IMPULSE

On-board safety system «ImproTRAIN-250»

SRPA «Impulse» - the leader of the Ukrainian market of instrumentation and control systems of critical infrastructure facilities

Areas of activity: development, manufacture, supply of railway automation systems; automation and safety systems for NPPs; digital relay protection equipment.

Competences and proposals for railways:

- Microprocessor electrical and traffic control system.
- System of train separation based on digital track circuit and axle counting equipment.
- Locomotive safety system (SLB «ImproTRAIN-250»).
- Rolling stock monitoring equipment: temperature control of axlebox units; means for creating hierarchical centralized structures.

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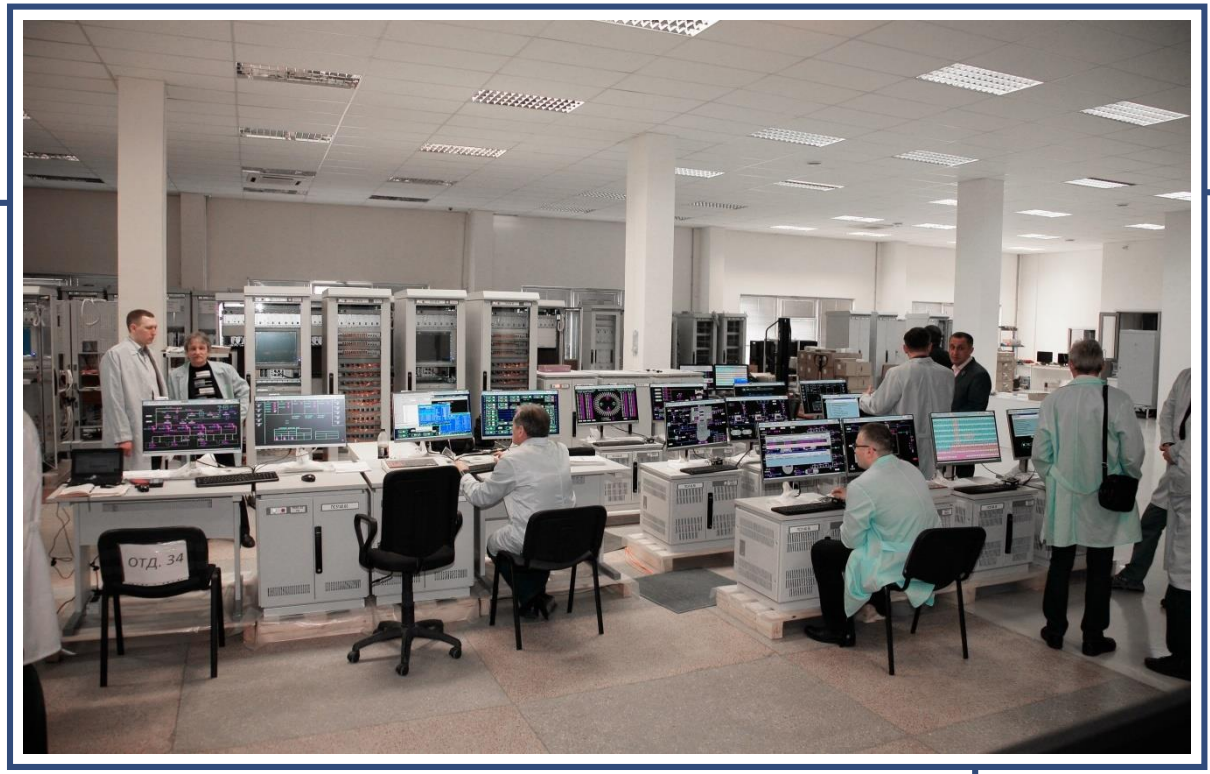
Certified systems in place for compliance requirements:

- quality management system ISO 9001:2015;
- environmental management ISO 14001:2015;
- occupational health and safety management ISO 45001:2018.

In 2022, the company successfully passed a compliance audit Siemens to suppliers (External Sustainability Audit).

Obtained the status of an official supplier of Siemens Mobility.



SRPA «Impulse» - the leader of the Ukrainian market of instrumentation and control systems of critical infrastructure facilities

Gained experience:

- More than 100 systems have been put into operation of railway automation, including in the European Union.
- The railway automation platform developed by SRPA «Impulse» is certified in the EU for SIL4 level (according to CENELEC standards).

CERTIFICATE

Number 9_OCN/CCS/2307/EN/2024-01/V01

TINSA

Certifying Body	„TINSA" Ltd 3A, Nikolay Haytov St., 1113 Sofia, Bulgaria A Product Certification Body „NB and DB" No9_OCN Accreditation of BDS EN ISO/IEC 17065:2012 and MNB – Assessment scheme 003:RA1044, ver. 2.0, by the order of BAS BP 8478/08.11.2023
Certificate Holder	Private Joint Stock Company Severodonetsk Research and Production Association "Impulse" Verbova st., 17a, Kyiv, 04073, Ukraine
Assessed Product	Computer based Interlocking System „MPC-U" (Modification and Upgrading - No1 and No2)
Manufacturer	Private Joint Stock Company Severodonetsk Research and Production Association "Impulse" Verbova st., 17a, Kyiv, 04073, Ukraine
Legal base	BDS EN 50126-1:2018, BDS EN 50126-2:2018, BDS EN 50128:2011, BDS EN 50128:2011/A2:2021, BDS EN 50129:2019, BDS EN 50159:2010 и BDS EN 50159:2010/A1:2020
Result of the Assessment	This Certificate is the result of the application of a documented procedure by the Certifying Body for assessing of the safety integrity level of equipment for modification and upgrading No1 and No2 of the previously certified product "Computer based Interlocking System MPC-U" (see Annex, Clause 5) for compliance with safety integrity level SIL4. From presented evidences on application of the targets, methods and means to ensure safety at the stages of development/ design, manufacture, validation and operation of the equipment for modification and upgrading No1 and No2 of the MPC-U, as well as based on the assessment results presented in the report SIL_REP_2307_CCS_BG_2024_1, Certifying Body certifies that modification and upgrade objects No. 1 and No. 2 for various independent applications (Generic Product) „Computer based Interlocking System MPC-U" fulfils the quantitative and qualitative requirements for safety integrity level SIL4 in accordance with BDS EN 50126-1:2018, BDS EN 50126-2:2018, BDS EN 50128:2011, BDS EN 50128:2011/A2:2021, BDS EN 50129:2019, BDS EN 50159:2010 and BDS EN 50159:2010/A1:2020. Within the first specific application for objects Nos. 7, 9, 10, 11 and 12 (see Annex A, Clause 5), performance tests shall perform and the Certifying Body must be informed about the test results.
Annex	The Annex A of 11 pages is an integral part of this Certificate.
Validity period	Unlimited. This certificate is valid for the equipment for modification and upgrading No1 and No2 of the product "Computer based Interlocking System MPC-U", whose production is performed in accordance with the mentioned in the Annex A list of documentation.
Head of the Product Certification Body „NB and DB" „TINSA" Ltd.	Eng. Borislav Boiadjiev, PhD
Date and Place of issue:	25.01.2024, Sofia

Currently, projects for railways are being implemented:

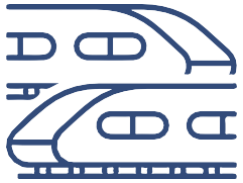
- Equipping the rolling stock of JSC «Lithuanian Railways» sets of ImproTRAIN-250 (186 pcs.).
- Manufacture and commissioning of centralized traffic control system for JSC «Ukrainian Railways», covering 1148 km of railway lines, including 122 stations, 267 open tracks/level crossings, 3466 points, 4725 traffic lights, 4304 track circuits.
- Manufacturing and commissioning of microprocessor track circuits (2460 pcs.) for Estonian Railways Ltd under the contract with Siemens.
- Deliveries of 190 sets of hot axle box detection system.

Train traffic safety issues

The main cause of major railroad derailments and accidents is the "human" factor (more than **90**% of cases).

Statistically, the most common violations are:

- passing a traffic signals with a prohibited aspects;
- improper brake control;
- exceeding speed limits.



On-board safety system **ImproTRAIN-250** is one of the solutions to increase traffic safety and minimize the influence of the «human» factor.

The system assures the highest operating safety level in accordance with the requirements of industry national standards, standards of the «1520 area» and the European Union.

Since 2019, SRPA «Impulse» mastered serial production and implementation of **ImproTRAIN-250** on railways of general use.

Based on the results of positive experience of application in Ukraine and Baltic countries on rolling stock of various types **ImproTRAIN-250** was selected as a new safety system for the entire rolling stock fleet of **JSC «Lithuanian Railways»**.

Main functions of ImproTRAIN-250

- Monitoring speed movement on a continuous basis and initiation emergency brake application in case admissible maximum speed is exceeded.
- Exclusion passing signals with prohibitive aspects.
- Exclusion unauthorized movement of a locomotive (rolling).
- Generating a value of admissible speed of movement using signals of ALSN, a radio channel, data of an electronic map.
- Displaying distance to an actual obstacle with giving speed it is passed with (speed target).
- Service brake application through a brake valve attachment on a command transmitted through a digital radio channel.
- Determining speed and a coordinate of a locomotive based on information from satellite navigation devices and distance and speed sensors.
- Monitoring vigilance of a driver.

The impact of using ImproTRAIN-250

Implementation of ImproTRAIN-250 on rolling stock will allow:

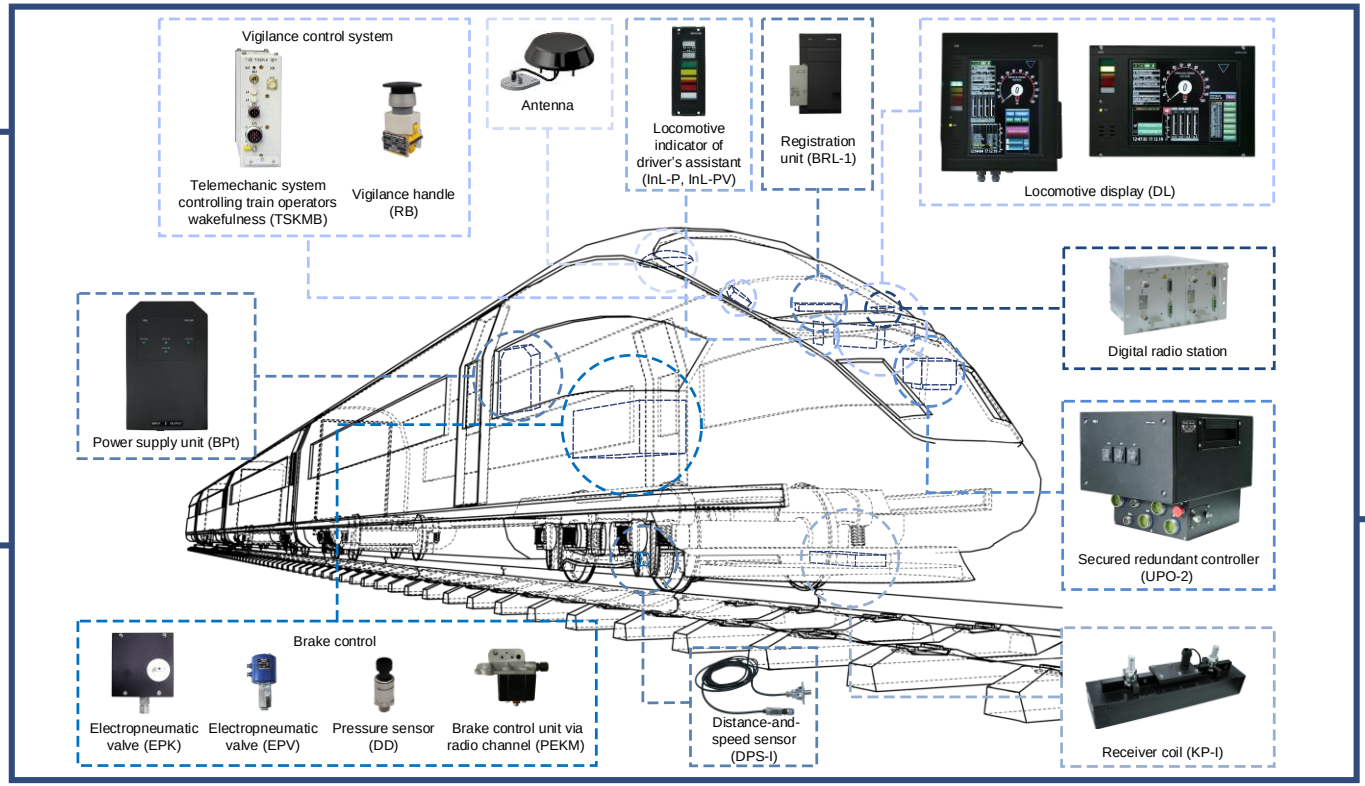
- Operating safety increase of rail traffic due to a multi-level system monitoring train parameters, infrastructure, and a driver actions.
- Improve locomotive availability due to high reliability of the SLB equipment, which has two-, threefold back up.
- Significantly reduce labour and financial costs for maintenance of traffic safety equipment.
- Eliminate ‘paper technology’ through the use of a contactless electronic logging device.

- Increase the time to take measures to stop a train in the event of a safety hazard by using calculations that take into account the dynamics of the movement and train characteristics (locomotive type, train weight, brake type, etc.), which reduces the probability of material damage.
- Optimise speed, save energy, fuel and increase the lifetime of braking equipment.
- Switch to ‘predictive maintenance’ maintenance of safety equipment due to self-diagnostics (without removing it from the locomotive and using external stands).

Main features of ImproTRAIN-250

- Universal - application for any type of rolling stock.
- High survivability - ‘single failure’ tolerance due to deep self-diagnosis and reconfiguration (2oo3d → 2oo2d).
- The frequency of occurrence of dangerous failures is not more than one in 70 thousand years.
- Recording of all trip information to a tamper-proof contactless cassette and back-up archive.
- Availability of an archive of ALS frequency signals with reference to coordinates for further analysis and diagnostics of signalling equipment.
- Interaction with other on-board systems via digital interfaces.
- Communication with higher-level systems via radio channel (via the secure exchange protocol «EuroRadio» (UNISIG Subset-037)).
- Cybersecurity.
- Protected case and small dimensions.
- User-friendly interface.
- Operational support and service from the manufacturer for the entire life cycle of the system.

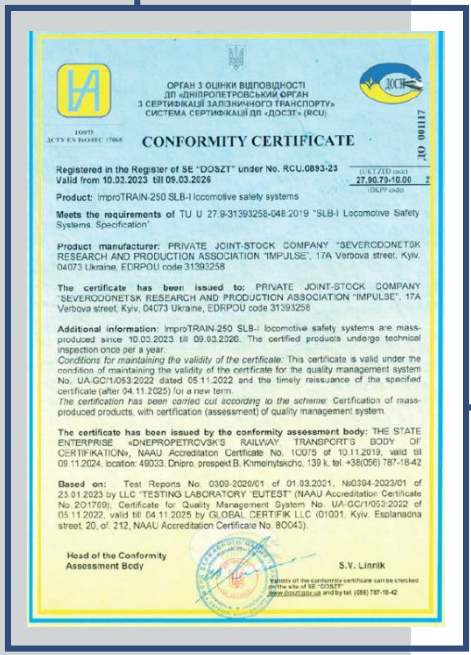
Structure of ImproTRAIN-250



Unit	Place of installation
DL-1, DL-2, DL-3 driver's display	Cab
InL-PV, InL-P indicating unit of an assistant	Cab
BRL-1 information registration unit	Cab
KR-1 removable contactless registration cassette	Cab
RB vigilance handle	Cab
Safe redundant controller (UPO-2)	Body / cab
Electropneumatic valve (EPK)	Cab
BPt power supply unit	Body
DD pressure transducer	Body / cab
DPS-I distance and speed sensor	Box
KP-I receiver coil	Under the body
Antenna of a satellite navigation system and radio channel	Roof
Digital radio station	Body / cab
Unit to control brakes through a radio channel (PEKM)	Body / cab

Main technical characteristics of ImproTRAIN-250

- The functional safety integrity level corresponds to SIL 4 and level 4 (DSTU 4178).
- Compliance with the requirements for electromagnetic compatibility - EN50121-4 (SOU 45.020-00034045-002). Emission level of industrial radio interference - EN50121-3-1 (class D5 according to GOST 30429).
- Conformity to EN50155 mechanical requirements (SOU 45.020-00034045-002).
- The accuracy of the navigation solution of satellite system signal receivers is ± 5 m.
- The accumulation time of information in the registration cassette is at least 140 hours.
- Actual speed measurement with absolute accuracy:
  - ± 1 km/h - in the speed range from 0 to 80 km/h;
  - ± 2 km/h - in the speed range from 81 to 250 км/ч.
- Degree of protection of equipment enclosures:
  - IP54 - in the cabin and body of the locomotive;
  - IP56 - outside the locomotive body.
- The range of measurement of pressure in the brake system is from 0 to 1.0 MPa. The basic absolute error of pressure measurement does not exceed ± 0.02 MPa.



ОРГАН З ОЦІНКИ ВІДПОВІДНОСТІ
ДП «ДНІПРОПЕТРОВСЬКИЙ ОРГАН
З СЕРТИФІКАЦІЇ ЗАЛІЗНИЧНОГО ТРАНСПОРТУ»
СИСТЕМА СЕРТИФІКАЦІЇ ДП «ДОСЗТ» (RCU)

CONFORMITY CERTIFICATE

Registered in the Register of SE "DOSZT" under No. RCU.0893-23
Valid from 10.03.2023 till 09.03.2026

Product: ImproTRAIN-250 SLB-I locomotive safety systems

Meets the requirements of TU U 27.9-31393258-048:2019 "SLB-I Locomotive Safety Systems. Specification"

Product manufacturer: PRIVATE JOINT-STOCK COMPANY "SEVERODONETSK RESEARCH AND PRODUCTION ASSOCIATION "IMPULSE", 17A Verbova street, Kyiv, 04073 Ukraine, EDRPOU code 31393258

The certificate has been issued to: PRIVATE JOINT-STOCK COMPANY "SEVERODONETSK RESEARCH AND PRODUCTION ASSOCIATION "IMPULSE", 17A Verbova street, Kyiv, 04073 Ukraine, EDRPOU code 31393256

Additional information: ImproTRAIN-250 SLB-I locomotive safety systems are mass-produced since 10.03.2023 till 09.03.2026. The certified products undergo technical inspection once per a year.
Conditions for maintaining the validity of the certificate: This certificate is valid under the condition of maintaining the validity of the certificate for the quality management system No. UA-GC/1/053:2022 dated 05.11.2022 and the timely reissuance of the specified certificate (after 04.11.2025) for a new term.
The certification has been carried out according to the scheme: Certification of mass-produced products, with certification (assessment) of quality management system.

The certificate has been issued by the conformity assessment body: THE STATE ENTERPRISE «DNEPROPETROVSK'S RAILWAY TRANSPORT'S BODY OF CERTIFIKATION», NAAU Accreditation Certificate No. 10075 of 10.11.2019, valid till 09.11.2024, location: 49033, Dnipro, prospekt B. Khmelnytskoho, 139 k, tel. +38(056) 787-18-42

Based on: Test Reports No. 0300-2020/01 of 01.03.2021, №0394-2023/01 of 23.01.2023 by LLC "TESTING LABORATORY "EUTEST" (NAAU Accreditation Certificate No.20176(9); Certificate for Quality Management System No. UA-GC/1/053:2022 of 05.11.2022, valid till 04.11.2025 by GLOBAL CERTIFIK LLC (01001, Kyiv, Esplanadna street, 20, of. 212, NAAU Accreditation Certificate No. 80043).

Head of the Conformity Assessment Body — S.V. Linnik

References

ImproTRAIN-250 are operated in Ukraine on new and modernized rolling stock:

- diesel trains DPKr-3;
- electric locomotives VL80S;
- electric locomotives ChS8;
- diesel locomotives 2TE116.

References

ImproTRAIN-250 are in operation in Lithuania:

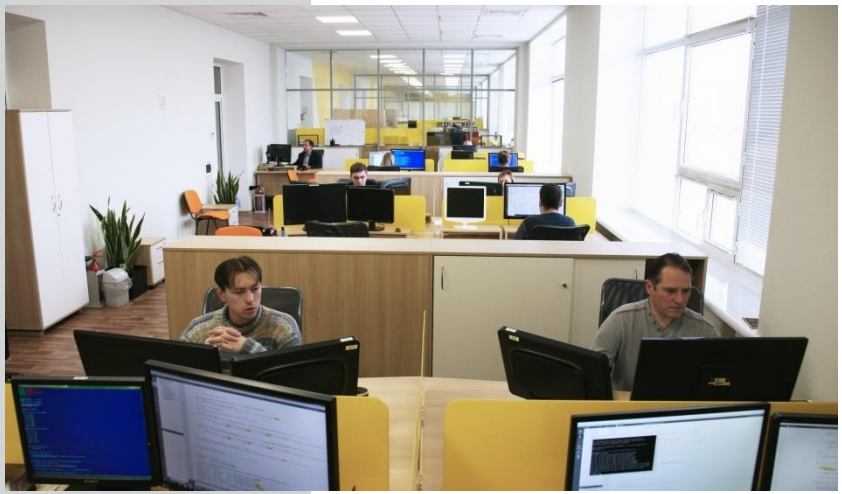
- on diesel locomotives 2M62 and ER20 (manufactured by Siemens) in LTG Cargo;
- on a laboratory-wagon (a joint project with TESMEC RAIL S.R.L., Italy) at LTG INFRA;
- on diesel locomotives TEM2UM-1000 (manufactured by LTG TECH);
- on self-propelled rolling stock APV520 (manufactured by SVI S.P.A. (Italy).

Contracts have been concluded for the modernization of the entire rolling stock fleet of JSC «Lithuanian Railways», including the supply of 186 systems.

Technical support

The company provides:

- engineering and technical support for personnel of operating organizations 24/7;
- carrying out modifications, including replacing obsolete and discontinued components to maintain the current technical level of equipment;
- performing warranty and post-warranty repairs with comprehensive testing to monitor the effectiveness of the work performed.



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