



Proximity Detection & Collision Avoidance

Tunnelling and underground construction



STRATA
WORLDWIDE

HAZARDAVERT®



Strata Worldwide has years of R&D and real-life experience with proximity detection and collision avoidance technologies. Working closely with managers and personnel around the world, the company continues to expand and enhance its safety technologies.

HazardAVERT® - Near-field electromagnetic detection, alarm and interlocking system for surface and underground

HazardAVERT® is an electromagnetic proximity detection system designed to increase personnel safety and awareness while working in and around mobile machinery. It was developed to prevent vehicle-to-vehicle and vehicle-to-pedestrian accidents and collisions, particularly crushing- and pinning-type accidents in underground environments.

HazardAVERT® detects people and/or vehicles entering potentially dangerous areas around machinery and automatically sends out warning alerts. Audible and visual alarms bring attention to a situation prior to contact or collision. If no corrective action is taken, or in the event of a sudden emergency, HazardAVERT® can be interlocked into the controls of the equipment to automatically slow and/or stop the machinery completely.

HazardAVERT® has been effectively used on all types and sizes of mobile machinery, vehicles and equipment in surface and underground mining, tunneling and other heavy construction operations.

FEATURES & USER EXPERIENCE

- No operator interaction required
- No line-of-sight required
- Direction of travel is irrelevant
- 100% perimeter coverage
- Unaffected by daylight/darkness, weather conditions, airborne debris
- Penetrates rock, coal, gravel, mud, water, ventilation curtains and barriers
- Monitoring and reporting capabilities

HazardAVERT® System Components

ON-DASH LED DISPLAY SCREEN

- 4.3" TFT Display
- 600:1 contrast ratio for optimized visibility in various light conditions
- Graphic representation of zone operating status, fault conditions and active alarms
- 5 softkeys for easy operator input
- Camera inputs for live camera feeds



On-Dash Display Screen

PROXIMITY GENERATOR

- Generates electromagnetic zones
 - Multiple generators enable zone shaping
 - GPS for time and position recording
 - Adjustable zone sizes
- Detects electromagnetic zones of other equipment



Proximity Module

INTERFACE MODULE

- Control unit for the system
- Power supply to Generators, On-Dash Display and/or sounder
- Controls equipment interlocking
 - Automatically slows or stops vehicle in an emergency
- Generates Silent Zone
 - Exclusion zone within hazard zone to enable operators to work
- Memory storage to monitor and log events
- Contains Wi-Fi board for data transmission



Interface Module

PERSONAL ALARM DEVICE (PAD)

- Personnel worn device which interacts with electromagnetic zones to determine proximity and emit warning alerts to the wearer
- Works to prevent vehicle-to-person contact
- Warning alerts increase safety awareness and reinforce training to maintain safe working distances from machinery



1. PAD with Warning Module – Small, lightweight unit attaches to hard hat and Warning Module with flashing LED light and audible sounder attaches to hard hat brim



HA PAD with Warning Module

2. PAD - Lightweight and ergonomically designed to be worn on the belt or arm. Flashing LED light and in-built audible sounder

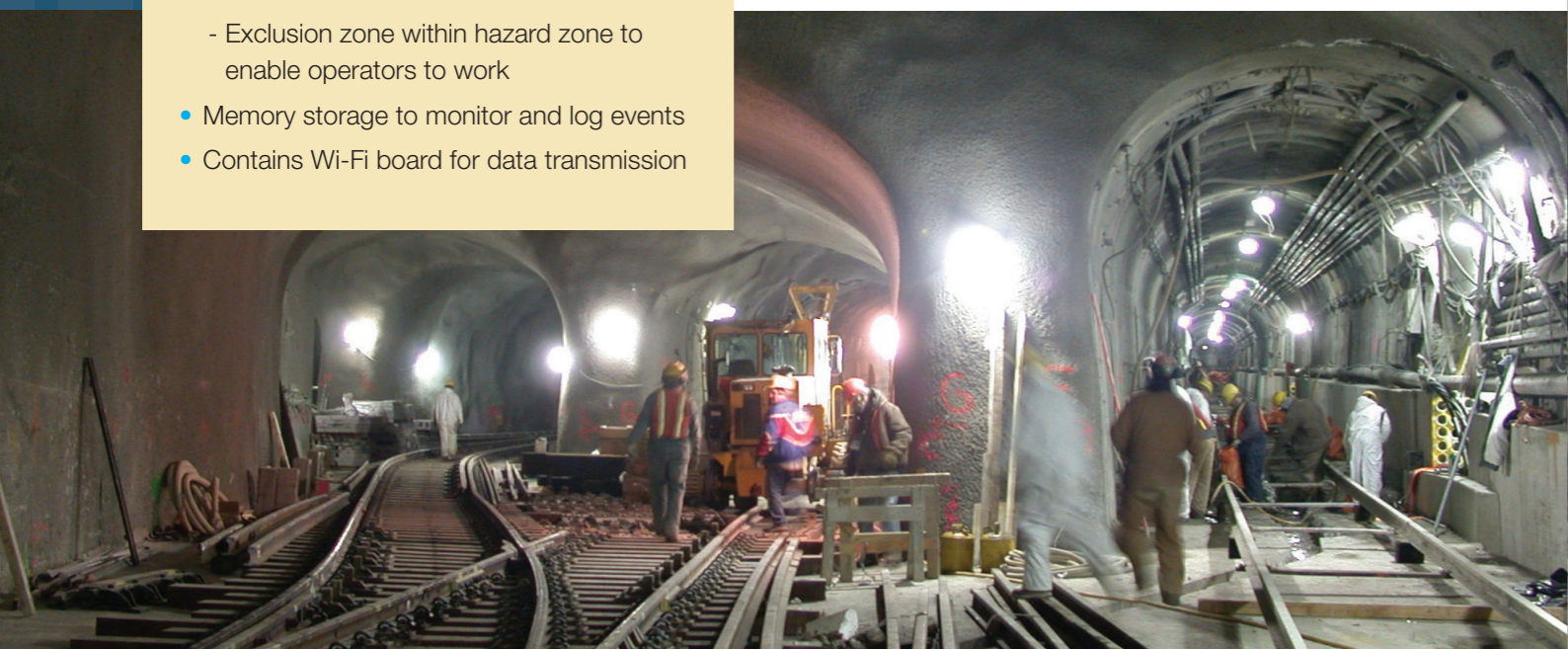


HA PAD

3. TPL-Eco - LED cap lamp powered by a small rechargeable battery pack worn on the belt. Proximity detection technology and sounder alarm located in the head piece



TPL-Eco



HazardAVERT® System Components

How do the components work together?



Generators installed on equipment generate electromagnetic fields or "zones." These are Warning & Hazard Zones.



Display Screen is the user interface for machine operators and includes audible and visual alarms. Displays a graphical representation of zone breaches to indicate the location of the breach (front/rear). It displays live video feed from front/rear cameras.



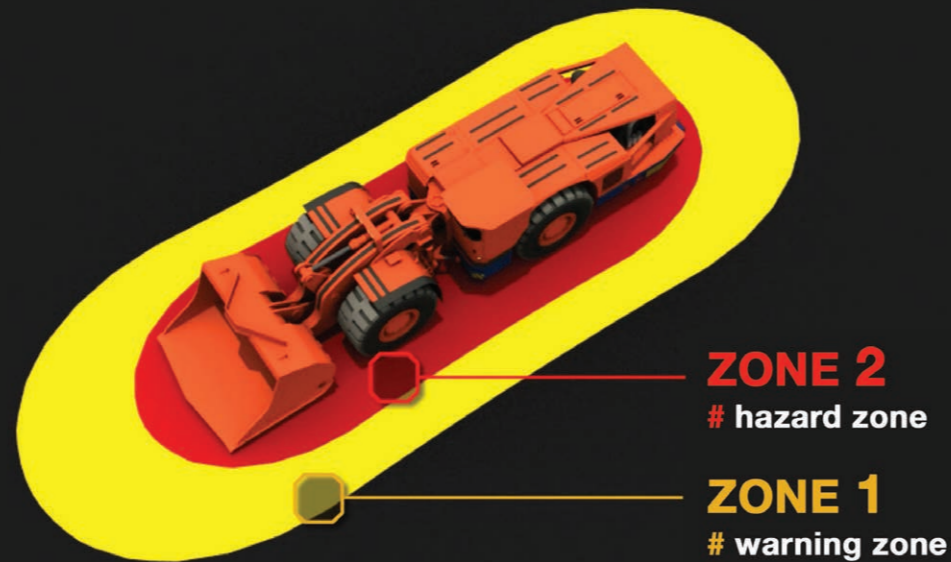
All workers wear a Personal Alarm Device (PAD) to detect electromagnetic fields and provide warning alarms. When a PAD breaches a zone, both the wearer and equipment operator are alerted.



Interface Module is the control unit for the system. It powers the generators and display screen and stores event activity. It controls the equipment interlocking for automatic slowing & stopping.



HazardAVERT® Underground & Surface



ELECTROMAGNETIC DETECTION

Key Features

- Can be interlocked into equipment controls to automatically slow, stop and/or disable hydraulics
- High resolution coverage extending up to 100 ft (30 m) at the front and rear of equipment
- Functions both on the surface and underground
- Does not require line of sight
- Detects pedestrians and vehicles of all sizes, even when stationary
- Stable, reliable and repeatable zones
- Does not affect production and enables workers to operate safely and effectively
- Capacity to function with hundreds of vehicles and pedestrians in close proximity without latency or delay



HAZARDAVERT® MARKER ZONES

- HazardAVERT® Proximity Generators installed on equipment create two levels of marker zones that completely surround the equipment, covering blind spots and turning radius.
- Warning Zone – Outer-most zone
- Hazard Zone – Inner-most zone
- Silent Zone – Exclusive zone within Hazard Zone to enable personnel to work as usual on machinery; such as the equipment operator
- Breach of the Warning and Hazard Zones by vehicles or pedestrians trigger audible and visual warning alarms to equipment operator(s) and pedestrian(s)

On-Dash Display Screen

- Five inch LCD display screen designed for use in harsh working environments. Installed in vehicle cabs, the screen displays HazardAVERT® zone status and activity, warning alarms and live camera feeds.
- HazardAVERT® Zones
 - ON/OFF Icon displays system status
 - Compass icon displays direction of travel
 - Orange – Warning Zone breached
 - Indication of front or rear of vehicle
 - Red – Hazard Zone breached
 - Indication of front or rear of vehicle
- Camera views
 - Live feed from front and rear facing cameras
 - Operable depending on direction of travel

Personal Alarm Device

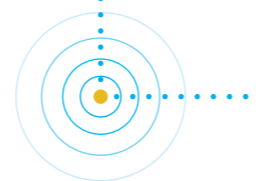
- Pedestrian PAD or TPL-Eco LED flashes and audible sounder alarms

Cameras

- Strata has integrated two wide-angle-lens cameras for front and rear viewing
- Live-feed displayed on On-Dash Display Screen
- Front versus back camera activity based on direction of travel
- Front view when stationary
- IP67 rating
- NTSC format

System Interlock & Equipment Override

- If HazardAVERT® has been interlocked into the controls of the equipment, configuration options include:
 - Warning Zone breach: All vehicles involved will be slowed
 - Hazard Zone breach: All vehicles involved will be slowed, stopped or hydraulics fully or partially disabled
- Machine functions that may be controlled by the proximity system relays are determined by the customer and the equipment OEM.



UNDERGROUND APPLICATIONS

Inherent dangers of this working environment for which HazardAVERT® is intended:

- Restricted visibility
- Confined work spaces
- Out of site pedestrians or vehicles around corners
- Mobile equipment and pedestrians working in close proximity
- Pedestrians interacting with numerous pieces of equipment at the same time
- Difficulty determining travel speeds
- Visual obstructions such as equipment, ventilation curtains and/or barriers

SURFACE APPLICATIONS

Inherent dangers of this working environment for which HazardAVERT® is intended:

- The large scale and volume of machinery
- The diverse scale of vehicles and machinery
- Significant blind-spots on large machinery
- Requirement for people to work in close proximity to machinery
- Large equipment starting up and/or moving in reverse
- Restricted vision due to time of day and weather conditions

Studies show that a large majority of accidents and injuries occur when machinery and vehicles are traveling at lower rates of speed and in reverse due to close proximity. HazardAVERT® can be programmed to stop or disable equipment at specified speeds determined by the OEM and customer.

Hard Hat Mounted PAD with Warning Module



HazardAVERT® Underground & Surface

HAZARDAVERT® MONITORING AND REPORTING

All vehicle-to-vehicle and pedestrian-to-vehicle interactions that trigger alarms and equipment overrides, are logged and stored in the Interface Module. This data can be downloaded for analysis and reporting via Wi-Fi or cable connection. In underground applications, data can also be wirelessly transmitted to dispatch over Strata's communication networks.

StrataConnect GUI features and capabilities

- Individual facility map.
- Easy view navigation with layers and tabs
- Ability to monitor at system level or zoom in to individual people and equipment
- High resolution tracking including direction of travel.
- Personnel tracking
- Asset tracking
- Critical safety data reports
- Productivity trends
- HazardAvert system operating status and maintenance
- Equipment operating status and maintenance

MONITOR

- Working & safety practices of personnel
- Worker and machinery interaction
- Warning and/or Hazard zone breaches and duration of breach
- Emergency, Hazard Zone breaches and/or stops
- Duration of inactivity
- Damage to components

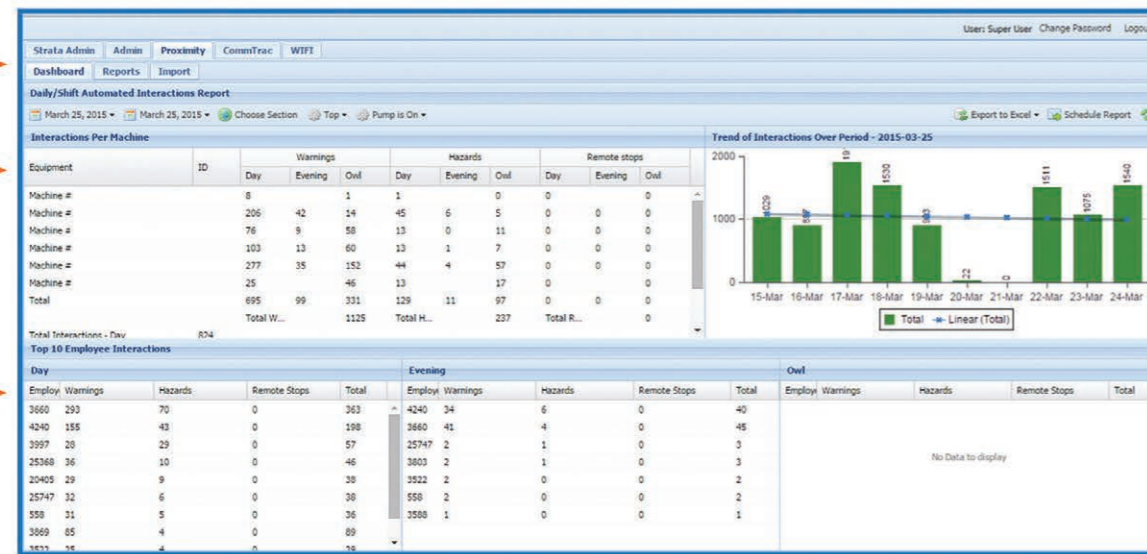
REPORTING

- Safety Reports
 - Worker and machinery operator safety practices
 - Zone breaches – frequency and duration
- Productivity reports
 - Machinery tracking
 - Travel time
 - Stop time
 - Interactivity time

HAZARDAVERT® SEES WHAT PEOPLE CAN'T, AND REACTS WHEN PEOPLE DON'T.

Multi-layered interface to toggle between system displays

Data reports and productivity matrices calculated



Monitor HazardAvert interactions and alarms by machine

Monitor HazardAvert interactions and alarms by individual miners





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