GO TOGETHER
WITH CONSILIUM
SUPERIOR ROLLING STOCK SAFETY SOLUTIONS
RAMS and SIL

The European standards EN 50126, EN 50128 and EN 50129 known as RAMS, are becoming increasingly important within the railway industry, focusing on life cycle cost and safety. These standards are the basis for qualified modern assessment of Reliability, Availability, Maintainability and Safety (RAMS).

Focusing on RAMS, Consilium has implemented RAMS processes throughout its organisation, meeting the modern requirements of the railway industries. New products have been developed according to the RAMS standards with the highest Reliability, Availability, Maintainability and Safety (SIL) in mind offering train manufacturers a fire detection system with a low life cycle cost and a high safety integrity level.

Safety Integrity Level (SIL)

SIL is defined as a relative level of risk-reduction provided by a safety function or to specify a target level of risk reduction. The technical progression in the railway industry, including unmanned operating rolling stock, puts a higher demand on the safety function in case of fire.

SIL analyses are designed to verify that the measures and operational rules are sufficient for achieving a prescribed SIL, ensuring risk reduction. Consilium’s products comply with the harmonized standard EN 50128 and EN 50129 referring to the SIL level, offering safety functions up to SIL 2.

NEW LAWS, LEGISLATIONS AND STANDARDS

New standards

One of the latest news for the European market is the release of the EN 45545-1 to-7 standards “Fire protection on railway vehicles”. These standards cover fire protection aspects from the requirements of fire properties of materials, to the overall design of the vehicles. New products have been developed according to the RAMS standards with the highest SIL.

Protecting the environment

Even if the protection of passengers and staff comes first, all train manufacturers and operators do what is practically possible to have a total protection of the full investment and environment. Preventing fire by implementing a proper fire protection system, can be the investment with the biggest impact on the protection of the environment.

Your trustworthy partner

As a worldwide market leader, Consilium deliver long experience, in-depth knowledge of safety solutions within Rolling Stock. We give you the ticket to go together with Consilium throughout the years as your partner.

Long term relationship

Consilium’s systems are flexible, module based, tailor made and proven in use and we support our customer throughout the whole train’s life cycle.

Our global support network

With a global market organisation, Consilium can offer its customers local installations, local services and support wherever in the world – whenever and wherever you need it.

Consilium today protects over 16 000 train cars – around the world 24/7/365
The control unit is the main part of the system containing all functionality for detection, alarm, controls and the main operator interface. The control unit communicates with other interface modules on a redundant bus system. The system can also be connected and controlled directly through the TCMS via high-speed interfaces such as Ethernet 10/100 or RS485.

The following parameters can e.g. be downloaded and configured:

- Number of detectors and other loop units
- Sensor sensitivity and alarm delay
- Number of operator interfaces and indication units
- Digital output/input functionality
- Multiple language control
- Explanatory text, which can be assigned to each detector. The text is displayed on the operator interface at alarm or fault. It is also possible to define texts for digital inputs and outputs

**CM 2.2**

- DIN-rail mounted control module, easily integrated with other modules.
- Small design, perfect for installation in narrow spaces as well as in refurbishment projects.
- Offers the same functions as a full size fire alarm system.

**CM 4.3**

- Large colour graphical display with full compliance with the European Fire Alarm Standard EN 54.
- The central unit is delivered in a cabinet, for both flush and surface mount installation.
- Suitable when communication with train control and monitoring system (TCMS) is limited.

**REPEATER MODULE**

The repeater module is used when information wants to be shared to other parts of the train, such as staff room or other staff accessed areas.

**RM 4.3**

The RM 4.3 is a repeater panel with a 4.3” graphical colour display used to indicate system status. The unit is connected to the redundant backbone bus or Ethernet and can therefore be independently mounted remotely from the central unit. RM 4.3 can be used in a CM 2.2 or a CM 4.3 system solution.
The interface modules are used to build up the different need of interfaces. The different modules are developed to support different functions in the system and are added on to meet the customers needs and requirements. Modules can be added on later for future expansions.

**Loop Mx**

The Loop Mx module includes one addressable detector loop interface handling up to 254 addressable detectors and/or other loop units. Module activity can easily be monitored on the fault and alarm indicators on the front panel as well as on the display of the control unit. Up to 64 Loop Mx modules can be connected to one central unit. The loop interfaces are using FSK modulation which is extremely robust making cable lengths up to 3000 m possible, with no specific cable requirements. The cable with its detectors and other loop units are continuously monitored for possible faults and disturbances providing the highest possible safety.

**I/O M 70 and I/O M 700**

The I/O M 70 and I/O M 700 modules are two types of I/O modules with eight identical and individually programmable input/output channels. I/O M 70 and I/O M 700 is used as digital input and output modules for monitoring and control of external devices. Such as alarm devices, fire barriers, extinguishing and suppression systems, doors and custom made mimic repeater panels, HVAC etc. Maximum output current per channel is 70 mA for I/O M 70 and 700 mA for I/O M 700 and it’s possible to bridge up to 2100 mA.

**Relay M 8**

The Relay M 8 module contains eight individually programmable relays. Each one of these relays provides a potential free change-over-contact capable of a 5A resistive load.

Use Relay M 8 for control units such as sirens, doors, flash lights, alarms and HVAC or where general dry contacts are required.

**Surge Prot M**

The Surge prot M module unit is a terminal board with four major functions:
- Surge protection for power inputs
- Terminal board for CM 4.3
- Electronic short circuit protected for power outputs
- Provides power to the backbone bus

The module is designed to be used where there are no requirements for electrical isolation between devices.

**Charger M**

The Charger M module provides redundant power to the system through the redundant backbone bus and also supervises the external power sources. The Charger M has a built-in intelligent battery charger for handling of backup battery power source of the system.

The Charger M is equipped with a supervised high current optically isolated output with a maximum of 8 Ampere.

**Bus Isolator M**

The Bus Isolator M module divides the redundant system backbone bus into electrically isolated segments. Its dual functionality isolates communication and basic backup signals between the distributed system parts creating effective EMC isolation from the surrounding environment.

Bus Isolator M is mandatory when extracting the system backbone bus using separate power sources for the different segments in order to preventing interference caused by ground currents or other equipment.

**SIL MODULES**

Consilium SIL fire detection system offers a platform with a safety function complying with up to SIL level 2. All loop units and detectors have built in short circuit isolators and Built-In Self-Test (BIST) in the detectors to improve the reliability of the system. The solution supports both redundant and single loop setup. All loop units are addressable to give individual fire and fault localization on a detailed level for easy maintenance. The SIL fire detection system is possible to integrate with the standard system using other modules in the platform to create the optimal system.

**CS-Loop M**

The CS-Loop M module includes one addressable loop interface handling in general up to 150 addressable detectors or other loop units. The loop interface are using FSK modulation which is extremely robust making cable lengths up to 2000 meters possible, with no specific cable requirements. CS-Loop M supports both redundant and single loop configuration for maximum safety.

**CS-Safety M**

The CS Safety M module is an interface module and data collector for systems with more than one CS-Loop M offering centralized outputs for fire, fault and disablersments. The module offers a SIL 2 classed protocol that can be run on RS485 or Ethernet. CS-Safety M supports both single and redundant setup with redundant data sharing with TCMS.
ADDRESSABLE LOOP UNITS

Consilium’s detectors and I/O units from the well-established fire alarm product range for rail, marine and industrial applications in harsh environments can be connected to the fire detection loop. In addition to this, the communication interface of the loop units is based on Frequency Shift Keying (FSK) modulation, which has proven outstanding performance in harsh electrical environments.

**Combined smoke/heat detector EV-PP**

The Consilium EV-PP is designed to give early warning in case of heat and/or smoke. Both heat and smoke alarm can be generated individually. At the same time, EV-PP offers a high protection against unwanted alarms. The detector has one configurable I/O for local control.

**IR flame detector with addressable base**

This IR detector is a triple frequency infra-red flame detector using the latest technology. The detector is made for detection of smokeless combustible liquid and gas fires, as well as smoke-forming open fire involving carbonaceous materials as contained in wood, plastics, gases, oil products etc. The detector is using intelligent signal processing and custom algorithms, achieving excellent detection reliability while maintaining the highest immunity to interference radiation and sunlight. The IR detector’s is suitable for harsh environments such as engine compartments or environments with high IP demands. The detector is used with an IP67 addressable base to connect it to the detector loop.

**Dual smoke detector EV-DP**

The unique Consilium EV-DP is a detector with a dual wavelength optical chamber. Two light sources with different wavelengths are used which gives the detector a reliable reaction to different kinds of smoke, making it insensitive to unwanted alarms caused by for example water steam.

**Aspiration detector ASP-02**

The aspiration box is used to sample and analyze the presence of smoke by using a built in fan which continuously gathers air samples into the detection chamber via the pipe network. ASP-02 uses one pipe per box to give a precise position of the alarm. The fan inside the aspiration box is continuously supervised in order to give fault indication in case of any disturbance caused in the aspiration box. ASP-02 is very suitable for use in areas with limited space or where the detector can be exposed to mechanical damage, tough environmental conditions or vandalism. The robust design, light weight and small size make it very attractive for railway applications.

**Address unit IC 10**

The IC 10 is an address unit for fire detector loops. It has been designed for use in damp spaces. This unit allows the connection of different types of devices with closing digital function to the fire alarm system, for example high temperature heat detector as LHD cable. IC 10 includes one input.

**Manual call point MCP-A**

MCP-A is an addressable manual call point available in different housings offering ingress protection for different environments. The unit provides the required system functionality for passenger activated emergency alert. LED on the front of the call point indicates the fire alarm being activated. The MCP-A provides optional built-in double sided short-circuit isolation.

**Address unit IC 44**

The addressable I/O control unit IC 44 is designed to control and monitor external devices, such as fire doors, watermist, aerosols, HVAC etc. The control unit is connected to a loop in the same way as other fire alarm loop units and can be used in damp spaces. The IC 44 includes four inputs and four relay outputs.

**Short circuit isolator NMI-SCI**

NMI-SCI is a double isolating short circuit isolator. A pair of short circuit isolator electrically isolates a short circuit occurring on the loop giving full availability and function to the unaffected loop despite the short circuit. The short circuit is indicated on the unit and on the control panel. NMI-SCI is installed on the loop between detectors and loop units, where short circuits or disturbances on the loop can be expected, for example at the interconnection between the vehicles in the train creating safety sectioning of the train set. The short circuit isolator is mandatory for redundant loop configurations.
Combined multi-function smoke/heat detector CS-PYH

The CS-PYH is designed to give early warning in case of heat and/or smoke and offers a high protection against unwanted alarms. The CS-PYH offers a variety of functions to be optimized for the installed environment. One configurable in/output is provided for local indication and data input, for devices and systems such as suppression, extinguishing as well as fire barriers and local.

CS-ASP

The aspiration box is used to sample and analyze the presence of smoke by using a built-in fan which continuously gathers air samples into the detection chamber via the pipe network. CS-ASP-03 uses one pipe per box to give a precise position of the alarm. The flow inside the aspiration box is continuously supervised in order to give fault indication in case of any disturbance caused in the aspiration flow. CS-ASP-03 is very suitable for use in areas with limited space or where the detector can be exposed to mechanical damage, tough environmental conditions or vandalism. The robust design, light weight and small size make it very attractive for railway applications.

Input interface loop unit CS-IC10-SS

The CS-IC10-SS is a unit for various integration of safety inputs. It has been designed for use in damp spaces. This unit allows the connection of different types of devices with closing digital function to the fire alarm system, for example high temperature heat detector such as LHD cable or sprinkler indication.

Input/output interface loop unit CS-IC22

The CS-IC22 is an input and output unit for various integration of safety I/O. It has been designed for use in damp spaces. This unit allows the connection of different types of devices with closing digital function to the fire alarm system, for example high temperature heat detector such as LHD cable or sprinkler indication as well as controlled safety relays for external control. The CS-IC22 is designed to control and monitor external devices, such as fire doors, fire dampers, sprinklers, hatches etc. The unit also gives support for fire, fault and disablements on individual level.

Manual call point CS-MCP

The CS-MCP is a manual call point existing in different models to fit the specific environment. The unit provides the required system functionality for passenger activated emergency alert. A LED on the front of the call point indicates the fire alarm being activated.

Thermal detector HC100

The Consilium HC100 is an II I G Ex ia IIC T5 intrinsically Safe conventional heat detector. The detector is designed for use in areas with high explosion risk. HC100 has a high resistance against humidity and vibrations and is suitable for location in harsh environments.

Smoke detector EVC-PY-DA

The Consilium EVC-PY-DA with contamination supervision is an intelligent conventional smoke detector with a monitoring circuit that continuously checks and adjusts the sensitivity for optimum functionality during the entire life of the detector. When the detector no longer can compensate for the contamination, a service alarm is generated.

Line heat detector cable (LHD)

Consilium’s line heat detector cable detects heat conditions anywhere along its length. The cable is available in a range of alarm temperatures and is suitable for a fire detection in areas such as traction units, electrical cabinets etc.
Modules

Universal detectors

Address units

Cables

Aspiration detectors

Displays

Fire extinguishing aerosols
Accessories

Apart from the fire protection system there are different accessories required in order to support the required functions or to protect the products.

Sounder beacon

The sounder beacon is a compact combination of a high output sounder and flash for areas requiring both audible and visual indication of alarms. The unit will sound and flash at the same time at activation. The sounder can be set to different sounds and has a built in volume control.

Sounder

The sounder is a compact high output sounder. The sounder can be set to different sounds and has a built in volume control.

Sounder SUM-3

The sounder SUM-3 is a small buzzer with a sound pressure of 80 dB(A) which easily snaps on to the detector base plate. The sounder is activated automatically on fire detection but can also be controlled independently from the control unit. It can be used in sleeping cabins or in other areas where a sounder is needed.

Dust filter

The Consilium dust filter is developed to protect detectors situated in extremely rough and dusty areas and environments. The filter prolongs the life-time of the detector and reduces the risk of false alarms due to contamination. The filter is attached to the detector by simple means and can easily be replaced when needed.

EMC cage EMC-1

The EMC-1 EMC Cage protects the detector from extreme electromagnetic fields and is necessary in environments with significant electrical interference, being out of range specified in standards. The EMC cage also protects the detector from damage such as vandalism.

Protection cage DPC-1

Consilium's protection cage DPC-1 is used to protect detectors from being damaged in rough environments or in areas where vandalism may occur.
The Consilium LASP detectors are a very early warning smoke detectors. The LASP provide the earliest warning of a potential fire and buys the user time to investigate, intervene and potentially avoid disruption in addition to the damage, downtime and cost of a suppression release.

The detector works by continually drawing air into sampling holes in a pipe network. The air is filtered and passed into a detection chamber where light scattering technology detects the presence of very small amounts of smoke. Detector status information is communicated on the detector display and via relays. The LASP systems can be installed and used together with other type of Consilium detectors to give full protection of a train. The ultrasonic flow sensing used in the detector provides a direct reading of the sampling pipe flow rate.

The high pressure water mist system controls, suppress and extinguishes fires by discharging a fine water mist at high velocity. The water mist is created by the system when it activates: it pushes the plain, potable water at high pressure through specially designed, patented sprinklers and spray heads. The water mist is discharged at high velocity by high-pressure pumps or accumulators. Water mist uses three mechanisms to fight fire: cooling, radiant heat blocking and local oxygen inerting. Traditional sprinkler systems use wetting as their main mechanism, and therefore use very large amounts of water. A high pressure solution uses water much more efficiently: it uses up to 90% less water than traditional sprinkler systems for the same application with equivalent or better performance.

Consilium can support a safe activation of the water mist system.

The water unit can be placed either on the roof or underneath the car.
Block diagram
The block diagrams show different kinds of configuration examples, describing a train set with four cars. Each car is equipped with smoke/heat detectors and distributed I/O units in typical installations.

Central unit CM-2,2 is used in all examples but CM-4,3 can of course be used in the same way or in combination. Communication with the train control and monitoring system can be done over RS485, RS422, digital I/O or Ethernet in all examples. The setups below are just examples as the concept promotes customer specified system design. The modules can be used in several other ways to control and monitor other systems onboard.

The backbone bus is used for communication between modules and stretched central segments. It includes redundant RS485 channels, redundant 24 VDC power line and the X-Fire signal.

X-Fire is a signal in the backbone bus used for transmitting the central alarm status. The signal is only used when a module in a managed mode loses communication with its control unit. This signal is used to ensure that the fire detection system can deliver an alarm signal even if the system processor is down.

Please note that all our applications are SIL 2 compliant.

Example 1 - Standard

The first example shows a system solution with one central unit in the complete train set located in the driving car where the TCMS is located.

A closed loop (return loop) ensures that all detectors can be accessed even if one connector between the cars has been damaged.

Example 2 - Redundancy

The redundancy system contains of two central units sharing one common loop. Both central units are activated, sharing information. If one central unit is lost, the other will take over the whole system.

Therefore no information will be lost, meeting the requirements for running capability. This system configuration requires the use of our internal serial bus for internal communication.

Example 3 - Stretched system

This setup takes advantage of our internal serial bus, enabling stretching the system through the train and use communication modules locally in each car. In the example one I/O 700 module is used.

These modules are used to control and monitor external functions such as fire doors, exit lights, extinguishing systems, shut down HVAC system etc.
Each car has its own independent fire detection system and communicates with the TCMS directly. If one control unit is lost in one of the cars, the other central units will take over the loop communication in the car and start reporting to the TCMS. This setup requires our internal serial bus between our controllers.

Example 5 - Multi system

Each car has its own independent fire detection system and communicates with the TCMS directly or via the master central unit. This configuration is preferred in an existing TCP/IP network to reduce cabling.

Example 6 - Independent suppression system

Each car has its own independent fire detection and extinguishing system. Each central unit communicates with the TCMS directly. In case of fire, the control unit will by intelligent decision activate the extinguishing system. The system can be activated in different zones or in the complete car depending on the fire. The system will also monitor the status of water, gas, pressure etc.

Example 7 - Centralized suppression system

This shows a redundancy with an extra I/O 700 module to control a centralized extinguishing system. In case of fire the control unit will by intelligent decision activate the extinguishing system. The system can be activated in different zones or in the complete car depending on the fire. The system will also monitor the status of water, gas, pressure etc.

Example 4 - Flexible system

This shows a redundancy with an extra I/O 700 module to control a centralized extinguishing system. In case of fire the control unit will by intelligent decision activate the extinguishing system.
**Example 8 - Laser aspiration system**

This shows a standard system with a local laser aspiration detectors in each car. The laser aspiration detectors provide a very early warning of potential fire and buy the user time to investigate, intervene and potentially minimize damage and downtime. The local laser aspiration detectors communicate via the IC44 address unit on the closed detector loop.

**Example 9 - Redundant sub loop system**

This shows redundancy with a local I/O on the redundant detection loop. With the local I/O on the sub loop is possible to control and monitor external functions such as fire doors, exit lights, extinguishing systems, shut down HVAC system, etc.
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