

# MITRAC

## Driven by Reliability



Propulsion & Controls

**BOMBARDIER**

# ◁ MITRAC – The Heart, Muscles and Brain of the Train ▷



**Propulsion & Controls**  
delivers **BOMBARDIER\* MITRAC\*** equipment:

#### **Traction Converters**

... transforming power from catenary or diesel engines

#### **Auxiliary Converters**

... supplying power to doors, lighting, air-conditioning etc.

#### **Drives**

... providing traction effort

#### **Electronics**

... managing all kinds of communication in a train  
... as well as controlling the propulsion system.

Without propulsion and control equipment no railway vehicle can move. In the end, this equipment defines the vehicle performance.

*MITRAC* equipment has been created with a clear ambition to fulfill customer needs. We create solutions which are boosting customer competitiveness and exceeding expectations. And we are driven by reliability and committed to sustainable mobility.

To achieve our ambitious objectives we are designing game changers – and as such we know that our *MITRAC* equipment is always judged on its single most important feature: Reliability.

*MITRAC* is driven by reliability.





### **Boosting Customer Competitiveness**

*MITRAC* is the most competitive propulsion and control product portfolio. It considers vehicle manufacturers needs and enables railway operators with customized applications to become more competitive by increasing passenger attractiveness and decreasing operational costs.

### **Exceeding Expectations**

*MITRAC* meets customer requirements as well as increasingly demanding industry standards and regulations. Our ambition is to deliver not just what's required, but to exceed expectations and to provide true revenue generating solutions for customers.

### **Driven by Reliability**

*MITRAC* powers some of the world's most reliable fleets because we are uncompromisingly optimizing the reliability of all our products. We design for reliability and achieve excellent reliability. For customers, passengers or freight transportation buyers this means simply: It works!

### **Committed to Sustainable Mobility**

*MITRAC* facilitates the inherent environmental advantage of rail. Our consistent energy efficient design of each propulsion and control component, as well as of the complete system, contributes strongly to a more sustainable mobility.

# ◁ Boosting Customer Competitiveness ▷



MITRAC C 1200 – Traction and Auxiliary Converters for roof mounting

**MITRAC is a complete propulsion and control product portfolio for all rail applications.**

## **Light Rail Vehicles**

A smooth start, rapid acceleration, constant speed and low noise are the basic prerequisites for economical, comfortable travel. And the less space the technology takes up, the more room is left for passengers. The result is increased operational efficiency that enhances the competitiveness of public transportation.



Light Rail Vehicles





**Metros**

### **Metros**

Bombardier's engineers flourish in the most challenging conditions. And they never fail to come up with innovative solutions. With our unmatched experience in metro systems, we know what it takes to continually optimize the safety, reliability and speed of the passenger transportation beneath the streets of our cities.

### **Intercity and High Speed Trains**

Shorter journey times, personal space to sit back and work or relax, a snack from the mini-bar or a leisurely dining in the restaurant car – these are the features that attract smart modern travelers to railways. And behind the scenes, *MITRAC* propulsion and control systems from Bombardier are powering intercity travel to new levels of safety, reliability and comfort.



**High Speed Trains**



**Regional Trains**

### **Commuter and Regional Trains**

Today's commuter and regional trains need a propulsion system that provides short travel times in a busy network. From an operator's point of view, the system must offer low life cycle cost together with high reliability. Bombardier has the right solution for any situation, no matter how tough the requirements.

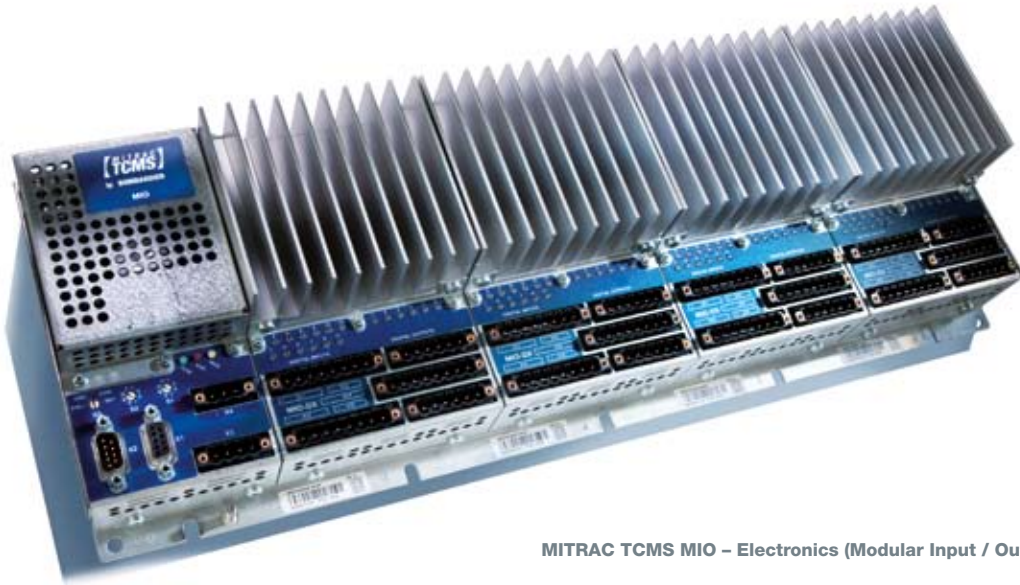
### **Locomotives**

The *MITRAC* product portfolio includes both single and multi-system propulsion and control equipment for locomotives and powerheads for passenger and freight transportation. Its modular structure enables us to provide customized applications meeting any individual requirements and at the same time simplifying handling, training and maintenance. These in turn reduce life cycle costs and increase operational safety.



**Locomotives**

# Exceeding Expectations



MITRAC TCMS MIO – Electronics (Modular Input / Output Unit)

**The MITRAC product portfolio meets requirements and exceeds expectations.**

## MITRAC Converters

Bombardier introduced the first IGBT propulsion converter in 1994. Our modular design allows considerable flexibility in adapting systems to individual customers' requirements. In addition, the modules are easily accessible for maintenance and repair purposes. Lower weight contributes to achieving lightweight rail vehicle construction. Some 40,000 MITRAC converters are in use globally.

## MITRAC Drives

Design and production of the MITRAC traction drives are based on a set of key requirements: High reliability and safety, high cost-efficiency of the entire range of traction drives and the complete traction chain, low energy consumption, low life cycle costs and maximum environmental friendliness. Almost 50,000 MITRAC drives have been sold to customers all over the world.

## MITRAC Electronics

Modern rail vehicles are sophisticated computer controlled units built for a long life time. Extensive data processing is necessary to achieve passenger attractiveness and operational efficiency. Based on the latest industry standards, Bombardier has applied railway requirements, creating rugged and reliable technology for today and for tomorrow.



MITRAC DR 1000 - Drives



**MITRAC TC 530 – Traction Converters for underfloor mounting**

### Performance

Regardless if the challenge is keeping tight timetables in the city centre or hauling heavier loads in mining transportation, *MITRAC* releases power whenever you need it.

### Standards and Regulations

Bombardier is deeply involved in moulding future rail standards and regulations. *MITRAC* meets the highest safety requirements, both current and foreseen. Our international presence with a long history of deliveries in countries all over the world, make us a competent partner for homologation and local conditions expertise across the globe.

### Future Proof

We apply new technologies that last. And we introduce technologies by taking into account how functionality and spare part supply can be secured for the entire life cycle of the vehicle.



**The MITRAC Traction Converter for BOMBARDIER\* SPACIUM\* is in terms of reliability the most advanced MITRAC product ever produced. It is designed for reliability requirements ten times higher than previous generations and fulfills low weight and compact design requirements.**



# ◁ Driven by Reliability ▷



MITRAC DR 3600 – Drives

**For us reliability simply means: It works!**

## **Designing Reliability**

MITRAC reliability performance starts already with the product development process. It continues without compromise throughout the system design, selection of components, the manufacturing and product introduction process.

## **Proven Reliability**

MITRAC powers some of the largest and most reliable fleets in the world. Under hardest conditions across the globe our equipment is ensuring traction efforts day and night. Based on the achieved successes we will leverage on our enormous experience for further developments.

## **Modularity and Component Commonality**

An essential element of achieving reliability is to maximize the level of component commonality. By reusing well-known and proven components and applying those for optimal customer solutions, the highest possible level of reliability is assured.

## **Supporting Reliability**

Through advanced maintenance processes and various diagnostics tools inclusive wireless data communication, we are able to efficiently manage the product introduction phase and continue the reliability performance throughout the entire life cycle of the train.





MITRAC TC 1410 – Traction Converters for underfloor mounting



The BOMBARDIER\* ELECTROSTAR\*, powered by MITRAC propulsion and control equipment was the past three years awarded the top position in Modern Railways UK Reliability Awards "Golden and Silver Spanners".



The BOMBARDIER\* REGINA\*, powered by MITRAC propulsion and control equipment has under harsh Scandinavian climate conditions been able to live up to extremely challenging reliability requirements of up to 99 %.

# ◁ Committed to Sustainable Mobility ▷



By introducing the *ECO4\** product suite, Bombardier Transportation is validating its commitment to sustainable development of our industry and our world.

## **ECO4 – The new formula for Total Train Performance**

Bombardier has put sustainable mobility in the focus of its design and operating philosophy. Implementing the Bombardier *ECO4* technologies will satisfy both business and wider social needs.

*ECO4* provides products and technologies and in the end solutions and services that offer the best-in-class total train performance by addressing the key challenges and opportunities of rail operators today:

- Energy
- Efficiency
- Economy
- Ecology

## **MITRAC for ECO4**

The inherent energy efficiency of the complete *MITRAC* product portfolio is a major contributor to a positive environmental impact to the global transportation system. Further well-known *MITRAC* product benefits are their lightweight and compact designs.

Essential for improving environmental performance are new technologies. The *MITRAC* Energy Saver and the *MITRAC* Permanent Magnet Motor are just two examples of our product portfolio of innovative solutions for increased rail sustainability. Both products are part of the *ECO4* product suite.



# eco<sup>4</sup>



## EPD for MITRAC

As a clear commitment and a measurable contribution to rail sustainability Environmental Product Declarations (EPD) will be acquired for a selection of *MITRAC* products. This means that we are quantifying the environmental impact over the products' entire life cycle.

The EPD's will enable us to continuously enhance our environmental performance. The first EPD ever for a *MITRAC* product was done for the powerful multi-system Traction Converter *MITRAC* TC 3300 MS V04 of the *BOMBARDIER\* TRAXX\** locomotive family. It is based on ISO standards (14025:2006 / 14040:2006) and performed in accordance with EMAS (Eco Management and Audit Scheme) regulations.



The *MITRAC* TC 3300 MS V04 – The first certified *MITRAC* converter in accordance with EMAS.



# ◁ Designing Game Changers ▷



MITRAC CM C – Electronics (Converter Module C)

**The rail industry is increasingly depending on continuous improvements to enhance its competitiveness towards other modes of transportation.**

## **Game Changer Philosophy**

Propulsion and control equipment is complex and has to work under hardest conditions during a long lifetime. Continuously improving railway competitiveness is fused by introducing new technologies. We carefully monitor new technologies and we select those for introduction which are adding sustainable value to our customers. In this way we design game changers for our industry and apply new technologies that last.

## **MITRAC TCMS**

When launching the IP (Internet Protocol) technology-based *MITRAC* TCMS (Train Control and Management System) in 2006, Bombardier set a new standard for the railway industry. IP technology offers high bandwidth for all data exchange and standard equipment interconnectivity (cameras, information panels and other non-railway specific units). It is also an easily upgradeable system contributing to the railway industry's standardization efforts. Since its introduction the new *MITRAC* TCMS has been selected for rail vehicles all over Europe, Asia and North America, where it offers new levels of passenger satisfaction and operational efficiency.



### MITRAC Permanent Magnet Motor

Bombardier has developed a motor design which will create the second generation of permanent magnet motors for rail vehicles. For selected applications the customer benefits are improved overall vehicle optimization, increased energy efficiency at reduced volume and weight, or higher performance. These result in lower operating costs and a positive environmental impact.

As an example, two *MITRAC* Permanent Magnet Motors replaced four forced air-cooled induction motors in the *BOMBARDIER REGINA* as part of the Gröna Tåget ("Green Train") project. Additionally, several new Swedish speed records were set during tests performed in the summer of 2008.



MITRAC Permanent Magnet Motor

### MITRAC Energy Saver

As one of the most fascinating sustainability innovations, the *MITRAC* Energy Saver is based on a set of intelligent technologies. Its innovative double-layer ultra-capacitors and the related intelligent controlling store the energy released each time a vehicle brakes and reuse it during acceleration or operation. Applied to light rail vehicles, the system has, over several years of testing, demonstrated an energy saving up to 30 %. Calculations show that as much as 35 % savings can be achieved for diesel multiple units, thus reducing emissions as well as costs. Alternatively, the technology can also be used as a performance booster by adding extra power to the vehicle during acceleration. It also enables catenary-free operation.



MITRAC Energy Saver

# ◁ Applying Game Changers ▷

## Energy Saver Application

The innovative *MITRAC* Energy Saver with its several positive environmental impacts has matured. With an integrated design our energy saver technology together with the propulsion system can fit into the same volume and weight as conventional propulsion systems. Making 30 % energy reduction available without negative impact on weight and space is a major milestone for a more sustainable mobility in urban areas.



## Hybrid Converter Application

Bombardier Transportation has created a vehicle that can combine extraordinary customer's power supply requirements with one basic product: The train fleet consist of diesel-electric and electrical (1.5 kV DC and 25 kV AC) base versions, a bi-mode version (diesel-electric and 1.5 kV DC), all with 3 or 4 cars, and a 4-car universal version (diesel-electric, 1.5 kV DC and 25 kV AC). This multi-system diesel-electric combination is the world's first.

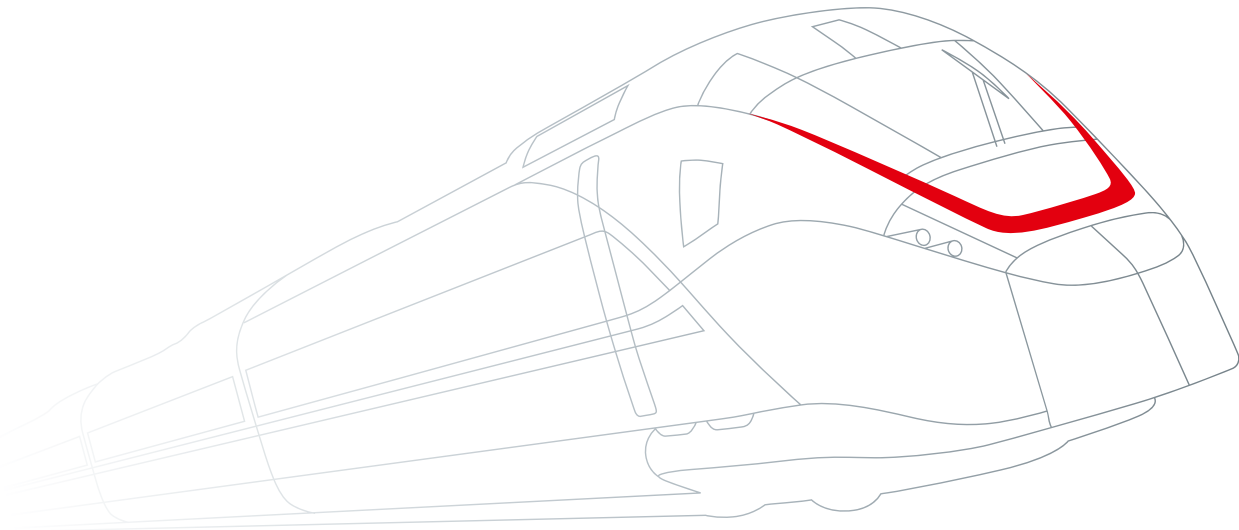
## Cross Border Converter Application

The highly successful *BOMBARDIER TRAXX* locomotive family is a tangible proof of the modular yet highly adaptive capabilities of *MITRAC*. The related powerful multi-system traction converter supports all line voltages across Europe and enables border-crossing operations for seamless international transportation.





# ◁ Bombardier Transportation The Climate is Right for Trains ▷



**Bombardier Transportation is dedicated to developing, manufacturing and servicing advanced transportation solutions for today's and tomorrow's railways.**

As the global leader in rail technology, Bombardier places environmental sustainability firmly at the top of the agenda. Our products and services combine energy conserving technology with optimal safety, reliability and cost efficiency. They are designed for sustainable mobility throughout their lifecycle.

Our portfolio of rolling stock and services encompasses passenger vehicles for urban and mainline operations, locomotives, bogies, rail control solutions, propulsion and complete transportation systems, as well as vehicle modernization and maintenance.

Over 100,000 vehicles in operation worldwide attest our unique strengths in project management and innovation, design and technology. For decades we have enabled millions of people everyday to reach their destinations in comfort and style.

Bombardier is a truly international business, which provides local support. Present in more than 60 countries and with more than 30,000 employees worldwide, we strive to be the partner of choice for all the world's rail operators.

Headquartered in Berlin, Germany, Bombardier Transportation is part of Canada based Bombardier Inc. It generates annual revenues in excess of US\$ 7 billion.

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Learn more about our commitment to sustainable mobility on: [www.theclimateisrightfortrains.com](http://www.theclimateisrightfortrains.com)

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