Sensor

The sensor enclosure is to be mechanical fixed; the enclosure has two mounting holes outside of the seal, the lid must be removed to expose these, this keeps the IP rating.

For access hatches, the hatch sensor is ideally installed on the underside of the lid. This allows for the tilt sensor to detect the lid being opened, if not possible then the base is sufficient.

For best results, install the sensor in a corner, preferably opposite the hinges, with the transparent cover of the enclosure facing the centre of the hatch.

A special mounting plate may needed, to be prefabricated for easy install onto specific structures, if a mounting plate isn't available.

The enclosure should be installed with IP rated glands for wiring and in a position that won't compromise the wiring loom when the hatch is opened and closed.

The hatch sensor is to be calibrated, with the sensitivity of several sensors to tailor the device to each application. This includes impact, sustained attack and detection of cutting torches.

After the device is mounted in its normal position, the user can save that as the expected orientation and calibrate how far the device is tilted before a tilt alarm occurs.

The device has a temperature read out visible in the software.

The hatch sensor shall be housed in a vandal proof, tamper proof enclosure rated to at least IP68. It shall have a wide input voltage range to allow many to be powered from a single supply over long distances, 12-36Vdc. It shall consume no more than 30mA at 12Vdc.

2.2.2 System Controller

The controller to control up to 16 hatch sensors on the network, the system controller is to fit into the same enclosure as the output cards.

The controller to have a port for connecting the output cards and a port for connecting the sensors. Both the output cards and sensors each sit on a multi-drop RS485 bus. Shielded twisted pair must be used to connect the devices on each bus.

The maximum distance from the controller to the furthest device must be no more than 1km. For best results, aim to have the devices in a single branch, although a star or web topology is possible. The device furthest from the controller on each bus must have the EOL switch on, all of the others should have the EOL switch in the off position.

For bus wiring, connect A-A, B-B and Shield-Shield on each port on the bus.

The controller and output cards will require 12Vdc. The sensors have a 12-48Vdc input range so can be powered from the central location using a higher voltage supply if needed. Make sure to calculate the voltage drop in the cable to ensure that the furthest device will have enough voltage to operate.

The controller can be programmed with a list of which devices to expect on each communication bus. This affects the ‘Bus Fault’ flag which can be allocated to an output. A bus fault occurs when one of the expected devices does not reply for several seconds.

3 System Operation

3.1 Environment

The entire system shall be capable of operation in all weather conditions over a temperature range of -40°C to +65°C with a relative humidity between 0 and 95% non-condensing.

All fence panels shall be taut and secure, and the fence and gates shall be rattle free. In gusting winds no audible noise shall be generated by the fence or gates.

The entire system shall be capable of operating in extreme EMI (electromagnetic interference) environments with no effect on the normal operating characteristics.

3.2 Performance

The configuration software should be able to calibrate each sensor's sensitivity to the desired level according to the environment, risk and response of the installation. The below sensitivities and calibrations are to be done with the hatch closed and secured.
This should include:
Impact Sensor – the impact detection range is to be set first (12-400g), starting with the most sensitive range(12g); the hatch is to then be tested for impact (observing the live impact count), each impact to be followed by an adjustment of the threshold for the specific range (if impact is not detected).
The aim for the impact detection calibration is to ignore a golf ball being dropped from 1m height on each corner and the centre of the hatch but detect any object of a higher mass being dropped from the same height.
Note: Impact Sensor might go into alarm for real Sustained attacks.

Tilt Sensor – for lid and base installation on the hatch the recommended sensitivity is >8; orientation is to be "asserted" with the hatch closed and secured. If the ambient temperature of the hatch is expected to fall below -5°C the sensitivity should be set to >14.
Note: Tilt Sensor might go into alarm for real Impact or Sustained attacks.

Sustained Attack Sensor – the sustained detection range is to be set first (0.25-2g), starting with the most sensitive range(0.25g); the hatch is to then be tested for sustained attack (observing the live sustained attack progress), each sustained attack (expected to last at least 5-10 seconds) to be followed by an adjustment of the threshold for the specific range (if sustained attack is not detected within 5-10 seconds).
Note: Sustained Attach Sensor might go into alarm for repeated real Impact attacks; sustained attacks can be simulated by temporarily placing a metal sheet on top of the hatch and drilling into it for at least 5-10 seconds;

Light Sensor - the light detection range is to be set first (0-7), starting with the most sensitive range(7); the hatch is to then be tested for light attack (observing the live light reading), each light attack to be followed by an adjustment of the threshold for the specific range(if light attack is not detected).
Note: light sensor calibration should be done during the day; threshold should be set to at least 50%> than live measured ambient light by sensor.
Note: any unsealed holes in the hatch should be patched as this is a crucial step in optimising the hatch detection system's accuracy, particularly concerning attack detection against cutting torches. Unsealed holes allow natural light to penetrate, potentially triggering the ambient light sensor within the sensor. This unintended activation can create false positives, compromising the sensor's ability to accurately differentiate between genuine threats - such as the use of cutting torches - and ambient light variations.

The Hatch Intrusion Detection system shall have been tested by the UK Home Office and approved by them for use on NPSA (CPNI) high risk sites and additionally for use in UK prisons.