FULLY REDUNDANT RINGBUS FIRE DETECTION SYSTEMS FOR RAILWAY APPLICATIONS:
Reducing false alarms.....

Reinhard HOFER
EUR ING, Ing. / Technical Sales Manager
NSC Sicherheitstechnik GmbH
Sales Direction Austria
Reinhard HOFER
Technical Sales Manager
NSC Sicherheitstechnik GmbH
Sales Direction Austria
Telephone: +43732 997078
Telefax: +43732 997078-78
E-mail: r.hofer@nsc-sicherheit.de
Internet: www.nsc-sicherheit.de

Reinhard RÖSSLER
CEO
Rail Services International Austria GmbH
Telephone: +431 61 77 771
Telefax: +431 61 77 771-28
E-mail: rroessler@railsi.at
Internet: www.railsi.at
### Content

1. **History / System Requirements**

2. **EN 54-2 FACP, EN 54-13 approved and certified systems**
   2.1 Cabling structure / short circuit isolators
   2.2 Reducing False Alarms
   2.3 Analogue / Digital Protocol Transmission

3. **Advantages of “open protocol”**
   3.1 Closed protocol - Dependency of system and supplier for the operator
   3.2 Open protocol - Independence for the system operator

4. **Distinction between pre-alarm / main alarm**

5. **Main characteristics of the railway-tested system NSC in combination with Apollo Discovery ringbus components**

### Summary
1. History / System requirements

Standards / Guidelines

EN 45545-6 Railway applications - Fire protection on railway vehicles - Part 6: Fire control and management systems

ARGE Guideline - Part 1: "Fire detection in rolling stock"

ARGE Guideline - Part 2: "Fire fighting in rolling stock"

ARGE Guideline - Part 3: "System functionality, fire detection and fire fighting systems in rolling stock"
Standards / Guidelines - Additional

EN 54-2: Fire detection and fire alarm systems - Part 2: Control and indicating equipment

EN 54-3: Fire detection and fire alarm systems - Part 3: Fire alarm devices - Sounders

EN 54-5: Fire detection and fire alarm systems - Part 5: Heat detectors - Point detectors

EN 54-7: Fire detection and fire alarm systems - Part 7: Smoke detectors - Point detectors using scattered light, transmitted light or ionization

EN 54-13: Fire detection and fire alarm systems - Part 13: Compatibility assessment of system components

EN 54-17: Fire detection and fire alarm systems - Part 17: Short-circuit isolators

EN 54-18: Fire detection and fire alarm systems - Part 18: Input/output devices
1. History / System requirements

Standards / Guidelines - Additional

EN 45545 ?
- No regulations concerning product / system

„ARGE – Guidelines“ ?
- Few regulations concerning products (EN 54-7, EN 54-5)
- Only Chapter 3.4 in part 3 contains a **recommendation, but not compulsory**.

*The monitoring requirement has to be realized in accordance with DIN EN 54-2 (affects fire alarm central control panels) and DIN EN 12094-1 (affects gas extinguishing systems), as far as required for rail vehicles.*

Practical Experience ?
- No requirement of conformity either to EN 54-2, either to EN 54-13 during public tenders !
1. History / System requirements

EN 50126 – derived from the IEC 61508……

Functional safety in accordance with DIN EN 61508 (VDE 0803) as regards fire detection and fire alarm systems

Special requirements for FDAS:
EN54-xx + DIN 14675 + DIN VDE 0833-1, -2

Functional safety acc. DIN EN 61508
1. History / System requirements

EN 50126 vs. EN 54-2 / EN 54-13

Conclusion:

When applying the application regulations and the harmonised standard for FDAS, DIN EN 54, whose requirements shall be fulfilled anyway, the graduation of requirements in accordance with DIN EN 61508 is of no added value in terms of safety aspects.

...... for all details see VdS 3166 (2012-06)
## 2.1 Cabling structure / short circuit isolators

Conventional detectors ("Stand alone", "Smoke switch")

### Typical Applications:

- Smoke monitoring of ventilation systems
- Fire detection in combination with hold-open systems for fire doors
- Fire detection in private houses
- Fire detection in small businesses (combined with EN 54-2 conv. FCAP)
- Fire detection in railway applications

**NO EN 54-13 SYSTEM !**
2.1 Cabling structure / short circuit isolators

Cabling structure – Conventional detectors ("line" or "zone")

NO EN 54-13 SYSTEM!
2.1 Cabling structure / short circuit isolators

Loop structure combined with short circuit isolators

All components loop-powered and monitored!

2-wire loop provides power and communication!

Only way to build a system, according to EN 54-13!
2.1 Cabling Structure / short circuit isolators

All different EN 54 components within the loop (EN 54-17 short circuit isolators integrated in every element)
2.2 Reducing false alarms

Prevent false alarms

How to?

- By using **analogue addressable** bus components with fully **digital protocol transmission to FACP** (see chapter 2.3 in abstract)
- By using detectors with integrated drift compensation
- By using control panels with programmable delay modes (within EN 54-7, 54-5 limits)
- By using detectors with, e.g. 5 programmable sensitivities
- By using FCAP’s fulfilling highest technical demands on the market (processor redundancy)

If it turns out that the false alarm behaviour in such areas occurs again and again, a different type of detection type (e.g. thermo-maximum or flame detector) must be selected.
A digital protocol is much less susceptible to corruption than the analogue protocol and is to be preferred in a system which is life-critical. Only digital protocols fulfil the high demands of EN 54-13!
3 Advantages of 'open protocol'
3 Advantages of ‘open protocol’

'Open protocol' vs. ‘closed protocol'

Two Concepts

Open protocol

Closed protocol

producer A

producer B

producer C
3.1 Closed protocol - Dependency for the system operator

Potential disadvantages:

- closed protocol ➔ only one panel (FACP) Producer is compatible
- access to configuration software can be limited
- after sales: 100% depending on 1 manufacturer
- availability and compatibility of panel and detector components and follow-up products in 15, 20 years ??
3.2 Open protocol – Independence for system operator

Open protocol – system constellations:

Multi-protocol FACP
4. Distinction pre-alarm/main alarm

Demands:

Why?

- Avoid panic reactions of staff and passengers → following the predefined alarming and emergency concept
- Avoid indifference of staff and passengers in case of a false alarm
- Only a second or a manually activated alarm should be perceived as an emergency alarm

Solution?

- Different tones, loudness volumes and duration of loop-controlled acoustic and/or visual alarm devices can be programmed with intelligent FACP
5. Main characteristics
NSC fire detection system
solution F1 Rail

Two examples:

- Processor redundancy 100%
  redundant main CPU, redundant loop card

- Patented manual addressing procedure with
  binary coded address card in the base - XPERT Card
  the system operator can change a polluted
  smoke detector without software and specific skills
  the location of the detector is always linked with the
  address in the base, no automatic software
  addressing

Many more characteristic in chapter 5 in the ABSTRACT.....
5. Conclusion

References:

Project SBB (06/2014 – 10/2016)

- Standard-IC rail wagon: 114 pcs.
- ICN passenger car fleet (7 wagon): 18 pcs.

Conception

Engineering

Component supply (fire detection and fixed fire fighting systems)

Assistance with assembly and commissioning

Training and instruction of operating staff
5. Conclusion

References:

Project SBB (06/2014 – 10/2016)

- Standard-IC rail wagon: 114 pcs.
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Impressions....
5. Conclusion

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- Standard-IC rail wagon: 114 pcs.
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Impressions....
SUMMARY

With the use of modern ringbus detection technology

- through which analogue measurement values are transmitted bi-directionally via a digitized protocol
- to an EN 54-2 certified, microprocessor-controlled fire alarm control panel
- within an EN 54-13 certified system,

the currently highest level of security against false alarms can be provided through intelligent algorithms (drift compensation, event delay, filtering of recurrent detection patterns).
CONTACT

Reinhard HOFER
NSC Sicherheitstechnik GmbH
Sales Direction Austria
Wiener Straße 131
4020 Linz / Austria

Telephone: +43 (0)732 997078
Fax: +43 (0)732 997078-78
E-mail: r.hofer@nsc-sicherheit.de
Internet: www.nsc-sicherheit.de

Reinhard RÖSSLER
Rail Services International
Austria GmbH
Domaniggasse 2
1100 Wien / Austria

Telephone: +43 (0)1 617 77 71
Fax: +43 (0)1 617 77 71- 28
E-mail: rroessler@railsi.at
Internet: www.railsi.at