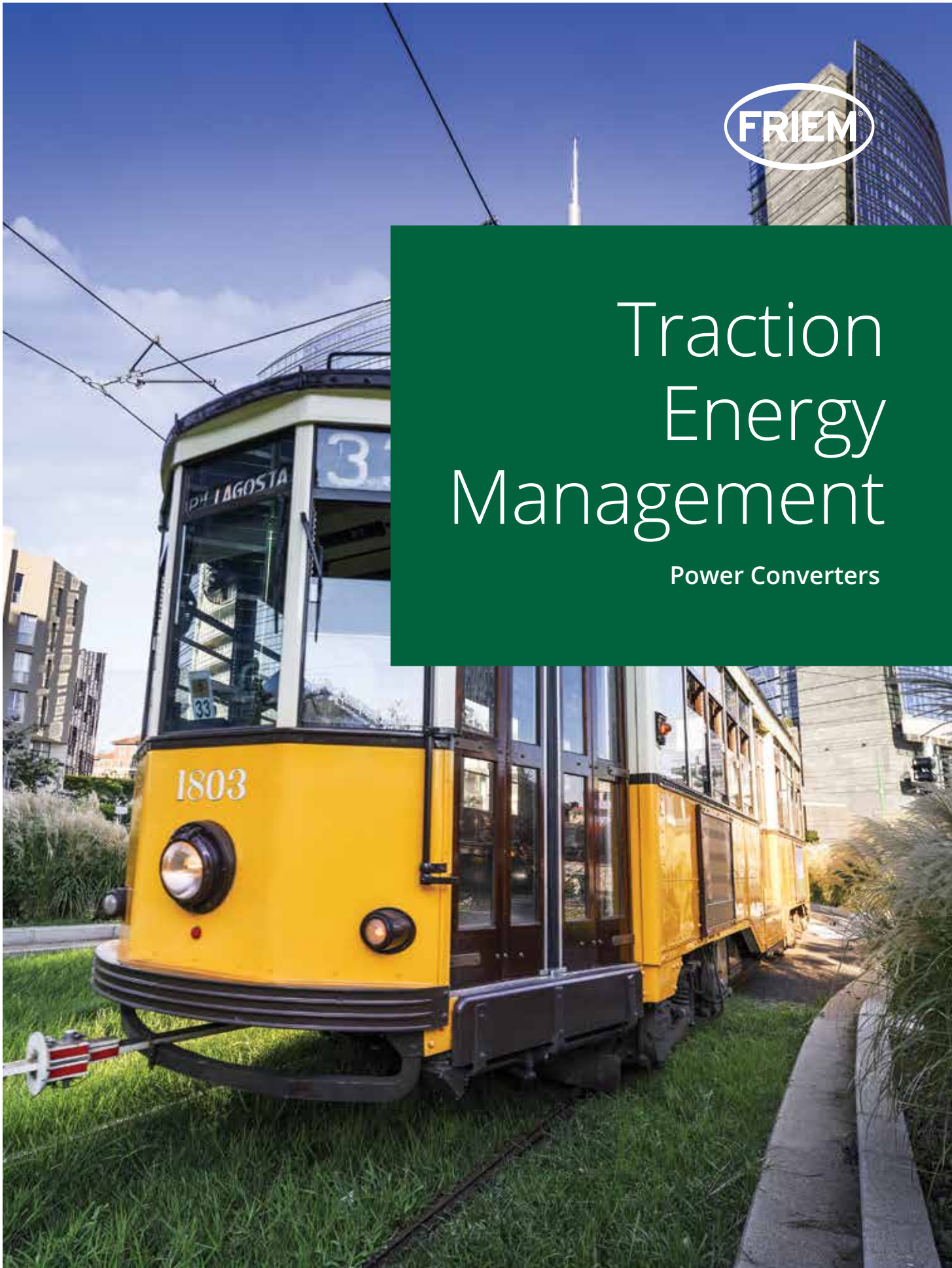




Traction Energy Management

Power Converters





We care

Continuous investment in research and development for a better future

These last few years have been characterized by a growing interest in environmental impact reduction especially through sustainable and efficient energy consumption.

Being energy intensive and with a continuously growing demand, the transport industry is looking more and more for technologies and solutions to reduce energy losses.

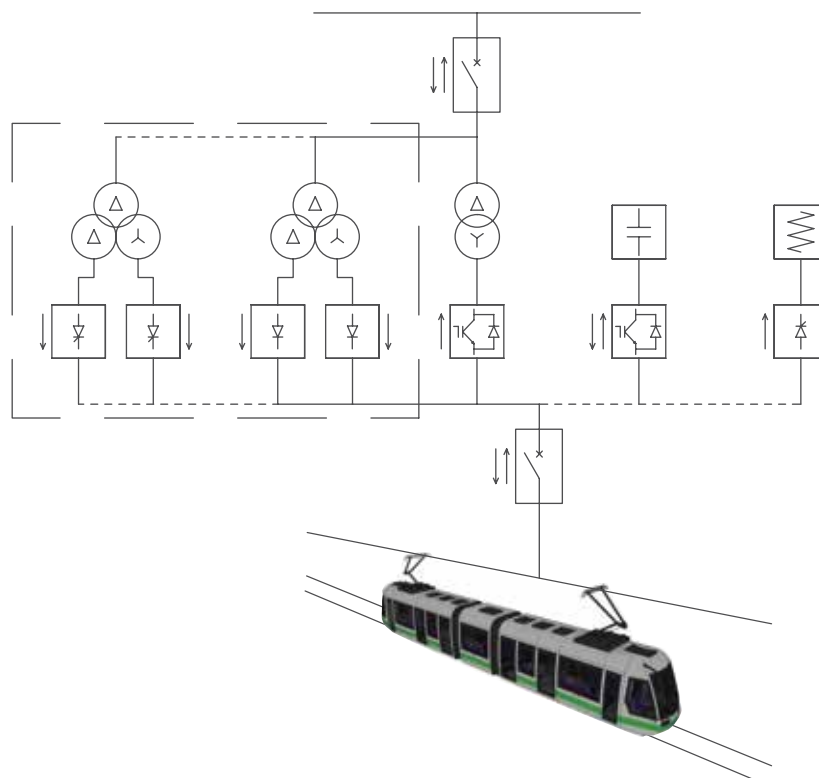
As a natural consequence of its experience in converters for traction and for renewable energy applications, FRIEM has developed a complete line of solutions to manage Braking Energy.

Our Line

- **ERCon - Line:** Energy Recovery Converter
- **EDCon - Line:** Energy Dissipation Converter
- **ESCon - Line:** Energy Storage Converter

Key Benefits

- Lower energy consumption
- Integration in existing system
- Reduced weight of the vehicles; a smart alternative to on-board resistors
- Reduced heat generation in tunnels



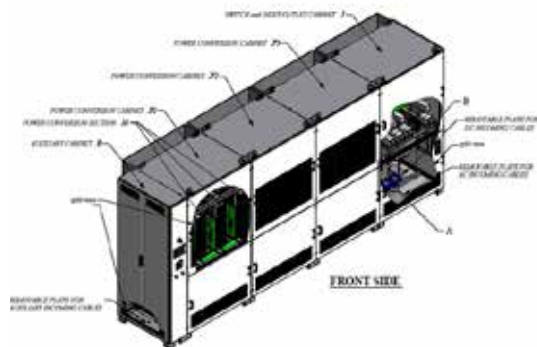
Energy Recovery Converter

ERCon-Line

The ERCon is a DC/AC power converter that allows to recover the kinetic energy of the vehicles during the braking phase.

The recovery takes place transferring energy from the DC line to the AC grid.

Such a system can reduce the energy consumption of a traction line up to the 30 percent.



ERCon Key Features

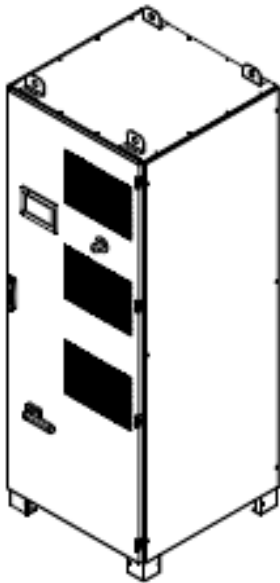
- Modular architecture
- Independent from main DC supply
- Operates on 750Vdc or 1500Vdc
- Optimised tunnel sizing thanks to lower heat generation with respect to on-board braking systems

ERCon Line		750 V	1500 V
Frequency	Hz	50 ± 2%	50 ± 2%
AC Input Voltage Vrms	Vrms	500 ± 10%	900 ± 10%
Rated AC Recovery Power (@ 1650VDC) kVA	kVA	334 - 1.000	667 - 2.000
Rated AC Recovery Current (@ 1650VDC)	A	385 - 1.155	428 - 1.283
Maximum AC Recovery Current	A	459 - 1.377	510 - 1.530
Rated DC Voltage (EN 50163)	V	750	1.500
Rated DC Current	A	404 - 1.212	404 - 1.212
Minimum Recovery DC Voltage threshold	Vdc	825	1.650
Efficiency at Rated Recovery Power	%	≥ 97,0	≥ 97,0
Power Factor at Rated Recovery Power	-	> 0,99	> 0,99
Technology	-	IGBT	IGBT
Duty Class (@ 1650VDC as per IEC 60146-1-1)	-	III	III
Operating Temperature Range	°C	0 ÷ 40	0 ÷ 40
Maximum Operating Temperature with Derating	°C	50	50
Storage Temperature Range	°C	-25 ÷ 70	-25 ÷ 70
Maximum Altitude	m/s.l.m.	1.000	1.000
Protection Degree	-	IP21 / IP42	IP21 / IP42

Energy Dissipation Converter

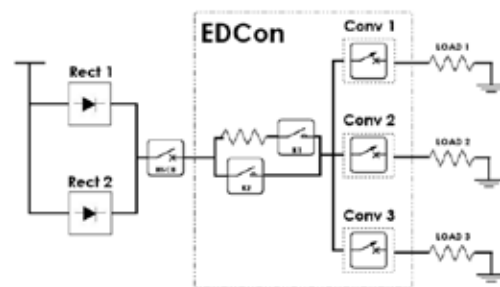
EDCon-Line

The energy dissipation converter EDCon is integrated in the traction systems to dissipate the excess kinetic energy during the vehicle braking. The use of EDCon together with the associated resistor banks in traction substations instead of on-board resistors reduces the vehicle weight, the energy consumption and solves the problem of heat in the tunnels.



EDCon Key Features

- Modular architecture
- Operates on 750V or 1500V
- Elimination of on-board resistors
- Optimised tunnel sizing thanks to lowest heat generation with respect to on-board braking systems
- Configurable with IGBT or GTO



EDCon Line		750 V	1500 V
Rated DC Voltage (EN 50163)	V	750	1.500
Operating voltage range	V _{dc}	825 - 1.000	1.650 - 1.950
Current capacity @20% duty cycle	A	3.000 - 6.000	3.000 - 6.000
Rated DC Voltage (EN 50163)	V	750	1.500
Technology	-	IGBT or GTO	IGBT or GTO
Operating Temperature Range	°C	0 ÷ 40	0 ÷ 40
Storage Temperature Range	°C	-25 ÷ 70	-25 ÷ 70
Maximum Altitude	m/s.l.m.	1.000	1.000
Protection Degree	-	IP21 / IP42	IP21 / IP42

Energy Storage Converter

ESCon-Line

The ESCon is an energy storage converter that, in the system, has the task of storing and reusing the excess kinetic energy during the vehicle braking. The use of ESCon helps to achieve up to a 30% reduction of total energy consumption and allows to support local grid services as frequency regulation, peak shaving or load shedding.



ESCon Key Features

- Modular architecture
- Operates on 750V or 1500V
- Elimination of on-board resistors
- Optimised tunnel sizing
- Configurable with batteries & capacitors
- Provides emergency traction power

ESCon Line		750 V	1500 V
Rated DC Voltage (EN 50163)	V	750	1.500
Operating voltage range	Vdc	825 - 1.000	1.650 - 1.950
Maximum system current	A	500 - 3000	250 - 1.500
Maximum system power	kW	350 - 2.100	350 - 2.100
System Stored Energy	kWh	2 - 18	2 - 18
Operating Temperature Range	°C	0 ÷ 40	0 ÷ 40
Maximum Operating Temperature with Derating	°C	50	50
Storage Temperature Range	°C	-25 ÷ 70	-25 ÷ 70
Maximum Altitude	m/s.l.m.	1.000	1.000
Protection Degree	-	IP21 / IP42	IP21 / IP42



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