



## **Automatic Fire Extinguishing System for Mobile Units VES-SRA1 Type with Electric Remote Controlled Monitors**

### **Description and technical data of the system**

The fire extinguishing system VES-SRA1 has been designed to be mounted on vehicles and mobile units and is able to work fully autonomously and automatically.

It consists of fire detection modules, a central module for data management and processing and fire extinguishing modules.

Each module has been designed and realized as integrated component that can be easily and quickly mounted, directly connected to the bus line for power supply and data transmission and (only for the extinguishing modules) to the fire extinguishing agent supply pipe.



The system has been designed to allow a fast and sure fire detection and, consequently, to provide a specific fire extinguishing intervention, that is completely harmless for people inside the protected areas and that, with the supply on board, can last at least 15 minutes.

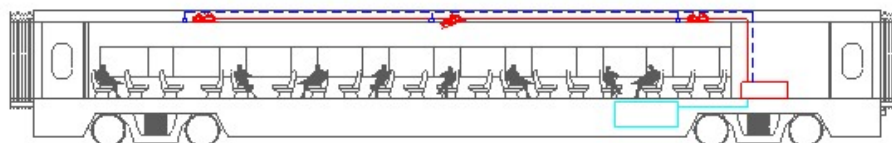
The following picture shows the main module of the system, the module for data management and processing that supervises command and control operations.



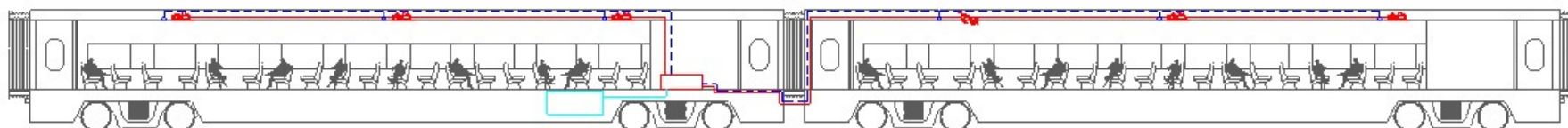
The system is based on the proven fire extinguishing technology represented by fire fighting water / foam monitors, assuring a fire extinguishing process which is highly efficient and absolutely safe for people.









## IMPIANTI FISSI DI ESTINZIONE INCENDI ex art. 1.5.7 All. II D.M. 28.10.2005 n° 89



Modulo centrale per singolo veicolo



Modulo centrale per coppia di veicoli

-  Modulo di rilevazione incendio
-  Modulo di spegnimento
-  Modulo centrale di gestione ed elaborazione dati
-  Serbatoio acqua
-  Tubazione antincendio
-  Cavo bus di alimentazione e controllo



### **Automatic operation of the system**

In normal operating conditions, the fire extinguishing modules are not in operation and kept in stand-by condition by the central module for data management and processing, while the fire detection modules are always working and control the vehicle area assigned to them.

Each fire detection module is able to control an area longer than 10 meters, with an angle of  $150^\circ$  on the horizontal axis and of  $\pm 85^\circ$  on the vertical one.

The number of the required fire detection modules depends only on the physical characteristics of the installation place and in particular on its compartmentation level.

In any case all the modules can be directly connected to a single bus cable for signal and power supply coming from the control module.

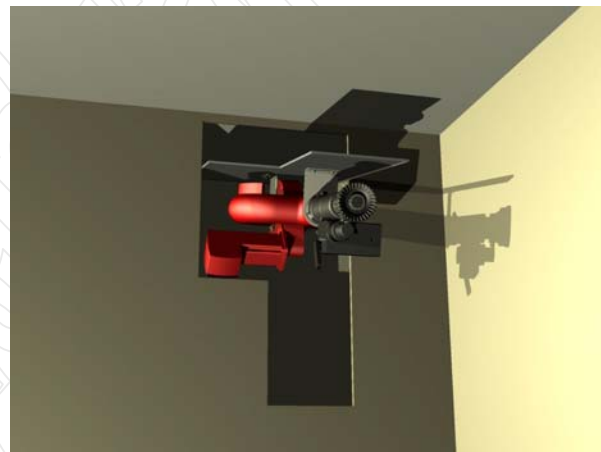
Each fire extinguishing module is equipped with a remote controlled monitor SRA1 with nozzle for variable jet.

Each module can protect a length of 6 meters upstream and downstream the installation point, with a width of 3 meters and a height of 3,5 meters.

The following sketch exemplifies both standard installation condition, near the centre of the area to be protected, and the installation on the area perimeter.



Ceiling mounting



Wall mounting

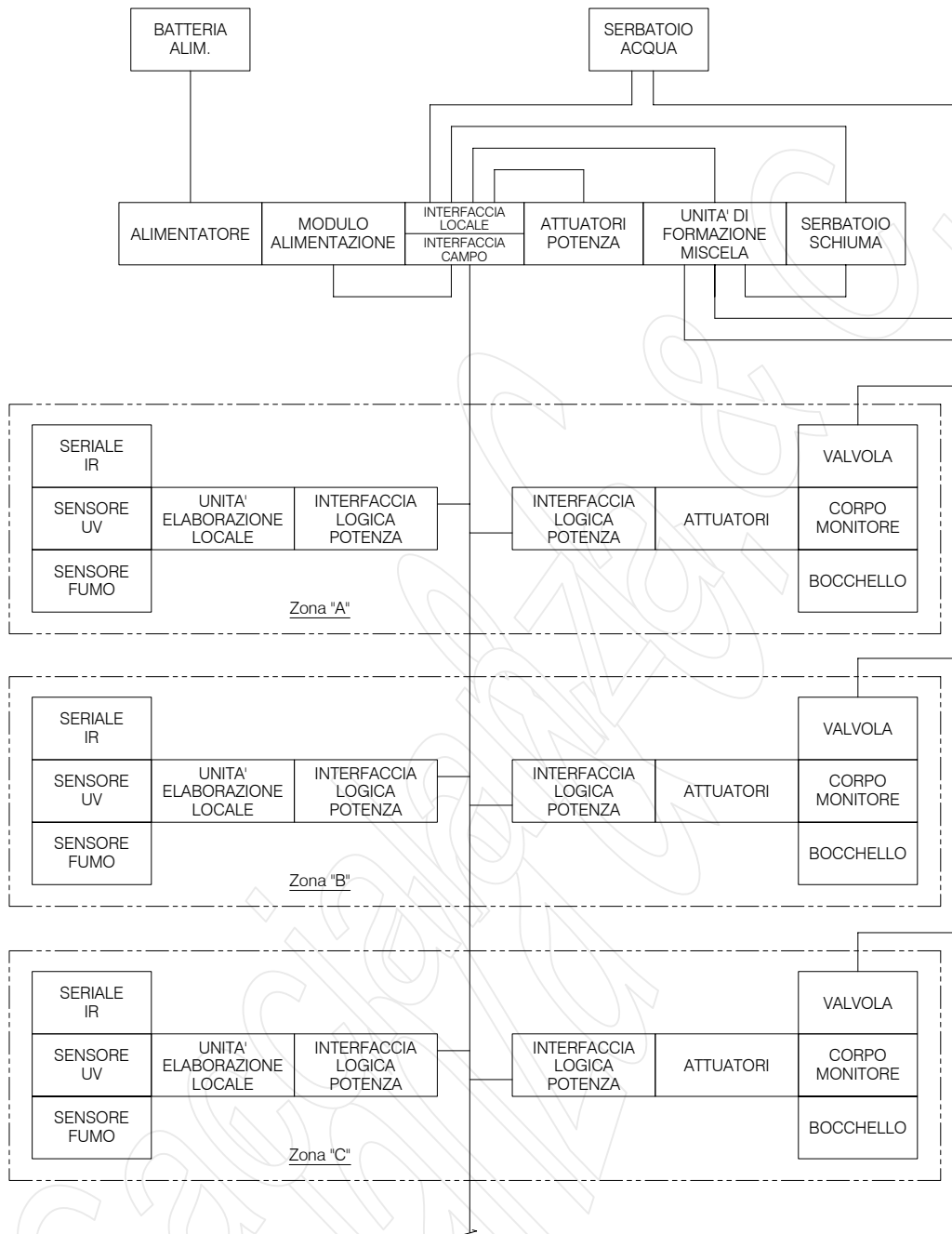
The modules have to be electrically connected to the same, previously described, bus cable for signal and power supply and hydraulically connected to a single pipe fed by the central management module.

The fire detection modules, always working, can detect in less than one minute a fire beginning, using a technique of combined detection of signal in the infrared spectrum and in the ultraviolet one, coupled with a time analysis of the related power levels.

Based on the combined analysis of the fire detectors, the area involved in the fire is determined univocally and surely by the central module for data management and processing.

The central module coordinates the operation of the modules and their logical management.

The standard configuration foresees a logical module for each vehicle, but in case of permanently coupled vehicles a module for each pair is enough.



SCHEMA A BLOCCHI  
SISTEMA DI SPEGNIMENTO  
VES - SRA1

After sending a vocal warning message, the module automatically pilots the fire extinguishing module assigned to the area involved in the fire.

The extinguishing operation is performed with an aerated water/foam premix which is neither dangerous nor toxic for people.



The area is covered with a low pressure fog jet in order to exclude any risk of damage to people that may be caused by the dynamic action of the jet.

The extinguishing agent supply on board assures an extinguishing intervention of at least 15 minutes.

Such a time can be indefinitely extended connecting the system by means of a special connection to an external water supply.

### **Manual local/remote control of the system**

Even though the system has been designed mainly for automatic operation, it can be operated also manually in any moment and in every operating condition.

Therefore, it is possible both to perform manually the fire extinguishing intervention in any area and to intervene in an automatic intervention already started, both in pre-alarm phase and in the fire extinguishing one.

The manual intervention on the fire extinguishing system VES-SRA1 is possible at 3 different levels:

- On the central module for data management and processing, directly mounted on each vehicle or carriage.



The manual intervention of first level can be performed by means of a colour graphic interface built in the module itself and it is essentially foreseen for control and maintenance operations. In any case the module interface allows the operator to perform all the operating manoeuvres without any restraint.



- On a centralized command console on board of the mobile unit or of the train, connected by means of a serial interface to all the single modules located in each vehicle or carriage of the train.



The centralized command console on the train is equipped with a colour graphic interface which allows to monitor all the alarm and fault conditions. The conditions are listed in hierarchically ordered pages and allow to visualize synoptically all the operating statuses of the units that make up a train. The console records all the events related to the train systems and automatically creates a database where all the events related to alarms or faults are recorded.

- On a centralized remote place located in a traffic control room. Using the data transmission systems of the system it is in fact possible to interconnect the operating control centre to the trains and, therefore, to its single modules.



From the centralized remote control place all the operations related to the fire extinguishing system can be performed for each train. The command console of the remote place in the traffic control centre is also equipped with a colour graphic interface that allows to monitor all the alarm and fault conditions.



The conditions are listed in hierarchically ordered pages and allow to visualize synoptically all the operating statuses of the units that make up a train or, for instance, all the conditions of the units that are in a specific line section, such as in particular a tunnel.

In parallel to the local system all the operating alarm or fault conditions are recorded also in the central remote database.

Any condition of critical alarm, and therefore the fire detected by one or more units, hierarchically has the highest priority and it is highlighted on a special display. It is also combined with an acoustical alarm that can be silenced so that the operators can acquire the information with the greatest ease.

In addition, an automatic alarm is sent through SMS to the operators on board of the train involved, who can go the centralized console of the train for eventual required operations.

### **Dimensioning of the system**

Despite the great progresses in the modern vehicle construction and in particular in their internal furnishing (nowadays realized only with materials able to delay the fire development and with low emission of smoke and toxic vapours), theoretical analysis and experimental tests have proven that in many situations the time required to stop in a proper place the train with the vehicle involved in the fire can widely exceed the time during which people in the vehicle can tolerate the inside conditions on the base only of the above described passive measures.

The variable represented by the fire load of passengers' clothes and (especially) luggage can assume very different values in the different operating conditions and, of course, decreases safety.

For this reason inside the vehicle also active fire fighting measures are necessary and this need was acknowledged some years ago by regulations for many operating conditions.

The fire extinguishing system has to be able to start automatically in a short time and to guarantee an extinguishing intervention that can assure inside the vehicle conditions for a safe survival of the passengers for all the time required to stop the train in a safe place and to evacuate them.

At the same time the system does not have to represent, in any case, a danger for people inside the vehicle.

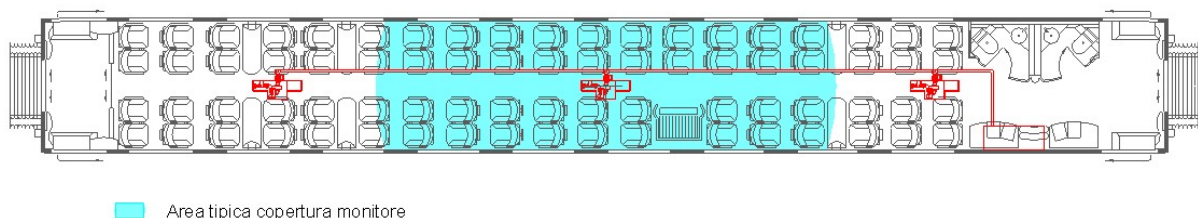
Last but not least, the system has to exclude absolutely the possibility of false alarms and to allow, if required, a complete interaction of the operators with its automatic operation.

The fire extinguishing system VES-SRA1 can detect a fire in the vehicle by means of dual technology flame detectors with combined with smoke detectors and perform the fire extinguishing operation with miniaturized automatic remote controlled monitors.

The presence of a double detection system made up by different complementary technologies represents the safety element assuring that the validation of the alarm signals and therefore the consequent piloting of the fire extinguishing system are undoubtedly associated with a real fire condition, excluding in such a way risk of false alarms.



Miniaturized monitors that perform their fire extinguishing operation spraying a foam premix, work at a reduced pressure and can spray eventually all the vehicle cubage. In such a way the fire development and the following increase of the temperature is stopped almost instantaneously by the monitors, without any danger for people in the area.



Each monitor can protect an area about 10 meters long and with the total width of the vehicle. The number of monitors required to protect each vehicle is therefore the ratio between this value and the overall length, or the number of smaller compartmentations in the vehicle layout.

The pairs of detectors required are usually equal to the number of monitors.

The time required for operation of the system can be 2 or 3 minutes, according to the choice to introduce or not, between the fire detection phase and the fire extinguishing one, 1 minute of optical acoustical pre-alarm, during which the operators who are on board or in the remote control centre can stop the intervention.



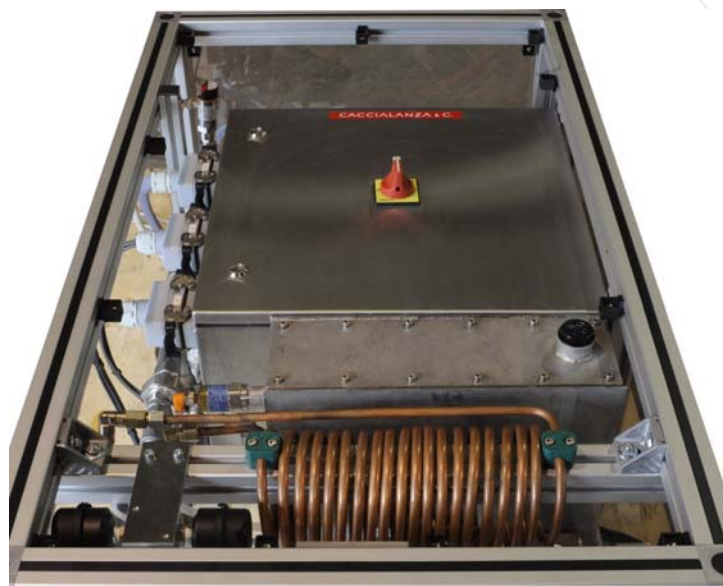
## **System structure**

The system VES-SRA1 consists of some blocks easy to be installed, connected by a cable, the bus backbone, and by a water/foam pipe (only for fire extinguishing blocks).

In each system there is a central operation module, very solid and compact, ready to be directly mounted among the components and devices of the mobile unit.

The central module feeds through a bus cable all the system components and manages the data traffic for communication with each of them.

The following picture provides a whole view of the module.



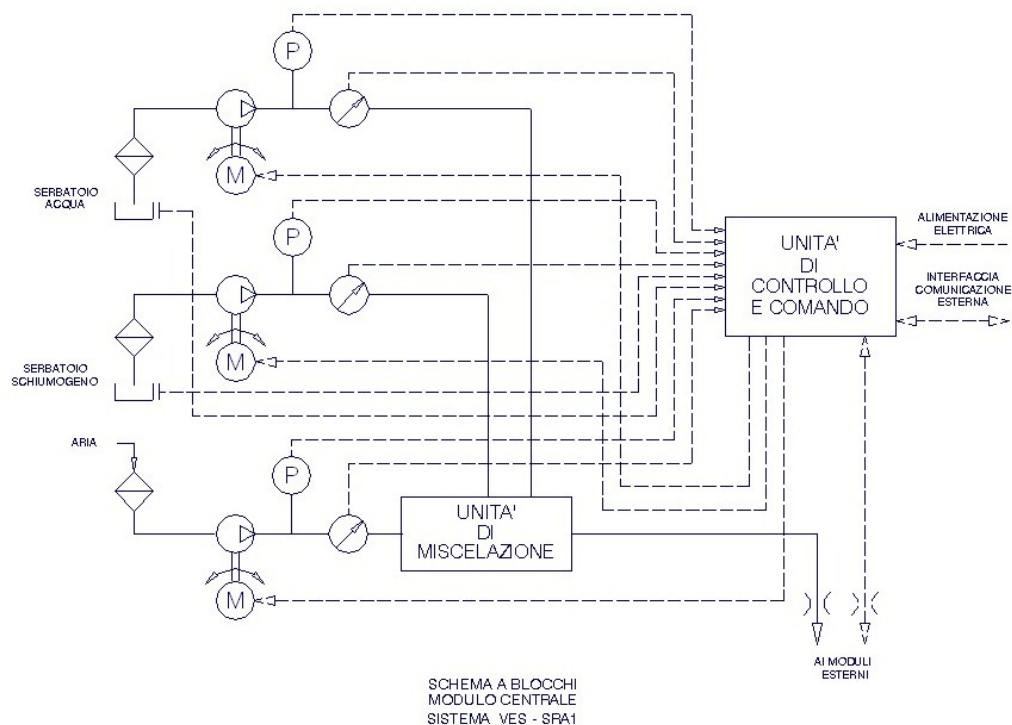
The same unit monitors continuously the supplies on board of the fire extinguishing agents (water and foam concentrate) and in case of fire extinguishing intervention, by means of two pumps and compressor which are built-in, it generates aerated foam premix.

Also the foam concentrate tank is built in the unit.



The water tank is instead mounted outside the central module, according to the total space available on the vehicle.

The following drawing shows the basic arrangement of the central module



The power supply of the module can be chosen between 24 V DC and 230 V / 50 Hz. In both cases two versions are available, with or without 24 V DC. buffer batteries. The hydraulic outlet of the central module is a 1" (DN 25) pipe for connection to monitors. The electric command and control panel is placed inside a solid box in AISI steel inside the central module. All the connections are realized by means of codified multiple connectors in order to avoid insertion mistakes, allowing therefore instantaneous disassembly and reassembly in case of maintenance.





The central module is equipped with a colour display as interface with the operator, beside some buttons and luminous led and a key switch to enable the operation of the local command devices (usually not in operation while the vehicle is working).



A serial interface, available both with Modbus and CanOpen protocol, is the connection to the train supervision system and to the remote one.

The fire extinguishing modules consist essentially of a special remote controlled monitor type A1, with nozzle for low pressure operation complete with electro valve, and of the related logic command and control interface.



Therefore, the module can be directly connected, by means of a provided T joint, to the 1" pipe from the central module and to the 1" pipe connecting the next fire extinguishing modules.

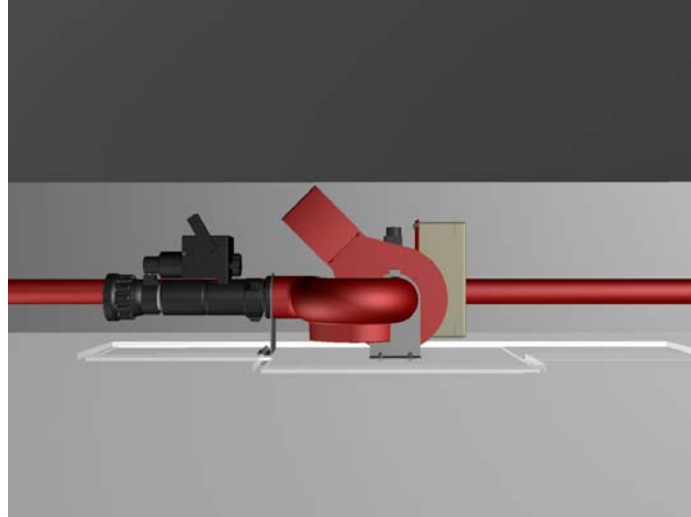
In the same way it is possible to connect to the special electric box the module is equipped with the bus cable for power supply and control, connected to the central module, and also the bus cable connecting the next modules.

The monitor rotation of 180° allows the jet to cover all the area inside the vehicle to be protected (usually the rotation is of 170°).

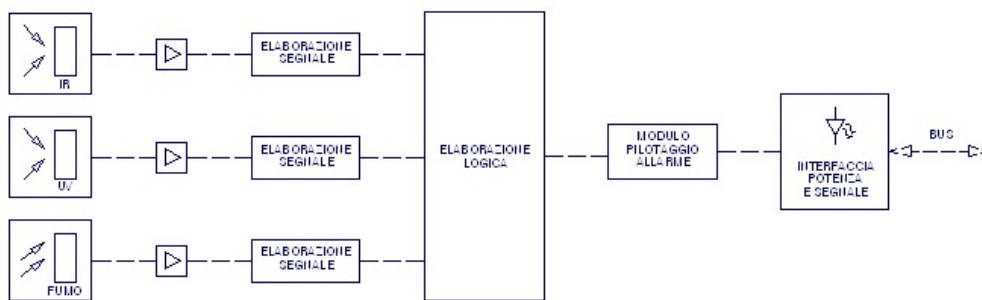
Also the nozzle can be automatically remote control operated from full jet to spray jet, adapting itself to the geometry of the area to be protected. Also this operation is performed fully automatically during normal working.



The overall structure of the fire extinguishing module has been designed to take up little room while the module is not in operation; it can be directly built in an eventual false ceiling in the vehicle to be protected.



The fire detection modules consist of a mono bloc, available both in wall mounting version and in false ceiling built in version, equipped with a smoke detector and the flame detector. The flame detector is a dual technology detector, therefore with two different photo-elements, one sensitive to infrared radiation and the other one to ultraviolet radiation. In such a way it is possible to get a special detection selectivity and the best insensitiveness to false alarms, that may be caused also by incorrect actions of the users.



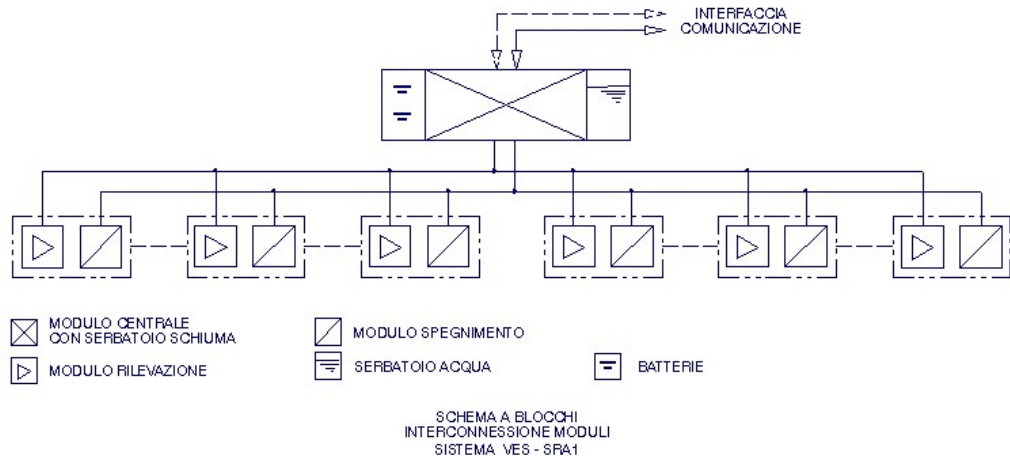
SCHEMA A BLOCCHI  
MODULO DI RILEVAZIONE

The module is complete of the its logic of interface with the power supply and control bus cable already described. Each module has special terminals for connection of the bus cable to previous module and to the next one.



The bus connection of the modules is performed by means of a single cable allowing both power supply and the bi-directional exchange of the data of the single unit.

The modules can be connected to the bus without a preset sequence and the total length of the bus can reach 30 meters, thus allowing an easy and simple connection of all the components.



the special bus cable is equipped with a high efficiency screening and is classified as flame resistant for a time of 180' according to the standards.

### **Features of the fire extinguishing system with fire fighting monitors**

The fire extinguishing system for vehicles VES-SRA1 has very innovating technical features assuring high performances.

In particular the system has the following features:

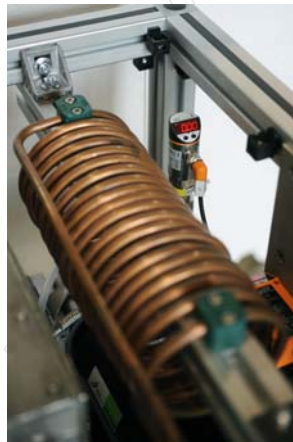
- Very little dimensions of the fire detection module and, above all, of the fire extinguishing module allowing to install it in spaces available especially in the false ceiling -
- Compact construction of the central module, with self-supporting structure, prepared for direct mounting among the equipment on board -
- Possibility of mounting and operation in any position (horizontal, vertical, inclined) -
- Operation with only one power supply source, 24 V DC or 230 V / 50 Hz -
- Foam concentrate tank directly on board of the unit; separate water tank (with shape and characteristics that can be personalized depending on the available spaces) connected to the central module by means of a single pipe -
- High operation reliability combined with proven fire extinguishing techniques -
- Reduced costs for the single modules and easy standard mounting -
- Special design for operation in mobile conditions and for extinguishing operation with water/foam premix suitable for all fire classes on a mobile unit.



### **System reliability**

The world wide proven extinguishing capacity of the automatic fire fighting system with remote controlled monitors is combined with the highest reliability of its components, considering the particular conditions where the fire fighting intervention must be performed. To assure the highest reliability, redundancy has been applied to all critical parts of the system, for which not only the best materials and components available on the market have been selected, but also the most updated and reliable technology of monitoring, communication and check procedures have been adopted.

In particular for the data transmission among the system modules a CanOpen system has been selected. The data transmission between the central module and the remote command and monitoring modules is performed according to Modbus or TCP/IP system, in order to allow the direct use of already existing communication structures or future structures to be realized for the remote transmission of alarms, commands and controls to the centralized Control Rooms of the tunnel without additional costs.



- **Easy system installation**

The system has been designed to be easily installed in the structures of the mobile unit to be protected as for operating aspects and dimensions.

It consists of fully prefabricated modules that, after the installation, require only to be connected one to the other with a single bus cable and (except fire detection modules) with a single pipe.

The modules are particularly compact and designed for false ceiling or wall installation; the central module is placed in a panel self-supporting structure allowing easy and quick insertion in suitable instrument place.

The connection to the data transmission systems on board is particularly easy as it can be performed with 2 interfaces to be chosen among the most used standard ones.

### **Maintenance**

Like any other fire extinguishing system this system requires periodical maintenance interventions, according to the regulations in force.



Rules clearly state that all the active system components, both the central and the peripheral ones, have to be subject to maintenance and that periodical tests have to be carried out; as for our system maintenance is particularly easy thanks to 2 main factors:

- all the system components are continuously monitored by the central control unit of the system, therefore any eventual problem is immediately signalled and recorded,
- the test of the monitors can be carried without delivering any liquid and consequently without damaging any place, thanks to a special function of the central module that foresees maintenance mode with a test supply of only air.

It is very important to highlight that in the whole system there are no important reductions of the pipe diameters or calibrated orifices of small section, particularly sensitive to impurities usually present in fire extinguishing water and therefore requiring an intensive maintenance to assure proper operation.



The Automatic Fire Extinguishing System for Mobile Units with Remote Controlled Monitors VES-SRA1 is protected by the following Patents:

Italian Patent MI2009A 001860 and MI2008A 000735

International Patent pending and PCT/EP2009/000335

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