
Tecnocons
Railway products
Control, safety and traction systems for locomotives,
on-track machines and track maintenance equipment
tecnocons.com

About Tecnocons

Tecnocons designs, develops and integrates electronic, control and automation systems for the railway sector. The work covers the whole cycle — requirements analysis, electrical and electronic design, software development, on-board integration, testing and support for type approval — on locomotives, on-track machines, motor trolleys and infrastructure maintenance machinery.

The distinctive competence is the integration of hardware, software and plant engineering. Control and power electronics, embedded software, operator interfaces and supervisory applications are developed in-house and tested as a single system, configured to the specification of the vehicle and to real operating conditions. Every system can be used on its own or as part of a modular architecture.

All systems include telemetry, remote diagnostics and remote software updating, with traceability on a cloud platform. On this basis, machine vision and machine learning models are applied to obstacle detection, predictive diagnostics and maintenance planning from operating data.

AT A GLANCE

20+

years in the railway sector

85+

railway vehicles equipped or completely refurbished

200+

EVREC 2.0 event recorders installed and in service

74

industrial locomotives and shunting tractors modernised, still in operation

11

catalogue systems, from on-board control to web platforms

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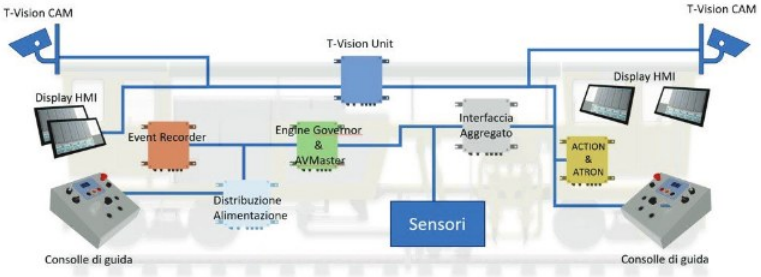
28 Contacts

System architecture

The on-board architecture is organised around the TCMS, which collects the distributed I/O, governs traction, braking and auxiliary systems and brings diagnostics to the driver's desks.

The specialised systems connect to its buses: Engine Governor towards the power unit, T-Vision for obstacle detection, EVREC 2.0 for protected recording of driving data, ACTION and ATRON on infrastructure maintenance machines.

On the ground, SyRail collects the track geometry surveys and Syfleet the fleet telemetry. Each subsystem can be installed on its own on an existing vehicle, or as part of a complete architecture on a new build.



Integration diagram of the Tecnocons systems on board the vehicle.

Which system for which vehicle

VEHICLE	ACTION	ATRON	ATRON V3	ENGINE GOVERNOR	TCMS	CONSOLE	T-VISION	EVREC 2.0	SYRAIL	SYFLEET	POWER-TRAIN
Tamping machines and ballast regulators	●	●	●	●		●	●	●	●	●	
Shunting locomotives				●	●	●	●	●		●	●
Motor trolleys and on-track machines				●	●	●	●	●		●	●
DMU and EMU railcars				●	●	●	●	●		●	●
Dedicated track recording vehicles		●	●			●		●	●	●	
Retrofit of existing vehicles	●	●	●	●	●	●	●	●	●	●	●

SECTION 1

On-board control and automation

ACTION

ATRON

ATRON V3

ENGINE GOVERNOR

TCMS

CONSOLE

Systems that govern the vehicle: from automatic guidance of the tamping machine to distributed control of traction, braking and auxiliary systems, through to the driver's desks and operator interfaces.



ACTION

Automatic guidance and control of the tamping machine

ACTION receives the theoretical design geometry and automatically drives the tamping machine during work. It translates the data into commands for the hydraulic and pneumatic units and governs tamping forces, advance speed and operating sequences, leaving the operator in a supervisory role. At the end of the run it generates the report on the geometry achieved to EN 13848.

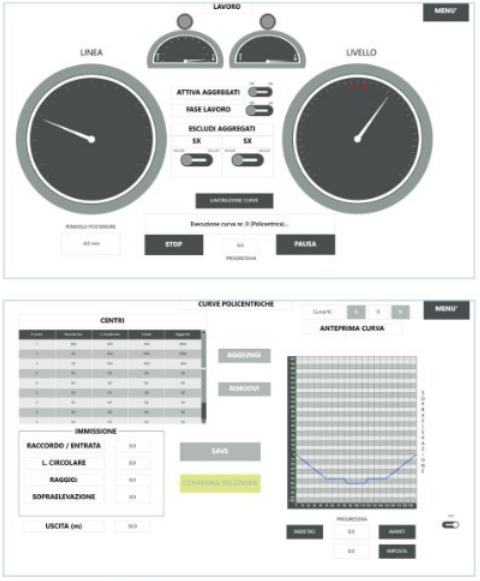
FEATURES

- Industrial CPU with real-time operating system for deterministic control
- Alignment data handling: manual entry, USB stick or download from SyRail
- Automatic parameter control with adaptive self-learning
- Interface to all the hydraulic and pneumatic systems of the machine
- Geometry reporting in PDF to EN 13848
- Can be fitted to any model of tamping machine

APPLICATIONS

Plain-line and switch tampers, both new and already in service

Design alignment data downloaded from **SyRail**; the report on the geometry achieved is published on the platform.



Design curve entry and working screen.

EN 13848 **NUMERICAL CONTROL** **RETROFIT**

ATRON

Track geometry by the versine (chord) method, to EN 13848

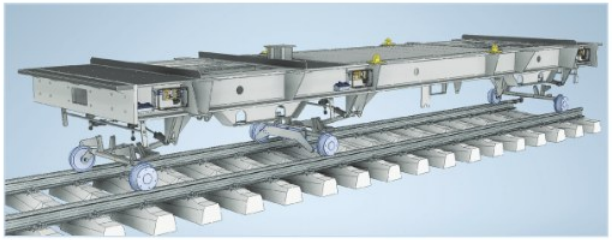
ATRON acquires track geometry by the versine method defined in the standard. Three independent measuring trolleys run on the rails at the front, centre and rear of the wagon: the chord between the leading and trailing trolleys forms the straight reference, while the centre trolley detects its offset, giving versine and longitudinal level. The measuring chain has no contact devices.

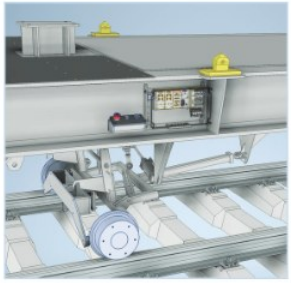
FEATURES

- Versine method to EN 13848, on three measuring trolleys
- Laser sensors and magnetostrictive transducer, with no wearing parts
- Sampling every 0.5 m with GPS position
- Filtering in wavelength ranges D1 (3–25 m) and D2 (25–70 m)
- Before and after maintenance comparison, event marking along the alignment
- PDF reports and export to USB memory
- LTE gateway for remote diagnostics and support
- Option: laser profilometers for rail wear measurement

APPLICATIONS

Track recording vehicles, tampers, work control, line acceptance





ATRON track recording vehicle: the three independent trolleys and the on-board cabinet.

EN 13848 **VERSINE METHOD** **NON-CONTACT**

Surveys uploaded to **SyRail**. On-the-move measurement: ATRON V3, p. 12.

ATRON V3

Optical-inertial measurement on the move, without trolleys and without contact

ATRON V3 measures on the move, without trolleys and without any contact with the track: it acquires track geometry and rail wear together, combining laser scanners, a high-precision inertial platform and GNSS georeferencing. Data is processed to EN 13848 and returned with AL, IL and IAL threshold exceedances flagged, ready for maintenance planning.

FEATURES

- No measuring trolleys: the unit mounts directly on the vehicle
- Non-contact measurement of track geometry and rail wear
- Laser scanners and high-precision inertial platform (IMU)
- GNSS georeferencing of every survey
- EN 13848 processing with reporting on AL / IL / IAL thresholds
- PDF report and data download to USB media
- Runs uploaded to SyRail for review and download

APPLICATIONS

Tamping machines, dedicated track recording vehicles, work quality control, line diagnostics

Surveys and wear profiles uploaded to **SyRail**. Versine method: ATRON, p. 11.



ATRON V3 measuring unit in position on the track.

EN 13848 **RAIL WEAR** **NO TROLLEYS**

ENGINE GOVERNOR

Universal interface between the vehicle control system and the power unit

Engine Governor sits between the vehicle control system and the engine unit, translating the operating demands of the vehicle into commands for the engine controller. It communicates over CAN J1939 with modern ECUs and, through analogue and digital interfaces, also governs engines with no electronic management. It regulates speed and torque according to the actual load, with a direct effect on fuel consumption and emissions.

FEATURES

- CAN J1939 interface for advanced engine diagnostics
- Analogue and digital inputs and outputs for older-generation engines
- Automatic optimisation of speed and torque according to load
- Electronic management of injection and torque curves
- Documented fuel saving of 15–20%
- Compatible with fuel cells and gas microturbines

APPLICATIONS

Diesel and diesel-electric locomotives and on-track machines, retrofit on existing engines, generating sets

Fuel consumption and engine hours to **Syfleet** through the vehicle control system.





Engine Governor unit and the interfaced engine-generator set.

CAN J1939 **MODERN AND LEGACY ENGINES**

TCMS

Train Control & Management System — distributed on-board control

The TCMS is the central node of the vehicle: it collects the distributed I/O, governs traction, braking, lighting and auxiliary systems and brings all information to the driver's desks. It runs on a Linux platform with a real-time soft PLC developed in CODESYS 3.5 and a SIL 2 safety architecture over the FSoE protocol. Event recorder and protected memory unit are integrated in the same platform.

FEATURES

- Diverse dual CPU 2oo2D, SIL 2 to EN 50129
- SIL 4 driver's safety device (DSD/vigilance) with dedicated safety relay, pedal and pushbutton
- System buses: EtherCAT ring with FSoE, Ethernet, CAN J1939, RS485
- Event recorder and PMU integrated in the platform
- MQTT telemetry to Syfleet, OpenVPN remote access over 4G/LTE and Wi-Fi
- Power supply 24–110 VDC, –25 / +70 °C, standards EN 50155, EN 50121-3-2, EN 50129

APPLICATIONS

DMU and EMU railcars, shunting locomotives, special vehicles, retrofit of existing vehicles

On-board telemetry and diagnostics to **Syfleet**.



Driver's desk with TCMS displays and on-board control panels.

SIL 2 — EN 50129 **SIL 4 VIGILANCE DEVICE** **CODESYS 3.5**

CONSOLE

Driver's desks and HMI interfaces built around the vehicle layout

The desks are built around the layout and ergonomics of the individual vehicle: steel structure, physical controls certified for heavy duty and high-brightness industrial touch displays, running the same interface as the on-board TCMS. Design, wiring and testing are carried out in-house.

FEATURES

- High-brightness industrial touch screen display
- Pushbuttons and joysticks certified for heavy duty
- Impact-resistant steel structure, IP66 protection rating
- Certified safety functions SIL 2 / CAT 4
- Integrated industrial PLC with on-board diagnostics
- Control layout defined together with the customer

APPLICATIONS

Locomotives · Tamping machines and ballast regulators · Rail motor trolleys · Track maintenance machines



Tecnocons driver's desk.

SIL 2 / CAT 4 **IP66**

SECTION 2

Safety, data and platforms

T-VISION

EVREC 2.0

SYRAIL

SYFLEET

Systems for the safety of those working on the line, for protected recording of driving data and for the analysis of operating data collected from the fleet.



T-VISION

Machine vision for the detection of people, vehicles and obstacles

Two HD cameras cover the line ahead of and behind the vehicle. The processing unit recognises people, vehicles and obstacles on the route in real time and returns the images to the operator's desks. As the distance decreases the system raises progressive visual and audible alarms and, below the safety threshold, commands emergency braking.

FEATURES

- On-board AI processing on NVIDIA Jetson Orin Nano
- 2 HD 1920×1080 cameras front and rear, expandable, PoE powered
- Detection of obstacles, people and vehicles; signal recognition
- Live image display on the operator's monitors
- Progressive visual and audible alarms according to distance
- Direct connection to the emergency braking system
- Video stream recording on the event recorder

APPLICATIONS

On-track machines on worksites, shunting locomotives, track maintenance machines



T-Vision industrial camera and recognition screen.

OBSTACLE DETECTION **EMERGENCY BRAKING**

EVREC 2.0

Event recorder to EN/IEC 62625-1, with crashworthy protected memory

EVREC 2.0 continuously records time, date, speed, position, driver commands and safety actions, storing them in a tamper-proof protected memory unit. Three simultaneous recordings at 1 Hz and checksums guarantee data integrity.

FEATURES

- Tamper-proof crashworthy PMU (Protected Memory Unit)
- At least 720 hours of continuous recording
- Multi-constellation GNSS with ±1 ms time accuracy
- Three simultaneous recordings at 1 Hz, data protected by checksum
- Backup battery for 10 minutes after an emergency
- Two analogue speedometers with recording indicator and audible alarm
- TrainGraph software for extraction, analysis and CSV export
- –55 to +85 °C, MTBF 50,000 hours

APPLICATIONS

On-track machines, locomotives, motor trolleys and maintenance vehicles

Operating data and position to **Syfleet**.



EVREC 2.0 unit with tamper-proof crashworthy memory.

EN/IEC 62625-1 **GNSS ±1 ms**

SYRAIL

Web platform for track geometry data and lineside monitoring

SyRail collects the surveys produced by the on-board measuring systems and makes them available from any workstation: interactive maps, track condition section by section, history of measurement runs and download of the recordings. The ATRON and ACTION surveys form the basis for scheduling maintenance work. The platform also receives data from the RailTemp sensors installed along the line: rail temperature and vibration, from which predictive analyses of track deterioration are derived.

FEATURES

- Interactive maps with the georeferenced position of every survey
- Track condition by section, with threshold exceedances highlighted
- History of measurement runs and comparison between successive surveys
- Download of recordings and reports in PDF
- Browser access, with no installation on user workstations
- Direct connection to the on-board measuring systems
- RailTemp lineside sensors: rail temperature and vibration
- Predictive deterioration analysis on continuously collected data

APPLICATIONS

Infrastructure managers, maintenance contractors, engineering departments





Reviewing a measurement run in SyRail; below, a RailTemp lineside sensor.

WEB PLATFORM **RAILTEMP** **EN 13848 DATA**

SYFLEET

Fleet management and predictive maintenance with artificial intelligence

Syfleet acquires vehicle telemetry and turns it into an operating picture: position and performance in real time, consumption in litres per kilometre and per engine hour, running hours per unit. On historical data it applies machine learning models to anticipate interventions and to schedule maintenance on actual kilometres and hours rather than by calendar.

FEATURES

- Live map with vehicle position and performance
- Per-vehicle dashboards: usage, consumption and critical parameters
- Preventive and predictive maintenance with machine learning models
- Automatic alerting and maintenance log
- Planning on actual kilometres and hours
- Balancing of running hours between engine units
- Remote software updates on connected vehicles

APPLICATIONS

Fleets of on-track and shunting vehicles, infrastructure managers, maintenance contractors



Syfleet dashboard with the fleet map.

CLOUD **PREDICTIVE MAINTENANCE**

SECTION 3

Electric traction

Complete traction chain: motor, power electronics, energy storage, charging and vehicle control. Modular configurations from 100 kW to over 1 MW, for new builds and for the conversion of existing vehicles.

ELECTRIC POWERTRAIN



ELECTRIC POWERTRAIN

Electric and hybrid traction from 100 kW to over 1 MW

The traction chain is designed and integrated as a whole: motor, inverter, batteries, charging systems and vehicle control unit. Configurations are modular and are sized on the mission profile of the vehicle, from the shunting locomotive to the regional train and on to rescue and maintenance vehicles.

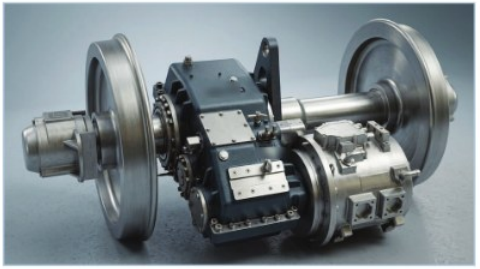
FEATURES

- Brushless permanent-magnet synchronous motors with high torque density
- Traction controllers with integrated inverters and regenerative braking
- Modular LiFePO4 batteries to EN 62928, expandable packs
- Predictive BMS monitoring cell voltage, temperature and state of health
- AC charging, DC fast charging and genset range extender
- Dedicated vehicle control unit with integrated diagnostics
- Standards: EN 50126, EN 50153, EN 61373, EN 62928

APPLICATIONS

Shunting locomotives, regional trains, rescue and maintenance vehicles, conversion of diesel vehicles

Battery, traction and charging status to **Syfleet**.





Powered wheelset with gearbox and traction motor; below, synchronous motor, inverter and battery pack.

EN 62928 **100 kW – 1 MW** **PMSM**

Custom systems and development

CUSTOM SYSTEMS

Electronics designed around the vehicle: hardware, software, integration and certification. Where no catalogue system meets the requirements, the system is developed to specification.

- Boards and electrical cabinets designed to the vehicle specification
- Control software and HMI developed in-house
- Integration with systems already on board
- Support for certification of the complete system

DESIGN AND DEVELOPMENT

From concept to prototype to series production, with test campaigns and support for type approval. Design, prototyping, production and certification are all carried out in-house.

- Feasibility study and requirements definition
- Rapid prototyping and test campaigns
- Industrialisation and series production
- Technical documentation for type approval processes

Services

The customer is supported from the preliminary analysis through to commissioning of the system, and for the entire operating life of the vehicle.

- Preliminary analysis and feasibility study
- Electrical, electronic and software design
- Development of custom HMIs and applications
- On-board integration, wiring and testing
- Support for type approval and certification processes
- Commissioning and training of technical staff

AFTER COMMISSIONING

Remote support over VPN, software updates on connected vehicles, maintenance scheduled on the operating data collected by Syfleet.

References

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IGECO SL80 · SL100 · SL110 locomotives
Acciaierie d'Italia, Taranto. Complete refurbishment of electrical and pneumatic systems, cabinets, radio control and telemetry. In service for over fifteen years with availability above 95%.

20

Zephir 8.9 · 16.300 · 20.450 shunting tractors
Same plant. New braking system, control cabinet, radio control operating 24/7 and telemetry integrated into the control system.

200+

EVREC 2.0 units in service
Event recorders installed on on-track machines, locomotives and motor trolleys.

OTHER INSTALLATIONS

- Plasser 09-3 Dynamic tamper with ACTION and Amberg and Trimble alignment data import, in service in Australia
- Plasser 08-32 Duomatic tamper with automatic tamping and levelling guidance
- SSP 203 ballast regulator: complete refurbishment of the electrical system and control architecture
- 3 diagnostic wagons fitted with the ATRON system
- 7 TM232 motor trolleys with electronic control, EVREC 2.0, GPS and remote access
- Refurbishment kits for tampers already in service, with ACTION and ATRON on board
- 3 complete locomotives under construction, with hybrid electric traction and telemetry

Contacts

TECNOCONS S.R.L.

Via Vittorio Emanuele 133
74012 Crispiano (TA) — Italy

VAT IT03696110265
REA TA/157334

CONTACT DETAILS

info@tecnocons.com
tecnocons.com
+39 099 9647738

Notes

We turn technology into solutions

FROM CONCEPT TO PROTOTYPE, FROM CUSTOM SYSTEMS TO ADVANCED RESEARCH

We design, build and certify the on-board electronics and software of railway on-track machines.

Industry 4.0 · Telemetry · Monitoring
Engineering · Plant automation · Software development

+39 099 9647738
info@tecnocons.com
tecnocons.com

Registered and operating office
Via Vittorio Emanuele 133
74012 Crispiano (TA) — Italy

VAT IT03696110265 · REA TA/157334

Tecnocons

From idea to realisation