Your Partner for Rail Traffic Systems

For over four decades, Schroff has been a world leader among developers and manufacturers of electronics packaging components and systems. Whatever challenges you have to overcome, together we can find the right solution. Our products and complete solutions combine the know-how of our specialists in the integration of mechanics, electronics and climate control together with many years of experience with the most diverse application requirements. They are based on globally standardised product platforms that support rapid, future-proof and cost-effective development. Schroff can offer design, project management, prototype and model construction, testing, certification, pre-production and series production under one roof. We can provide fully-equipped and verified systems from a single source – a service that you would demand from a leading supplier - quickly and tailored to your specific requirements and we will remain a reliable partner throughout the entire lifecycle of your products, worldwide.

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An industry leader
For more than 40 years, Pentair has claimed a worldwide leading position for the reliable and secure protection of electronic systems. Our decades of experience and comprehensive applications knowledge in rail systems enable us to offer precisely what will take you a step further: complete solutions that can be implemented globally and are developed to meet your particular requirements, that will withstand the strict safety requirements of railway applications, including international certification.

Wide selection and high flexibility
Our comprehensive range of certified standard products demonstrates its capabilities and safe operation every day, on rail vehicles, in buildings and trackside. Because of Schroff’s modular platform concept, our products can be quickly and easily adapted to meet your individual requirements. In fact, they are so flexible that they impress on two counts: by both their high level of technical functionality and their ergonomic appearance.

Project support and service
Engineering and manufacturing know-how under a single roof guarantees our customers complete confidence, efficient implementation and fast delivery. Because of our global presence, you benefit from manufacturing facilities and sales organizations at locations near you. As a result, our global project engineers bring expertise to meet the particular requirements for each region. Our team of experts are at your side worldwide and around the clock. Schroff supports you for the entire life cycle of the product.
COMPONENTS AND SYSTEM SOLUTIONS

CUTTING-EDGE TECHNOLOGY - CUSTOMISED

The best solution for every application

Whether for rail vehicles, at the station, in the signal box or trackside, our modular product platform, specific applications expertise and innovative new technology offer individual solutions for every operating environment. Superb mechanics, shock and vibration resistance, perfect shielding, optimised cooling, dependable power supplies and outstanding system management ensure the secure protection of your electronics, including rail certification.

■ WALL-MOUNTED ENCLOSURES
  - Dustproof and waterproof enclosures for use on the platform, in tunnels, on rail vehicles, in the station or in the maintenance shop
  - Composite cases for highly corrosive environments

■ INDOOR CABINETS
  - Electronics cabinets for traffic guidance systems and control computers
  - Shock and vibration resistant cabinets for mobile application on board the vehicle
  - Data and network cabinets for data centres and control rooms

■ OUTDOOR CABINETS
  - Robust, climate-controlled outdoor cabinets for use trackside or on the platform
  - Modular, maintenance-friendly outdoor cabinets for wall, mast and ground mounting
  - Information panels for passenger information on the platform and in the station

■ COOLING SOLUTIONS
  - Passive meander system: maintenance-free and energy-efficient heat removal
  - LHX heat exchanger: energy-optimised cooling of up to 40 kW per cabinet
  - Fan trays and air conditioners for direct heat extraction
ADAPTED TO ANY APPLICATION

■ SUBRACKS AND 19” CHASSIS
Rail-certified solutions
Shock and vibration-resistant, shielded and optimally climate-controlled
Modular subrack systems with flexible dimensions
Complete chassis, universal applications

■ EMBEDDED SYSTEMS
Subracks or cases with integrated backplanes, power supplies and cooling
Leading solutions conforming to the latest standards
Mechanics and electronics from a single supplier - and perfectly matched to one another

■ FRONT PANELS, PLUG-IN UNITS AND HANDLES
Multiple finishes, wide range of handles
Shielded or unshielded, custom modified or screen printed on request
Rapid delivery service for individual versions, easily and conveniently via the Internet

■ POWER SUPPLY UNITS
19” or open-frame power supply units for instrumentation and control equipment, communications devices and many more...
For all European railway voltage ranges
Intelligent battery-charging systems

■ BACKPLANES
Wide selection of VME, VME64x, VXS, VPX, CompactPCI, CompactPCI Plus and MicroTCA, plus individual solutions on request
SMD components for shock and vibration resistance
Special protective lacquer (conformal coating) provides best protection from environmental influences
SOLID, ROBUST AND SPACE-SAVING

EQUIPPED FOR MOBILE ENVIRONMENTS

For operation in mobile environments, electronic systems require a physical construction capable of withstanding extreme conditions in harsh environments. Our cabinets, cases and subracks are designed to protect the electronics they house with high levels of mechanical stability and resistance to shock and vibration. Their dimensions are so flexible that you can make the best use of the available space. Furthermore, we can develop custom solutions within the shortest time, thanks to our modular platform concept.

EFFICIENT COOLING

The higher the packing density of your electronic applications the more you will need a sophisticated cooling system to remove heat efficiently from cabinets and cases. Pentair offers modular air filtered fans, fan trays, air/air and air/water heat exchangers, compressor-driven air conditioners through to conductive cooling. This will help you meet the highest quality and environmental requirements in all situations.

EUROPACPRO - IMPACT RESISTANT

Our europacPRO subracks combine multiple benefits. Designed using materials providing strength and appropriate fixing elements, they are impact resistant while also satisfying the latest standards with respect to dimensions and environmental requirements. Tested to EN 50155 with typical loads, they offer the best conditions for secure and reliable systems for on board rail vehicles.

VARISTAR - VIBRATION AND SHOCK RESISTANT

With VARISTAR you are playing it safe. The robust, heavy-duty frame with its high degree of rigidity meets IEC 61587-1 classes DL5 and DL6 under dynamic loads and can carry equipment weighing up to 800 kg. For more critical applications, optional shock absorbers provide further protection. Earthquake resistance has been verified in dynamic tests to Zone 4.

EMBEDDED SYSTEMS. ROBUST AND SECURE

Regardless of which bus technology is used, our systems are based on robust subracks, high-spec power supply units and backplanes with various bus structures. We offer cost effective solutions and a comprehensive product range with almost unlimited options. They maintain the safety of the overall system under the most demanding situations. The components employed also meet enhanced system requirements, in particular the requirements for shock and vibration resistance, immunity to electromagnetic interference and effective cooling.
EFFICIENT COOLING WITH MAXIMUM PERFORMANCE

CONTROL SYSTEMS ON THE TRANSRAPID SERVICE
Modular 19” subracks used to house control electronics in cabinets or in underfloor areas.

AUTOMATIC TRAIN CONTROL SYSTEM
On-board computer system, housed in GL66 Enclosures (IP 66) with europacPRO subracks and customized front panels.

MOBILE COMMUNICATION SYSTEMS
GL66 case with heat exchanger (IP 54), subracks and backplane for the digital GSM-R communications network.

BENEFITS AT A GLANCE:

<table>
<thead>
<tr>
<th>Robust:</th>
<th>Proven mechanics for mobile applications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Secure:</td>
<td>Shock and vibration resistant to DL6 of IEC 61587-1, IEC 60068-2-6 and IEC 60068-2-28</td>
</tr>
<tr>
<td>Efficient:</td>
<td>Individual cooling concepts for demanding applications</td>
</tr>
<tr>
<td>Protected:</td>
<td>Lacquer finish to protect electronic components from corrosion, fungal attacks, etc. [conformal coating]</td>
</tr>
<tr>
<td>Complete:</td>
<td>Mechanical, electrical, electronic and thermal developments to customer requirements</td>
</tr>
</tbody>
</table>
PROTECTED FROM THE ELEMENTS

SOLID, ROBUST AND SPACE-SAVING

APPLICATIONS TRACKSIDE

OUTDOOR CABINETS: DUAL SECURITY
Be it in track and train control or in communications between the signal box and the train driver, electronics housed in outdoor cabinets are of vital importance for railway safety. Our outdoor cabinets provide double security: protected on the outside from vandalism and on the inside with climate-control, to ensure that the electronics can withstand ambient temperatures between -33 °C and +45 °C.

CLIMATE CONTROL: LOW-NOISE AND ENERGY-EFFICIENCY
Our double-walled outer shell and innovative “passive meander” system provide our outdoor cabinets with an effective natural cooling. This reduces both energy consumption and noise levels. Schroff brings “green technology” to stations, trackside and within tunnels. We see this as progress.

See page 16 for further information.
Design: attention to every detail.

ROBUSTNESS
Schroff outdoor cabinets withstand even the strongest gusts and the impact of rocks kicked up by passing trains.

FIRE SAFETY
Fire safety is also built in: in the event of a fire, smoke detectors send an alarm to the control room, while fire-extinguishing system [mixed gases] in the cabinet puts out the flames.

PERSONNEL SAFETY
The telescopic cover and the side panel can be extended to protect your maintenance personnel from the elements and from ballast being tossed around.

Measurement systems along the tracks
Robust, vibration-resistant “modular” outdoor cabinet with air conditioner for safe positioning close to the track, e.g. for detecting the wheel temperature of passing trains.

Voltage monitoring
“Unibody” outdoor cabinet with low-energy, low-noise convection cooling for monitoring the cable voltage of overhead contact wires. Wall or mast mounting is also possible.

Infrastructure along the tracks
Embedded systems consisting of matched components such as subracks, HF shielding, backplane, power supply and climate control, e.g. for axle counting or points heating.
REDUCED NOISE LEVELS

APPLICATIONS IN OR AROUND STATIONS

SYSTEM SOLUTIONS FROM A SINGLE SUPPLIER

While the robust, standardised construction of our outdoor cabinets assures problem-free maintenance, your computers, housed within, monitor and control train traffic and ensure safety. The greater the compatibility of all components, the more perfectly the system will function.

One solution, one supplier. Our complete CompactPCI, VME and MicroTCA systems make it easy for you: backplanes, power supply units, battery control, mechanics and climate control - all components work dependably together. And thanks to conformal coating, environmental factors will not impact your electronics.

See page 22 for further information.

Platform monitoring

“Unibody” outdoor cabinet with heating, internal ventilation, power supply unit and 19” internal assembly for video monitoring of platforms.

Passenger information systems at stations

Climate-controlled outdoor cabinet with VME system to control indicator boards on the platform. Information terminal with integrated control unit to display and control passenger information.

BENEFITS AT A GLANCE:

<table>
<thead>
<tr>
<th>Secure</th>
<th>Best protection against vandalism and extreme temperatures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Efficient</td>
<td>Energy-efficient climate control</td>
</tr>
<tr>
<td>Quiet</td>
<td>Exceptionally low noise level</td>
</tr>
<tr>
<td>Appropriate</td>
<td>Modular product platforms that form the basis for individual solutions</td>
</tr>
</tbody>
</table>
EVERYTHING UNDER CONTROL

MODULAR PLATFORM FOR MAXIMUM FLEXIBILITY

APPLICATIONS IN SIGNAL BOXES

EMBEDDED SYSTEMS.

Our electronics enclosure systems make monitoring and control tasks as simple as possible for you. From the mechanics, the backplane and power supply to the thermal management design and individual expansion options, their modular design, comprehensive accessory programme and support of various bus technologies offer you everything a system requires. The benefits are clear: extremely high flexibility, absolute operational reliability and an optimal price-to-performance ratio.

Read more on page 22.

Electronic signal box

Signal box computer with shielded 19” subracks and special backplane, designed for a wide temperature range of -20 °C to +70 °C.

Guidance systems

Guidance systems with modified standard cabinets and subracks, designed for a wide temperature range of -25 °C to +75 °C.

CONTROL IN SIGNAL BOXES

Control in signal boxes

Electronics cabinets, open or with glass doors, to accommodate systems and subracks in the signal box.

BENEFITS AT A GLANCE:

<table>
<thead>
<tr>
<th>Secure:</th>
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</tr>
<tr>
<td>Appropriate:</td>
<td>Modular product platforms that form the basis for individual solutions</td>
</tr>
</tbody>
</table>
COMPLETE SOLUTION WITH HIGH FUNCTIONALITY

DATA CENTRE APPLICATIONS

RELIABILITY DOWN TO THE SMALLEST DETAIL
In rail systems, safety is everything. Both at the control point and in the data centre, modern control and communication systems ensure continuity. Our components, complete systems, cabinet solutions and monitoring systems, prepare you for many scenarios. Certified quality, coupled with decades of experience and competence, assure reliability down to the smallest detail. And this is the first prerequisite for solving complex safety tasks.

INTELLIGENT AND SECURE MONITORING
Our range of services dependably solve the most demanding monitoring tasks from operating parameters (temperature and humidity) to control fans and heat exchangers, smoke detection, network failure response and lock mechanisms.

All components offer a high degree of flexibility and adaptability to easily meet a variety of requirements.

VARISTAR: Stability due to robust frame, cooling of up to 40 kW per cabinet for all housed components and static load carrying capacity up to 1600 kg.

POWERFUL: THE VARISTAR NETWORK AND SERVER CABINET
Whether it be loading capacity, energy efficiency, security or dynamic or climatic limit stresses, VARISTAR cabinets provide robust, durable protection in environments subject to shock and vibration and high-frequency interference. But that is not all. VARISTAR also helps you to reduce project costs, since it is both powerful and also economical. Its technical parameters are proof of this.

Read more on page 18.
WHERE PERFORMANCE MEETS DEPENDABILITY

PROFESSIONAL PROJECT MANAGEMENT

COMPETENCE FOR INDIVIDUAL SOLUTIONS.
We have more than 40 years of experience in developing, manufacturing and integrating mechanical, electronic and thermal components. And this know-how is in each of our solutions, from a computer simulation to the specification and design of prototypes and production runs.

You profit from technically mature, individually-tailored and economic enclosure solutions for railways that can be used anywhere in the world, all from a single supplier. How do we do it? We have made the needs and future of our customers our highest priority.

CONSULTANCY FROM THE START
A team of experts is available to you from the start and accompanies your project through the entire development cycle.

SHOCK, VIBRATION AND HEAT SIMULATIONS.
Mechanical simulations based on the finite-element method and thermal simulations using Flowtherm software verify our products even before the prototype phase. Selection and design of shock absorbers is carried out by our renowned specialist partner.

Modern 3D CAD-based design shortens development times and reduces development costs up until the design is approved. Prior to building a prototype, we typically perform a 3D CAD data exchange with our customers.

PROTOTYPES AND PRE-PRODUCTION RUNS.
The function and loading capacity of individual designs are tested in the shortest time and under realistic conditions.

TESTING AND INSPECTION SYSTEMS.
An extensive range of testing and inspection systems for thermal, electronic, mechanical and shielding testing on our premises form an integral part of the development process and contribute to permanent quality assurance.

www.schroff.co.uk/railway
PROJECT MANAGEMENT

COMPLETELY FOCUSED ON CUSTOMER REQUIREMENTS

MODERN MANUFACTURING FACILITY
Innovative production methods and modern machinery allow optimal use of resources. With manufacturing facilities in Europe, the Americas and Asia, we are able to manufacture in proximity of our customers.

SYSTEM INTEGRATION
We integrate mechanical, electrical, electronic as well as non-proprietary components in a cabinet or case. You receive a plug-and-play product from a single source.

CERTIFICATION
We ensure the certification of customised products meeting your individual requirements.

READY FOR OPERATION - WITH CERTAINTY
We will professionally install your indoor and outdoor cabinets on site. Detailed quality assurance documentation is provided upon final acceptance. And your product is ready for operation in the shortest possible time.

REGULAR MAINTENANCE
Based on an agreed maintenance contract, our experts will check and inspect your systems and equipment and report within a set period of time. And with GuaranteePLUS you can extend the warranty period.

BENEFITS AT A GLANCE:

| Guaranteed reliability: | Exceptional products manufactured to the highest quality standards |
| The best advice: | One contact partner throughout the entire development period |
| Achieve your goals quickly: | Short project times, everything from a single supplier and high-precision logistics |
| Customer first: | Clearly structured service options through ServicePLUS |
WHERE PERFORMANCE MEETS DEPENDABILITY

AN ACTIVE MEMBER IN INTERNATIONAL STANDARDS COMMITTEES

CERTIFIED QUALITY AND COMPETENCE

As applications grow more complex, the dependability of partners and long-term confidence in technology are increasingly important. For 30 years we have participated actively in the standards committees of international organisations such as IEC, IEEE, VITA and PICMG. Pentair stays abreast of worldwide standards and you customers profit from the latest technologies. Plus the Schroff brand is certified to ISO 9001, ISO 14001 and OHSAS 18001 and has been for many years.

MOBILE - AND SECURE

In railway systems, the highest security has absolute priority. Our products fulfill demanding railway standards in areas of mechanical stability, shock, vibration and EMC, for standard components or custom developments. The trust and satisfaction that our customers have placed in us are proof.

IRIS CERTIFICATION

Building on DIN ISO 9001, our Straubenhardt and Betschdorf sites will be certified to the International Railway Industry Standard (IRIS) by 2010.

<table>
<thead>
<tr>
<th>Standard</th>
<th>International</th>
<th>German Railways</th>
<th>French Railways</th>
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<tbody>
<tr>
<td>Dimensions</td>
<td>IEC 60297-3:100 ... 705</td>
<td>BIN 411003</td>
<td>NF F 61-005</td>
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<tr>
<td></td>
<td>IEEE 1101.1</td>
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<tr>
<td></td>
<td>IEEE 1101.10</td>
<td></td>
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<tr>
<td>Shock and vibration</td>
<td>IEC 61507-12</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>EN 50155</td>
<td></td>
<td>NF F 67-012</td>
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<tr>
<td>EM/ECM</td>
<td>IEC 61507-13</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IP protection</td>
<td>EN 60529</td>
<td></td>
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</tbody>
</table>

VARISTAR - Shock and vibration:
- Results of testing to IEC 61507-1: 2000-01
- Installed load: 150 kg
- Shock: maximum acceleration 5 g, duration 11 ms
- Vibration: from 5 to 100 Hz
- Acceleration: DL5: 5 m/s² (0.5 g); DL6: 10 m/s² (1 g)

DL5: Shock and vibration loads as it applies to railway and road signalling equipment. DL6: Stresses present on merchant ships and in low-demand military installations.

VARISTAR - Seismic:
- Results of testing to IEC 61507-2: 2000-01
- Installed load: 250 kg
- Acceleration: Bellcore Zone 3: 3 g, 1 Hz-5 Hz
- Bellcore Zone 4: 5 g, 2 Hz-5 Hz

Subracks - Vibration test (noise waveform):
- Results of testing to EN 50155
- Test duration: 5 h per spatial axis, in 3 spatial axes
- Amplitude:
  - Longitudinal/Transverse axis
    - 5 Hz, 0.00901 g²/Hz
    - 0 Hz, 0.00901 g²/Hz
    - 150 Hz, 0.0001603 g²/Hz
  - Vertical axis
    - 5 Hz, 0.01857 g²/Hz
    - 20 Hz, 0.01857 g²/Hz
    - 150 Hz, 0.0003301 g²/Hz

Subracks – Shock testing (half-sinusoidal waveform):
- Results of testing to EN 50155
- Amplitude: 5 g
- Shock duration: 30 ms
- Number of shocks: 3 shocks in both axis directions of the three orthogonal main axes of the test object. Test was conducted as per Class B of the standard.
COMpletely focused on customer requirements

Shock and vibration test
Schroff branded products from Pentair assure impact resistance in mobile applications. Our products are tested with typical loads, either in-house or in laboratories of certified institutions.

HF Shielding test
HF shielding is designed into the basic structures of our products. Testing takes place in our own laboratory or at the High Frequency Institute the University at Karlsruhe.

Flowtherm Simulations
Simulations of temperature distribution and airflow patterns assist in designing the cooling concept and in locating hot spots.

Climate bay testing
Products can be tested under extreme environmental conditions in our in-house climate bays.

Wind-tunnel testing
Airflow volumes and resistance characteristics are determined in a wind tunnel, allowing us to establish air cooling for optimal efficiency.

Salt spray testing
Corrosion resistance and surface ageing of the test object are tested in a vaporised salt solution.

Noise measurement
The noise level generated by an object is measured using the latest technology to ensure conformity to the industry standard.

Benefits at a glance:

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>Conformity to standards</td>
<td>Tested to all industry standards</td>
</tr>
<tr>
<td>Superb stability</td>
<td>High physical robustness up to earthquake zone 4</td>
</tr>
<tr>
<td>Perfect climate control</td>
<td>Variable cooling concepts up to 40 kW</td>
</tr>
<tr>
<td>Tailored HF shielding</td>
<td>Outstanding shielding to meet your requirements</td>
</tr>
<tr>
<td>Modern</td>
<td>The most up-to-date measuring and testing systems in our in-house laboratory</td>
</tr>
</tbody>
</table>
OUTDOOR CABINETS

ROBUST AND HIGHLY FUNCTIONAL

VERSATILE.
Whether it be for track control, train monitoring or platform control, you can use our outdoor cabinets in a variety of settings.

CERTIFIED QUALITY.
Pentair’s Schroff outdoor cabinets ensure the smooth and dependable functioning of sensitive electronics in outdoor environments. Their standardised components are based on IEC 61969. They not only fulfill the guidelines and standards for shock, vibration and earthquake resistance but also offer climate protection tested to IEC 68-2-1.

IMPRESSIVE ALL AROUND.
Additional technical benefits include weight-efficient, corrosion-resistant and robust aluminium construction, the ease of access and special cable entry provision. Newly designed cladding parts, hinges and locks provide enhanced protection from vandalism. And the expansion options are flexible, accepting 19”, ETSI and other non-standardised accessories.

TWO TYPES, ONE SYSTEM.
Unibody: simple and cost-optimised.
Whether wall, pole or ground mounted, the unibody design scores with its cost-optimised inner enclosure and removable outer cladding. Benefits can be found particularly in smaller cabinets, including easy access via the front door for equipment installation.

MODULAR: FLEXIBLE AND OPTIMISED FOR MAINTENANCE.
The modular version consists of an aluminium profile frame with removable double-wall cladding. Its high flexibility offers significant advantages for larger cabinets and where access from all sides is needed.

BENEFITS AT A GLANCE:

Secure: Best protection against vandalism and extreme temperatures
Superb climate control: Energy-saving, low-maintenance and low-noise climate regulation
Perfect solutions: Two designs - Unibody and Modular
Windproof and weather resistant: Weight-saving, corrosion-resistant and highly robust aluminium construction
Securely protected: Vandalism-proof, with anti-graffiti coating available upon request; protection class IP 55
INNOVATIVE CLIMATE-CONTROL SYSTEMS

NEW APPROACHES TO HEAT REMOVAL.
WE ARE INNOVATION LEADERS IN OUTDOOR CABINET COOLING

- Passive ventilation in the double wall
- Energy-efficient heat extraction with the passive meander system with zero energy input and noise levels
- Fans in space between the double walls
- Fresh air cooling via air-filtered fans, heat exchangers or air conditioners

NATURALLY INGENIOUS: THE DOUBLE-WALL DESIGN.
Use of a double wall sharply reduces heating within the cabinet from solar radiation. At the same time, it helps remove the heat inside the double wall natural air flow. The benefit: substantial reduction in cost for additional cooling. The double wall offers similar benefits in protecting from the cold.

TECHNICALLY BRILLIANT: THE PASSIVE MEANDER SYSTEM.
Our new outdoor cabinets further establish Pentair as a leader in innovation: in this passive system, the inner walls are constructed in a ‘meander’ form. The increase in surface area acts as a heat exchanger, transferring more heat from the interior to the gap between the walls. Up to 600 - 800 watts at a temperature difference of 25 K.

“GREEN TECHNOLOGY” FOR RAILWAYS.
Often enough, the passive meander system achieves sufficient cooling on its own, requiring no energy input and creating no noise, providing total reliability and zero maintenance. This is indeed a sound implementation of “green technology” for outdoor applications.
HIGHLY STRESS-RESISTANT, UNBELIEVABLY POWERFUL

JUST THE JOB FOR EXTREME ENVIRONMENTAL CONDITIONS
VARISTAR electronics cabinets function in unique environmental conditions. They have been designed for 100% dependability in the most extreme situations. After all, it is reliability, down to the last detail, that makes complex safety tasks achievable - and cost-effective.

SLIM-LINE
The special Slim-Line extruded profile is capable of a static load-carrying capacity of 400 kg with a minimum load, and satisfies the DL5 and DL6 requirement classes of IEC 61587-1 for dynamic loads.

HEAVY-DUTY
The robust Heavy-Duty frame was specially designed for high load-carrying applications. Thanks to its higher bending stiffness it can accept a static load of 800 kg, while under dynamic loads it satisfies classes DL5 and DL6 of IEC 61587-1. Dynamic tests also demonstrate earthquake resistance up to zone 4.

VIBRATION AND SHOCK RESISTANT
These characteristics are of particular importance for mobile applications on board rail vehicles. Both VARISTAR profiles, Slim-Line and Heavy-Duty, protect electronic systems with high mechanical stability and dynamic load-carrying capacity as required by each application, thus making an important contribution to the safe and problem-free operation of the overall system.

LONG-TERM SERVICE
VARISTAR resists even the most unfavourable conditions such as humidity and dirt. Zinc-plating and additional powder-coating provide a double protection against corrosion.

HF SHIELDING AND IP PROTECTION
The VARISTAR shielding principle protects sensitive data from interference radiation and is tested to IEC 61587-3. The HF gasket simultaneously forms a barrier against dust and water to IP 55.
AS VERSATILE AS YOUR REQUIREMENTS

VARIABLE CABINET COOLING UP TO 40 KW

Scaleable, modular and energy-efficient: with our cooling solutions you are playing safe. Our VARISTAR LHX programme, a complete solution with integrated heat exchanger, excels with its high energy efficiency and high cooling capacity. The cabinet can be cooled using a very small footprint minimal power consumption, and reduced noise levels. VARISTAR LHX to increases space availability by 20% in comparison to other cabinet solutions.

MODULAR AND EFFICIENT

Depending on the amount of heat generated and the internal and external temperatures, various cooling concepts may be applied to keep electronics cabinets cooled effectively. The range of cooling options includes air-filtered fans, fan trays, controlled airflow systems, air/air or air/water heat exchangers and compressor-driven air conditioners.

BENEFITS AT A GLANCE:

<table>
<thead>
<tr>
<th>Type of protection</th>
<th>≤ IP 54</th>
<th>≤ IP 54</th>
<th>≤ IP 54</th>
</tr>
</thead>
<tbody>
<tr>
<td>Noise level approx.</td>
<td>39 … 71 dB (A)</td>
<td>55 … 75 dB (A)</td>
<td>50 … 81 dB (A)</td>
</tr>
<tr>
<td>Ambient conditions</td>
<td>T &gt; t₁</td>
<td>T &gt; t₁</td>
<td>t₁ ≤ t ≤ C</td>
</tr>
<tr>
<td>Cooling capacity approx.</td>
<td>&lt; 1500 W</td>
<td>&lt; 2000 W</td>
<td>&lt; 2400 W</td>
</tr>
</tbody>
</table>

Robust: Proven mechanical design for mobile applications
Secure: Shock and vibration resistant to DL6 of IEC 61587-1 and IEC 60068-2-6
Extras: Additional protection with optional shock absorbers
Shielded: Exceptional shielding characteristics as standard; 60 dB at 1 GHz, 40 dB at 3 GHz
Ideal cooling: Heat removal to exact requirements with a variety of cooling concepts; water cooling of up to 40 kW
Well-protected: Protection class up to IP 55
Flexible: Modified and fully assembled VARISTAR cabinets at www.schroff.co.uk/ServicePlus
EUROPAC PRO SUBRACKS

SIGNIFICANT TECHNICAL AND ECONOMIC BENEFITS

EUROPAC PRO SUBRACKS
The europacPRO 19” subrack system with modular construction offers many advantages, both in terms of technical innovation and cost-savings. Its standard components allow versatile combinations, letting you implement a range of versions in varying height, width and depth, simply, cost-effectively and with no design outlay.

SHOCK AND VIBRATION RESISTANT
The europacPRO system meets strict requirements for rail applications and protects electronics with its robust construction. Use of high-strength material and hardware, together with TOX-cold welded side panels, ensure resistance to shock and vibration even in the most demanding environments on rail vehicles.

ELECTROMAGNETICALLY SHIELDED
Contact-spring or conductive textile gaskets in the front panels of plug-in units also provide secure HF shielding.

COMPREHENSIVE TESTING AND RAIL CERTIFIED
Safety is guaranteed with testing and certification to many current standards. You can download all tests from www.pentairprotect.com.

OPTIMAL COOLING
Our systems are designed to ensure optimal cooling of electronics together with maximum shielding and IP protection.

BENEFITS AT A GLANCE:

| Variable: | Flexible dimensions from 3 U to 12 U and 21 HP to 84 HP in standard range |
| Standards compliant: | The subrack programme conforms to IEC 60297-3-100 to IEC 60297-3-105, IEEE 1101.1, 1101.10 and 1101.11 |
| Secure: | Tested to BN 411002, NF F 67-012, NF F 60-002, EN 50155 and IEC 61587-2 |
| Shielded: | EMC tested to IEC 61587-3, VG 95373 T.15 |
| Assembled: | For modified and completely assembled subracks go to www.pentairprotect.com |
AS FLEXIBLE TO CONFIGURE AS YOUR APPLICATION

VARIOUS FINISHES.
Shielded or unshielded, flat or U-profile - you have flexibility right down to the front panel. Aluminium anodised, pre-anodised, plain or iridescent green chromated – you decide on the best finish for your application, to suit both form and function.

A WIDE RANGE OF HANDLES.
Static handles, special handles for embedded systems or heavy-duty insertion and extraction handles for applications with very high insertion and withdrawal forces - our range of handles ensures that functionality does not sacrifice convenience.

FRONT PANEL EXPRESS.
Cut-outs for connectors, LEDs, handles, switches, and screen printing – the front panel strongly determines the appearance of a case or subrack. With Front Panel Express you can give your front panels an individual configuration. Fast delivery from two days. More information at www.frontpanelexpress.eu

BENEFITS AT A GLANCE:

<table>
<thead>
<tr>
<th>Benefit</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Large selection</td>
<td>A comprehensive programme with various finishes including non-RoHS compliant</td>
</tr>
<tr>
<td>High functionality</td>
<td>Handles for the most diverse applications</td>
</tr>
<tr>
<td>Fast delivery</td>
<td>Fast delivery service of customised items, including downloadable drawings</td>
</tr>
<tr>
<td>Flexible</td>
<td>Retrofitted HF shielding available</td>
</tr>
</tbody>
</table>
LEADING CONFIGURABLE SYSTEM SOLUTIONS

COMPLETE SYSTEMS.
Our standard systems already cover many applications in railway technology. We can adapt them quickly to your specific product requirements at any time. Either way, you have a complete solution from a single source.

SHOCK AND VIBRATION RESISTANT. WITH OPTIMAL COOLING.
All systems meet the highest requirements for shock and vibration resistance, and therefore meet the high demands of railway applications. High-end cooling solution maximizes thermal performance in this environment. Our systems are designed to ensure optimal cooling of electronics and maximum shielding and IP protection.

MICROTCA:
The new standard for fast computer systems. Micro Telecom Computing Architecture achieves the highest data-transfer rates with maximum system availability. We offer the MicroTCA.1 (Rugged MicroTCA) standard which also satisfies the requirements of railways, including shock and vibration and extended temperature ranges. Because we play a major role in the development of new standards, we already offer a broad spectrum of MicroTCA products and accessories such as front panels, filler panels, management solutions and backplanes. Pentair supplies Schroff subracks and front panels for Rugged MicroTCA.

For further information see www.pentairprotect.com

VME64X AND VME: FLEXIBILITY WITH VARIABLE MODULES.
Our plug-in VMEbus systems meet the latest standards. Their physical construction is based on the industry leading 19” europacPRO subrack. In addition to a range of standard configurations, these systems can be equipped with backplanes, power-supply units, fans, drives and other components as needed. The microcontroller-based monitoring system ensures high functional security for the fans and reduces the noise level. Even custom modifications can easily be implemented.

For further information see www.pentairprotect.com

COMPACTPCI: SYSTEMS OUT OF THE BOX.
Our CompactPCI systems conform to the latest version of the standard. Based on the robust 19” europacPRO subrack, they satisfy all requirements for shock and vibration resistance. Simple to complete with versatile standard components such as backplanes, power supply units or fans from our kit system, Schroff CompactPCI systems offer not only an high degree of flexibility but also an optimal price-to-performance ratio. In addition, customisation or modification to specific requirements can be easily effected.

For further information see www.pentairprotect.com
POWERFUL AND FUTURE-PROOF

BACKPLANES.
The performance of the backplane is decisive for the overall performance of the system. Our backplanes are ideal for use in railway systems: the exclusive use of SMD components makes them very resistant to shock and vibration. A further benefit: to decouple the supply voltage, we employ ceramic capacitors only with selected electrical values. The power supply system remains stable and low in impedance up to the highest frequencies. Both emission and initiation of power-related faults are prevented.

For further information see www.schroff.co.uk/backplanes

POWER SUPPLY UNITS.
Schroff also offers the best components in the area of power supplies. Our power supply units have a wide-range input of 16 to 154 VDC and cover all voltage ranges for the European railway network. They are extremely reliable, even at temperature ranges of -40 °C to +85 °C.

For further information see www.schroff.co.uk/powersupplies

CONFORMAL COATING.
To protect them from humidity, fungal infestation and condensation, we can cover our backplanes and power supply units with a special lacquer - the conformal coating. This special surface protection is added in our purpose-built in-house facility, in a laminar box with water curtain to ensure dust-free conditions.

BENEFITS AT A GLANCE:

<table>
<thead>
<tr>
<th>Benefit</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Robust</td>
<td>Backplanes and power supplies protected by special conformal lacquer coating</td>
</tr>
<tr>
<td>Conforming to standards</td>
<td>Conformity to railway standards, including EIRENE (European Integrated Railway Radio Enhanced Network) for GSM-R, the first pan-European railway standard</td>
</tr>
<tr>
<td>From a single source</td>
<td>Short development times and all required competencies under one roof</td>
</tr>
<tr>
<td>Large selection</td>
<td>Standard range from stock; customising for backplanes, power supply units and systems on request</td>
</tr>
</tbody>
</table>
VERSATILE

To accommodate of non-standard components, we have developed a robust and versatile complete 19” chassis - the multipacPRO (1U to 5U). Integrate your non-standard components, electrical components and power supply units with ease. Expansion kits also accept standard board formats.

VERSATILE.

MultipacPRO features expansion options, optional HF shielding, mounting and telescopic rails and can be used in a variety of applications:

- Electrical control systems in signalling or for display boards
- Passenger information displays or video applications in the data centre
- Installation of routers and switches
- Video surveillance of platforms and subways

BENEFITS AT A GLANCE:

<table>
<thead>
<tr>
<th>Description</th>
<th>Feature</th>
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<tbody>
<tr>
<td>Form plus function</td>
<td>Highly robust, based on a simple design principle</td>
</tr>
<tr>
<td>Rich in ideas</td>
<td>Universal and highly adaptable in all areas of electronics</td>
</tr>
<tr>
<td>Strong performance</td>
<td>A cost-effective alternative to a subrack or system</td>
</tr>
<tr>
<td>Compatibility</td>
<td>Based on the IEC 60297-3-105 19” standard</td>
</tr>
<tr>
<td>Complete design</td>
<td>High shielding in all frequency ranges</td>
</tr>
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</table>
WALL-MOUNTED ENCLOSURES

ADAPTABLE

THE RIGHT ONE FOR EVERY PLACE
Our wall-mounted enclosures offer a tailored solution for any requirement even in the tightest spaces. They provide a basis for rail applications to be specified individually and tested to EN 50155.

INDOOR CASES IN STEEL
GL66 in steel with standard dimensions up to 1200 mm height allow exact matching of the exterior dimensions to the specific installation position. The 600 mm wide version can be fitted with 19” panel/slide mounts and thus accept all 19” components, from subracks to complete systems. The INLINE product range includes terminal and installation cases with heights up to 400 mm. DIN rail mounting and mounting plate applications provide additional hardware flexibility.

INDOOR AND OUTDOOR APPLICATIONS: PLASTIC CASES
The A48 case in fibreglass reinforced polyester is particularly suited to highly-corrosive environments (caused by oil, lubricants or salt compounds). Further small cases in polycarbonate with transparent or solid cover complete our range of plastic cases.

OUTDOOR CASES IN ALUMINIUM
The COMLINE series of cases is an ideal solution for outdoor applications. These aluminium cases are well-suited for high corrosion environments. Choose between several standard sizes, each with or without a rain cover.

BENEFITS AT A GLANCE:

<table>
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<tr>
<th>Securely protected:</th>
<th>Up to IP class 66</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flexible expansion options:</td>
<td>Depth-adjustable 19” installation plane or via mounting plates</td>
</tr>
<tr>
<td>Detailed design:</td>
<td>Gland plate for cable entry</td>
</tr>
<tr>
<td>For use worldwide:</td>
<td>Certified by UL and CSA</td>
</tr>
</tbody>
</table>
CLIMATE CONTROL

PRECISION COOLED

GOOD ADVICE ALL ROUND.
Whether it is complete cabinet systems or a single application, our experienced climate experts draw on extensive know-how and the most modern technology to help you find the optimal climate-control concept. We ensure in simulated environments that the cooling capacity required is precisely matched to your planned equipment and its performance. And we have exactly the right components for every need.

19” FAN TRAYS: TARGETED HEAT REMOVAL.
Where electronic components within systems or cabinets require cooling, fan trays provide a controlled removal of heat. Our fan trays offer several advantages: long service life and minimum-noise operation, optional function monitoring systems, mechanical protection to prevent accidental blade contact and adaptability for use with subracks. Customized fan tray solutions are available upon request.
For further information see www.schroff.co.uk/fanunits

HEAT EXCHANGERS AND AIR CONDITIONERS: EFFECTIVELY COOLED.
In closed electronics cabinets, heat can be very efficiently extracted via heat exchangers [air/air or air/water]. Compact and slim design, a low noise level and high efficiency make these devices the first choice - for even the most diverse of requirements and custom projects. Where no water supply is available and the inner cabinet temperature must be kept below ambient temperature, the use of compressor-based air conditioners is essential. These devices remove heat by means of a coolant. Our side-mounted air conditioners, covering a range from 400 W to 2600 W, offer and highly efficient design. Integrated condensate water evaporation and temperature control via thermostat or microcontroller contribute to even greater efficiencies.
For further information see www.schroff.co.uk/airconditioners

AIR FILTERED FANS: COOLING WITH PROTECTION.
Air-filtered fans represent a highly cost-effective and efficient method of climate control in cabinets. They ensure optimal air circulation and can quickly switch between suction and blowing settings. An additional benefit is ease of installation: simply clip them in, and function immediately. This saves time and money. IP54 protection remains intact and slim design ensures minimal use of internal space. Air-filtered fans with HF shielding are also available upon request.
For further information see www.schroff.co.uk/airfilteredfans