

**SIL2**

**Fail safe**

**Public Address and Intercom**



## Initial Situation

In general, a tendency to increase safety requirements for rail vehicles can be currently observed. This is also the case in the area of fire protection. New European standards contain more stringent requirements concerning firefighting. This especially applies to trains travelling through longer tunnels.

An important element hereby is the PA and Intercom system of the train. It is most important for the coordination of procedures in case of fire. Firstly, it allows the notification of a fire by passengers or train staff, secondly it gives the driver the ability to coordinate firefighting and evacuation of the train via announcements.

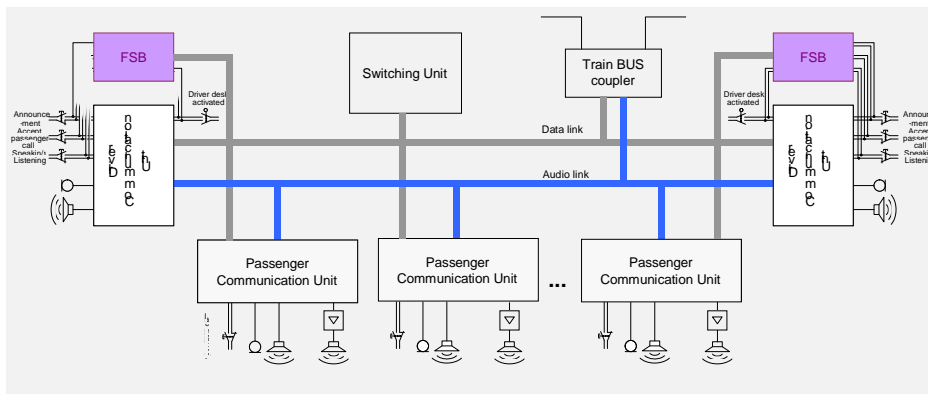
ANNAX has developed such a system with PA40, which is equipped with hardware and software structures according to SIL2. The system has been approved from the Federal Railway Authority (EBA) of Germany. It is in use in the new S-Bahn trains of the BR430 type in Stuttgart and Frankfurt.

## System Architecture

The PA40 PA and Intercom system consists of a driver communication unit per driver desk, a central switching unit and passenger communication units in each entrance area. These passenger communication units additionally contain power amplifiers directly connected – without additional transformers - via low impedance to nearby interior and exterior loudspeakers. The loudspeakers hereby are attached to these amplifiers in such a way, that a maximum of 50% of the loudspeakers are connected to one amplifier. This ensures that in case of a drop out of one amplifier still a minimum of 50% of the loudspeakers are still available.

In each vehicle an additional fail safe supervision unit (FSB) – as according to SIL2 – watches over the system functionality. It supervises all signals triggered by pushbuttons or emitted by microphones and in parallel traces all data telegrams on the system bus connecting all PA components.

In multiple-traction mode, the PA systems of all vehicles communicate with each other via train bus transmission units, preparing internal signals via digital modulation for transmission via automatic train couplers.



Principle system architecture of PA40 within a vehicle

## PA 40 - SIL2

### Functions at a glance

- Availability of PA secured by continuous automatic verification
- HW & SW according to SIL2
- EBA-approval



## PA40 - SIL2

### Advantages at a glance

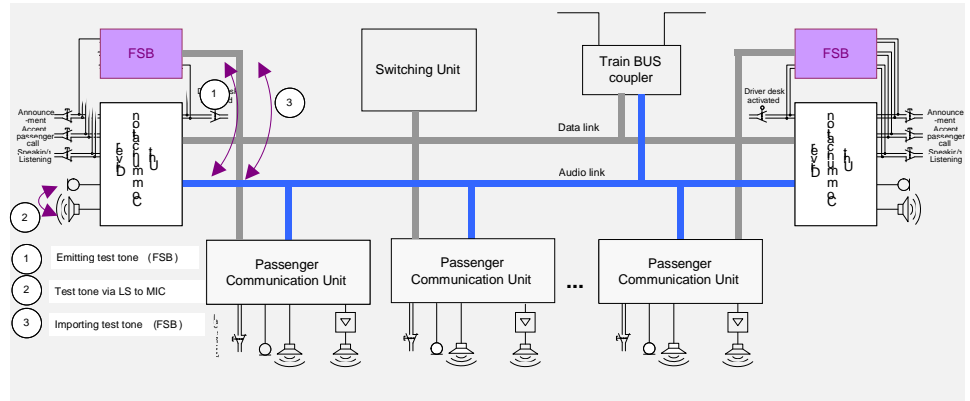
- periodical overall check including loudspeakers and microphones
- continuous surveillance of most important system functions
- train wide supervision during multiple traction
- safe status signalling via lamp
- detailed diagnosis via Ethernet network connected to TCMS

## System Functionality

The SIL2 system supervision is carried out in two forms

- periodical checks of the complete system
- continuous surveillance of system operation with limited extent

The check of the complete system is initialized by the driver after being prompted by the supervising unit (FSB). It consists of a sequence of test tones in which, for example, tones are sent out via the control loudspeaker and read back via the driver microphone. In the supervising unit the emitted test tones are then compared to the received tones and evaluated according to their similarity.



Example of driver controls test

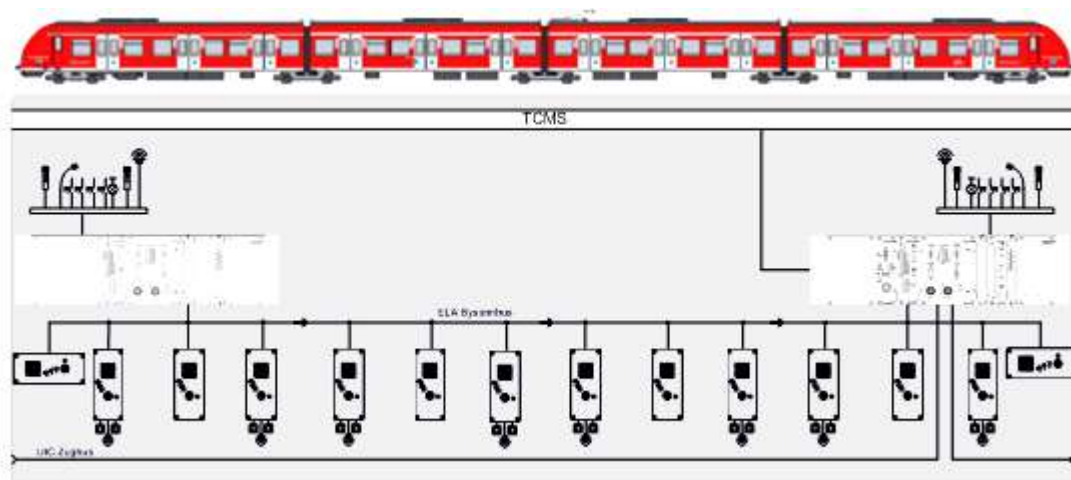
This overall test is not only carried out in the vehicle itself, but is extended in multiple-traction mode over the coupling to all other vehicles attached together in the train set.

Via the continuous surveillance FSB checks, commands of the driver issued to the system via push buttons are correctly executed. To recognize contact problems, always two independent – antivalent - contacts of one push button are imported. The connections demanded from the switching unit, and the according actually established connections between system components, are verified by the FSB.

The result of the supervision process is shown to the driver via a lamp in a secure way. More detailed diagnostic information is sent to train management system (TCMS) via data telegrams.

## Advanced Information Systems

ANNAX was established in 1996 by a management buy-out from BOSCH. Since then, the company established its leading position on the Passenger Information Systems market through organic growth and strategic acquisitions in the area of rail systems. Currently, almost 230 highly motivated employees in our subsidiaries in Germany, Switzerland, Austria, China and Poland are working together to develop, to design and to manufacture a wide range of products and services for international rail projects in Europe, Asia, Australia and North America.



Our SW and HW development is based on the V-Model® XT. In all processes ANNAX uses IRIS requirements, high performance SW development standards (e.g. EN50128, CMI or IEE), and innovative SW technologies with large-scale integration within the ANNAX group.

For further information: **ANNAX**  
Eugen-Sänger-Ring 15  
DE-85649 Brunenthal, Germany  
E-mail: [sales@annax.com](mailto:sales@annax.com)  
Internet: [www.annax.com](http://www.annax.com)

