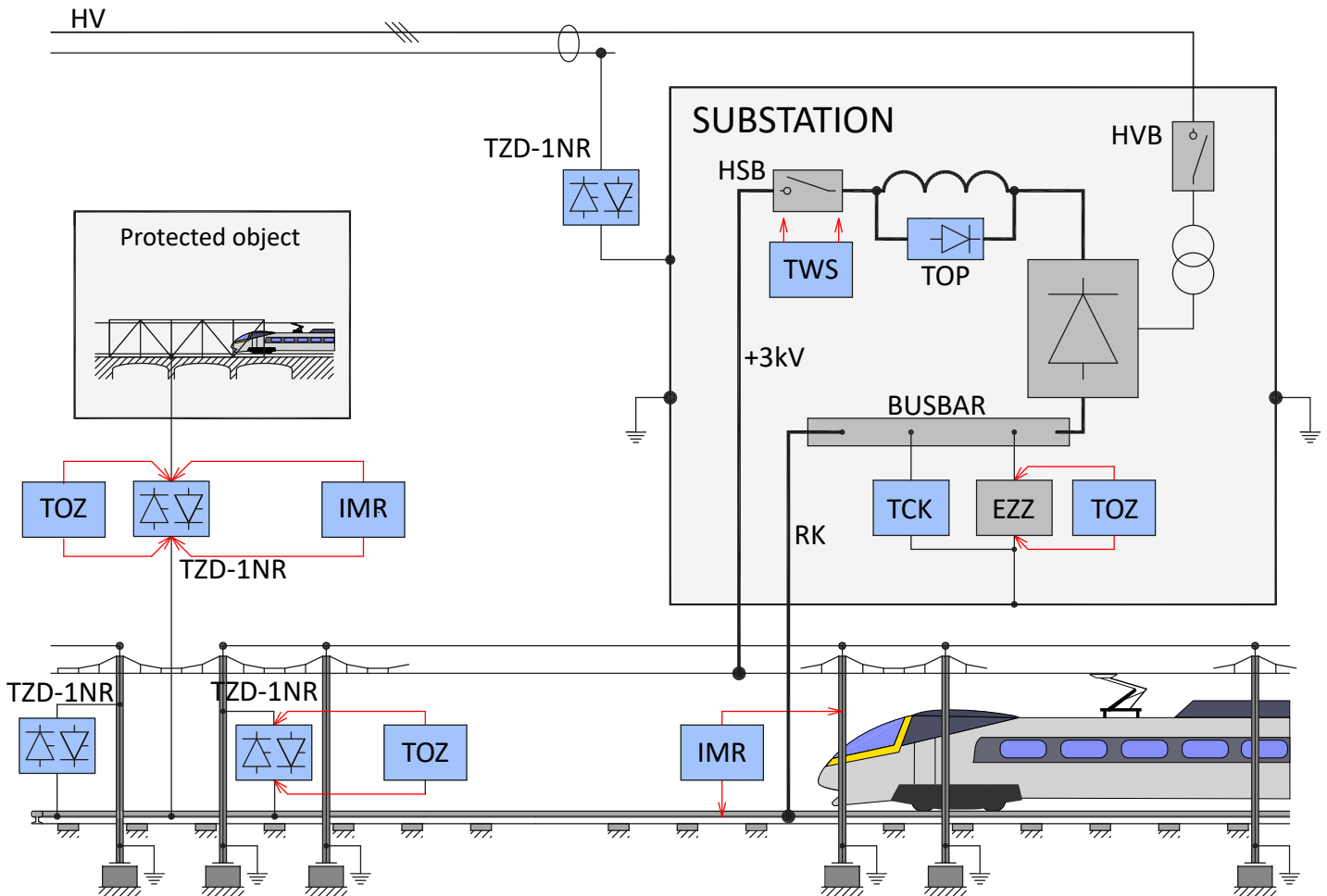


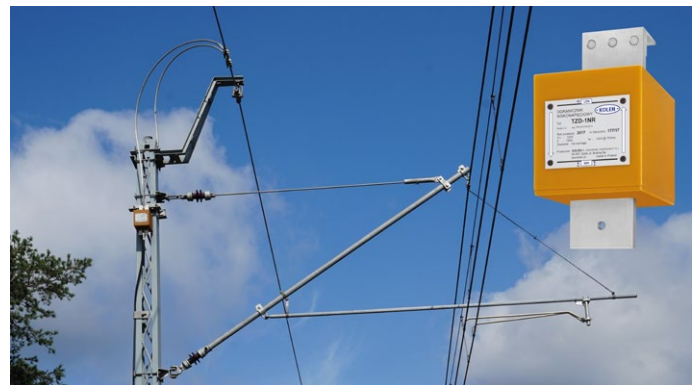
Since year 1992, KOLEN is leading manufacturer of all kinds of instrumentation dedicated to earth-fault protection in DC railway traction system and instrumentation dedicated to limit stray-currents in the whole supply network. Based on the extensive experience, KOLEN offers also technical consultancy services in the field of earth-fault protection and all kind of issues related to stray-current limitation.

## KOLEN SOLUTIONS FOR THE EARTH-FAULT PROTECTION SYSTEM



Earth fault protection system with voltage limiting devices TZD/EZZ assures that earth-faults in the area of substation, power supply HV cables and rail traction are switched-off. Thus, proper level of protection against impermissible touch voltages and limitation of stray current down to minimum values is achieved. Voltage limiting device TZD connected between substation earthing and cooper shield of HV cables eliminates electrical connection (bond) between railway, tramway and subway through powering system. Thyristor overvoltage limiter TOP improves working conditions of high speed circuit breaker HSB. All devices manufactured by KOLEN are marked in the figure above.

### TZD VOLTAGE LIMITING DEVICE



**Voltage limiting devices TZD-1NR** are designed for open connection between running rails and common buildings (railway support, bridges, viaducts). Voltage limiting devices assure that earth-faults and short circuits between catenary and protected objects are switched-off. Nominal voltage threshold level is 120 V for rail traction, 60 V for tram traction (TZD-1NR/T) and others. Patent Nr 170994.

### TOZ TESTER OF VOLTAGE LIMITING DEVICES

Tester of voltage limiting devices TOZ is designed for test and verification of TZD devices. All functional test can be performed without powering-off the traction system. TOZ is portable, enclosed in a case and powered from internal battery. Tester TOZ can be also used for tripping testing of earth-fault protection devices EZZ and its predecessor TUZZ.



### IMR IMPULSE METER OF RESISTANCE

IMR meter is dedicated to earth electrode resistance measurements in the vicinity of DC railway traction systems. Unique measurement method eliminates impacts of inductance, DC voltage level and harmonics of power supply network on the measurement result, which is a huge advantage compared to commonly used measurement equipment. Measurement can be performed with only two electrodes (when current probe resistance is known, i.e. railway or tramway running rails, station earthing) or with three electrodes when the third electrode acts as reference earth. IMR meter is battery powered. Patent Nr 199600, Certificates IEL Nr Z/1460/0001/2010 and N/1460/0001/2010.



### TCK RETURN CABLE CONTINUITY TESTER

Return cable continuity tester TCK installed in the traction substation monitors the resistance of the circuit consisting of: substation earthing resistance, rail to earth resistance and return cables resistance. Exceeding the threshold resistance value causes either notification or powering-off substation depending on the value of the resistance. In most practical situation, too high resistance indicates broken return cables. Patent Nr 171001.



### TWS-6000 TESTER OF HIGH SPEED CIRCUIT BREAKERS

High speed DC circuit breaker tester TWS is designed for inspections of overcurrent tripping release settings, making capability, switch-off time and main contact resistance of High Speed DC Circuit Breakers. Optionally, it can also be used for testing of relays and current sensors. Battery of supercapacitors is used as the energy source. Power consumption from 230 VAC supply network is up to 2 kVA, output current is up to 6000 A, weight 50 kg. Patent Nr 206036. Certificate IEL Nr 0788/NBR/2010.

