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MITRAC TRAIN CONTROL AND MANAGEMENT SYSTEM

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Propulsion & Controls

BOMBARDIER
the evolution of mobility

THE BRAIN OF THE TRAIN

A train speeding across the landscape at over 350 km/h is an impressive sight. So impressive it is, easy to forget the control and management system working invisibly in the background, ensuring operational safety and passenger comfort all down the line.

The BOMBARDIER* *MITRAC** Train Control and Management System (TCMS) is the brain behind the muscles that powers Bombardier's rolling stock. The *MITRAC* TCMS is a modular, scalable, secure and open-standard control and communication platform. It manages and controls the flow of information both on-board between the different sub-systems like converters, doors, heating, ventilation and air conditioning and also between the train and ground.

A platform covering any need

Bombardier's *MITRAC* TCMS platform is the set of a fully integrated product portfolio that is built on a generic concept. It can be adapted to the individual needs of the different vehicle types simply by adding self-contained modules for clearly defined functionalities. This allows for efficient and reliable train operation, diagnostics based maintenance, trains operating at a high level of safety and security as well as excellent and convenient services for passengers.

A universal solution

The *MITRAC* TCMS platform offers a modular concept at a high degree of standardization. It provides high level of flexibility in terms of configuration, scalability and interfacing to sub-systems with the additional benefit of being cost-effective.

Bombardier has developed a state-of-the-art TCMS platform in which the same components and architectures can be adapted to meet the demands of any kind of rolling stock. It is in use in all types of trains and applications all over the world including High Speed Trains, Locomotives, Intercity Trains, Regional Trains, Metros, Light-Rail Vehicles and Passenger Coaches providing control, monitoring, capability of inter-operation and sharing solutions like fleet management based on diagnostics combined with train to ground communication.

Global compliance and open standards

The *MITRAC* TCMS platform enjoys global acceptance as it is based on open interfaces and complies with all relevant international railways standards. Operators choose Bombardier because of its complete and advanced functionality, open standards and therefore future-proof solutions.



BOMBARDIER TRAXX AC locomotive



BOMBARDIER TWINDEXX Vario

CONTROL AND MANAGEMENT OF TRAINS AND COMFORT FOR PASSENGERS

The *MITRAC* TCMS platform is designed as a distributed, modular, scalable solution. It is very reliable and supports redundancy and the building of highly available architectures. The communication is based on an IP back-bone. It controls and manages all sub-systems on the train, independently of supplier or technical generation.

The *MITRAC* TCMS platform is a fully integrated solution which includes all major functions necessary to design, implement, validate and maintain vehicle control systems for all type of trains. It is based on a three domain concept:

- The Operational domain implements all functions which perform control and management of a train to fulfill its mission with efficient fleet operation e.g. by providing extensive diagnostics and is characterized by high reliability and availability
- The Safety domain implements all safety-related functions up to SIL2 and supports implementation of vehicle safety designs
- The Comfort domain implements all functions for high passenger comfort e.g. passenger Wi-Fi access and entertainment as well as seat reservation and passenger information.

When it comes to control, safety and enhanced railway experience, Bombardier leads the way.

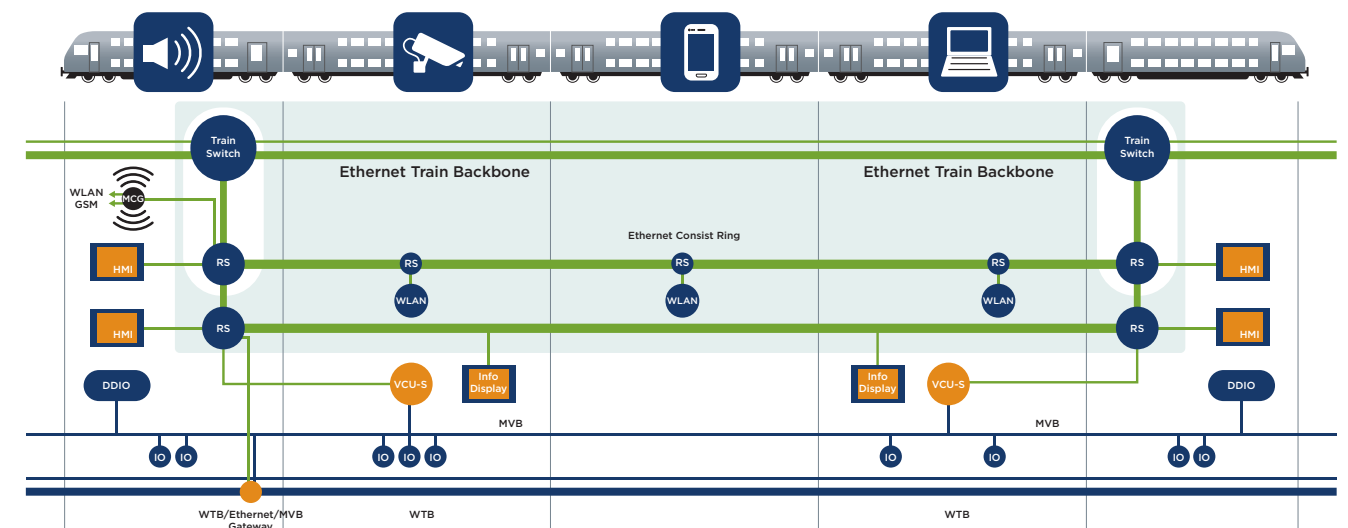
In a class of our own

Bombardier is the world's only railway equipment manufacturer to offer a fully integrated TCMS platform supported by an entire portfolio of products, guaranteeing perfect interaction with other systems based on open standards.

Simply ingenious

The *MITRAC* TCMS is an all in one system that grows stepwise with your needs. The IP Train communication backbone allows seamless on-board communication and wireless communication between train (on-board) and ground (off-board), and facilitates easy upgrades of on-board equipment (data, information, video streams, etc.) by using the integrated Fleet Management solution. Based on state-of-the art mobile communication standards, it minimizes wiring, facilitates communications and handles passenger information and entertainment.

Fleet Management solution combined with real-time access to continuously updated information together with high-bandwidth communications keeps operators in touch with the train's health, fleet movements and supplies passengers with up-to-the-minute news about services, connections and other items of interest and also enables security staff to monitor all sections of the train, anticipate problem situations and act decisively to solve them.



BOOSTING CUSTOMER COMPETITIVENESS

At Bombardier, we believe that smarter trains are more reliable, more efficient and more attractive for the passengers. And for the operator, they are more profitable and competitive.

The *MITRAC* TCMS platform brings people, process and technology together and reduces the total cost of ownership of the transportation system. Furthermore, the advanced TCMS with the integrated Fleet Management solution leads to significant reductions in fleet operation costs. It allows service personnel to respond swiftly, schedule maintenance efficiently and order spare parts in advance, leading to improved fleet uptime and better fleet availability. The system accurately interprets and analyzes sub-system and equipment data, anticipating problems well in advance. This is a prerequisite for cost-efficient condition based maintenance.

Making railway operations more profitable

The *MITRAC* TCMS addresses the high demands of operators. The result is a more appealing profit and

income statement for operators due to more reliable operation. It also cuts costs by rationalising maintenance with remote access, online diagnostics and troubleshooting.

Assure investments in assets

Bombardier's *MITRAC* TCMS platform operates smoothly with existing systems and, thanks to the use of standardized interfaces, it is guaranteed future-proof by allowing possible extensions or retrofits. This gives operators the reassurance of a rock-solid investment.

IP technology makes the system universally compatible, extendable and future-proof. Operators can purchase the system secure in the knowledge that they will have no unpleasant surprises if they decide to extend or buy into future advances. By using *MITRAC* TCMS based on open standards as a gateway to all sub-systems, all necessary adaptations are basically accomplished in the gateway layer, while the existing vehicle application can stay unchanged.



Attracting passengers

Bombardier's *MITRAC* TCMS enhances the overall travel experience by giving passengers online access to e-mail and the Internet as well as to news services, weather reports and sportscasts. Apart from watching movies or listening to music, they can also keep in touch with travel and traffic information. And whether they are aware of it or not, the same intelligent system managing all these facilities also continuously monitors the safety of the train.

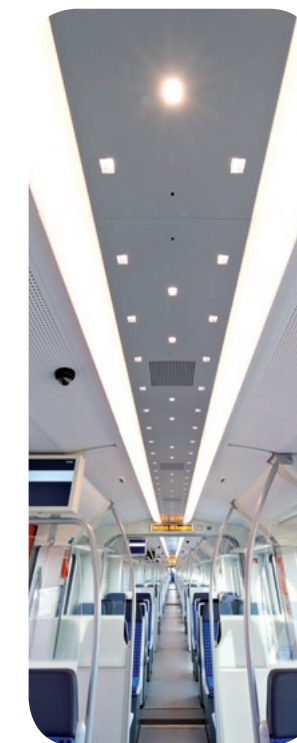
With the *MITRAC* TCMS the train operators are now able to offer their customers practical services before they even board the train. Passengers can find out if trains are running to schedule, check seat availability and make inquiries about connections to other trains, flights or buses. With the *MITRAC* TCMS, Bombardier takes passenger services to the next level.



BOMBARDIER ELECTROSTAR train sets for Gautrain in Midrand



Futuristic visualisation of a driver's cabin



Interior design of the ET430



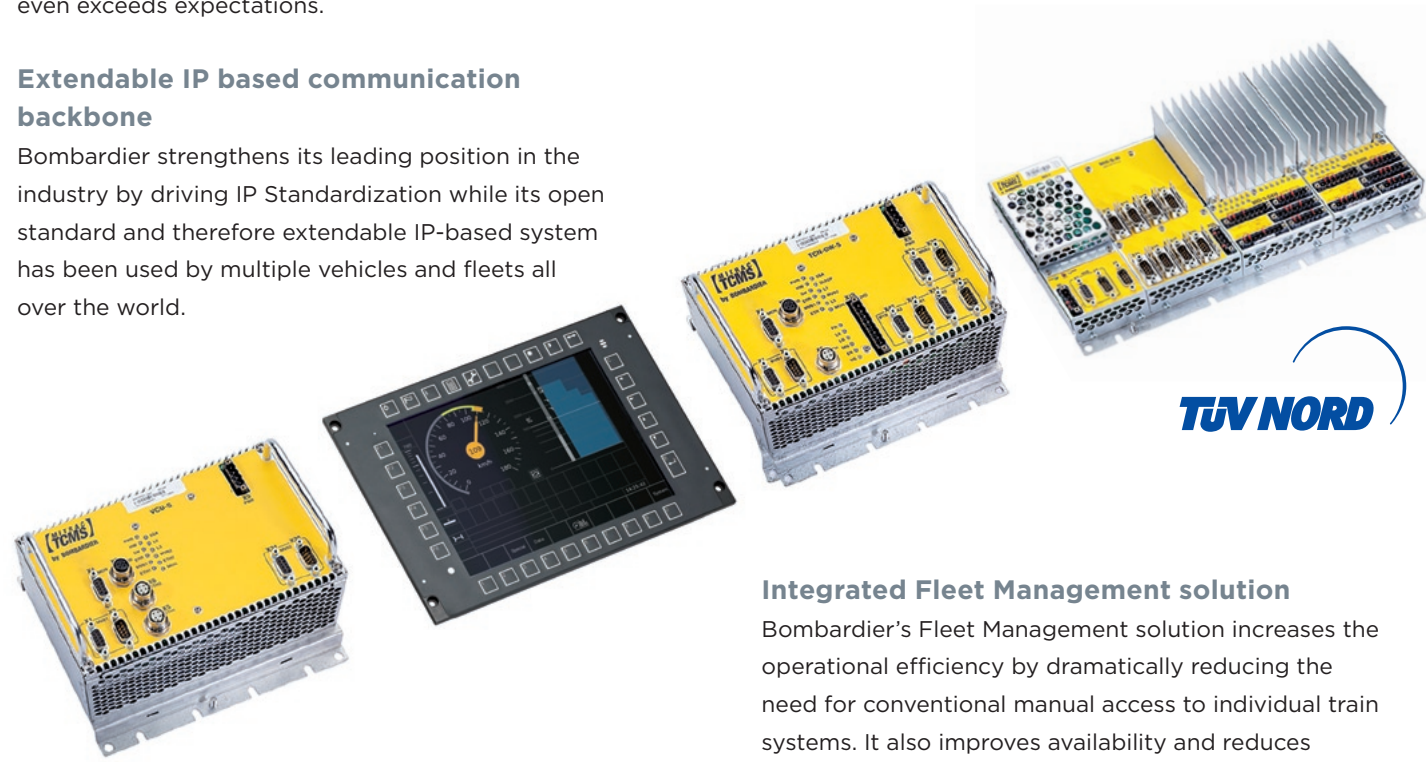
BOMBARDIER FLEXITY tram for Berlin

EXCEEDING EXPECTATIONS

When we board a train, it is only if things fail to function normally that we notice how much we take for granted. *MITRAC* TCMS is a solution which not only fulfills but even exceeds expectations.

Extendable IP based communication backbone

Bombardier strengthens its leading position in the industry by driving IP Standardization while its open standard and therefore extendable IP-based system has been used by multiple vehicles and fleets all over the world.



MITRAC TCMS safety-assessed product platform

When it comes to safety standards, we are on a leading position

The safe functions and the safe data transmission protocol used by the *MITRAC* TCMS permits the implementation of safe train functions and safe communications between the devices and sub-systems, thereby fulfilling the relevant standards.

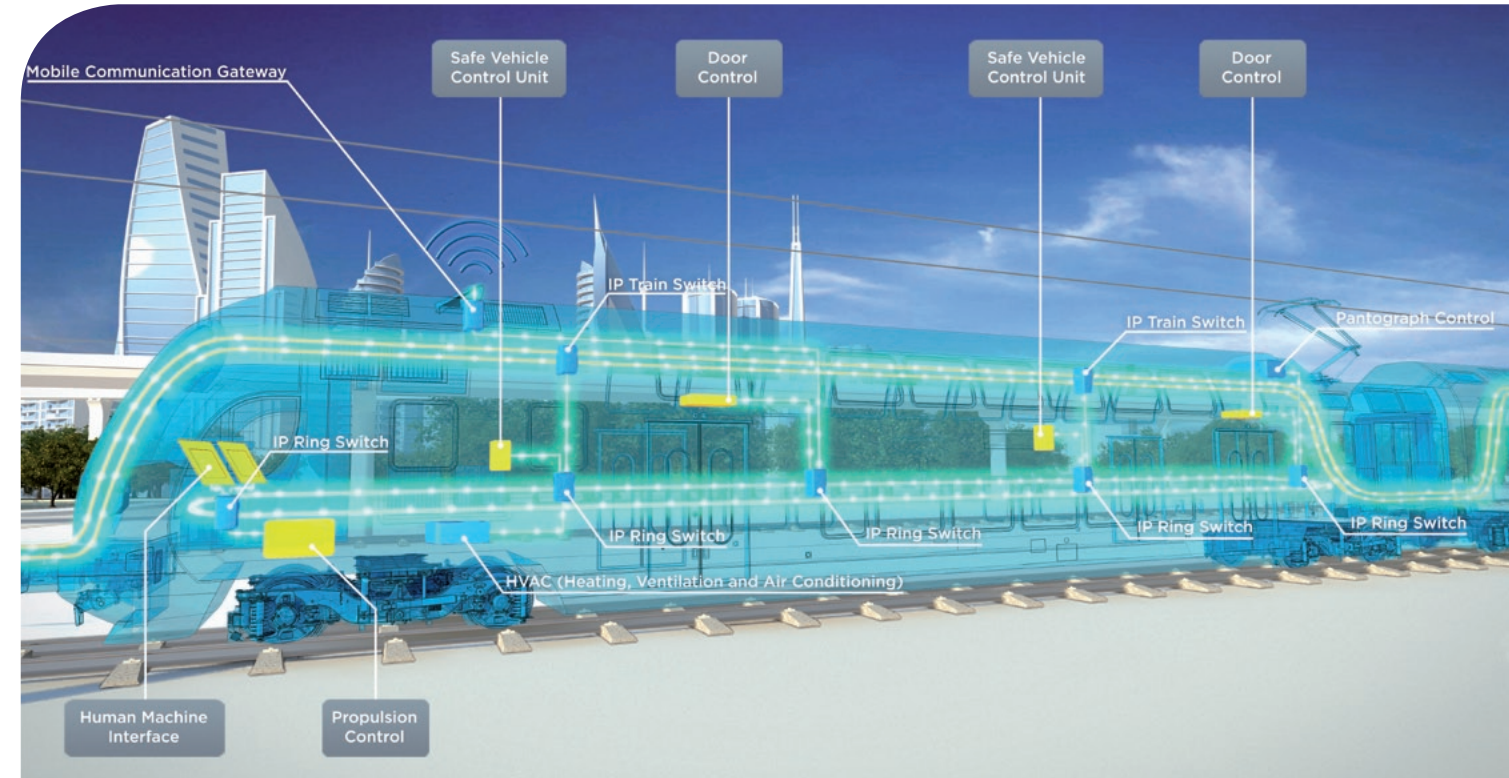
Here, once again, Bombardier's *MITRAC* TCMS leads the way with its generic safety assessed platform which makes authorization more efficient. The main functions of the train control and management system are certified independently of the type of train, which significantly reduces the cost and effort involved in authorization

Integrated Fleet Management solution

Bombardier's Fleet Management solution increases the operational efficiency by dramatically reducing the need for conventional manual access to individual train systems. It also improves availability and reduces maintenance costs by providing automated predictive analysis and decision-support information. When it comes to passenger's comfort, it provides a wide range of services such as real-time journey information, streamed audio and video entertainment and dynamic seat reservation.



Standard MITRAC TCMS platform



TWINDEXX Vario with TCMS components

DRIVEN BY RELIABILITY

High device reliability and system availability

The TCMS platform is based on highly reliable devices, supporting redundancy and intelligent failure handling. This leads to highly available system solutions and ultimately highly available trains and fleets.

Challenging lifecycle

The continuous replacement of obsolete electronic components to keep trains running is a waste of human,

natural and financial resources. Addressing the problem at source, Bombardier has installed a proactive Health Monitoring & Obsolescence Management, which takes care about the inevitability of obsolescence. By this Bombardier achieves exceptional product and platform lifecycles.

COMMITTED TO SUSTAINABILITY

Bombardier takes a two-track approach to sustainability. Firstly, it designs systems with longer than normal service life, and secondly, it enhances the quality of our customer's offering, ensuring that their operations continue to prosper well into the future.

Bombardier Transportation has an active set of environmental print guidelines, for further details click onto:

www.transportation.bombardier.com

Learn more about our commitment to sustainable mobility on:

www.theclimateisrightfortrains.com

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Bombardier Transportation

Brown-Boveri Strasse 5
CH - 8050 Zurich, Switzerland

Tel +41 44 318 33 33

Fax +41 44 318 30 80

www.bombardier.com

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