Company KONČAR - ELECTRIC VEHICLES Inc. upgrades electric locomotives, electric multiple unit and electric tramcars. Upgrading proceedings comprise the application of the most recent technological solutions for main subsystems such as:

- main and auxiliary drive electronic converters
- micro-processing control systems
- air conditioned and ergonomically modelled driver cabs

Any upgraded electric traction vehicle is brought to a higher technological level resulting in:

- exploitation and maintenance cost reduction,
- enhanced reliability and availability,
- better working conditions.

Due to rationalization, general overhaul of the vehicle is generally performed within the frames of modernisation. Any upgrading programme comprises all functional units of the vehicle, while the solutions applied provide for an optimum cost-effect ratio.

KONČAR performs type and serial tests and inspections of electric vehicles and equipment as well.
MODERNISED ELECTRIC VEHICLES

Bo’Bo’ LOCOMOTIVES
- 25 kV, 50 Hz
- 3860 kW
- 120-140-160 km/h
Customers: Croatian Railways, Railways of Federation of Bosnia and Herzegovina, Serbian Railways, Macedonian Railways, Romanian Railways, Turkish State Railways

Bo’Bo’ LOCOMOTIVES
- 25 kV, 50 Hz
- 3020 kW
- 130 km/h
Customer: Bulgarian State Railways

Co’Co’ LOCOMOTIVES
- 25 kV, 50 Hz
- 5100 kW
- 130-150 km/h
Customer: Bulgarian State Railways

ELECTRIC MULTIPLE UNITS
2’2’-Bo’Bo’-2’2’
- 25 kV, 50 Hz
- 1240 kW
- 120 km/h
Customers: ŽTO Sarajevo, Federation of Bosnia and Herzegovina, ŽTP Zagreb / HŽ Zagreb, Croatia

TRAMCARS
- 600 V DC
- 240 kW
- 60 km/h
Customer: ZET Zagreb, Croatia
DIGITAL CONTROL SYSTEM FOR TRACTION APPLICATION

Digital control system is used for modernization (thyristorization) of old diode locomotives and supports: control, regulation, measuring, sequencing, protection, supervising and communication. It’s software allows for the easy designing of a particular traction application because of the wide range of hardware modules available as well as flexible programming. Digital control system has been successfully certified in exploitation and continuously improved and extended with new features.

THYRISTOR CONVERTER

Replacing diode converters with thyristor converters and implementing the digital control system for traction application enables the conversion of old diode locomotives into modern thyristor locomotives with superior traction and exploitation characteristics, of which we would highlight: continuous speed and torque control of traction motors; sequential control of thyristor bridges; limits consumption of reactive power; use of reliable and already proven electromechanical and electronic components and units decreases repair and maintenance costs and facilitates spare parts management; easy control and automation simplify and facilitate the work of engineering and traffic staff.

**TECHNICAL DATA**

- **Rated input AC voltage:** 1144 V; 50 Hz
- **Permissible input voltage deviation:** from 70% to 120% Un
- **Rated DC voltage - rated voltage of traction motors:** 870 V
- **Rated DC current:** 1180 A
- **Permissible over currents:** 1250 A (1h); 1715 A (5min)
- **Cooling:** forced in the existing cooling system
- **Permissible ambient temperature changes:** from -35°C to +40°C
- **Air flow in heat sink:** 1.8 m³/s
- **Relative humidity of cooling air:** 100%
- **Size (W x L x H):** 770 x 575 x 840 mm
- **Mass:** 150 kg
- **Standards:** IEC 60146; IEC 61287-1; UIC 616 VE

OVERVOLTAGE PROTECTION

Overvoltage protection protects sensitive semiconductor valves (thyristor and diodes) against discharging, direct lighting strikes on contact lines and switching off the inductive loads. Overvoltage suppressing is based on the absorption of impulse wave energy and its dissipation into heat by means of polarized RC-circuits.

**TECHNICAL DATA**

- **Rated input AC voltage:** 4x1144 V, 104V; 50 Hz
- **Maximum input voltage:** 120% Un
- **Cooling:** natural and forced air cooling (for resistance unit)
- **Permissible ambient temperature changes:** from -35°C to +40°C
- **Relative humidity of cooling air:** 100%
- **Size (W x L x H):** 810 x 350 x 1660 mm
- **Mass:** 150 kg
MULTIOUTPUT AUXILIARY POWER SUPPLY CONVERTER 
FOR ELECTRIC LOCOMOTIVES

PJUT-2 is intended for application in new and for the refurbishment of existing locomotives. The converter is based on cutting-edge philosophy with excellent characteristics such as: modularity, IGBT technology, microprocessor control, detailed diagnostics and communication with overriding control system. PJUT-2 provides power supply for traction motor blowers, brake resistor blower, transformer oil cooler blower, pump, compressor, HVAC and all electric locomotive DC consumers.

TECHNICAL DATA
Nominal power: 4 (5) x 52 kVA + 6 kW
Input voltage: 1 x 900 V, 50 Hz
AC Outputs: 4 (5) x (3 x 56-400 V, 7-50 Hz)
DC Output: 135 V (72 V), 50 A
Location: machine compartment
Cooling: forced air
Size (L x W x H): 1360 x 900 x 1675 mm
Mass: 1450 k

MULTISYSTEM STATIC CONVERTER

VIS 50-1 is state-of-the-art static converter that provides the power supply for air conditioned passenger coaches with any of the conventional power supplies on European railways, contributing significantly to passenger comfort.

TECHNICAL DATA
Nominal power: 50 kVA
Input voltages: 1000V, 16 2/3Hz (22, 50Hz)
1500V, 50Hz
1500V DC
3000V DC
Output voltages: 3x400V, 50Hz, 22 kVA, sinus
3x400/230V, 50Hz, 8kVA, sinus
3x (82-400) V, (20-87) Hz, 30kVA, sinus
30V DC, 6kW
Total power factor on AC input: >0.95
Efficiency: approx. 91%
Temperature range: -25ºC to +40ºC
Size (L x W x H): 2750 x 2090 x 605 mm
Mass: 1600 kg
International standards: complies with UIC, IEC and RIC

LEVEL CROSSING

- the built-in equipment meets safety requirements for remote-controlled level crossings and EN50126, 50128 and 50129 requirements
- the central logical device is designed as flexible solution meeting specific traffic and interlocking requirements

LEVEL CROSSING CONSIST OF

WAYSIDE EQUIPMENT
- road signals (up to 6) with bells
- half-barriers (up to 4)

INDOOR EQUIPMENT
- central logic equipment racks
- motion sensor racks
- rectifiers
- storage batteries (maintenance free)
- cabinet (thermally insulated)
equipped with:
- distribution panel with FID switch 25/0.5A and automatic fuses
- box with inductor telephone and local control switch
- floor openings for cable entry
- earthing busbar
- measuring-connection box with single (three) - phase kWh-meter and main fuse (where required)
CENTRAL LOGIC EQUIPMENT
• safety principle of 2 of 2 - systems A and B are fully independent physically and functionally
• self-check circuits built in each module
• central logic is galvanic separated from batteries and wayside equipment
• surge protection
• events recording

FUNCTIONS
• control and supervision of wayside equipment
• permanent control of main auxiliary bulbs on the road signals
• control of position of half-barriers in the upper and lower position
• control of half-barriers integrity
• flasher function
• programmable pre-ringing time
• built-in diagnostics tools - module status LED indicators plus diagnostic messages on the diagnostic module - rapid troubleshooting

ELECTRIC TRACTION SUBSTATION 110/25 KV
• two phase connection on 110kV overhead line
• outdoor 110 kV switchyard
• 110/25 kV transformers
• indoor 25 kV switchgear
• use of numeric relays for the protection
• three level control

SWITCHYARD 110 kV
• outdoor mounting equipment
• 123 kV rated voltage level
• 2-pole SF-6 circuit breakers
• 2-pole center break rotary disconnectors
• oil immersed current transformers
• oil immersed inductive voltage transformers

SWITCHYARD 25 kV
• 38 kV rated voltage level
• indoor mounting equipment
• 1-pole vacuum circuit breakers (wheels - truck)
• 2-pole / 1-pole vertical break disconnectors
• epoxy resin cast current transformers
• epoxy resin cast voltage transformers
• 25/0.22 kV auxiliary transformer
TRANSFORMERS
• one phase power transformer with on-load trap-changer
• 7500 MVA / transformation ratio 110000/27000 +/- 10X1.5% V
• ONAN cooling

CONTROL AND PROTECTION
THREE LEVEL CONTROL:
• manual
• local (mimic panel / computerized)
• remote

PROTECTION:
• overcurrent
• transformer guard
• overvoltage
• tank-earth
• distance protection
• Buchholz relay
• temperature protection

SWITCHGEAR FOR PRE-HEATING AND AIR-CONDITIONING OF THE PASSENGER COACHES
• 25 kV contact network supply
• two transformers
• overload and short-circuit numerical protection
• line protection with ultra fast fuse
• control cubicles with one or two lines

TRANSFORMER STATION 25/1,5 kV
• equipment 25 kV
• transformers 25/1.5 kV, 500 kVA
• equipment 1,5 kV
• DC system

CUBICLE 1500 V
• with one or two line connector
• tripping contactors
• short circuit fuses
• thermal overload protection
• transformer 1500/50 V
• checking of installation with 50 V