Digital-inspired technologies that will make the Rail 4.0 a safe and efficient reality

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Company Facts

100% family-run, medium sized company

Financially independent company

Fast, independent decision-making

Long-term corporate - success over short-term results

Profits are reinvested, guaranteeing further growth
Our mission

We automate.

Safely.
The power of innovation
We automate. Safely

- Train Protection
- Rolling Stock
- Workshops
- Track Works
- Freight Transport
- Intermodal Transport
**Figure A-5**: Major accidents in Europe (ERA countries, 1988-2019)

Serious accidents resulting in five or more fatalities

- **Blue bars**: Serious accidents with five and more fatalities
- **Blue line**: 3-year moving average

*Source: ERAIL and Database of historical accidents - Courtesy of Andrew Evans, Imperial College London*
Report on Railway Safety and Interoperability

Figure A-6: Fatal train collisions and derailments (ERA countries, 1990-2019)

Accident and accident rate per million train kilometer

Source: ERAIL and Database of historical accidents - Courtesy of Andrew Evans, Imperial College London
Figure A-16: Significant accidents per type (EU-28, 2014-18)

Source: Common Safety Indicators (CSIs) as reported by National Safety Authorities (NSAs) to the Agency, published in ERAIL
Report on Railway Safety and Interoperability

Figure A-17: "Internal" and "external" significant accidents (EU-28, 2010-18)
Collisions, derailments and fires in rolling stock against accidents to persons and level-crossing accidents

Source: Common Safety Indicators (CSIs) as reported by National Safety Authorities (NSAs) to the Agency, published in ERAIL.
**Smart Sensors – IoT**
Condition and preventive maintenance
Enables Robotics implementation
Fully automates railroad traffic
Optimizes line capacity
Improves train safety

**Predictive Maintenance**
Increase line availability
Increases efficiency and safety
Allows Budget optimization

**Big Data**
Allows advanced computing
Increases efficiency and safety
Allows monitoring and active maintenance

**Cloud Computing**
Allows data availability
Increases speed decision
Increases security

**Artificial intelligence**
ATO implementation
Evaluates impacts on actions / investments
Allows Dynamic route planning
Diagnoses train and track condition
Challenges to improve competitiveness of the railway business

**Cost**
- Costs on rail raising faster than for road
- Way access charging, fuel prices, authorization
- Costs of infrastructure makes 15 - 40 % of overall costs for train operators

**Quality**
- Train delays due to old and diverse signalling technology
- Route availability threatened by shortage of crucial signalling components and knowledge

**New competitors/ Business models**
- New players with new business models
- Road mobility far ahead in IT-integration
- Autonomous driving decreases costs on road significantly

**Customers**
- Rapidly growing demands in information, and operational excellence
- Door-to-door solutions
- Total safety request
<table>
<thead>
<tr>
<th>Factor</th>
<th>Current situation</th>
<th>EULYNX</th>
</tr>
</thead>
<tbody>
<tr>
<td>Common Architecture</td>
<td>Not available</td>
<td>Standard architecture</td>
</tr>
<tr>
<td>European Standards</td>
<td>Weak and incoherent</td>
<td>Implemented and ready for Plug and Play</td>
</tr>
<tr>
<td>Formal Methods</td>
<td>In its infancy</td>
<td>Established</td>
</tr>
<tr>
<td>Time to market</td>
<td>Not transparent and hardly predictable</td>
<td>Pilots successfully in operation, shortening time to market</td>
</tr>
<tr>
<td>Lifetime</td>
<td>System life time imposed by interlocking life time</td>
<td>Independent life times of modules</td>
</tr>
</tbody>
</table>

Lifecycle savings up to **50 %**
- We provide flexible solutions to system integrators by facilitating certified secure hardware and software blocks.
- Reducing risk and increasing competitiveness by sharing developments
- Cost reduction
- System based on industry-proven principles: Modularity, pre-engineered solutions and standardization
Decentrality

PSS 4000-R is a true multi-master system. This means that several individual systems can be interconnected to form a network remote-controlled centrally.

To save wiring effort, I/O modules can also be combined decentrally and connected to the control head via the secure Ethernet connection.
Pilz Axle Counter Suite

Communication direct from Frauscher Axle Counter system to PILZ PSS4000

Benefits:
- 250+ Variables in PLC
- Train information
  - Direction and Occupation
  - Nr. of Axles and Speed
- Wheel diameter
- Diagnostics
**In development:** Standardized interfaces library based on Eulynx for Pilz software suite for communication with interlocking.

Software Function Block you can parametrize for multiple objects, e.g.:
- Point
- Level Crossing
- Train Detection
- Signaling (?)
- I/O
FUNCTION_BLOCK Calculate_CRC

VAR_INPUT
   arbyData : ARRAY[0..147] OF SBit2; //ARRAY[0..162] - Size of arbyData

VAR_OUTPUT
   outByteData : BYTE;

VAR
   bFlagParameterError : BOOL;

Array
   arbyExit;

Constant
   uiIndexData = 0;

END_VAR

BEGIN_procedure

  Parameter check

  IF ParameterOK THEN
    CASE uiAlgorithm3 OF
      1 : doCRC32C := CRC32C(4); // CRC32C(4)
      2 : doCRC35s := CRC35S(5); // CRC35S(5)
      3 : doCRC16H := CRC16H(6); // CRC16H(6)
      4 : doCRC16W := CRC16W(7); // CRC16W(7)
      5 : doCRC16D := CRC16D(8); // CRC16D(8)
      6 : doCRC16D := CRC16D(8); // CRC16D(8)
      7 : doCRC35v := CRC35V(9); // CRC35V(9)
    END_CASE;
  END_IF;

END_FUNCTION_BLOCK
Higher Efficiency

Retrofit

System openness makes it possible: old control systems can be replaced while retaining existing system components.
Proven Solutions

Our products and solutions are proven in applications of our system partners and customers
Pilz Safe Automation in Railway Infrastructure

Example: Level Crossing

Features and options

- SIL 3 or SIL 4
- Display for fast on-site diagnosis
- Remote control via safe Ethernet protocol SafetyNETp
Example: Retrofit. Remote control of relay operated interlockings.

- Safe transmission via fibre optics with safe Ethernet protocol SafetyNETp over a distance of 5 and 10 km resp.
- The remote interlockings operate 41 tracks, 40 points and 44 signals.
- Existing relay operated control desks have been integrated.