ŠKODA

ATO
AUTOMATIC TRAIN OPERATION SYSTEM

ATO

DESCRIPTION

The ATO system performs the function of automated train control. Its primary purpose is to automate the driver's tasks and to plan the journey with respect to the timetable and energy consumption.

This is a semi-automatic train control, where the presence of a driver is required to deal with emergencies and unexpected events. Responsibility for the operational safety is delegated to the train protection system and the driver. Turning off the device does not affect the operability of the train.

ATO was designed as a supplement of the train control system (TCS) and the train protection system (ATP). The control units are installed in each vehicle head car. The system uses Ethernet communication lines for data exchange between head cars and other train subsystems.

Operating modes include driver assistance and automatic operation. In automatic operation mode, the system guides the specified speed with an adjustable limit of acceleration and jerk, stabilizes the speed using information about the slope profile of the track, regulates braking to the speed limitation on the track and stops according to a dynamically generated braking profile. Driving and braking modes are controlled by TCS by a unified signal of relative force and the required speed obtained from ATO.

The positioning subsystem is based on its own odometry (distance, speed, acceleration) and position information from a multiband GNSS (GPS / Glonas / Galileo / Beidou satellite navigation) and balises.

The ATO system uses information from the infrastructure operator obtained by a shared communication channel (not part of the system) i.e. a timetable update, information of track conditions and additional RTK parameters for GNSS navigation.

KEY FEATURES

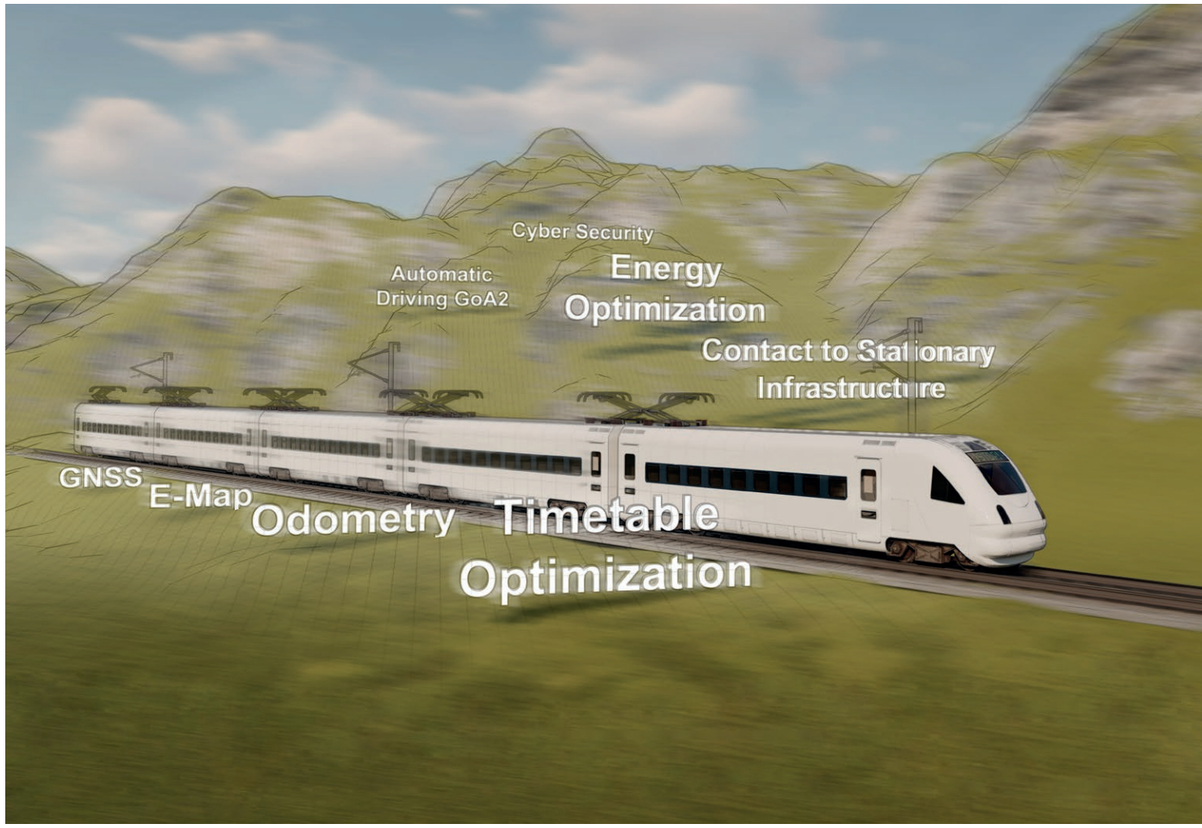
- Automation category GoA 2 according to UITP classification.
- ATO and Driver Assistance (DAS) modes.
- In ATO automatic mode, speed limitation is in accordance with the track speed profile.
- System response to train protection system commands.
- Position subsystem based on own odometry.
- Position information obtained from GNSS multiband satellite navigation and trackside balises.
- Automatic stop in station with an accuracy corresponding to the quality of the position information from GNSS; typically ± 2 m.
- Time and energy optimal driving according to the timetable and infrastructure operator commandability to speed up.
- Electronic track map support with the possibility of user changes.
- Provision of data for displaying assistant and operating information on the driver's display.
- Provision of position information for other train subsystems.

DEVICE MODELS

High Performance Computer.ATO.DI8PS15GNS.A	1× P75, 1× CPU, 1× IFC, 1× DI8.A, 1× PS15.A, 1× GNS.A
High Performance Computer.ATO.DI16PS15PS24GNS.A	1× P75, 1× CPU, 1× IFC, 2× DI8.A, 1× PS15.A, 1× PS24.A, 1× GNS.A

STANDARDS

EN 50155; EN 50121-3-2; EN 61373; EN 50657; ГОСТ 33436.3-2-2015 (IEC 62236-3-2:2008); ГОСТ 33787-2016; ГОСТ 14254; ГОСТ Р 54434



OPERATING CONDITIONS

Operating temperature range	-40 to +70 °C	Class TX according to EN50155
Supply voltage	24 V DC, Class 52	Range according to EN 50155
Power input	< 20 W	
Galvanic isolation	1,000 V AC, 50 Hz	
Relative air humidity	80% at 20 °C	
Shock & Vibration	Category 1, Class B	
Altitude	Up to 1,400 mm	Class A1 according to EN 50125-1
Case dimensions (w × h × d)	206 × 133 × 123 mm	Rack or wall-mounted
Weight	< 3.5 kg	
Cooling	Natural	
Protection	IP20	
CPU	QarIQ LS1043A	4× Cortex-A53 64-bit cores at 1.0 GHz
Memory	1 GB DDR RAM, 256 MB NOR Flash, 2 MB MRAM	SD Card slot
Link to TCMS, ATP and PIS	Yes	Necessary. Ethernet communication, 2× 1000BASE-T
GNSS signal processing	Yes	Multiband GNSS antenna (L1/L2/L3) with LNA, cable length 5 m, SMA
Speed sensors signal processing	Yes	Up to 4 dual channel speed sensors.
Modem LTE	Optional	
Own display unit	No	System provides data for visualization.
Link to stationary infrastructure	Yes	Necessary. Timetable, track conditions, RTK for GNSS.

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