

SynQor[®]

HELIOS[®]

POWER SOLUTIONS

RAIL TRANSPORTATION ISOLATED DC-DC CONVERTERS

RailQor[®]



Railway Power Supply

RAIL TRANSPORTATION ISOLATED DC-DC CONVERTERS



DC-DC CONVERTER KEY PERFORMANCE HIGHLIGHTS

SynQor's RailQor® line of DC-DC converters is designed to provide isolated DC power in the transportation industry for such electronics as LED displays, audio amplifiers, safety monitors, lighting, and communications systems under the European Standard EN 50155. These converters use SynQor's synchronous rectifier based technology to achieve extremely efficient industry leading performance. Due to the difficult environmental conditions the transportation market poses on power supplies, SynQor has designed the RailQor line for optimal performance in the most demanding applications.

RailQor Input/Output Ratings

| Family | VOUT | 3.3V | 5V | 12V | 15V | 24V | 48V | 56V | Package Size / Power Level |
|-------------------------|-----------------------|--|---|--------------|-------------|--------------|-------------|-----------|----------------------------|
| 2:1 Input Ratio | | 72V (42V - 110V) Continuous Input Range, (150V Transient, QT and HP only) | | | | | | | |
| RQ72 | Max. Iout / Power Out | | 10A / 50W | 4.1A / 49W | 3.3A / 50W | 2A / 48W | | | Quarter-brick / Mega |
| | | | 25A / 125W | 12A / 144W | 10A / 150W | 6A / 144W | 3A / 144W | | Quarter-brick / Tera |
| | | | 46A / 230W | 21A / 252W | 17A / 255W | 10.4A / 250W | 5.2A / 250W | | Half-brick / Peta |
| 2:1 Input Ratio | | 110V (66V - 160V) Continuous Input Range, 200V Transient | | | | | | | |
| RQ1B | Max. Iout / Power Out | 15A / 50W | 10A / 50W | 4.1A / 49W | 3.3A / 50W | 2A / 48W | 1A / 48W | | Quarter-brick / Mega |
| | | | 20A / 100W | 8.4A / 101W | | 4.2A / 101W | 2.1A / 101W | | Quarter-brick / Giga |
| | | 30A/99W | 25A / 125W | 12A / 144W | 10A / 150W | 6A / 144W | 3A / 144W | 3A / 168W | Quarter-brick / Tera |
| | | | 48A / 240W | 21A / 252W | 17A / 255W | 10A / 240W | 5.2A / 250W | | Half-brick / Peta |
| | | | 60A / 300W | 27A / 324W | 27A / 326W | 13.6A / 326W | 6.8A / 326W | | Half-brick / Exa |
| | | | 60A / 300W | 42A / 504W | 33A / 495W | 21A / 504W | 10A / 480W | | Half-brick / Zeta |
| 4:1 Input Ratio | | 18V (9V - 36V) Continuous Input Range, 40V Transient | | | | | | | |
| RQ18 | Max. Iout / Power Out | | 10A / 50W | 4.1A / 49W | 3.3A / 50W | 2A / 48W | | | Quarter-brick / Mega |
| | | | 20A / 100W | 8.0A / 96W | 7.0A / 105W | 4A / 96W | 2A / 96W | | Quarter-brick / Tera |
| | | | 36A / 180W | 15A / 180W | 12A / 180W | 7.5A / 180W | 3.7A / 178W | | Half-Brick / Peta |
| 4:1 Input Ratio | | 36V (18V - 75V) Continuous Input Range, 80V Transient | | | | | | | |
| RQ36 | Max. | | 10A / 50W | 4.1A / 49W | 3.3A / 50W | 2A / 48W | 1A / 48W | | Quarter-brick / Mega |
| 4:1 Input Ratio | | 90V (34V - 160V) Continuous Input Range, 200V Transient | | | | | | | |
| RQ90 | Max. Iout / Power Out | | 10A / 50W | 4.2A / 50W | 3.3A / 50W | 2.1A / 50W | 1A / 48W | | Quarter-brick / Mega |
| | | | 24A / 120W | 10A / 120W | 8A / 120W | 5A / 120W | 2.5A / 120W | | Quarter-brick / Tera |
| | | | 40A / 200W | 19A / 228W | 15A / 225W | 9.5A / 228W | 4.6A / 221W | | Half-brick / Peta |
| | | | 13.8Vout – 21.7A / 300W (40V - 160V Continuous, 200V Transient) | | | | | | |
| 12:1 Input Ratio | | 68V (12V - 155V) Continuous Input Range, 170V Transient | | | | | | | |
| RQ68 | Max. Iout / Power Out | | 5.3A / 26W | 2.2A / 27W | 1.8A / 27W | 1.1A / 26W | | | Quarter-brick / Mega |
| | | | 10.6A / 53W | 4.4A / 53W | 3.5A / 53W | 2.2A / 53W | | | Half-brick / Giga |
| | | | 20A / 100W | 8.4A / 101W | 6.7A / 101W | 4.2A / 101W | 2.1A / 101W | | Half-brick / Exa |
| | | | 30A / 150W | 12.5A / 150W | 10A / 150W | 6A / 144W | 3A / 144W | | Half-Brick / Zeta |

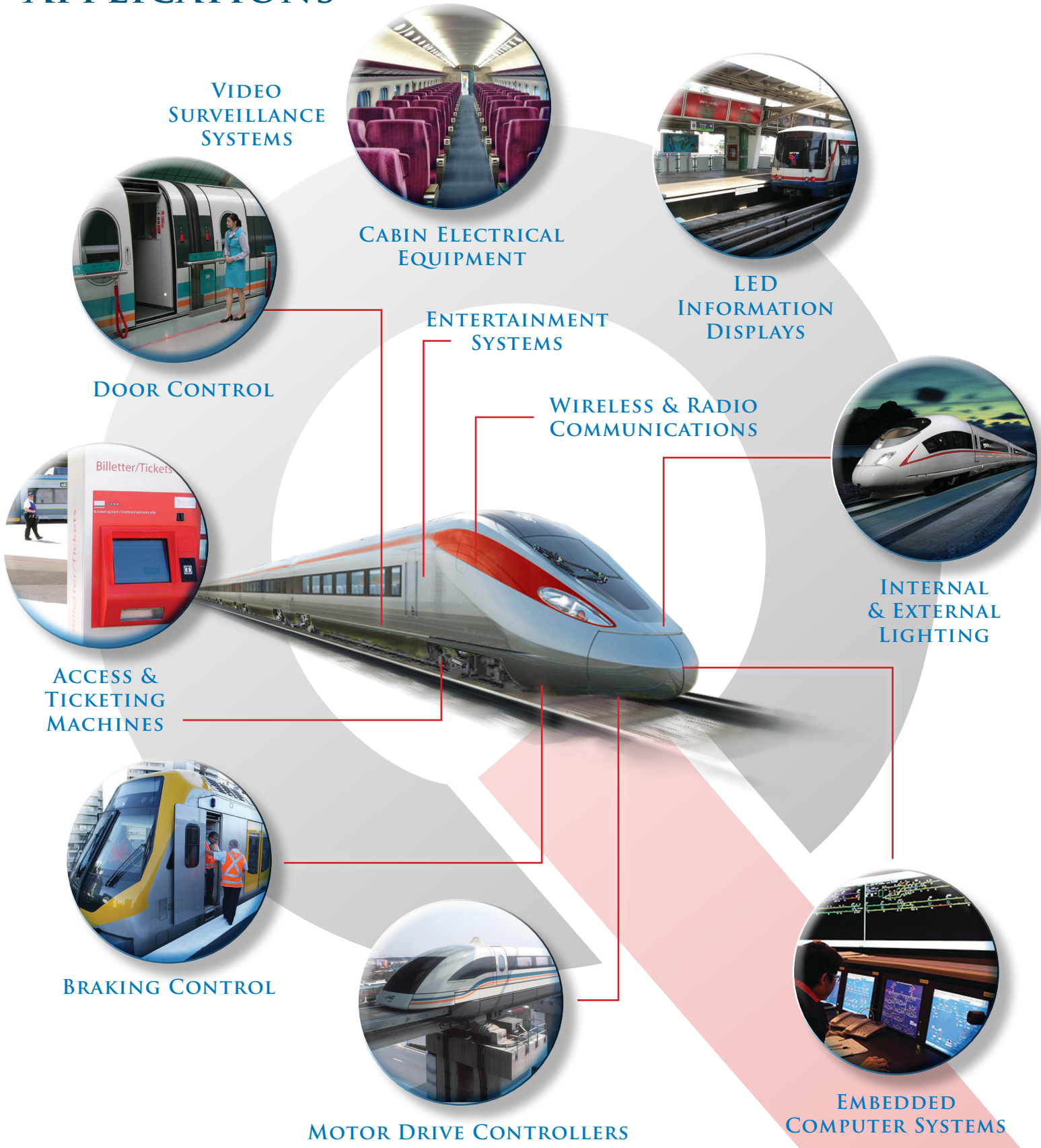
| Family | Output Voltage | 40V | Package Size / Power Level |
|------------------------|-----------------------|--|----------------------------|
| 2:1 Input Ratio | | 24V (18V - 45V) Continuous Input Range, 50V Transient | |
| RQ24 | Max. Iout / Power Out | 12.5A / 500W | Half-brick Zeta |

EN50155 Requirements and RailQor Features

| RailQor Capabilities | | | |
|----------------------|-------------|------------------|-----------------|
| Input Ratio | Family | Continuous Input | Transient Input |
| 2:1 | RQ72 | 42V– 110V | 42V – 150V (1s) |
| 2:1 | RQ1B | 66V– 160V | 66V – 200V (1s) |
| 4:1 | RQ18 | 9V– 36V | 9V – 40V (1s) |
| 4:1 | RQ36 | 18V– 75V | 18V – 80V (1s) |
| 4:1 | RQ90 | 34V– 160V | 34V – 200V (1s) |
| 12:1 | RQ68 | 12V– 155V | 12V – 170V (1s) |

| EN50155 Requirements | | |
|----------------------|------------------|-----------------|
| Nominal | Continuous Input | Transient Input |
| 72V | 50V – 90V | 43V – 101V |
| 110V | 77V – 137V | 66V – 160V |
| 24V | 17V – 30V | 14V – 34V |
| 72V – 110V | 50V – 137V | 43V – 160V |
| 24V – 110V | 17V – 137V | 14V – 160V |

APPLICATIONS





TECHNICAL SUPPORT

SynQor understands the need for rapid development of new projects in the transportation industry and provides excellent support for new designs incorporating the RailQor product lines. Concerns regarding EN 50155 compliance, transient and surge suppression to meet RIA 12, design for optimal thermal performance and other techniques are described in our RailQor datasheets and in technical papers available at www.synqor.com.

RAILQOR DC CONVERTER PART NUMBERING GUIDE

| Family | Cont. Vin | Output Voltage | Package Size | Series | Thermal Design | Max. Output Current | Enable Logic | Pin Length | Features |
|--------|--|--|---|---|--|---|--------------------|------------------|---|
| RQ | 18: 9 - 36V 24: 18 - 45V 36: 18 - 75V 68: 12 -155V 72: 42 -110V 90: *34-160V 1B: 66 -160V | 033: 3.3V 050: 5V 120: 12V 138: 13.8V 150: 15V 240: 24V 480: 48V 560: 56V | Q: Quarter-brick H: Half-brick | G: Giga M: Mega P: Peta T: Tera E: Exa Z: Zeta | C: Encased D: Encased, Non-threaded Baseplate V: Encased, Flanged Baseplate | 60: 60A 48: 48A 46: 46A 36: 36A 25: 25A 21: 21A 15: 15A 12: 12A 10: 10A 08: 8A 07: 7A 06: 6A 05: 5A 04: 4A 02: 2A 01: 1A | N: Negative | R: 0.180" | S: Standard F: Full Feature (HE/HZ only) |

Part Numbering Example: RQ90050QMC10NRF-G For valid part numbers, refer to the website or contact your local sales representative or distributor.

*RQ90138HEX22 Only Vin Range 40 - 160V.

RAILQOR DC FILTER PART NUMBERING GUIDE

| Family | Cont. Vin | Filter Type | Package Size | Series | Thermal Design | Max. Output Current | Options Description | | |
|--------|-----------|--------------------|------------------|---------|------------------------------------|---------------------|---------------------|------------|-------------|
| | | | | | | | Enable Logic | Pin Length | Features |
| RQ | 200:±200V | PF: Passive Filter | Q: Quarter Brick | T: Tera | C: Encased V: Flanged Baseplate | 10: 10A | S: Standard | R: 0.180" | S: Standard |

Part Numbering Example: RQ200PFQTC10NRS-G For valid part numbers, refer to the website or contact your local sales representative or distributor.

| Model Number | Input Voltage | | Max. Output Current | Isolation Voltage (to common-mode / baseplate) | Maximum DC Resistance @ 100°C | Differential-Mode Attenuation | Common-Mode Attenuation |
|--------------|---------------|----------------|---------------------|--|-------------------------------|-------------------------------|-------------------------|
| | Continuous | Surge (<100ms) | | | | | |
| RQ200PFQTx10 | ±200V | ±250V | 10A | 3000V | 70mΩ | >80dB @ 250kHz | >50dB @ 250kHz |

RAILQOR QUALIFICATION TESTING

| Testing Type | Units | Test Conditions |
|-----------------------|-------|--|
| Vibration | 5 | EN 61373:1999 Category I, Class B, Body mounted |
| Life Test | 30 | 95% rated Vin and load, units at derating point, 1000 hours |
| Cold | 5 | EN 60068-2-1:2007 |
| Dry Heat | 5 | EN 60068-2-2:2007 |
| Mechanical Shock | 5 | EN 61373:1999 Category I, Class B, Body mounted |
| Temperature Cycling | 5 | -40°C to 100°C, unit temp. ramp 15°C/min., 500 cycles |
| Power/Thermal Cycling | 5 | Toperating = min to max, Vin = min to max, full load, 100 cycles |
| Design Marginality | 5 | Tmin-10°C to Tmax+10°C, 5°C steps, Vin = min to max, 0-105% load |
| Damp Heat, Cyclic | 5 | EN 60068-2-3:2005 |
| Solderability | 15 | Pins MIL-STD-883, method 2003 |

Note: Governing Standard BS EN 50155:2007 Railway applications - Electronic equipment used on rolling stock



PRODUCT FEATURES

The RailQor converter series is composed of next-generation, board-mountable, isolated, fixed switching frequency DC-DC converters that use synchronous rectification to achieve extremely high power conversion efficiency, even at low output power levels. The Quarter-brick 25W-50W Mega Series power dissipation is so low that no heatsink is necessary to operate at 85°C in an enclosed environment without airflow. Each module is supplied completely encased to provide protection from the harsh environments seen in many industrial and transportation applications.

OPERATIONAL

- High efficiency at full load up to 93%
- Quarter-brick 25-50W Mega Series has no derating in environments with zero airflow and ambient temperatures up to 85°C with no heatsink.
- Input voltage ranges: 9-36V, 18-45V, 18-75V, 12-155V, 42V-110V, 34V-160V and 66V-160V
- Input voltage ranges fully cover the requirements of EN 50155
- Full power operation at baseplate temperature range from -40°C to 100°C.
- Output power up to 500W
- Fixed frequency switching, low output noise
- No minimum load requirement
- Encased module to provide protection from harsh environments and available with optional flanged style baseplate.

MECHANICAL

- Industry standard pin-out configuration
- Flanged baseplate available
- Industry standard footprint:
Half-brick: 2.4" x 2.5"
Quarter-brick: 1.5" x 2.4"

PROTECTION/CONTROL

- Input under-voltage lockout
- Output current limit and short circuit protection
- Active back bias limit prevents damage to converter
- Output over-voltage protection
- Thermal shutdown

GENERAL SPECIFICATIONS

- Operating Temperature -40°C to +100°C
- Output Voltage Set Point $\pm 1.0\%$
- Output Voltage Ripple <1% of V_{out} (typ.)
- Switching Frequency 240 - 350kHz
- Transient Response <7% of V_{out} (typ.)
- Output Voltage Trim Range +10% to -20%
- Isolation Voltage Up to 2000Vrms
- EN50155 Compliance
- RIA 12 Compliance with external circuit

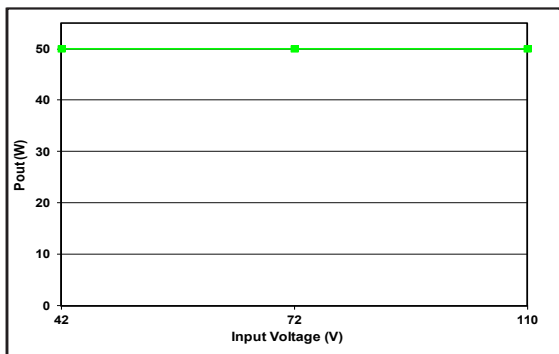
SAFETY

RQ1B, RQ72, RQ68 & RQ90

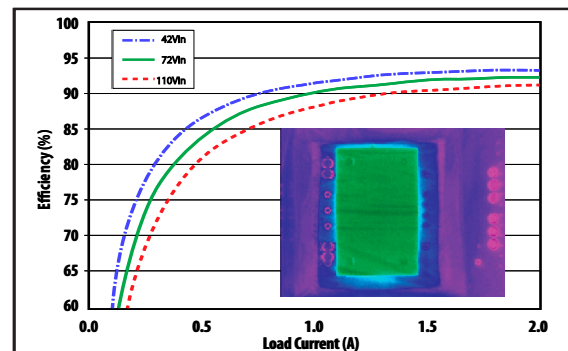
- Up to 2000Vrms, 100M Ω input-to-output isolation
- CAN/CSA C22.2 NO. 60950-1
- UL 60950-1
- EN 60950-1
- EN45545-2 R24/R25 Compliant
- CE marked

RQ18, RQ24, RQ36

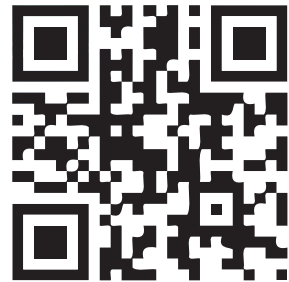
- 1500Vrms, 100M Ω input-to-output isolation
- CAN/CSA C22.2 NO. 60950-1
- UL 60950-1
- EN 60950-1
- EN45545-2 R24/R25 Compliant



Typical RailQor quarter-brick 50W encased converter (no heatsink) maximum output power derating over input voltage at 85°C and natural convection airflow.



Efficiency at nominal output voltage vs. load current for minimum, nominal, and maximum input voltages at 25°C of a typical RailQor quarter-brick 50W converter.



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RAILQOR APPLICATION NOTES

- **“RailQor EN 50155 / RIA-12 Compliance & Evaluation Board Application Note”** – Addresses the input voltage requirements of the European Railway Standards EN50155 and RIA-12 and how to meet them using SynQor’s RailQor DC-DC converters. The RailQor converters are designed to meet or exceed EN50155 input static and transient DC voltage requirements. Since some equipment is being designed to also comply with RIA-12 surges and transients, those requirements are discussed as well, along with the supplemental circuitry needed to meet those requirements.
- **“EMI Characteristics”**
– An overview of EMI with suggestions for external filtering solutions and suggested layout and grounding practices.
- **“Input System Instability”**
– Describes the phenomena of input instability in DC-DC converters and the preferred solution for correcting it.

RAILQOR DATASHEET APPLICATION INFORMATION

- How to lay out a board for optimal thermal performance with RailQor product
- Circuits for driving the enable pin
- How to trim the converter to compensate for resistive drops between supply and load