

SYKO - Expert in Power Electronics

# SYKO POWER<sup>®</sup>

*Railway*

System solutions

Photo: DB German Rail



Long-distance transportation

Photo: DB German Rail



Local transportation

Photo: Manufacturer: Bombardier Transportation with driver's control panel terminals from ELCON mobility GmbH



Photo: LIREX rail car, manufacturer: ALSTOM Transport with displays from Gersys GmbH



Photo: ÖBB Austrian Railways, locomotive series 2016 Manufacturer: Siemens Transportation Systems



Display power

Equipment/drives

## Power Supplies for Railway Technology

DC/DC converters, regenerators, power supply units, 1ph/3ph inverters

### 3 W to 3 kW

System solutions in the train and along the track

**(9/13,5 - 154)V DC / (30-360)V DC / (82-264)V AC**

Overhead cable power supply and UIC voltages

**(1000/1500)V sine/square wave // 750V/1500V/3000V DC**

# DC/DC converters, 3 Watt - 660 Watt

## Non-isolated / PCB mounting / 19" slide-in modules

### Series MSR.A/K, MSR, NSR, SR.K, LSR.M 6 W - 150 W

DC step-down converters, not isolated  
 Printed circuit board module / 19" slide-in modules / chassis mounting  
 Short-circuit proof, overload-protected, no-load proof, unipolar  
 Vin range: (7 - 38)V to (15 - 158)V / (19 - 450)V\*  
 Vout: 5.1 V to 24 V  
 Modules' RFI can be easily suppressed  
 LSR.M incl. RFI suppression EN 55022.B  
 Shock/vibration: EN 50155  
 \* Operation with permanently excited three-phase generators

Product Line A

Series MSR.K

Series MSR.A



(Series LSR.P for Peltier elements heating + cooling)



### Series MSR.V/NSR.V/PSR.V 10 W - 40 W

Product Line B

Safety-relevant regenerator topology 1)  
 Printed circuit board module  
 Vin lower than, same as, or higher than Vout  
 Short-circuit proof, overload-protected, no-load proof, unipolar  
 Vin range: (4 - 45)V / (8 - 72)V / (13.5 - 154)V  
 Vout: 5.1 V to 48 V  
 Printed circuit board module (40 x 40) mm<sup>2</sup> MSR.V  
 Printed circuit board module (48 x 51) mm<sup>2</sup> NSR.V  
 Printed circuit board module PSR.V without potting compound  
 (91 x 65 x 22.5)mm PSR.V surge-proof SGrd3 / 2 Ohm  
 Featuring: variable Vout, RFI can be easily suppressed  
 Optional long-term transient adjustment

### Series LSV.V/LSR.V/ESR.V up to 120 W

Safety-relevant regenerator topology 1)  
 Short-circuit proof, overload-protected, no-load proof  
 Unipolar, featuring: variable Vout (battery charging)  
 Vin lower than, same as, or greater than Vout  
 Vin range: (6 - 34)V, (9 - 60)V  
 (14.4 - 45)V, (14.4 - 154)V  
 VG 96916 T5, DIN ISO 7637 T 1/3  
 EFT/surge immunity: EN 61000-4-4/5 SGrd.3  
 19" slide-in module, 4 TE, 5 TE front panel

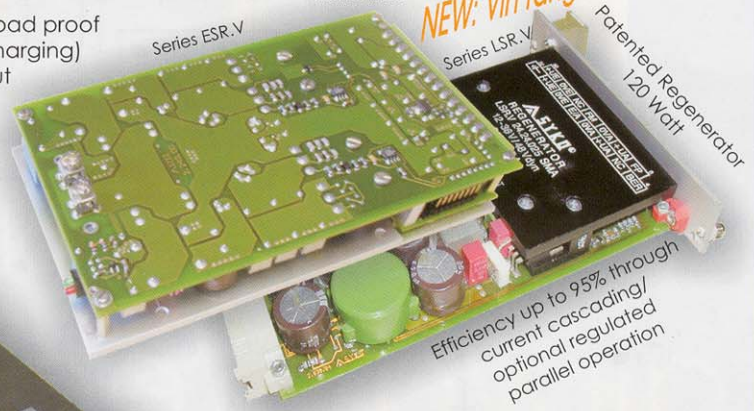
Product Line B

Series ESR.V

NEW: Vin range (6 - 60)V

Series LSR.V

Patented Regenerator  
 120 Watt



Efficiency up to 95% through current cascading/  
 optional regulated parallel operation



### Series DBR.V up to 660 W

Product Line B

Safety-relevant regenerator topology 1)  
 Short-circuit proof, overload-protected, no-load proof  
 Vin lower than, same as, or higher than Vout  
 Vin range: (14.4 - 34)V stat. (8 - 38)V dyn.  
 (66 - 158)V stat. (35 - 170)V dyn. up to 660W  
 (16.8 - 158) V stat. 250 Watt  
 Burst/surge: EN 61000-4-4/5 SGrd 3  
 Vout: 24V/48V/60V/110V / optional: adjustable  
 Connection: terminal strip, 16mm<sup>2</sup>  
 For regeneration of on-board electrical system,  
 BigCap or battery charging

1) SYKO patented regenerator / safety-relevant topology (US Pat. Nr. 5,991,166 & 6,094,366 / German Pat. Nr. 195 15 210 & 195 05 417), registration of a dual-voltage on-board electrical system. The advantage of the regenerator topology is that it is safety-relevant. In case of fault, especially in dual voltage on-board electrical systems (batteries, BigCaps), punch-through from the primary side to the secondary side (and vice-versa) can be prevented. Advantages include current and voltage cascading, also with isolation and single-stage PFC, and functionality as a short circuit-proof buck-boost converter. The input voltage can be lower than, the same as, or higher than the regulated, short circuit-proof output voltage (which is adjustable from 0V to the maximum Vout).

All converters optionally with extended temperature range: (-40...+85)°C

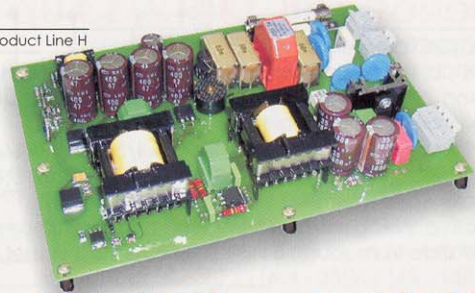
Without isolation

# High voltage and start-up power supplies Universal power supply units

## Series ABS 04 / 05 up to 100 W

DC/DC converters with isolation, unipolar  
Short-circuit proof, overload-protected, no-load proof  
**ABS 04:** Vin range: (400 - 1050)V + transients  
Vout: 24V/28V switchable, 48V, 50W stat./75W dyn.  
**ABS 05:** Vin range: (600 - 1600)V / 2550V long-term transients  
Vout: 24V/28V switchable, 48V, 75W stat./100W dyn.  
EFT / surge immunity: EN 61000-4-4/5, 6kV / 2 Ohm  
RFI suppression: EN 55022.A, shock/vibration: EN 50155  
Dimensions: ABS 04: (215 x 145 x 40)mm/ABS 05: (225 x 155 x 40)mm  
For static loads or start-up operation

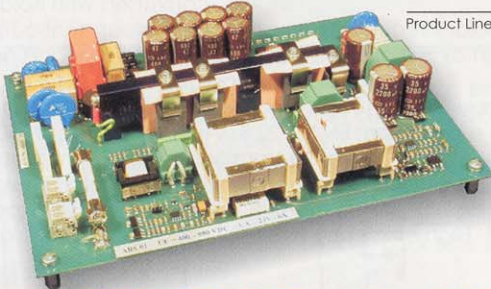
Product Line H



## Series ABS 01/02 up to 200 W

DC/DC converters with isolation, unipolar  
Short-circuit proof, overload-protected, no-load proof  
Vin range: (400 - 950)V / + transient adjustment  
EFT / surge immunity: EN 61000-4-4/5 3kV / 2 Ohm  
RFI suppression: EN 55022.A, shock/vibration: EN 50155  
**ABS 01:** Vout: switchable from 24V-28V up to 48V  
**ABS 02:** Vout: >48V up to 110V  
Dimensions: (250 x 170 x 40)mm  
For static loads or start-up operation

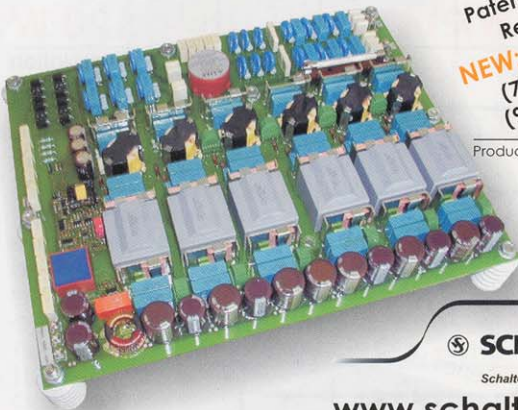
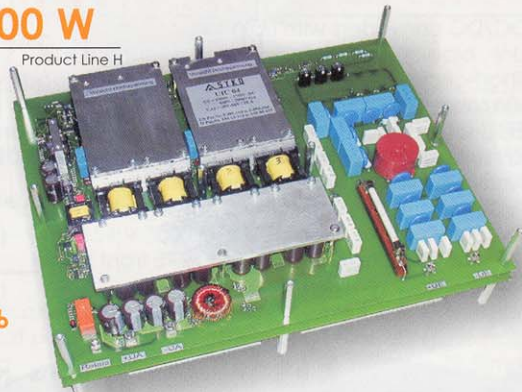
Product Line H



## Series UIC 02/04 up to 500 W/1500 W

Static or start-up system power supply for UIC voltages  
for rail traffic throughout Europe.  
Patented cascading regenerator  
EFT / surge immunity: EN 61000-4-4/5 6kV/20Ohm - 10kV/2ms  
RFI suppression: EN 55022.A, shock/vibration: EN 50155,  
**UIC 02** Vin range: (600 - 1400)Veff 16<sup>2</sup>/3 Hz, sine/square wave  
(900 - 2100)Veff 50 Hz, (900 - 2100)V DC without switching  
Dimensions: (420 x 338 x 40)mm  
**UIC 04** Vin range: (950 - 3000)V DC without switching  
Dimensions: (420 x 338 x 125)mm

Product Line H



Patent Cascading  
Regenerator  
NEW: Series UIC 06  
(700 - 2100)Veff /  
(900 - 5000)V DC

Product Line H

## Series UIC 03 up to 350 W

Static or start-up system power supply for UIC voltages  
for rail traffic throughout Europe. Patented regenerator  
EFT / surge immunity, transients: UIC 550  
RFI suppression: EN 55022.A, shock/vibration: EN 50155  
Vin range: (700 - 1860)Veff (16<sup>2</sup>/3 - 60)Hz, (900 - 2500)V DC,  
Dimensions: (420 x 338 x 42)mm  
Static output power 250W, Vout: 24V - 110V

**SCHALTBAU**  
Schalten · Stecken · Steuern

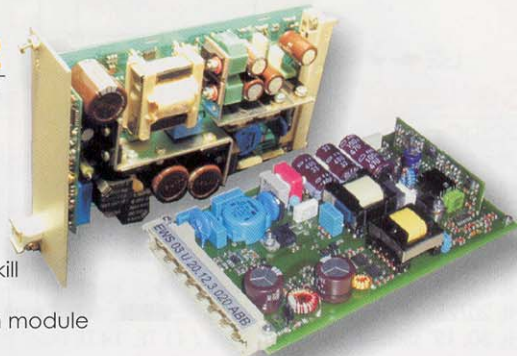
[www.schaltbau.de](http://www.schaltbau.de)

Sales as UIC start-up equipment  
exclusively through Schaltbau GmbH, Munich

## Series EWS 01/03, series ROS 01/02

AC/DC universal power supply units  
Short-circuit proof, overload-protected, no-load proof  
Uni-, bi-, tripolar with wide input range  
Vin ranges: (82 - 264)V AC (40 - 320)V DC  
(40 - 264)V AC (18 - 320)V DC  
(16<sup>2</sup>/3 - 400)Hz (optional: also for square wave voltages)  
EFT / surge immunity: EN 61000-4-4/5 SGrd. 4  
Active transient protection (AFI)/inrush current limiting/transient kill  
Active power loss ride-through, optionally up to 500ms  
EWS 01 up to 12W DIN rail-mountable/EWS 03 to 25W, 19" slide-in module  
ROS 01/02 up to 80W / 120W, 19" slide-in module

Product Line F



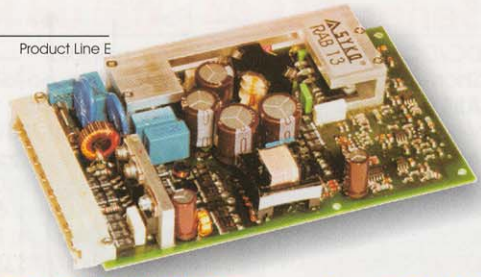
“ Your customer specification is our standard ”

# DC/DC system converters, 20 Watt-500 Watt Isolated / 19" slide-in modules

## Series RAB 11/12/13 up to 25 W

DC/DC converters with isolation  
 Uni-, bi-, tripolar / functionally independent outputs  
 Short-circuit proof, overload-protected, no-load proof  
 Vin range: (8 - 38)V / (14.4 - 158)V  
 EFT / surge immunity: EN 61000-4-4/5, VG 96916 T5  
 RFI suppression: EN 55022.B, shock/vibration: EN 50155  
 Active transient filter (AFI) (optional: RIA 12)  
 Active storage time >50ms starting at minimum input voltage  
 19" slide-in module, 3 HE / 5 TE, 6 TE front panel

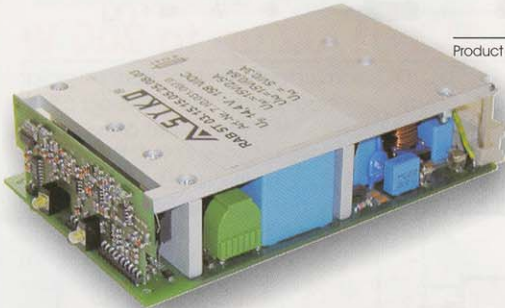
Product Line E



## Series RAB 5 U/B/T up to 70 W

DC/DC converters with isolation  
 Uni-, bi-, tripolar / regulated, functionally independent outputs  
 Short-circuit proof, overload-protected, no-load proof  
 Vin range: (8 - 36)V / (14.4 - 158)V  
 EFT / surge immunity: EN 61000-4-4/5, RIA 12 optional, VG 96916 T5  
 RFI suppression: EN 55022.B, shock/vibration: EN 50155  
 Active transient filter (AFI), transient kill  
 Active inrush current limiting, power failure signal  
 19" slide-in module, 3 HE / 7 TE, 8 TE front panel  
 High efficiency through synchronous rectification

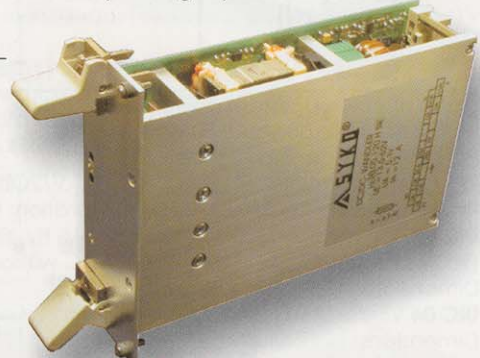
Product Line E



## Series HL 10 up to 100 W / 60 W

DC/DC converters with isolation  
 Uni-, bipolar / regulated, independent outputs  
 Short-circuit proof, overload-protected, no-load proof  
 Vin range: (13.5 - 52)V / (40 - 154)V  
 EFT / surge immunity: EN 61000-4-4/5, RIA 12 optional  
 RFI suppression: EN 55022.B, shock/vibration EN 50155  
 Active transient filter (AFI), transient kill  
 Active inrush current limiting, power failure signal  
 Output voltages: 3V - 110V fixed  
 19" slide-in modules, 3 HE / 8 TE, 9 TE front panel  
 Synchronous rectification

Product Line E



## Series FWK 01.U/B/T up to 120 W

DC/DC converter with isolation  
 Regenerator basis, uni-, bi-, tripolar  
 Short-circuit proof, overload-protected, no-load proof  
 Vin range: (14.4 - 154)V / (13.5 - 52)V / (40 - 170)V  
 EFT / surge immunity: EN 61000-4-4/5  
 RFI suppression: EN 55022.B, shock/vibration EN 50155  
 Active transient filter (AFI)  
 19" slide-in module, 6 HE / 8 TE front panel  
 With heat sink connection (flat heat sink)  
 Active storage time, cross plug protection

Product Line E



Customer requirement:  
 Vin: (14,4 - 154)V to 120W  
 Patented Regenerator  
 Logistic advantage with  
 very wide input voltage ranges

## Series HL 15-HL 30 150 W-300 W

DC/DC converters with isolation  
 Unipolar, short-circuit proof, overload-protected, no-load proof  
 Vin range: (13.5 - 52)V / (35 - 154)V / (66 - 170)V  
 EFT / surge immunity: EN 61000-4-4/5, RIA 12 optional  
 RFI suppression: EN 55022.B, shock/vibration EN 50155  
 Active transient filter (AFI), inrush current limiting  
 HL 15: 19" slide-in module, 3 HE 9/10 TE front panel or chassis-mountable  
 HL 20/25: 19" slide-in module, 3 HE / 9 TE, 10 TE front panel  
 HL 30: 19" slide-in module, 3 HE / 11 TE, 14 TE front panel

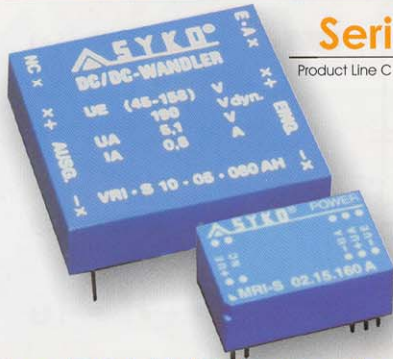
Product Line E



" What we control becomes standard! "

# DC/DC converters, 3 Watt - 50 Watt

## Isolated / PCB mounting / chassis mounting



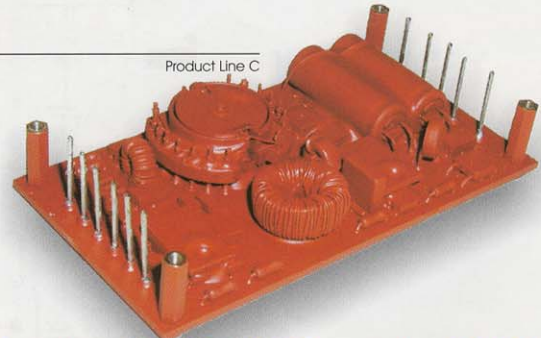
### Series MRI.S up to 3 W / VRI. up to 12 W

Product Line C

DC/DC converters with isolation  
Printed circuit board modules / potted  
Short-circuit proof, overload-protected, no-load proof  
**MRI:** uni-, bipolar with I/O operation  
Outputs functionally independent  
Vin range: (6 - 38), (19 - 80)V  
DIL 24, RFI can be easily suppressed  
**VRI:** uni-, bi-, tripolar with I/O operation  
Outputs functionally independent  
Vin range: (8 - 38) / (14.4 - 38)V / (45 - 158)V  
(48 x 51 x 10.5)mm, RFI can be easily suppressed

### Series DRI.U/B/T up to 10 W

DC/DC converters with isolation  
Short-circuit proof, overload-protected, no-load proof  
Unipolar, bipolar, tripolar / with inrush current limiting  
Vin range: (14.4 - 85)V, (14.4 - 154)V / 190V dyn.  
Overload protection, input current filter, output spike filter  
Application for EMV, transients, power loss ride-through  
Printed circuit board module with protective coating,  
without potting compound, Dimensions (95 x 51 x 18)mm



Product Line C

### Series SRI.E/Z/D up to 30 W

Product Line C

DC/DC converters with isolation  
uni-, bi-, tripolar / outputs functionally independent  
Short-circuit proof, overload-protected, no-load proof  
Incl. long-term transient adjustment  
Vin range: (8 - 72)V / (13.5 - 52)V 110V/10ms  
(35 - 154)V 300V/10ms / (13.5 - 154)V 300V/10ms  
with application for EFT / surge  
EN 61000-4-4/5, RIA 12, VG 96916  
Application for EMV, transients, power loss ride-through  
Printed circuit board module with protective coating, no resin  
Dimensions: (91 x 65 x 22.5)mm

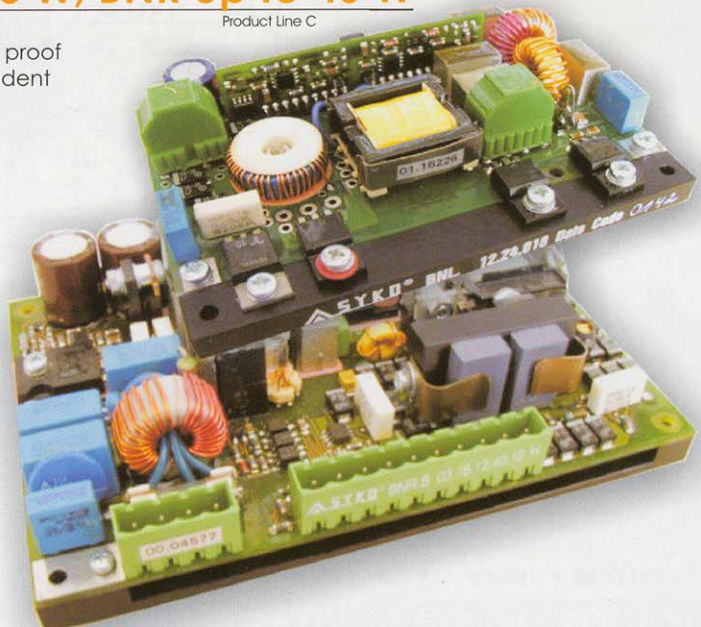
### Series BNL.U/B/T up to 50 W, BNR up to 40 W

Product Line C

DC/DC converters with isolation  
Short-circuit proof, overload-protected, no-load proof  
**BNL:** uni-, bi-, tripolar / functionally load-independent  
Vin range: (8 - 38)V / (19 - 76)V  
(45 - 154)V, surge SGrd.3 / 2 Ohm  
EN 55022.B without external filter circuitry  
Open design, chassis mounting with flange  
Temperature range: (-25...70)°C or (-40...+85)°C  
(135 x 76 x 23.5)mm  
Optional: DIN-rail mounting

#### **BNR:**

Vin range: (14.4 - 154)V  
EN 61000-4-4/5, burst/surge SGrd.3 / 2 Ohm  
EN 55022.B without external filter circuitry  
Active storage time >10ms starting at  
minimum input voltage,  
Advanced functions for  
powering displays and heating  
Open design, chassis mounting with flange  
Temperature range: (-25...70)°C or (-40...+85)°C  
(146 x 100 x 31)mm



# Coil drivers and DC/DC field regulators Single-phase/three-phase inverters

## Series MSG 01 up to 50 W

DC/DC coil drivers with programmable constant current to drive inductors  
Safety-relevant regenerator topology 1)  
Short-circuit proof, overload-protected, no-load proof  
Vin lower than, same as, or higher than Vout  
Without potential isolation  
Switching of static holding current / holding current  
Vin range: (9 - 18)V / (8 - 26)Vdyn. / (9 - 34)V 50V/50ms  
(16.8 - 34)V 50V/50ms 70V/2ms 9V diesel cold start  
(14.4 - 154)V surge-proof SGrd.3/2 Ohm  
Dimensions: (90 x 60 x 35) mm

Product Line B



Patented regenerator  
A single coil voltage for all  
input voltages of (14 - 154)V

## Series ERG 01/02 up to 500 W/900 W

Product Line B



For operation of separately excited asynchronous machines in diesel-electric engines, for driving large inductors in a field regulator coil  
Safety-relevant, cascading regenerator topology  
Adjustable constant voltage  
Optional: adjustable constant current  
Isolated set point selection  
Isolated actual value return  
Short-circuit proof, overload-protected, no-load proof  
Vin range: (16.8 - 34)V 14.4V dyn.  
(20 - 50)V 16V dyn.  
(67 - 154)V 40V dyn.

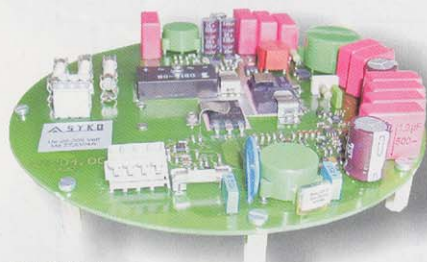
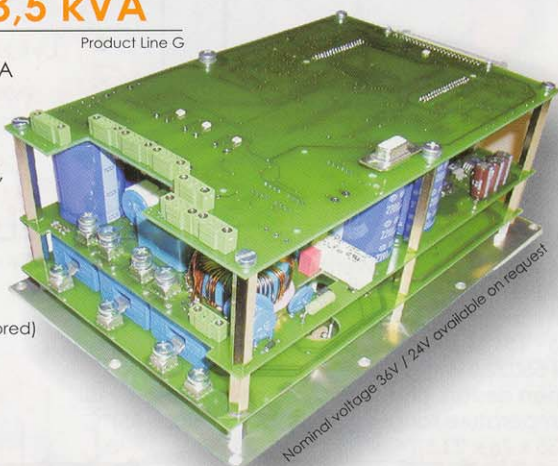
**ERG 01:** voltage-regulated, 0V - max. 90V / 6A  
Optional: with constant current

**ERG 02:** current-controlled, 0A - 8A / 10A dyn. / 90V  
EFT / surge immunity: EN 61000-4-4/5, RFI suppression: EN 55022.B

## Series WER 01 / DRR 01 up to 3,5 kVA

Single- and three-phase inverters for railway use  
For operation of asynchronous machines dyn. up to 3,5 kVA  
Input voltage range: (76 - 170)V [optional: (400 - 900)V]  
EFT / surge immunity: EN 61000-4-4/5 SGrd.3  
Inrush current / pick-up current limiting (pre-charging)  
Device parameters: Vout, Ik, fout, U/f control, status report, approach/braking, phase sequence rectification,  
Adjustment and remote query of device parameters via RS 232 or RS 485 (CAN is in planning) with SYKO software  
Signal notification 2 relays / signal input: 14V - 300V 1mA  
24V/0.5A for external pre-charging contactor  
Ambient temperature: (-40...+70)°C with cooling fan (monitored)  
Dimensions (without transformer): (260 x 160 x 120)mm,  
Weight: 3kg, adjustment of output voltage via transformer

Product Line G



## Customer-specific solutions up to 2 kW

Product Line K

For low-voltage and high-voltage applications  
DC/DC converters, AC/DC universal converters  
Emergency start-up equipment, single- and three-phase inverters  
High voltage DC and AC input, AC input with PFC  
Battery charging, regeneration of on-board electrical system

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**POWER**

SYKO Reinhard Kalfhaus offers customer-specific development