![RPS Rail Power Systems logo]

TracFeed® OLSP

Emergency Tunnel Earthing System

The Task

Railway links usually involve viaducts and tunnels to a significant extent to cross mountainous regions. Hence, tunnel safety is a major issue which additionally came under scrutiny after the recent series of disastrous fire accidents in road tunnels. Top priority must therefore be assigned to modern and effective tunnel safety concepts. Deutsche Bahn AG uses modern safety systems like Trac-Feed® OLSP in its tunnels.

In the event of a tunnel accident, passengers and rescue services are exposed not only to hazards from debris, fire and smoke but also from live overhead lines. In the case of tunnel fires in particular, a fast evacuation by means of self-rescue or external intervention is crucial, because the majority of the damage is avoided within the first 15 minutes of the incident occurring.

The railway service operator must ensure that all parts of the overhead traction voltage system are disconnected from the mains and earthed before rescue services can enter the tunnel. While disconnecting the affected section is typically done by a remote Energy Control Centre, earthing has to be performed manually on site.

It is therefore essential to ensure that an automatic emergency earthing system is provided that

- checks the voltage-free status of the overhead line
- automatically performs an earthing sequence
- verifies the successful earthing at both tunnel portals
- indicates the safe status to the rescue services

Normally, the earthing sequence is initiated by remote command from the railway operator´s Energy Control Centre immediately after the overhead line has been disconnected from the mains.

However, it must also be possible to carry out emergency earthing using OLSP on site. For this purpose, a control and display unit must be provided at all tunnel accesses where this can be done simply in a way that is comprehensible to the laymen.

As a safety-oriented system, the Emergency Tunnel Earthing System (ETES) is equipped equipped with self-monitoring functions, redundancies in communication lines, fail-safe-strategies and an uninterruptible power supply (UPS) to ensure a high degree of operational availability and to prevent any false notifications that would lead to dangerous situations for rescue services.

The technical specification for interoperability that is binding within the EU with regard to "Safety in railway tunnels" (TSI SRT) in conventional trans-European railway systems and in the trans-European high-speed railway system (EU 1303/2014) requires self-rescue materials for evacuation and rescue in the event of an incident in the infrastructure area and a way of earthing the overhead line or power rail in the energy area for tunnels over 1 km. The "Fire and catastrophe requirements for the construction and operation of railway tunnels" directive requires the installation of a system for automatic earthing and an overhead line status display for railway tunnels over 500 m long.

The Solution

TracFeed® OLSP has been developed to meet the functional and safety requirements of all relevant directives and standards. It fulfills the stringent demands of a safe, reliable and easy-to-operate solution perfectly. TracFeed® OLSP is certified by the German Federal Railway Authority (EBA) for installation in railway tunnels. Not just tunnels on high-speed routes such as Nuremberg- Ingolstadt but also other new tunnels such as the City Tunnel Leipzig and the route to Berlin-Brandenburg International airport are equipped with TracFeed® OLSP systems. Tunnels in the existing network will also be equipped with OLSP systems.

The Product

TracFeed® OLSP as an integrated, functional product consists of two parts: the automation and telecontrol system and the overhead line components. In addition, a number of services are necessary to install an ETES and to put it into operation. This includes preparation of the system design, including approvable documentation plus proof of conformity with the regulations pertaining to electromagnetic compatibility, project-specific engineering, supply, installation, commissioning and support of the approval process, through to maintenance of the system. All twelve phases of the lifecycle described in EN 50126 are covered.

Rail Power Systems is able to offer all components and the whole range of services necessary to set up an ETES. The customer benefits greatly from this "one interface philosophy", not only through streamlined project planning, but by avoiding interfaces to third-party components and through a higher standardisation of products (like disconnector or electrical drives) employed along the route.

TracFeed® OLSP can be used for all known network types. It can therefore be operated universally in 16.7 Hz, 50 Hz and direct current networks

Field picture from an interference calculation

The System Overview

The TracFeed® OLSP systems consists of
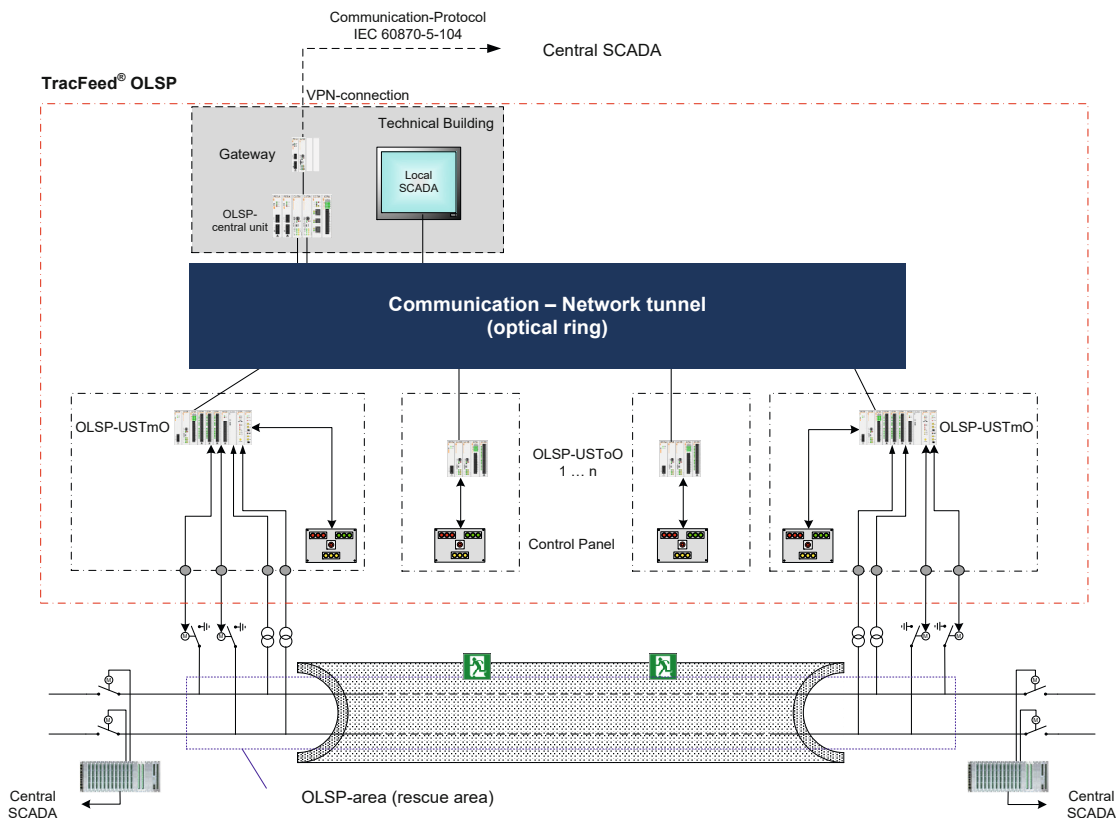
Primary equipment

- Earthing switches
- Remote switch drives
- Voltage transformer and
- "Safety limit for rescue team" warning signs

Secondary equipment

- With one OLSP unit and local control equipment per portal
- One OLSP unit with control panel for each rescue access
- One OLSP central unit for each ETES area

All TracFeed® OLSP units communicate via redundant communication links. The units at the tunnel portals monitor and control the assigned primary equipment and send the information to the ETES central unit. The ETES central unit collects and evaluates the system status and distributes the informaton to all other units.

Earthing normally takes place on the basis of a remote command from the operator's superordinate control centre. For on-site operation each OLSP unit has an OLSP controller and indication panel. All OLSP units are equipped with an uninterruptible power supply (UPS) for autonomous operation for up to 3 hours.

System overview TracFeed® OLSP

The Operation

Freely accessible TracFeed® OLSP control and indication panels are installed at all tunnel access routes, i.e. at the portals and at all rescue accesses. Each panel features three indicator lamps (green, yellow and red) and a control button. The indicator lamps show the status of the overhead line and the control button allows emergency earthing to be triggered on-site.

In case of an emergency, the operator's Energy Control Centre disconnects the overhead line and subsequently starts the earthing sequence of TracFeed® OLSP by remote control. If this procedure has been completed successfully, all panels show a green light to indicate that accessing the tunnel is safe. In addition, the earthed area is now visually restricted by collapsible signs that appear at the poles which have mounted earthing switches. As a result, a safe and clearly indicated overhead line condition has been achieved within a very short, period of time, meaning that, as required, this status has been established before rescue services arrive at the scene. The relevant TSI SRT tunnel safety requirement has therefore been fulfilled.

If the overhead line has been disconnected but not yet earthed (e.g. due to an interrupted communication between the ETES unit and the Energy Control Centre), the panels show a red light. The earthing sequence can now be initiated locally by pressing the control button at any of the control and indication panels. Successful termination again is indicated by a green light at all panels.

When the overhead line is energised, pressing the control button has no effect at all. Misuse of the ETES by trespassers during normal train operation is therefore not possible. In the unlikely event of an interrupted communication between the TracFeed® OLSP units, the blinking yellow lamp indicates the locally earthed status. To ensure that the overall situation is safe, all slave units with disconnector control – usually those at the tunnel portals – must show this yellow blinking indication which needs to be verified by personnel e.g. by means of radio communication.

Indicator lights	Meaning	Possible or necessary action/ comments
All indicators dark	⚠ **High voltage!** The catenary systems in the tunnel are **not** switched off!	Entering the tunnel is **not** possible
Red continuous light	⚠ **High voltage!** The catenary systems in the tunnel are switched off but **not** earthed!	By pressing the emergency button ('Earthing the catenary'), the railway earthing can be initiated. Entering the tunnel is **not** possible
Red flashing light	⚠ **High voltage!** The catenary systems in the tunnel are switched off, the railway earthing is currently being performed!	No action required. Wait for the indicator light to change. It is **not** possible to enter the tunnel!
Green continuous light	The catenary systems in the tunnel are switched off and properly earthed!	It is possible to enter the tunnel!
Yellow flashing light	The catenary systems in the tunnel are switched off. Proper railway earthing has not been confirmed as the communication of the individual stations is disrupted.	Check the indicator lights at the other control stations specified in the emergency plan. It is only possible to enter the tunnel when the indicator lights at these control stations are also flashing yellow.

TracFeed® OLSP quick reference guide control panel

The Conclusion

TracFeed® OLSP improves tunnel safety significantly by providing reliable and easy-to-operate emergency earthing of the overhead line. Rescue services immediately get a clear indication of the overhead line status and, if necessary, are able to perform an on-site emergency earthing at the push of a button.

TracFeed® OLSP has been developed under the strict rules applicable to safety-relevant devices and is certified by the German Federal Railway Authority (EBA). This Emergency Tunnel Earthing System concept has been installed about 50 times, comprising more than 180 units. The most recent references for TracFeed® OLSP include the highspeed rail link Nuremberg – Ingolstadt, the rail connection to Germany's new capital airport Berlin Brandenburg, the Katzenbergtunnel on the Rhine Valley line Karlsruhe – Basel and the City-Tunnel in Leipzig.

The TracFeed® OLSP has also been used under the respective country-specific designation and design in Austria as OLSIG as part of the projects "Wienerwald Tunnel", "Arlberg Tunnel" and "Lainzer Tunnel" as well as in Switzerland as AEE as part of the projects "Zurich Cross-City Link" and "Gotthard Base Tunnel".

With TracFeed® OLSP, Rail Power Systems is able to offer an integrated Emergency Tunnel Earthing System, including all relevant components and services, from one source.