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# Reference list

## Selected projects for rolling stock



Leading in Railway Technology

#### REFERENCE LIST

Publisher:  
SMART Railway Technology GmbH

Miramstrasse 87  
34123 Kassel  
Germany

Phone +49 561 50634-6000  
Fax +49 561 50634-6001

#### Responsible for the content:

Dirk Wimmer  
Dirk.Wimmer@SMART-Railway.de

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# SMART Railway products at a glance

Proven systems for global application



## SMARTconverter for short-distance trains

The SMARTconverter is an auxiliary power converter with an input converter with medium frequency galvanic separation. It is highly energy-saving and reliable and used in metros, urban railways and commuter trains all around the world.



## SMARTconverter for long-distance trains

The SMARTconverter is also designed for cross-border long-distance passenger trains. The multi-voltage auxiliary power converter with medium-frequency galvanic separation is in service throughout Europe. It is highly reliable since it has no electro-mechanical change of configuration.



## SMARTcharger

The SMARTcharger is a battery charger that converts the input voltage into the DC output voltage required for the train battery. It is available for all common input voltages, battery systems and performance classes as standard and characterized by its compact design and reliability.



## SMARTcooler

The SMARTcooler is a reliable inverter especially for air conditioning systems. It is available with and without galvanic separation, universally applicable and delivered either as single device or for integration into the air conditioning inverter.



## SMARTview

SMARTview is a diagnostic tool that collects the most important operation data. The collected data is transferred to a PC via an Ethernet interface and displayed with a standard browser in an easy-to-read format. Moreover, SMARTview can be easily retrofitted into products that are already in service.



## Custom-tailored solutions

SMART Railway also offers customized converters that are suitable for applications other than standard. Together with the customer, experienced development engineers select the ideal power electronics topology. Thus, it is possible to elaborate a custom-tailored solution within a very short time.








# SMARTconverter

## MEENT-SD: auxiliary power converters for short-distance trains

Project & facts	Quantity	Customer	Type
	<b>Bilbao Metro – Line 3</b> Operator: Eusko Trenbideak, Ferrocarriles Vascos S.A., Basque Country, Spain Delivery: 2015 – 2016  Input: 1,500 V DC AC output: 3 x 230 / 400 V AC, 50 Hz, 75 kVA DC output: 110 V DC, 20 kW Installation: underfloor container	56	CAF New built
	<b>Santiago de Chile Metro</b> Operator: Metro de Santiago S.A., Chile Delivery: 2015 – 2017  Input: 1,500 V DC AC output: 3 x 230 / 400 V AC, 50 Hz, 140 kVA DC output: 110 V DC, 20 kW Installation: underfloor container	74	CAF New built
	<b>Santiago de Chile Metro</b> Operator: Metro de Santiago S.A., Chile Delivery: 2015 – 2017  Input: 750 V DC AC output: 3 x 230 / 400 V AC, 50 Hz, 170 kVA DC output: 72 V DC, 30 kW Installation: underfloor container	70	Alstom Refurbishment
	<b>Kochi Metro</b> Operator: Kochi Metro Rail Ltd., India Delivery: 2015 – 2016  Input: 750 V DC AC output: 3 x 415 V AC, 50 Hz, 170 kVA DC output: 110 V DC, 30 kW Installation: underfloor container	50	Alstom New built
	<b>NSR Sprinter</b> Operator: Nederlandse Spoorwegen N. V., Netherlands Delivery: 2016 – 2019  Input: 1,500 V DC AC output: 3 x 230 / 400 V AC, 50 Hz, 145 kVA DC output: 110 V DC, 15 kW Installation: roof-mounted	236	CAF New built






# SMARTconverter

## MEENT-SD: auxiliary power converters for short-distance trains

Project & facts	Quantity	Customer	Type
	66	CAF	New built
<p><b>Izmir EMU</b>            Operator: Izmir Banliyö Tasimaciligi A. S. (IZBAN), Turkey            Delivery: 2009 – 2010</p> <p>Input: 1 x 400 V AC, 50 Hz            AC output: 3 x 230 / 400 V AC, 50 Hz, 115 kVA            DC output: 110 V DC, 14 kW            Installation: underfloor container</p>			
	192	CAF	New built
<p><b>Caracas Metro</b>            Operator: C.A. Metro de Caracas, Venezuela            Delivery: 2010 – 2012</p> <p>Input: 750 V DC            AC output: 3 x 220 / 380 V AC, 60 Hz, 135 kVA            DC output: 72 V DC, 14 kW            Installation: underfloor container</p>			
	178	CAF	New built
<p><b>São Paulo Metro – Line 3 and Line 5</b>            Operator: Companhia do Metropolitano de São Paulo, Brazil            Delivery: 2009 – 2014</p> <p>Input: 750 V DC or 1,500 V DC            AC output: 3 x 220 / 380 V AC, 60 Hz, 135 kVA            DC output: 72 V DC, 14 kW            Installation: underfloor container</p>			
	60	Scomi	New built
<p><b>Mumbai Monorail</b>            Operator: Mumbai Metropolitan Region Development Authority (MMRDA), India            Delivery: 2009 – 2010</p> <p>Input: 750 V DC            AC output: 3 x 230 / 400 V AC, 50 Hz, 22 kVA            DC output: 24 V DC, 13 kW            Installation: open frame for integration</p>			
	84	Siemens	New built
<p><b>Kaohsiung Metro</b>            Operator: Kaohsiung Rapid Transit Corporation (KRTC), Taiwan            Delivery: 2004 – 2006</p> <p>Input: 750 V DC            AC output: 3 x 220 / 380 V AC, 60 Hz, 135 kVA            DC output: 110 V DC, 16 kW            Installation: underfloor container</p>			

# SMARTconverter






## MEENT-SD: auxiliary power converters for short-distance trains

Project & facts	Quantity	Customer	Type
	300	Alstom	New built
<p><b>Regio Citadis</b>            Operator: Regionalbahn Kassel (RBK), Germany, RandstadRail, Netherlands            Delivery: 2004 – 2011            Input: 750 V DC            AC output: 3 x 230 / 400 V AC, 50 Hz, 35 kVA            DC output: 24 V DC, 13 kW            Installation: roof-mounted</p>			
	50	NedTrain	Refurbishment
<p><b>Intercity DDZ</b>            Operator: Nederlandse Spoorwegen N.V. (NS), Netherlands            Delivery: 2011 – 2014            Input: 1,500 V DC            AC output: 3 x 230 / 400 V AC, 50 Hz, 80 kVA, redundant            DC output: 110 V DC, 15 kW, redundant            Installation: special integration into vehicle            Diagnostics: SMARTview</p>			
	187	NedTrain	Refurbishment
<p><b>Intercity ICM</b>            Operator: Nederlandse Spoorwegen N.V. (NS), Netherlands            Delivery: 2006 – 2011            Input: 1,500 V DC            AC output: 3 x 230 / 400 V AC, 50 Hz, 140 kVA            DC output: 110 V DC, 16 kW            Installation: underfloor container</p>			
	538	Alstom	New built
<p><b>Coradia Nordic X60/X61/X62</b>            Operator: e.g. AB Storstockholms Lokaltrafiken, Skånetrafiken, Norrtåg AB, Sweden            Delivery: 2003 – 2018            Input: 1,500 V DC            AC output: 3 x 230 / 400 V AC, 50 Hz, 105 kVA            DC output: 110 V DC, 20 kW            Installation: roof-mounted</p>			
	72	CAF	New built
<p><b>Istanbul Metro</b>            Operator: İstanbul Ulaşım Sanayi ve Ticaret A.Ş., Turkey            Delivery: 2010 – 2012            Input: 1,500 V DC            AC output: 3 x 230 / 400 V AC, 50 Hz, 135 kVA            DC output: 110 V DC, 18 kW            Installation: underfloor container</p>			








# SMARTconverter

## MEENT-SD: auxiliary power converters for short-distance trains

Project & facts	Quantity	Customer	Type
	<b>EuskoTren EMU</b> Operator: Eusko Trenbideak, Ferrocarriles Vascos S.A., Basque Country, Spain Delivery: 2011 – 2012  Input: 1,500 V DC AC-Ausgang: 3 x 230 / 400 V AC, 50 Hz, 135 kVA DC output: 110 V DC, 18 kW Installation: underfloor container Diagnostics: SMARTview	30	CAF New built
	<b>Santiago de Chile Metro</b> Operator: Metro de Santiago S.A., Chile Delivery: 2012 – 2016  Input: 750 V DC AC output: 3 x 220 / 380 V AC, 50 Hz, 135 kVA DC output: 72 V DC, 14 kW Installation: underfloor container Diagnostics: SMARTview	96	CAF New built
	<b>United Streetcar, USA</b> Operator: e.g. DC Streetcar, District Department of Transportation (DDOT), Washington DC, USA Delivery: 2011 – 2013 Input: 750 V DC AC output: 3 x 460 V AC, 60 Hz, 50 kVA, redundant DC output: 24 V DC, 5.5 kW, redundant Installation: roof-mounted Diagnostics: SMARTview	22	Siemens AG, Österreich New built
	<b>Panama Metro</b> Operator: Metro Panama City, Panama Delivery: 2012 – 2014  Input: 1,500 V DC AC output: 3 x 220 V AC, 60 Hz, 127 kVA DC output: 72 V DC, 18 kW Installation: underfloor container Diagnostics: SMARTview	38	Alstom New built
	<b>Singapore Metro</b> Operator: SMRT Corporation Ltd., Singapore Delivery: 2013 – 2015  Input: 750 V DC AC output: 3 x 230 / 400 V AC, 50 Hz, 127 kVA DC output: 110 V DC, 27 kW Installation: underfloor container Diagnostics: SMARTview	48	Alstom New built

# SMARTconverter






## MEENT-LD: auxiliary power converters for long-distance trains

Project & facts	Quantity	Customer	Type
	18	Rail Service International	Refurbishment
<p><b>Venice Simplon Orient Express</b>            Operator: Orient-Express Hotels Ltd., United Kingdom            Delivery: 2005 – 2006, 2016</p> <p>Input: 1 kV AC, 1.5 kV AC and DC, 3 kV DC            AC output: 3 x 230 / 400 V AC, 50 Hz, 35 kVA            DC output: 24 V DC, 6.6 kW            Installation: underfloor container</p>			
	8	Bombardier	Refurbishment
<p><b>CityNightLine</b>            Operator: City Night Line AG (CNL), Switzerland            Delivery: 2003</p> <p>Input: 1 kV AC, 1.5 kV AC and DC, 3 kV DC            AC output: 3 x 230 / 400 V AC, 50 Hz, 69 kVA            DC output: 24 V DC, 6.6 kW            Installation: special integration into vehicle</p>			
	240	Schweizerische Bundesbahnen	Refurbishment
<p><b>EuroCity</b>            Operator: Schweizerische Bundesbahnen (SBB), Switzerland            Delivery: 2009 – 2014</p> <p>Input: 1 kV AC, 1.5 kV AC and DC, 3 kV DC            AC output: 3 x 230 / 400 V AC, 50 Hz, 57 kVA            DC output: 36 V DC, 16 kW            Installation: underfloor container</p>			
	296	Deutsche Bahn AG	Refurbishment
<p><b>Various German InterCity and EuroCity coaches, including couchette, service and bistro coaches</b>            Operator: Deutsche Bahn AG (DB), Germany            Delivery: 2000 – 2014</p> <p>Input: 1 kV AC, 1.5 kV AC and DC, 3 kV DC            AC output: e.g. 3 x 230 / 400 V AC / 50 Hz, 35 kVA            DC output: e.g. 24 V DC, 6.6 kW            Installation: underfloor container            Diagnostics: SMARTview</p>			
	30	Medel	New built
<p><b>Sleeping car, Bulgaria</b>            Operator: Bulgarian State Railways (BDZ), Bulgaria            Delivery: 2011 – 2012</p> <p>Input: 1 kV AC, 1.5 kV AC and DC, 3 kV DC            AC output: 3 x 230 / 400 V AC, 50 Hz, 35 kVA            DC output: 24 V DC, 8 kW            Installation: underfloor container            Diagnostics: SMARTview</p>			








# SMARTview

## Diagnostics via Ethernet interface

Project & facts	Quantity	Customer	Type
	100	Alstom	New built
<p><b>AGV</b>            Operator: Nuovo Trasporto Viaggiatori, Italy            Delivery: 2010 – 2011</p> <p>Type: Ethernet, integrated webserver            Function: diagnostic, vehicle interface</p>			
	50	NedTrain	Refurbishment
<p><b>Intercity DDZ</b>            Operator: Nederlandse Spoorwegen N.V. (NS), Netherlands            Delivery: 2006 – 2011</p> <p>Type: Ethernet, integrated webserver            Function: diagnostic, vehicle interface</p>			
	34	CAF	New built
<p><b>Civity DMU / EMU</b>            Operator: Trenitalia, Sardinia, Italy            Delivery: 2012</p> <p>Type: Ethernet, integrated webserver            Function: diagnostic</p>			
	240	Schweizerische Bundesbahnen	Refurbishment
<p><b>EuroCity</b>            Operator: Schweizerische Bundesbahnen (SBB), Switzerland            Delivery: 2009 – 2014</p> <p>Type: Ethernet, integrated webserver            Function: diagnostic</p>			
	2	UGL Rail	Refurbishment
<p><b>Melbourne Metro</b>            Operator: Metro Trains Melbourne Pty Ltd (MTM), Australia            Delivery: 2011</p> <p>Type: Ethernet, integrated webserver            Function: diagnostic</p>			






# SMARTcharger

## Compact battery chargers for every application

Project & facts	Quantity	Customer	Type
	100	Alstom	New built
<p><b>AGV</b>            Operator: Nuovo Trasporto Viaggiatori, Italy            Delivery: 2010 – 2013</p> <p>AC input: 3 x 400 V AC, 50 Hz            DC output: 110 V DC, 30 kW            Installation: underfloor container</p>			
	40	Pesa	New built
<p><b>Pesa DMU 620M</b>            Operator: different operators, Lithuania, Ukraine            Delivery: 2006 – 2011</p> <p>AC input: 3 x 400 V AC, 50 Hz            DC output: 24 V DC, 6.6 kW            Installation: open frame for integration</p>			
	348	Changchun Bombardier RC	New built
<p><b>Movia Shanghai, Guangzhou and Shenzhen</b>            Operator: Shanghai Shentong Metro Group Co., Ltd., Guangzhou Metro Corporation (GMC), Shenzhen Metro Co., Ltd., China            Delivery: 2000 – 2011</p> <p>DC input: 1,500 V DC            DC output: 110 V DC, 25 kW            Installation: underfloor container</p>			
	700	Alstom	New built
<p><b>TGV POS, TGV Dasye and RGV2N2</b>            Operator: Société Nationale des Chemins de Fer Français (SNCF), France            Delivery: 2006 – 2018</p> <p>DC input: 530 V DC            DC output: 72 V DC, 9 kW            Installation: underfloor container</p>			
	650	Deutsche Bahn AG	Refurbishment
<p><b>Interregio coaches</b>            Operator: Deutsche Bahn AG (DB), Germany            Delivery: 1990 – 1996</p> <p>AC input: 1,000 V AC, 16.7 Hz            DC output: 24 V DC, 6.6 kW            Installation: underfloor container</p>			

# SMARTcharger

## Compact battery chargers for every application

Project & facts	Quantity	Customer	Type
	8	CAF	New built
<p><b>Civity DMU, Sardinia</b>            Operator: Trenitalia, Sardinia, Italy            Delivery: 2012 – 2013</p> <p>AC input: 3 x 400 V AC, 50 Hz            DC output: 24 V DC, 10 kW            Installation: roof-mounted            Diagnostics: SMARTview</p>			
	15	CAF	New built
<p><b>Civity EMU, Trieste</b>            Operator: Trenitalia, Italy            Delivery: 2011 – 2012</p> <p>AC input: 3 x 400 V AC, 50 Hz            DC output: 24 V DC, 10 kW            Installation: roof-mounted            Diagnostics: SMARTview</p>			
	62	PESA	New built
<p><b>DMU, Czech Republic</b>            Operator: České dráhy a.s., Czech Republic            Delivery: 2012 – 2013</p> <p>AC input: 3 x 400 V AC, 50 Hz            DC output: 24 V DC, 10 kW            Installation: open frame for integration</p>			
	85	Alstom	New built
<p><b>Shanghai Metro</b>            Operator: Shanghai Shentong Metro Group Co., Ltd. China            Delivery: 2008 – 2010</p> <p>AC input: 3 x 400 V AC, 50 Hz            DC output: 110 V DC, 9 kW            Installation: underfloor container</p>			
	24	PESA	New built
<p><b>DMU, Oberpfalzbahn</b>            Operator: Netinera Deutschland GmbH, Germany            Delivery: 2012 – 2014</p> <p>AC input: 1 x 230 V AC, 50 Hz            DC output: 24 V DC, 6.6 kW            Installation: open frame for integration            Diagnostics: SMARTview</p>			




# SMARTcooler

## Compact and flexible three-phase inverters

Project & facts	Quantity	Customer	Type
	120	Thermo King / Siemens	New built
<p><b>Combino Plus</b>            Operator: BKV Zrt. Budapest, Hungary            Delivery: 2006 – 2007</p> <p>DC input: 600 V DC            AC output: 3 x 400 V AC, 50 Hz, CVCF, 30 kVA            Installation: special integration into vehicle</p>			
	44	Webasto / Ansaldo Breda	New built
<p><b>Riyadh Metro</b>            Operator: Saudi Railways Organization (SRO),            Saudi Arabia            Delivery: 2010 – 2011</p> <p>DC input: 750 V DC            AC output: 3 x 400 V AC, 50 Hz, VVVF, 30 kVA            Installation: open frame for integration</p>			
	240	Thermo King	Refurbishment
<p><b>Athens Metro</b>            Operator: ISAP S.A. (urban rail), Greece            Delivery: 2007</p> <p>DC input: 750 V DC            AC output: 3 x 400 V AC, 50 Hz, CVCF, 35 kVA            Installation: special integration into vehicle</p>			
	275	Mitsubishi Electric, Alstom	New built
<p><b>AGV</b>            Operator: Nuovo Trasporto Viaggiatori, Italy            Delivery: 2010 – 2011</p> <p>AC input: 3 x 400 V AC, 50 Hz, PWM            AC output: 3 x 400 V AC, 60 Hz, VVVF, 6 kVA            Installation: special integration into vehicle</p>			
	17	Verkehrs Industrie Systeme GmbH	Refurbishment
<p><b>Arriva-Länderbahn Express ("Alex")</b>            Operator: Regentalbahn AG, Germany            Delivery: 2008</p> <p>Input: 1 kV AC, 1.5 kV AC and DC, 3 kV DC            AC output: 3 x 400 V AC, 50 Hz, VVVF, 35 kVA            Installation: underfloor container</p>			

# SMARTcooler

## Compact and flexible three-phase inverters

Project & facts	Quantity	Customer	Type
	<b>Rotterdam Citadis</b> Operator: Rotterdamse Elektrische Tram N.V., Netherlands Delivery: 2015 – 2016  DC input: 600 V DC AC output: 3 x 480 V AC, 60 Hz, 57 kVA 3 x 400 V AC, 50 Hz, 5 kVA Installation: roof-mounted container	61	Alstom Refurbishment
	<b>Bursa Tram</b> Operator: Burulaş Bursa Ulaşım Toplu Taşıım İşletmeciliği Turizm San. Ve Tic. A.Ş., Turkey Delivery: 2011  DC input: 1,500 V DC AC output: 3 x 400 V AC, 50 Hz, 36 kVA Installation: roof-mounted Diagnostics: SMARTview	49	Webasto Refurbishment
	<b>ET 474 Plus, S-Bahn Hamburg</b> Operator: Deutsche Bahn AG (DB), Germany Delivery: 2010  DC input: 1,200 V DC AC output: 3 x 460 V AC, 60 Hz, 13 kVA 3 x 560 V AC, 35 ... 65 Hz, 18 kVA Installation: open frame for integration Diagnostics: SMARTview	3	Faiveley Refurbishment
	<b>Bistro coaches, Germany</b> Operator: Deutsche Bahn AG (DB), Germany Delivery: 2002 – 2009  AC input: 460 V AC (2 x 230 V AC) 50 Hz, 16 2/3 Hz AC output: 3 x 285 V AC, 65 Hz, 25 kVA Installation: special integration into vehicle	239	Deutsche Bahn AG Refurbishment
	<b>Denver Light Rail</b> Operator: Denver Regional Transit District (RTD), Colorado, USA Delivery: 2013 – 2015  DC input: 600 / 750 V DC AC output: 3 x 208 V AC, 60 Hz, 21 kVA Installation: special integration into vehicle	65	Thermo King / Ingersoll Rand Refurbishment

# Special solutions

## Customized systems from one source

Project & facts	Quantity	Customer	Type
 <p><b>IGBT traction power stack</b> Type: DRTU</p> <p>Operator: AKN Eisenbahn AG, Germany Delivery: 2005</p> <p>DC input: 750 V DC AC output: 0 ... 560 V AC, 0 ... 200 Hz, 200 kVA</p>	80	AKN Eisenbahn AG	Refurbishment
 <p><b>Electronic replacement of traction transformer</b> Type: MEV</p> <p>Operator: Alstom, Germany Delivery: 2004</p> <p>AC input: 15,000 V AC, 16.7 Hz DC output: 1,650 V DC, 1,500 kW</p>	1	Alstom	New built
 <p><b>Power converter for variable speed generator set</b> Type: MSA125 and MSA40</p> <p>Operator: various military applications Delivery: 2009 – 2011</p> <p>AC input: 3 x 310 ... 620 V AC, 120 ... 240 Hz AC output: 3 x 230 / 400 V AC, 50 Hz, CVCF, 125 or 44 kVA</p>	85	Kirsch GmbH	New built
 <p><b>Heat regulator for ICE 1, ICE 2, BVMZ IC coaches</b> Type: NHS</p> <p>Operator: Deutsche Bahn AG, Germany Delivery: 2002 – 2007</p> <p>AC input: 3 x 400 V AC, 50 Hz AC output: 3 x 0 ... 400 V AC, 50 Hz, 2 kVA</p>	1,200	Deutsche Bahn AG	New built
 <p><b>Step-up/step-down converter for fuel cells</b> Type: Hotis</p> <p>Operator: e.g. Kasseler Verkehrs-Gesellschaft AG (KVG), Germany Delivery: 2006 – 2008</p> <p>DC input: 37 ... 57 V DC DC output: 60 ... 110 V DC, 12 kW</p>	18	e.g. Hydrogenics Europe	New built





**SMART Railway Technology GmbH**

Miramstrasse 87  
34123 Kassel  
Germany

Phone +49 561 50634-6000  
Fax +49 561 50634-6001

info@SMART-Railway.de  
[www.SMART-Railway.de](http://www.SMART-Railway.de)

