



# Introduction to Frauscher Advanced Counter FAdC<sup>®</sup>

Nov 2020



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Audio Settings

Chat Box

Q&A Box



MP

Michael Parzer

Participants

Search

Panelists (4)

- AJ Ashish Jain Host
- MP Michael Parzer
- HG hal gordon
- LF laura falcon

Attendee

Your name



**Jon Lundberg**  
Business Development



**Jae Lee**  
Sales Engineer

## **Frauscher Sensor Technology USA**

21 Roszel Road, Suite 115

Princeton, NJ 0854

USA

**[www.frauscher.us](http://www.frauscher.us)**

# Agenda

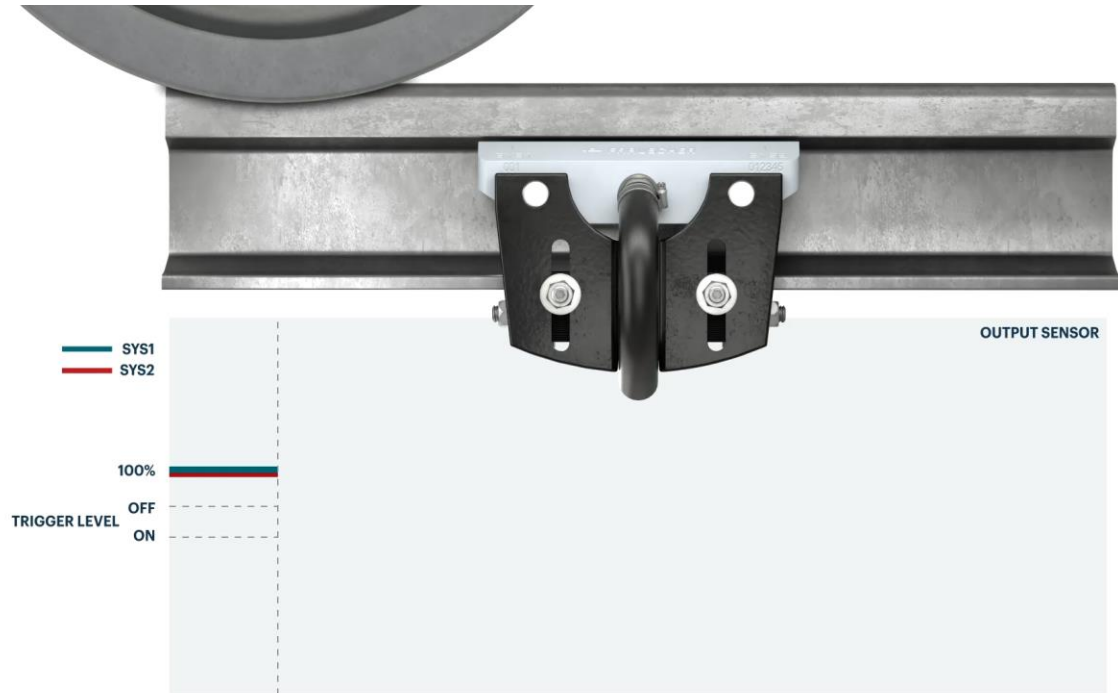
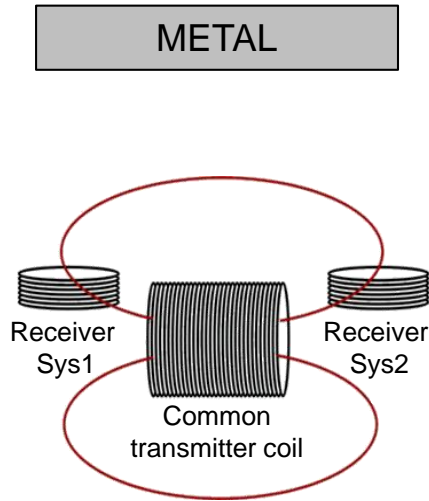
- Axle Counting Review
- FAdC Overview
  - Outdoor Equipment
  - Indoor Equipment
- Algorithms to Increase Uptime & Availability
- Maintenance
- Diagnostics and Monitoring
- Q&A

# Axle Counting Review



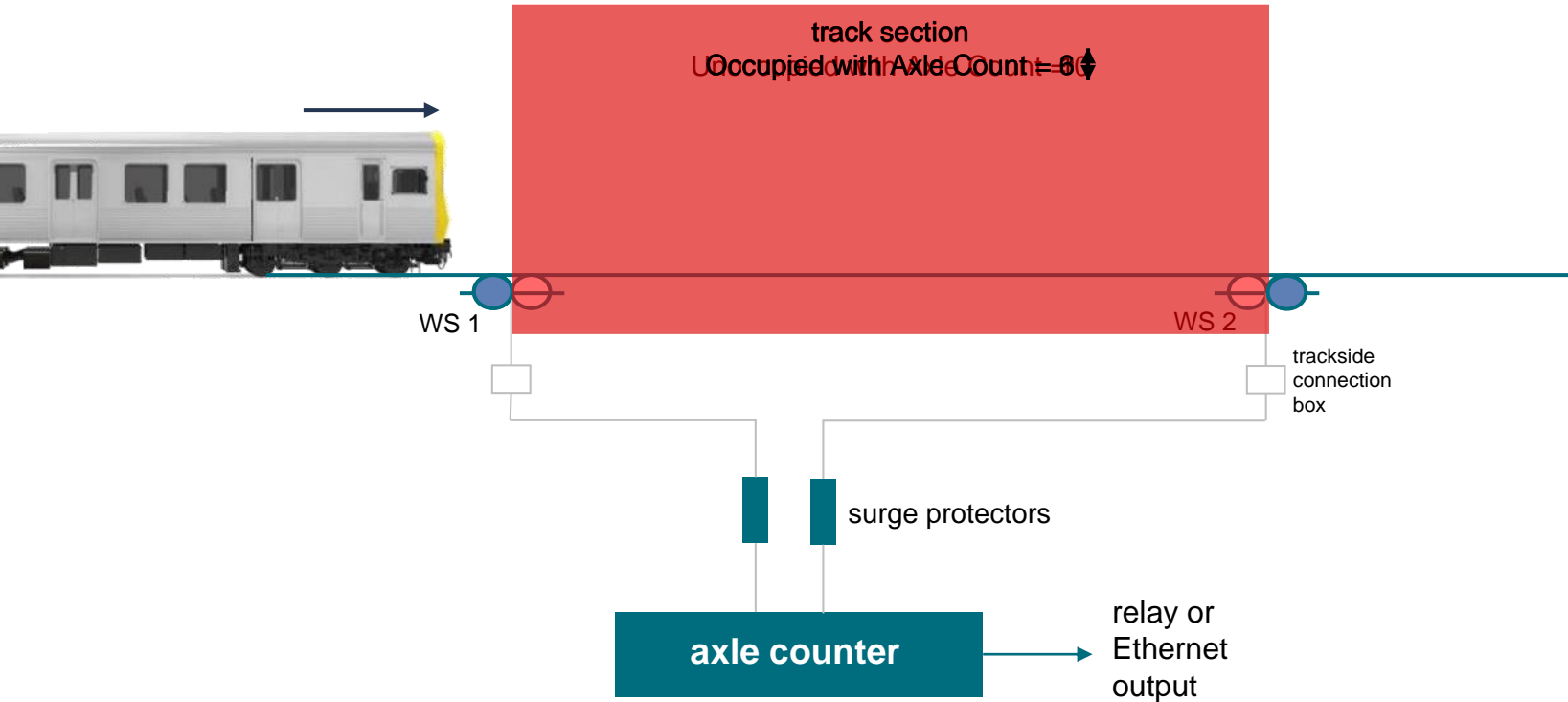
# Fundamental Principle of Axle Counting

Operation of the inductive wheel sensor



# Track Sections with Axle Counters

Works with any train direction and movement, including at a full stop





# Common Applications

Frequent use cases of axle counters

- Primary train detection for signaling
- CBTC secondary system - transits
- Grade crossings
- Traffic light preemption
- Yard control systems
- Switch point protection
- Speed measurement
- Train tracking in dark territories
- Red signal overrun





## Why Axle Counters?

Improved safety and availability

- Vital and fail-safe
- Quick and easy install
- Operates in harsh environments
- Low maintenance
- Easy to overlay
  - Compatible with electric traction
  - Compatible with track circuits
  - No track alterations needed



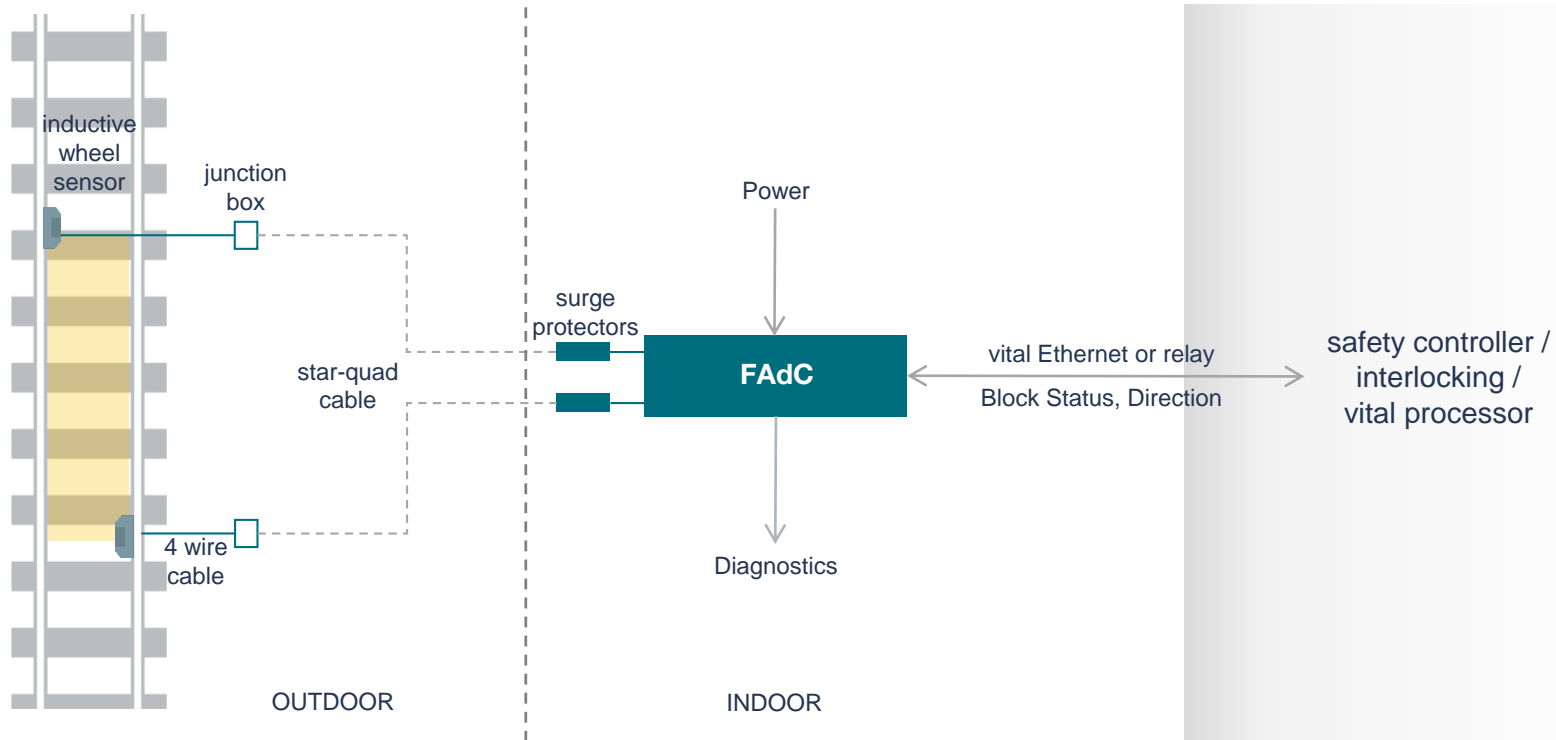
# Harsh Environments

Function reliably in challenging conditions



# Typical Frauscher Equipment Layout

Track-mounted wheel sensors and indoor electronics



# Outdoor Equipment

Wheel Sensor RSR180

Rail Claw SK140 or SK420

Trackside Connection Box TCB

# Outdoor Equipment

Standard components and installation



Rail Claw SK140



Wheel Sensor RSR180



Trackside Connection Box (TCB)

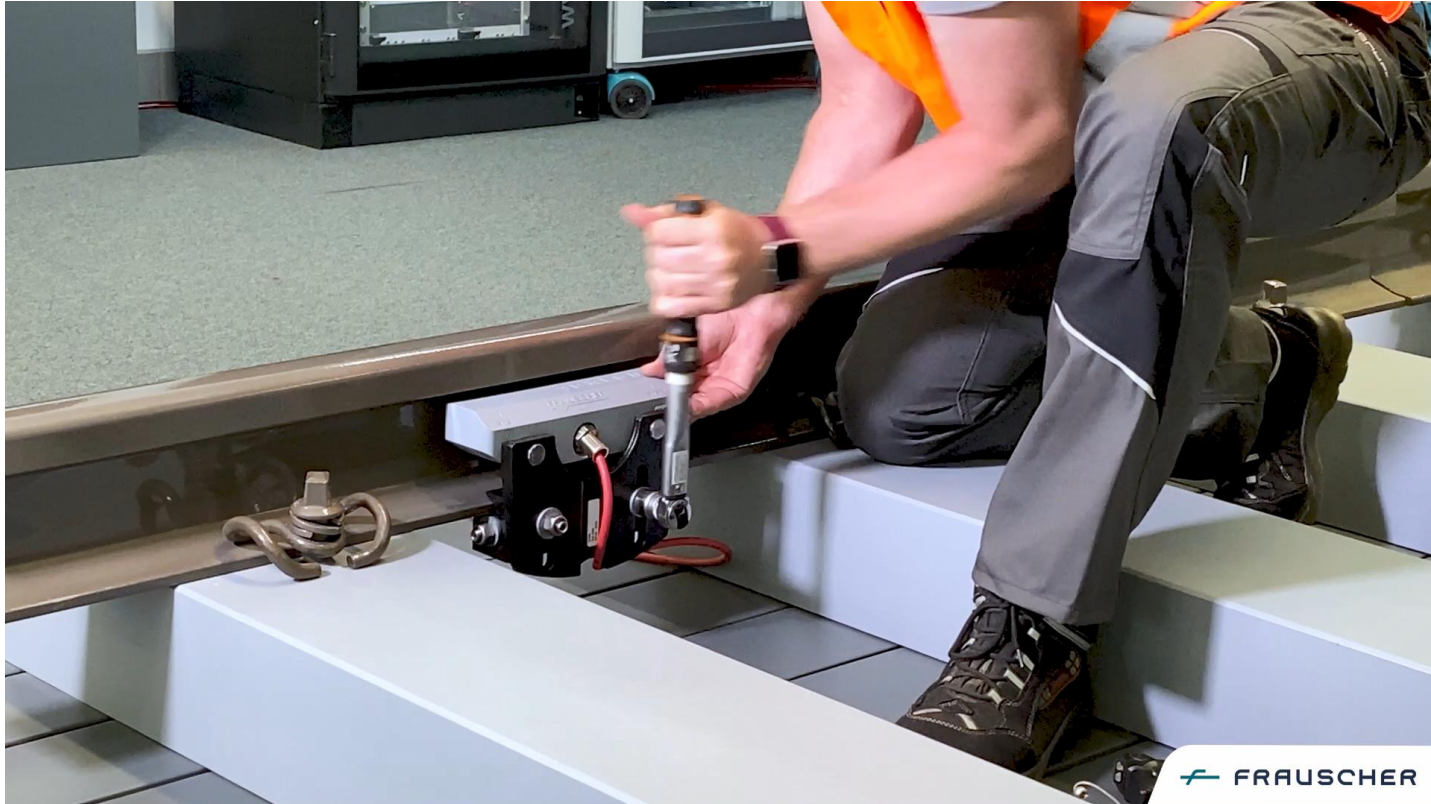
# Wheel Sensor RSR180

Vital and fail-safe per CENELEC SIL4 standards



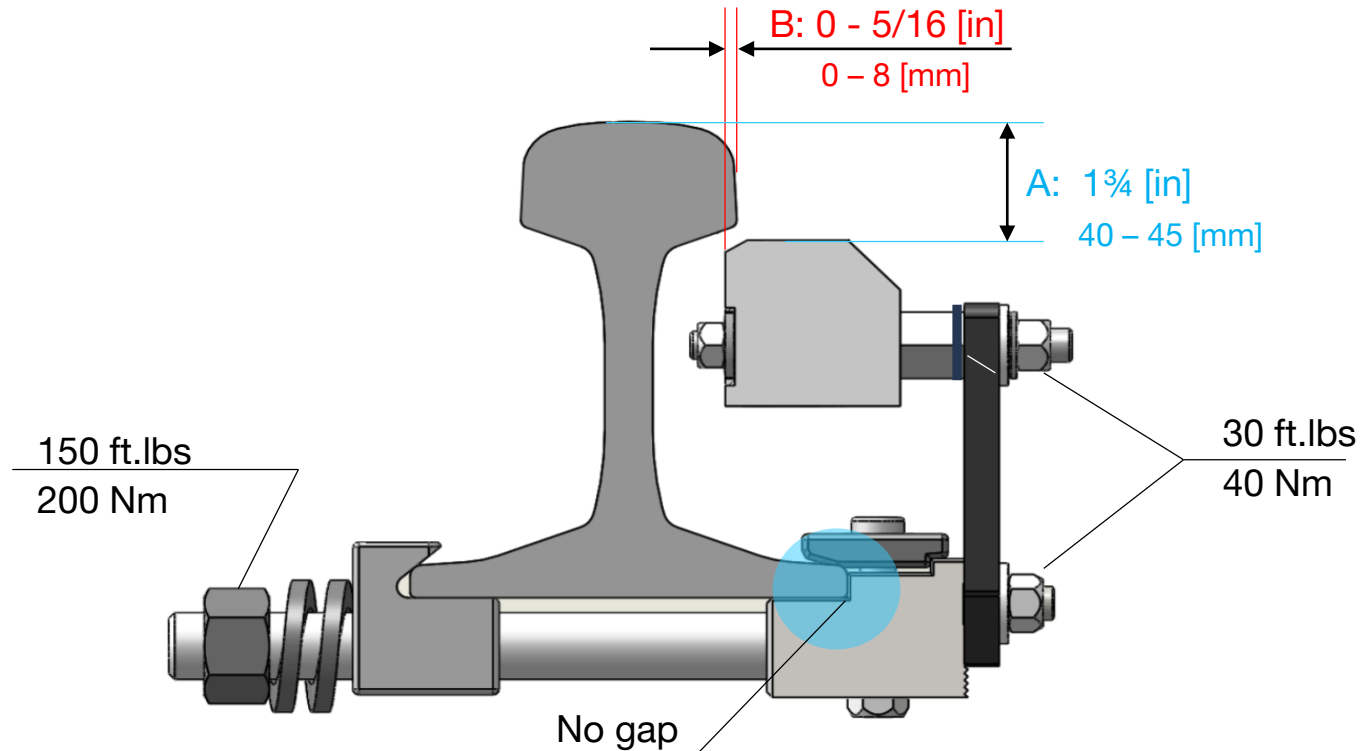
- IP68 rated – waterproof and dustproof
- Operating temperature: -40°C to +85°C (-40°F to +185°F)
- Low maintenance requirement – 2-year cycle
- High reliability MTBF > 4 million hours
- No trackside electronics
- Calibration performed at the indoor equipment
- Distance up to 6 miles from indoor equipment
- EMI resistant – including AC traction motors

# Quick and Easy Wheel Sensor Mounting



# Standard Wheel Sensor Mounting Specifications

May change with railclaw versions and wheel flange dimensions

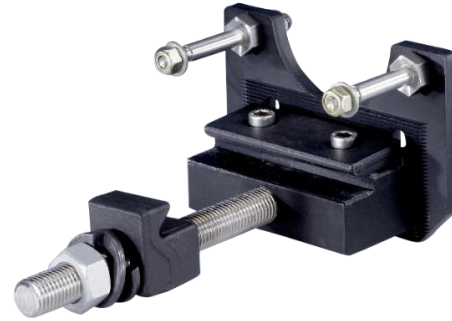




# Rail Claws

Available for ballasted, concrete, and embedded track

- Clamped to rail - no drilling of rail
- Fits all standard rail profiles:
  - Ballast track
  - Concrete slabs
  - Embedded rail
  - Elevated structures
- Minimizes track installation time
- Factory pre-adjustment available
- Different clamping bolts for different rail profiles



SK140 standard claw



SK420 embedded claw

# Trackside Connection Box TCB

- Connects wheel sensor cable to cable routed to indoor equipment
- Simple connection terminal – no electronics
- Connects up to 3 wheel sensors
- IP68 rated – waterproof and dustproof
- HB fire rating per UL94
- Can be buried or pedestal mounted

cable termination



# Indoor Equipment

Surge protector BSI

Power Supply Board PSC

Communication Board COM

Evaluation Board AEB

Relay IO Board IO-EXB

# FAdC Indoor Equipment

## Key Features

- Vital and fail-safe
- Relay & Ethernet interfaces
- Hot swappable boards
- Optional redundancy
- Modular design / architecture
- Software-based configuration
- Remote diagnostics
- Power Input: 19-72V DC

# Overtoltage Protection Board

BSI



- Protects indoor equipment against induced surges (e.g. lighting, overhead line short circuits)
- One BSI per wheel sensor
- DIN rail mounted
- Maintenance-free

# Indoor Equipment

FAdC board types



PSC  
power supply  
board



COM  
communication  
board

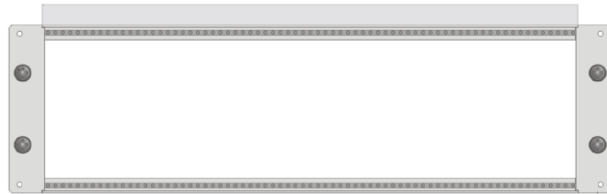


AEB  
Advanced  
Evaluation Board



IO-EXB  
Input Output Extension  
Board (Optional)

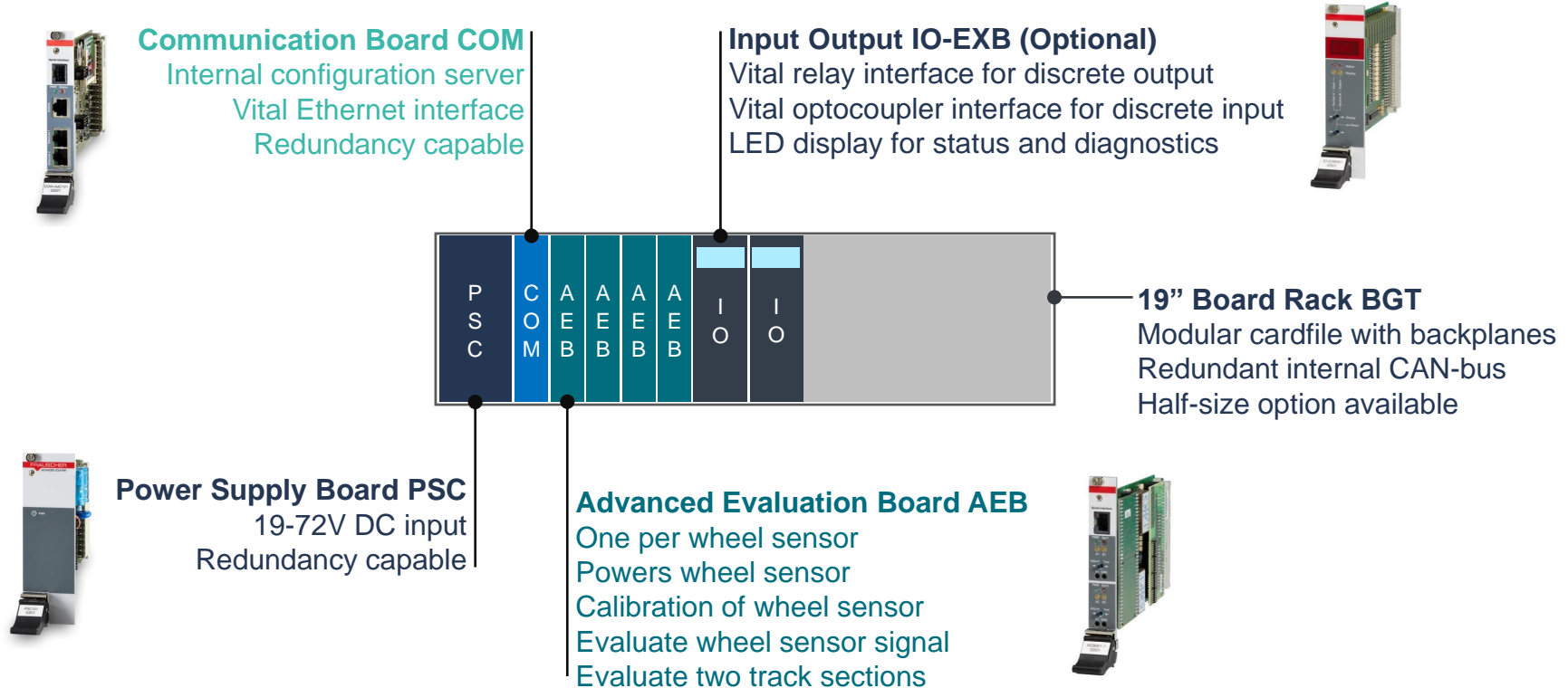
BGT  
Board rack for FAdC



FDS  
Frauscher Diagnostic System  
(Optional)

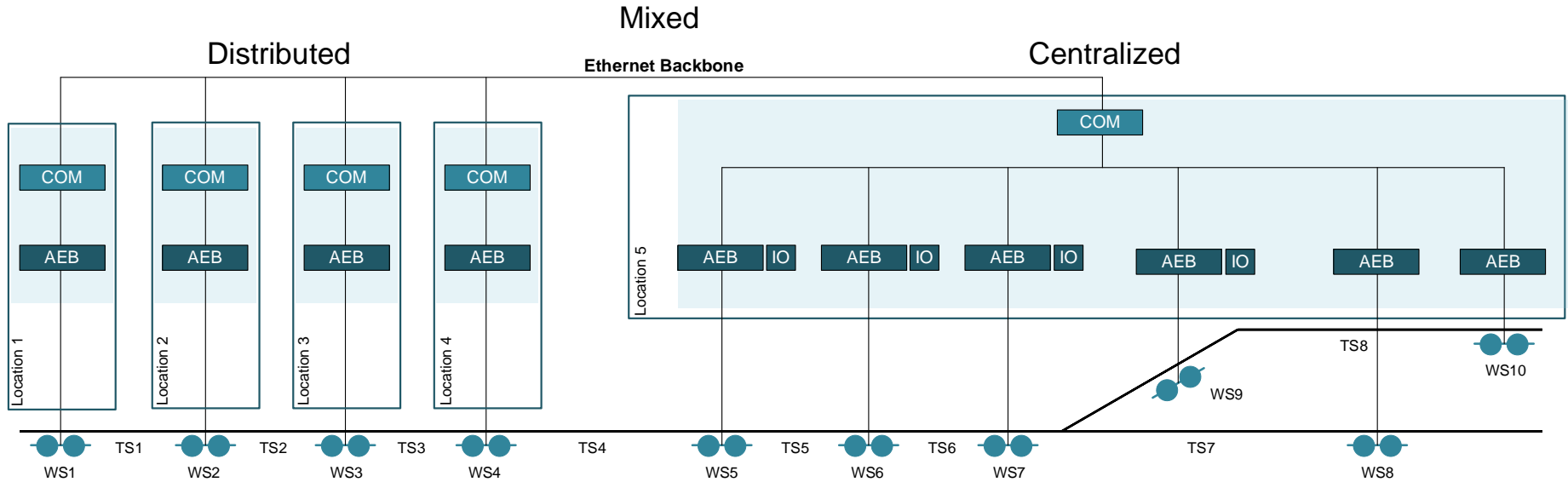
# Indoor Equipment: Frauscher Advanced Counter FAdC

Typical arrangement and main functions of various boards



# Flexible Architecture

Centralized, distributed, or mixed



No distance limitation between locations  
Operates and performs as a single system  
Ethernet connectivity can be copper, fiber, wireless, or mixed



# Interfaces of the Frauscher Axle Counter

Integrates with controllers, interlockings, and train control systems

## Ethernet Interfaces

### VITAL

- Track section occupancy
- Direction of travel

### NON-VITAL

- Reset information
- Error / Diagnostics
- Axle count in track section
- Train length
- Wheel speed indication
- Wheel diameter indication

Accepts reset commands from interlocking

## Supported Ethernet Protocols

- Frauscher Safe Ethernet (FSE)
- Other customer-specific

Under Development

- *EULYNX*
- *Digisafe*

## Vital Relay Interfaces

- Track section clear / occupied
- Sensor system 1 & 2 occupancy
- Direction of travel
- External data transmission

Also accepts reset inputs

## Vital Optocoupler Output

- Sensor system 1 & 2 occupancy
- Direction of travel

# Algorithms to Increase System Uptime & Availability

Counting Head Control CHC

Supervisor Track Section STS

# Counting Head Control CHC

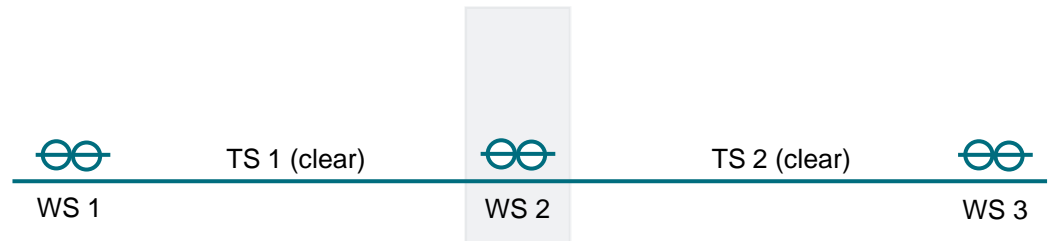
Suppression of false positives



## Benefits

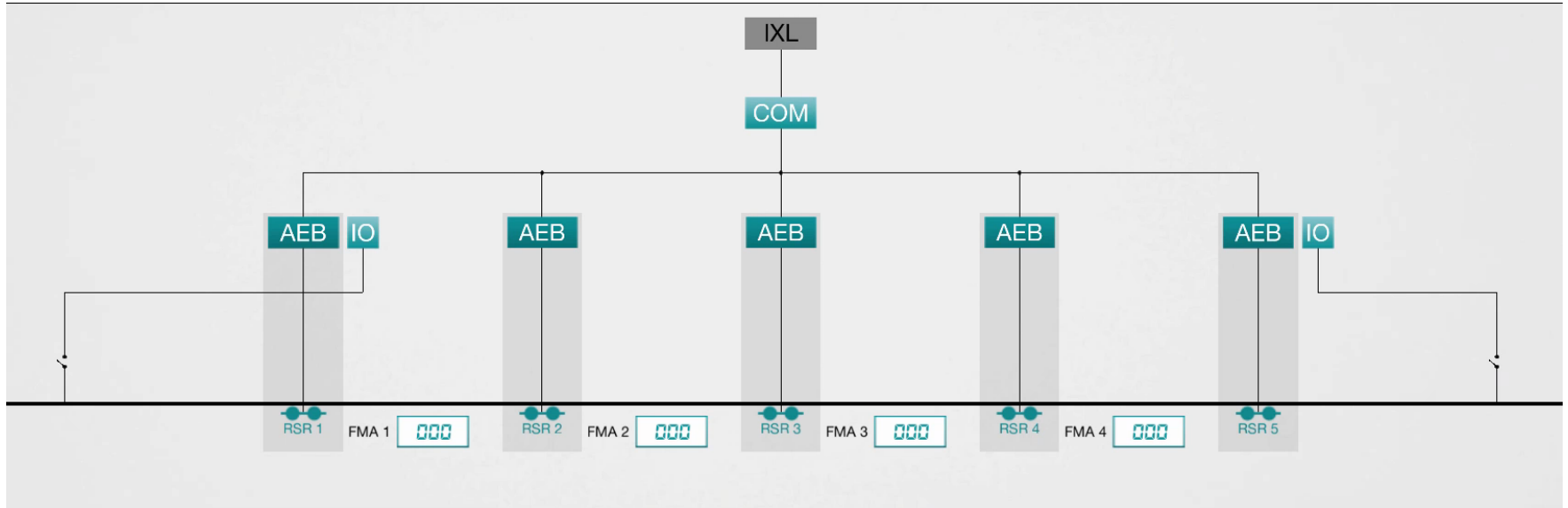
- Increased uptime with no additional equipment
- Suppression of metallic debris
- CENELEC SIL4 compliant - vital and failsafe

**Principle:** if both adjacent track sections are clear, dampings of wheel sensor will be suppressed



# Counting Head Control

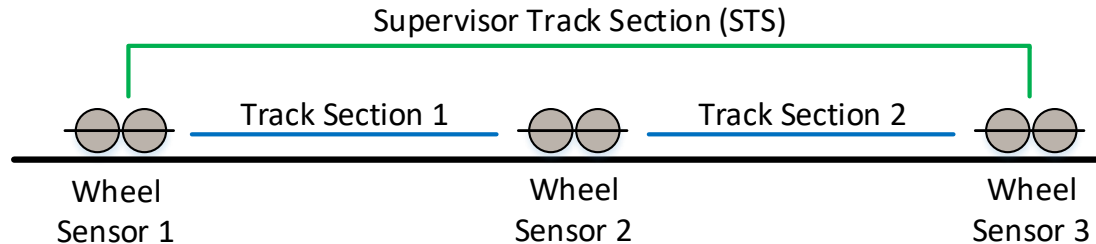
Increased availability



# Supervisor Track Sections

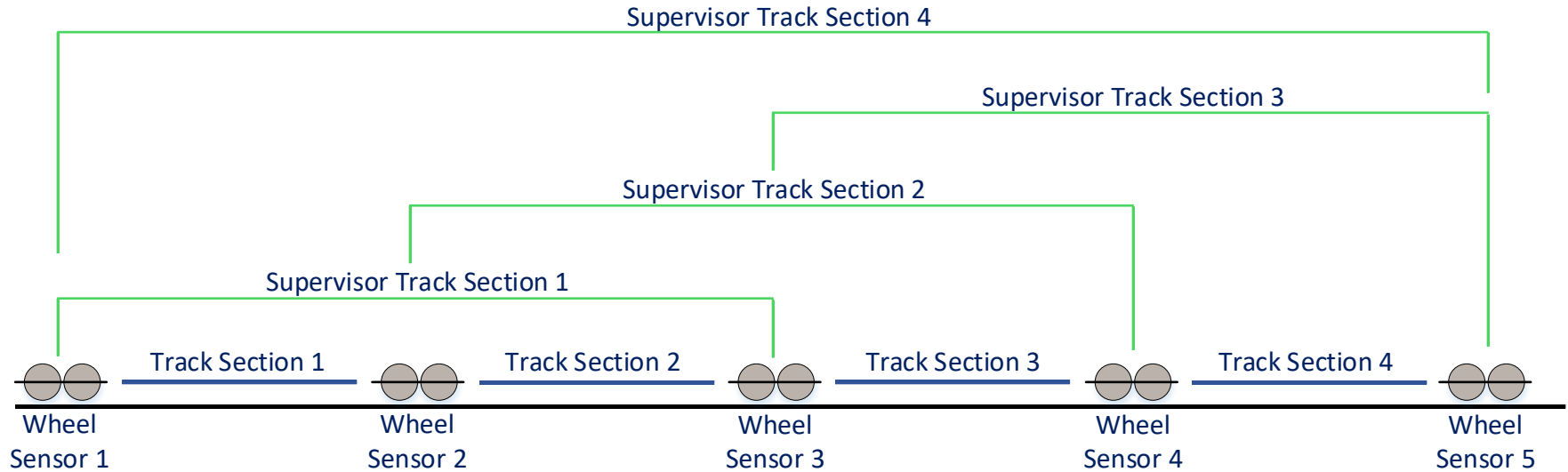
Automatic reset of track sections in certain situations

- Automatically resets track sections without operator intervention *if STS clear*
- Automatically corrects false positives
- System availability is increased without additional equipment
- Complies with CENLEC SIL 4, vital and fail-safe
- Resets can occur both top-down and bottom-up (if configured)



# Supervisor Track Sections

Increased availability



# Vitality, Safety, and RAMS

Highly reliable and safe operation under all operating conditions

## SAFETY, RELIABILITY & MAINTENANCE

- Vital per CENELEC SIL4
- Fail-safe
- **MTTHE:**  $0.069 \times 10^{-9}$  / hour per track section
- **MTBM:** 2 years
- **MTTR:** 18 minutes max.
- Redundancy
- Minimal on-track personnel requirement

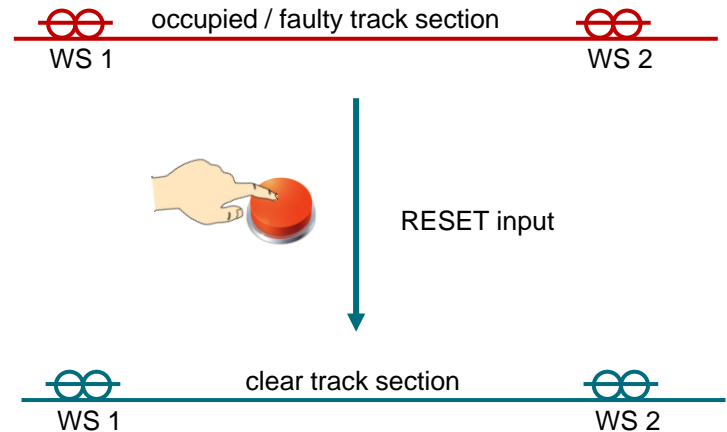
## OPERATION

- **On-track Equipment (AREMA Class A):**
  - 40°F to +185°F (-40°C to +85°C)
  - Waterproof and dustproof
  - No electronics
- **Wayside Equipment (AREMA Class C):**
  - 40°F to +167°F (-40°C to +75°C)
  - 100% non-condensing humidity

# Resets

Change from an occupied / faulty track-section to a clear status

- Resets are required after:
  - Power-up (e.g. commissioning)
  - Resolution of errors
  - Tests / maintenance work / exchange of boards
- Reset commands can be sent to the FAdC:
  - Remotely via Ethernet interface
  - Electrically via IO-EXB inputs (can be triggered locally or remotely)
  - Toggle buttons on AEB and IO-EXB



**SAFETY CONDITION:** no axles must be in a track section during reset execution



# Maintenance

# Maintenance

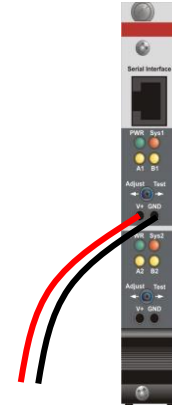
Preventive check required once every two years

## Outdoor Equipment

- RSR180 and SK140:
  - Visual and mechanical inspection
    - Mounting position
    - Correct torques
    - Physical condition
  - Verify track occupancy detection capability
    - i.e. regular train passing

## Indoor Equipment

- AEB:
  - Measurement of sensor current
    - Done with voltmeter or ASD



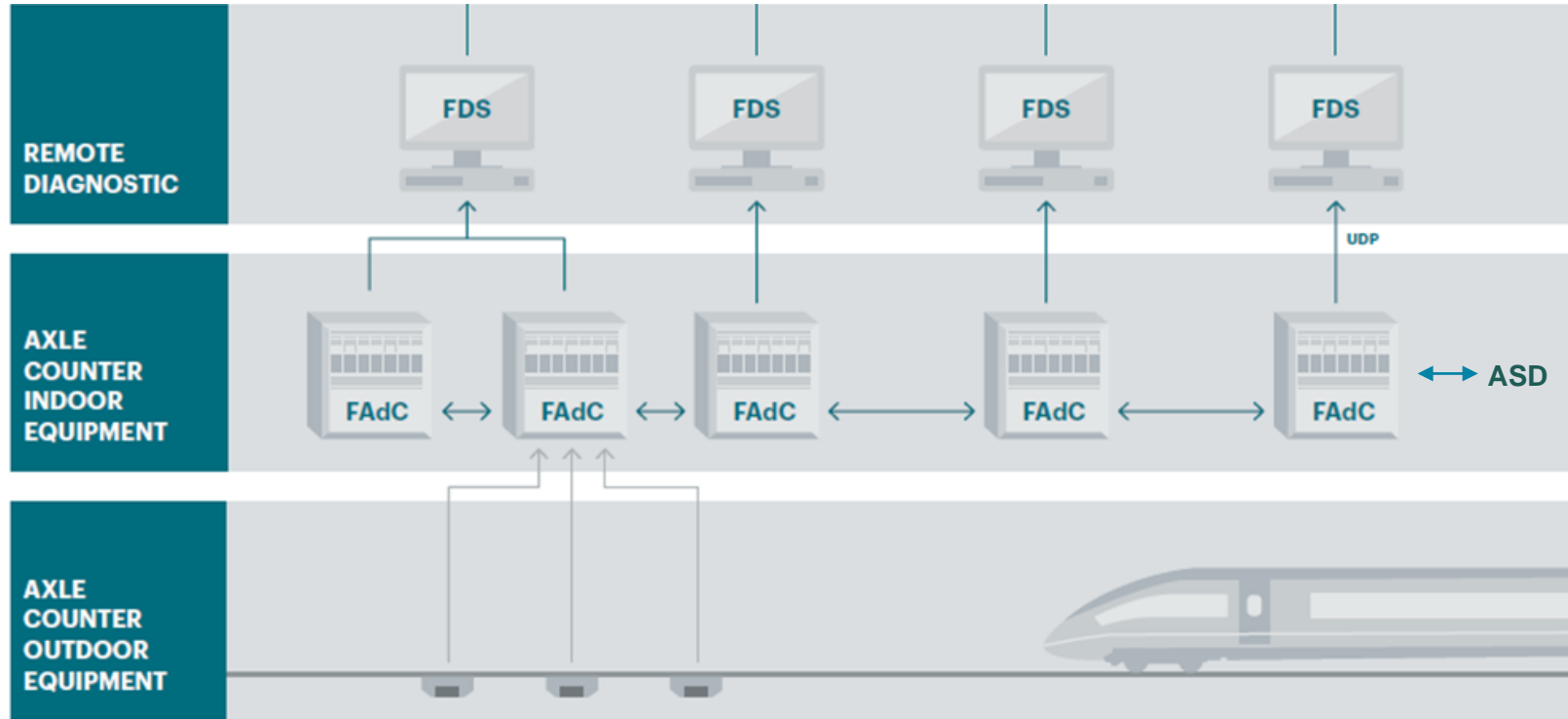
# Diagnostics and Monitoring

Advanced Service Display ASD

Frauscher Diagnostic System FDS

# FAdC® Diagnostics

Local and remote diagnostics



# Advanced Service Display ASD

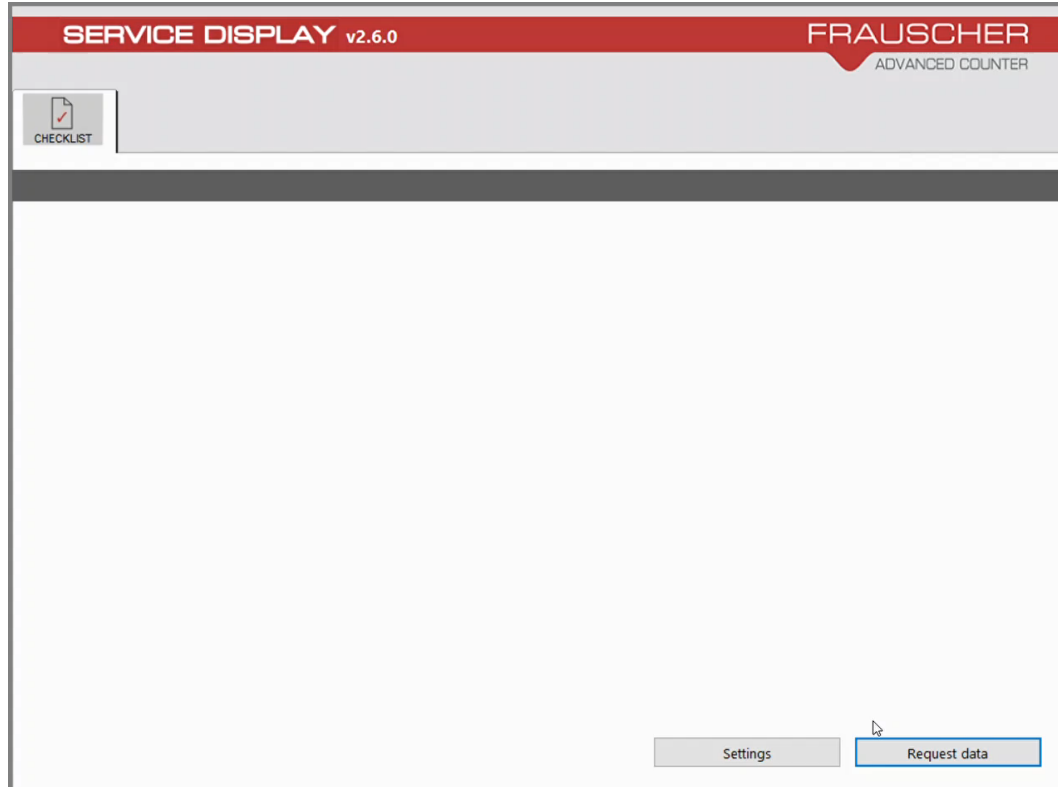
## Local diagnostics

- Tool for local diagnostics and implementation
- Request of AEB and COM boards
  - Status of board
  - Sensor system currents
  - Serial number
  - Diagnostic and error codes
- Verification testing
  - ID of the board
  - Version of configuration file
  - Checksum



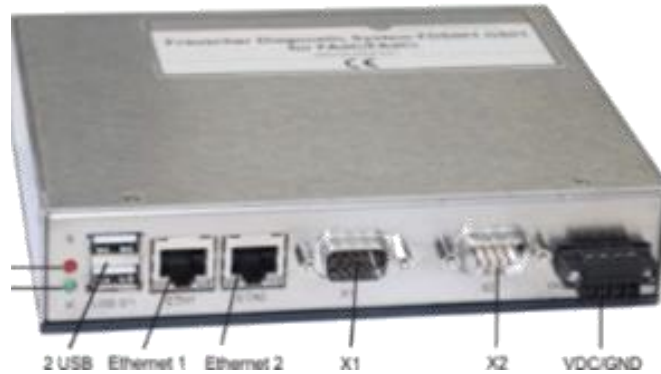
# Advanced Service Display ASD

GUI adapts information to the connected board



# Frauscher Diagnostic System FDS

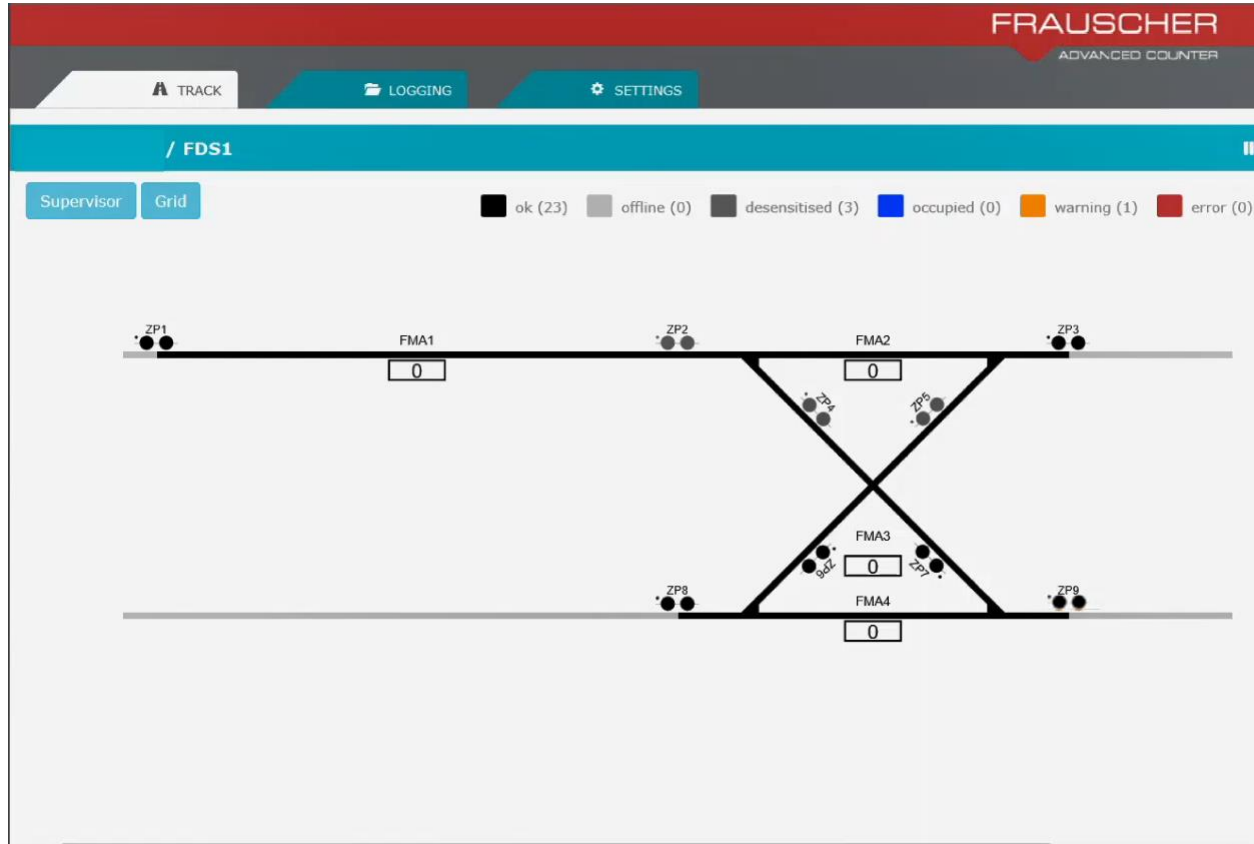
Remote monitoring via web-based GUI



- Status of track section
  - Clear, occupied, warning, error
  - Plain text error message (warning, error)
  - Number of axles within the track section
- Status counting head
  - OK, warning, error
  - Plain text error message (warning, error)
  - Counting Head Control  
(active / inactive)
- Information on resets and adjustments
- XML interface

# Frauscher Diagnostic System FDS

GUI





# Summary

- Easy to install and maintain
- Modular architecture
- Flexible interfaces





**Jon Lundberg**

Business Development

[jon.lundberg@us.frauscher.com](mailto:jon.lundberg@us.frauscher.com)



**Jae Lee**

Sales Engineer

[jae.lee@us.frauscher.com](mailto:jae.lee@us.frauscher.com)

## **Frauscher Sensor Technology USA**

21 Roszel Road, Suite 115

Princeton, New Jersey 08540

USA

**[www.frauscher.us](http://www.frauscher.us)**



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