Rittal

EMC range

Perfect shielding
Perfect shielding

The ultimate in shielding for all frequencies

Today’s technical measurement and control, communication and data technology systems are extremely powerful, as they contain large numbers of complex electronic components which can be highly sensitive to electromagnetic influences. Good, professional planning of electromagnetic compatibility (EMC) from the outset is therefore crucial to the lasting functional reliability of equipment and systems.

Put your trust in the expert advice and wide range of practically tested solutions from Rittal, one of the world’s leading suppliers of enclosure and case technology. We have decades of expertise in the handling of various materials and are therefore able to translate the latest findings quickly and reliably into practical solutions.

Your perfect partner – from analysis to problem-solving

It’s a familiar dilemma: Your product needs EMC, but you’re not an EMC expert. We offer the ideal solution: Our specialists will provide you with expert assistance and advice. From obtaining initial information, to theoretical training, through to practical implementation.

An analysis of the EMC risks of your application allows us to discuss the proposed solutions and the range of products available for selection. Rittal gives you the peace of mind needed to confirm compliance with specified EMC protection targets. It’s reassuring to know that you are also ideally equipped to meet the requirements of the future.
The Rittal EMC concept

EMC wall-mounted enclosures
- Terminal boxes KL
- E-Box EB
- Compact enclosures AE
- Electronic Kombi system EL, 3-part

EMC subracks
- Ripac Vario

EMC instrument cases
- Rittal Vario Case iS

EMC enclosures
- Baying systems TS 8
- flexRack

EMC accessories
- Basic EMC information
- Notes/contact
The Rittal EMC concept

Interference can be fatal

Rittal offers excellent pre-requisites for EMC enclosure configurations with its standard sheet steel enclosures, EMC-shielded enclosures, and a practical range of EMC accessories. Even the standard enclosures offer a good shielding effect against electrical fields which is sufficient for many applications. Depending on the individual application, anything is possible, be it closely intermeshed potential equalisation in a standard enclosure to prevent conducted interference, or extra shielding to protect against high-frequency electromagnetic fields. For large enclosures in the ES 5000 series, standard version, we can even offer fast, simple upgrades of the screening attenuation up to a maximum of 20 dB.

Rittal EMC enclosures with a high level of shielding are based on the following concept: Conductive sealing edges offer maximum protection against corrosion, thanks to aluminium zinc coating of sheet steel enclosures or chromate conversion of aluminium enclosures. In conjunction with low-resistance EMC seals, this produces a largely slot-free, electrically conductive surface, which in turn leads to excellent attenuation levels and good value for money.
**Partial shielding**
It is not always necessary to provide a high level of shielding for the entire enclosure. When it comes to shielding a single source of interference in the system or protecting a particularly sensitive assembly, an “enclosure-within-an-enclosure” structure can often provide a viable alternative. The efficient use of EMC enclosures is not only a question of materials, but also a design issue. With this in mind, Rittal offers a wide selection of small enclosures and subracks which can be used for partial shielding in standard enclosures. There is an almost unlimited choice of combination variants with large enclosures and wall-mounted enclosures.

**The influence of holes and slots**
Openings in the structure may severely impair the local shielding effect of the highly shielded enclosure. The interference depends on the type of field, and the size and geometry of the openings. EMC viewing windows, EMC cable entry glands, EMC fan-and-filter units, wire screens and standard commercial perforated plates for the shielding of cutouts for heat dissipation and other components mean that the effects of such unavoidable leaks may be significantly reduced. The attenuation levels given were ascertained by accredited test centres to VG 95373, part 15 and the former MIL STD 285, and should be seen as orientation guidelines for sealed empty enclosures with no cutouts or other modifications. Deviations are possible, particularly with customised designs.

**EMC – Standard protection**
Standard enclosures of sheet steel offer adequate EMC protection in many cases, thanks to their electrically conductive material. A zinc-coated mounting plate offers the option of large-scale potential equalisation. For large enclosures in the TS 8 series, the standard protection will match or exceed the average protection levels of the predecessor model PS 4000.

**EMC – Medium protection**
(EMC retrofitting)
In standard enclosures, medium levels of EMC protection are achieved via additional electrical connections between the enclosure and the doors/walls. Depending on the EMC requirements, contact clips may be retro-fitted to the profiles of ES enclosures to improve the EMC shielding effect. In this way, attenuation can be increased by up to 20 dB. EMC earthing straps ensure optimum potential equalisation. In TS/ES enclosures, EMC gland plates may be used for the entry of shielded cables. Shield buses for contacting the cable shields or EMC cable glands may additionally be used in all enclosures.

**EMC – High protection**
A high level of shielding is afforded by an enclosure body or enclosure frame of sheet steel with an aluminium zinc surface finish, spray-finished on the outside. The roof, base, door and sides likewise have an uncoated aluminium zinc interior finish, and therefore offer excellent slot-free contact via self-adhesive, low-resistance EMC seals to the enclosure or enclosure frame.
### EMC terminal boxes KL

![Graph](image)

**Material/surface finish:**
Sheet steel with aluminum zinc coating, powder coated in RAL 7032 on the outside, interior surfaces conductive.

**Supply includes:**
Enclosure, cover with special seal and cover screws.

**Protection category:**
IP 55 to EN 60 529/10.91.

The EMC version ("high RF attenuation") has been certified by the VDE.

<table>
<thead>
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<th>Width mm</th>
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<th>Model No. KL</th>
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<tbody>
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<td>1507.710</td>
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</tbody>
</table>

Other sizes available on request.

### EMC E box EB

![Graph](image)

**Material/surface finish:**
Sheet steel with aluminum zinc coating, powder coated in RAL 7032 on the outside, interior surfaces conductive.

**Supply includes:**
Enclosure with mounting plate, door with special seal including 180° hinge and cam lock with double-bit insert.

**Protection category:**
IP 55 to EN 60 529/10.91.

The EMC version ("high RF attenuation") has been certified by the VDE.

<table>
<thead>
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<tr>
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<td>1000</td>
<td>300</td>
<td>1180.700</td>
</tr>
</tbody>
</table>

All sizes available on request.

### EMC compact enclosures AE

![Graph](image)

**Material/surface finish:**
Sheet steel with aluminum zinc coating, powder coated in RAL 7032 on the outside, interior surfaces conductive.

**Supply includes:**
Enclosure with mounting plate, door with special seal (130° hinge) including cam lock with double-bit insert.

**Protection category:**
IP 55 to EN 60 529/10.91.

The EMC version ("high RF attenuation") has been certified by the VDE.

<table>
<thead>
<tr>
<th>Width mm</th>
<th>Height mm</th>
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<th>Model No. AE</th>
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<td>300</td>
<td>1180.700</td>
</tr>
</tbody>
</table>

Other sizes available on request.
We have opted to eliminate gland plates from EMC enclosures, in order to achieve maximum shielding effectiveness.

EMC wall-mounted enclosures KL, EB, AE have the following approvals:
- UL
- CSA
- TÜV
- Norske Veritas
- Lloyds Register of Shipping
- VDE

1. **EB:** Opening angle 180°.

2. **KL/EB/AE:**
   - The combined, self-adhesive EMC/IP seal provides reliable, long-lasting EMC/IP protection with low-resistance conductance values.

3. **EB/AE:**
   - The double-bit insert is easily exchanged for standard lock inserts.

4. **KL:**
   - Profile strips with mounting holes on both sides.

5. **KL:**
   - Removable cover, paint-free on the inside, with cover screws. Cover screws may be exchanged for quick-release fasteners or hinges.

6. **KL/EB/AE:**
   - The holes drilled in the rear panel are sealed by blind rivet nuts, thereby preserving the EMC protection when wall mounting.

7. **KL/EB/AE:**
   - In all wall-mounted enclosures, the enclosure edges are kept paint-free in order to ensure contact with the door or cover via the EMC seal.

8. **AE:** Opening angle 130°.

9. **AE:**
   - Perforated mounting strips are spot-welded to both inner sides of the door.

10. **EB/AE:**
    - The zinc-coated mounting plate installed in all EMC enclosures permits large-scale earthing of components, thereby making a direct contribution towards reducing EMC interference.

**Accessories:**
EMC accessories, see page 14 – 19.
EMC fan-and-filter units, see Climate Control brochure, page 142/143.
Ripac Vario EMC, see page 8 – 9.
Ripac Vario EMC

The Ripac Vario EMC subrack system was developed with a view to EMC aspects. The subracks are equipped with a conductive surface and may be supplemented with additional EMC components such as gaskets and extrusions. This allows individual EMC requirements to be met, depending on the specific application in question.

Technical specifications:
- Overall depth: 245, 285, 305, 345, 405, 465, 525, 585 mm
- Installation width: 84 HP
- Height: 3 U, 4 U, 6 U, 7 U, 9 U

Material:
- Side panels: 2.5 mm aluminium plates
- Flanges and horizontal rails: Extruded aluminium section
- Cover plates: Aluminium

Surface finish:
- Clear chromated

Testing:
- Vibration and shock-tested to: IEC 600-68-2-6 test Fc
- IEC 600-68-2-27 test Ea

Standards:
- Ripac Vario subracks are based on the system dimensions to DIN 41 494, part 5 and IEC 60 297-3.

EMC gaskets, vertical

To ensure EMC protection between the subrack side panel and the front/rear panels. Both segmented and one-piece versions are optionally available.

EMC gaskets, horizontal

For horizontal EMC protection. For snap-fastening onto the front horizontal rails.

EMC contact strip

To ensure EMC protection with recessed horizontal rails. Integral channel to accommodate vertical EMC gaskets. 2 extrusions are required for each subrack.

Mounting blocks

For mounting the cover plates on the subrack side panel. For EMC applications, mounting blocks must be fitted across the entire subrack depth.

EMC gaskets for cover plates

For EMC shielding between the horizontal rails and cover plates.
The EMC subracks in the Rittal range provide shielding for assemblies which may emit, or be sensitive to external influence.

![Accessories:](esd_clip.jpg)

Other accessories for EMC configuration may be found in the Rittal Electronics Catalogue.

- Horizontal EMC gaskets for horizontal rails (optional).
- EMC gaskets, vertical (optional).
- Keyable plastic guide rails.
- U-shaped EMC front panels with ejector/retainer handles.
- Mounting blocks for covers.
- Covers, punched or solid, with EMC gaskets.
- Trim for rear 84 HP termination.

ESD clip in the PCB guide for reliable discharge of static charges.
EMC baying systems TS 8

The enclosure frame is of sheet steel with an aluminium zinc surface finish. The TS 8 Top Enclosure is painted on the outside, including rear panel, roof and door. There are self-adhesive EMC/IP combination seals on the zinc-plated interior surfaces, which ensure slot-free all-round contact. The base is sealed by standard gland plates with a zinc-plated surface finish, which contact the same EMC/IP seal.

Material:
Sheet steel with an aluminium zinc surface finish
Door: 2.0 mm
Rear panel: 1.5 mm
Mounting plate: 3.0 mm
Surface finish:
Framework, door, rear panel and roof plate of sheet steel with an aluminium zinc surface finish, painted in RAL 7032 on the outside and unpainted on the inside.

Protection category:
IP 55 to EN 60 529/10.91.

Supply includes:
Enclosure frame with removable door, rear panel and roof plate, r/h door hinge, can be changed to opposite side, 4 eyebolts, fitted, mounting plate, three-part gland plates.
The EMC version ("high RF attenuation") has been certified by the VDE.

All sizes and side panels available on request.

Also required:
EMC baying seal TS 8800.690, see page 16, for bayed enclosures.

Approvals:

EMC free-standing enclosure ES 5000

The enclosure body is of sheet steel with an aluminium zinc surface finish. The door and rear panel likewise have a conductive aluminium zinc surface finish. The ES 5000 free-standing enclosure is painted on the outside, including the rear panel and the door. There are self-adhesive EMC/IP combination seals on the zinc-plated interior surfaces, which ensure slot-free all-round contact. The base is sealed by standard gland plates with a zinc-plated surface finish, which contact the same EMC/IP seal.

Material:
Sheet steel with an aluminium zinc surface finish
Enclosure body: 10-fold profiled
Door: 2.0 mm
Rear panel: 1.5 mm
Mounting plate: 3.0 mm
Surface finish:
Enclosure body, door and rear panel of sheet steel with an aluminium zinc surface finish, painted in RAL 7032 on the outside and unpainted on the inside.

Protection category:
IP 55 to EN 60 529/10.91.

Supply includes:
Enclosure, closed top and sides, removable rear wall, r/h door hinge, can be changed to opposite side, 2 eyebolts, not fitted, mounting plate, three-part gland plates.
The EMC version ("high RF attenuation") has been certified by the VDE.

All sizes available on request.

Also required:
EMC contact clips are required in order to achieve the medium attenuation level shown in the diagram with standard enclosure, see page 17.
EMC enclosures

Baying systems TS 8, free-standing enclosure ES 5000

The cost-cutting alternative to large EMC enclosures is the high shielding of potential sources of interference or sensitive components using EMC subracks or EMC small boxes.

German utility model no. 295 21 087
European patent no. 0 857 406 with validity for CH, ES, FR, GB, IT, NL, SE
US patent no. 6,384,323
Jap. patent no. 3 193 059

Accessories:
EMC accessories, see page 14 – 19.
EMC fan-and-filter units, see Climate Control brochure, page 142/143.
Ripac Vario EMC, see page 8 – 9.

EMC E box EB on the mounting plate.

EMC cable entry – for fast, inexpensive, reliable contact. Model No. see page 14.
EMC flexRack

Material:
Base frame: Aluminium
Cover sections: 1.5 mm sheet steel

Surface finish:
Base frame: Zinc plated, passivated
Cover sections: Yellow passivated on the inside, painted in RAL 7035 on the outside.

The EMC version ("high RF attenuation") has been certified by the VDE.

Supply includes:
1 base frame,
1 rear door, solid,
1 front door, solid,
(1 door with Ergoform-S handle and security insert),
2 side panels,
1 gland plate, one-piece,
1 roof plate, solid,
4 levelling feet,
EMC seals.

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* Delivery times available on request

EMC electronic Kombi system EL, 3-part

Material:
Wall unit and centre part: 1.5 mm sheet steel, yellow passivated on the inside
Mounting plate: 2.75 mm sheet steel
Front door: Extruded aluminium section, die-cast aluminium corner connectors,
4 mm safety glass, with EMC mesh.

Surface finish:
Textured stove enamel, enclosure RAL 7032, interior surfaces zinc plated and yellow passivated, door frame RAL 7033.

Protection category:
IP 55 to EN 60 529/10.91

Supply includes:
1 wall unit, solid,
2 gland plates, solid,
1 centre part, hinged,
2 x 482.6 mm (19") mounting angles, fitted,
1 mounting plate, zinc-coated, passivated,
1 front door with EMC safety glass.

<table>
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</tbody>
</table>

* Delivery times available on request

EMC Vario-Case iS

Instrument case for 482.6 mm (19") modules and modular assemblies to DIN 41 494, part 5
Width: 534 mm

Material:
Side panels: Extruded aluminium section, chromated on the inside, painted on the outside
Cover trays: Plastic to UL 94-V0 (self-extinguishing), with conductive coating on the inside
Rear panel: 2 mm aluminium, chromated

Surface finish:
Chromated/painted, RAL 7030/7035.

Supply includes:
2 plastic cover trays,
8 enclosure feet (12 with 400 mm depth),
2 side panels,
1 rear panel,
1 front panel,
4 x 482.6 mm (19") mounting angles,
4 threaded inserts,
4 plain inserts,
assembly parts.
EMC flexRack has the following approvals:
- UL
- CSA

EMC electronic Kombi system EL, has the following approvals:
- TÜV
- Norske Veritas
- Russian Maritime Register of Shipping
- Lloyd’s Register of Shipping
- VDE
- UL – Underwriters Laboratories Inc.

For USA and Canada

Accessories:
EMC accessories, see page 14 – 19.
EMC fan-and-filter units, see Climate Control brochure, page 142/143.
Ripac Vario EMC, see page 8 – 9.

1. Front door with EMC safety glass.
2. Aluminium door frame.
3. Lock system, may be exchanged for Ergoform-Mini handle.
4. 482.6 mm (19”) mounting angles, depth-adjustable.
5. Continuous knife edge.
6. Centre part of 1.5 mm sheet steel, multi-folded, yellow passivated on the inside.
7. Wall unit locked from the front.
8. Removable cable gland plate top and bottom.
10. Extruded aluminium section side panels, interior surface chromated.
11. Plastic base and cover tray, coated in aluminium. Conductive connection to the side panels via RF spring seal system.
12. Removable side panel, yellow passivated on the inside.
13. One-part solid roof panel, removable.
14. Depth-adjustable 482.6 mm (19”) or metric mounting angles (accessories).
15. Torsionally rigid aluminium section.
16. Removable, one-part gland plate.
17. Solid, removable front/rear door with EMC seal and Ergoform-S handle.
**EMC gland plates**
For shielded cables with a maximum diameter of 20 mm. EMC cable shield contact over a conductive rubber cable clamp strip. Combined EMC/IP seal provides low-resistance contact between cable shield and gland plate. For all enclosures with a depth of 400, 500, 600 and 800 mm.

German patent no. 196 04 219

**Single-row version (upper illustration):**
For one cable entry level in conjunction with standard gland plate.

**Supply includes:**
1 gland plate with twin hammer-head punching,
1 sliding gland plate,
2 IP/EMC gaskets.

**Width mm**
<table>
<thead>
<tr>
<th>Model No. TS single-row</th>
<th>Model No. TS twin-row</th>
<th>Model No. PS single-row</th>
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</table>

Packs of 1 kit
1) For one enclosure half only
2) For installation in ES, PC enclosures based on ES and PS, universal console with contact clip PS 4313.000, see page 17.

**Twin-row version (bottom illustration):**
May only be used in conjunction with single-row EMC gland plates. Provides a further cable entry level.

**Supply includes:**
1 gland plate with twin hammer-head punching and integral sliding gland plate, 2 IP/EMC gaskets.

**Metal cable ties**
For 360° contact of shielded cables on the EMC gland plate. The cable ties are not toothed, thereby eliminating the risk of damage to insulation and braided screens.

**Material:**
AISI 316 (similar to V4A), anti-magnetic and rust-proof.

**Length mm**
<table>
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<tr>
<td>200</td>
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<td>2598.200</td>
</tr>
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</table>

**Tightening tool**
For simple tightening of metal cable ties SZ 2598.125 and SZ 2598.200.

**Material:**
Handle: Polypropylene
Blades: Chrome vanadium steel, tempered, nickel-plated.

**EMC cable entry gland**
The EMC cable entry gland permits super-fast, EMC-compatible cable entry into the zinc-plated gland plates. Simply lock into position and voilà!

Other benefits include:
- 360° contact.
- Fastens without lock nuts.
- May be used with PG or metric holes.
- Adapts flexibly to existing cable diameters.
- Contact directly at the point of cable entry on the enclosure.
- The spring action means permanent contact pressure.
- The cable insulation is only stripped off at the shielded point of contact.

**Material:** Stainless steel

**Supply includes:**
Cable entry glands including seals and cable ties.

German patent no. 197 01 959

**Installation diagram:**
Before snap-fastened

**Cable shield diameter in mm**
<table>
<thead>
<tr>
<th>from</th>
<th>to</th>
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**Hole diameter in mm**
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**Packs of**
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**Spring-loaded piece snap-fastened, seal compressed**
EMC cable glands
The cable sheathing may optionally be interrupted at the contact point or removed completely inside the enclosure. The cable shield in the enclosure is retained.

The supplied lock nut cuts automatically into the paint when screwed down, thus creating a conductive connection.

**Protection category:** IP 68 to EN 60 529/10.91

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<td>18 – 25</td>
<td>15</td>
</tr>
<tr>
<td><strong>36</strong></td>
<td><strong>2411.360</strong></td>
</tr>
<tr>
<td>22 – 32</td>
<td>19</td>
</tr>
<tr>
<td><strong>42</strong></td>
<td><strong>2411.420</strong></td>
</tr>
<tr>
<td>30 – 38</td>
<td>27</td>
</tr>
</tbody>
</table>

* Minimum shield diameter = cable diameter less cable sheathing

Other sizes available on request.

---

**EMC shield bus**
EMC shield bus of yellow passivated steel strip, 75 mm² cross section, for cable shield contact. 10 (16) connections for cable shield contact.

**Supply includes:**
1 shield bus,
2 (3) slotted screws M6 x 12 mm,
2 (3) M6 nuts,
4 (6) serrated lock washers,
2 (3) spacer bolts.
Figures in brackets for SZ 2413.550

<table>
<thead>
<tr>
<th>Rail length mm</th>
<th>Packs of</th>
<th>Model No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>375</td>
<td>1</td>
<td>2413.375</td>
</tr>
<tr>
<td>550</td>
<td>1</td>
<td>2413.550</td>
</tr>
</tbody>
</table>

---

**EMC earth clamps**
The clamps may be used directly on the consumer or operating equipment on the mounting plate for cable shield contact.

**Material:**
Sheet steel, zinc plated, passivated.

<table>
<thead>
<tr>
<th>Size mm</th>
<th>Packs of</th>
<th>Model No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>50</td>
<td>2367.040</td>
</tr>
<tr>
<td>6</td>
<td>50</td>
<td>2367.060</td>
</tr>
<tr>
<td>8</td>
<td>50</td>
<td>2367.080</td>
</tr>
<tr>
<td>12</td>
<td>50</td>
<td>2367.120</td>
</tr>
<tr>
<td>16</td>
<td>50</td>
<td>2367.160</td>
</tr>
<tr>
<td>20</td>
<td>25</td>
<td>2367.200*</td>
</tr>
<tr>
<td>25</td>
<td>25</td>
<td>2367.250*</td>
</tr>
</tbody>
</table>

* 2 assembly brackets

---

**Central earthing point**
For connecting
● Earth straps
● Earthing braids
to the vertical and horizontal enclosure profile. The connection bracket is connected to the enclosure frame with 2 screws and is securely contacted. Earth connection is carried out via the threaded bolt M8 x 20 mm.

**Material:**
Sheet steel, zinc plated, passivated.

<table>
<thead>
<tr>
<th>Packs of</th>
<th>Model No. DK</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>7829.200</td>
</tr>
</tbody>
</table>

**Supply includes:**
1 connection bracket,
2 screws BZ 5.5 x 13 mm,
2 serrated washers,
1 nut M8,
1 contact washer M8,
1 washer.
Accessories

Assembly parts
For the attachment of earth straps and earthing straps to:
- Horizontal TS 8 enclosure sections
- PS/ES/universal console AP rail systems using captive nuts, see below.

<table>
<thead>
<tr>
<th>Size</th>
<th>Packs of</th>
<th>Model No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>M6</td>
<td>10 set</td>
<td>2570.000</td>
</tr>
<tr>
<td>M8</td>
<td>10 set</td>
<td>2559.000</td>
</tr>
</tbody>
</table>

Captive nuts/
threaded blocks
For rectangular system punchings (10.5 x 12.5 mm) in:
- Horizontal TS 8 enclosure sections
- PS/ES/universal console AP rail systems

<table>
<thead>
<tr>
<th>Thread</th>
<th>Packs of</th>
<th>Model No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>M6</td>
<td>50</td>
<td>4164.000</td>
</tr>
<tr>
<td>M8</td>
<td>50</td>
<td>4165.000</td>
</tr>
</tbody>
</table>

Captive nuts
The compression spring, designed as an insertion aid, ensures reliable mechanical and electrical connection in the system punchings.

Thread Packs of
Model No. PS
- M6 50: 4162.000
- M8 50: 4163.000

Threaded block
With snap-off insertion aid, die-cast zinc.

<table>
<thead>
<tr>
<th>Thread</th>
<th>Packs of</th>
<th>Model No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>M6</td>
<td>50</td>
<td>4162.000</td>
</tr>
<tr>
<td>M8</td>
<td>50</td>
<td>4163.000</td>
</tr>
</tbody>
</table>

Captive nuts
The nuts are inserted from the outside, thereby enabling the use of attachment points of the same height or width around corners. The spring cage also ensures electrical connection in the system punchings.

Thread Packs of
Model No. TS
- M6 50: 8800.340
- M8 50: 8800.350

EMC baying seal
For baying enclosure systems. Seal with all-round, electrically conductive sheathing.

<table>
<thead>
<tr>
<th>Enclosures</th>
<th>Diameter (mm)</th>
<th>Model No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>TS</td>
<td>6.3 x 6.3</td>
<td>TS 8800.690</td>
</tr>
<tr>
<td>PS</td>
<td>6.4 x 3.2</td>
<td>PS 4346.000</td>
</tr>
</tbody>
</table>

Packs of 1 set consisting of 3 seals, each 2 m long

EMC divider panel seal
This seal ensures optimum contact in bayed EMC enclosure systems and when using a zinc-plated divider panel.

Material: PU foam with electrically conductive sheathing.

Supply includes:
1 roll (12.7 x 12.7 x 5300 mm)

Packs of 1 | Model No. PS
---|---------|
1 | 4348.000 |
Accessories

Contact cutter
The contact cutter enables EMC-compatible preparation of the contact point e.g. for earthing straps. Plastic-bound abrasive with guide pin for round system punchings. With location point for drill, grinder etc.

<table>
<thead>
<tr>
<th>Model No.</th>
<th>Description</th>
<th>Packs of</th>
<th>Contact clips for</th>
</tr>
</thead>
<tbody>
<tr>
<td>SM</td>
<td>For frame section</td>
<td>1</td>
<td>Increases the shielding effect</td>
</tr>
<tr>
<td></td>
<td>For earthing bolts*</td>
<td>1</td>
<td>PE conductor connection (potential equalisation)</td>
</tr>
</tbody>
</table>

* Not necessary with TS 8

Contact paint
Contact paint prevents the corrosion of conductive, unprotected contact points.

Contents:
12 ml

Contact clips for exclusive enclosures ES 5000
There’s no faster, cheaper way of connecting a PE conductor/upgrading EMC shielding:
- Potential equalisation of the panels and the frame of the switchgear enclosure.
- PE conductor connection in accordance with EN 60 439, part 1, VDE 0660, part 500 and IEC 60 439-1 on panels to which no electrical equipment is fastened.
- Multiple-contacting increases the shielding effect by up to 20 dB, raising it to a medium shielding level.

Material:
Rust-proof spring steel

<table>
<thead>
<tr>
<th>Contact clips for</th>
<th>Increases the shielding effect</th>
<th>PE conductor connection (potential equalisation)</th>
<th>Packs of</th>
<th>Model No. PS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roof</td>
<td>●</td>
<td>●</td>
<td>50</td>
<td>4312.000</td>
</tr>
<tr>
<td>Side panel</td>
<td>●</td>
<td>●</td>
<td>50</td>
<td>4332.000</td>
</tr>
<tr>
<td>Rear panel</td>
<td>●</td>
<td>●</td>
<td>50</td>
<td>4334.000</td>
</tr>
<tr>
<td>Door</td>
<td>●</td>
<td>●</td>
<td>50</td>
<td>4313.000</td>
</tr>
<tr>
<td>Mounting plate</td>
<td>●</td>
<td>●</td>
<td>50</td>
<td>4331.000</td>
</tr>
<tr>
<td>Gland plate</td>
<td>●</td>
<td>●</td>
<td>50</td>
<td>4330.000</td>
</tr>
<tr>
<td>Baying connection</td>
<td>●</td>
<td>●</td>
<td>50</td>
<td>4337.000</td>
</tr>
</tbody>
</table>

EMC viewing windows
are designed to prevent weakening of the shielding effect in enclosures with a high protection level, even with cutouts, and preserve this high standard of protection. Further information available on request.
**Rail for EMC shielding bracket and strain relief**

Combined rail for strain relief and EMC contacting of inserted cables.

**Mounting options:**
- On the horizontal/vertical TS, PC, ES enclosure section
- On a mounting plate
- May also be fitted without a retaining bracket. Additional contacting on the left or right of the rail via existing holes (9 mm diameter).

**Material:**
Sheet steel

**Surface finish:**
Zinc plated, passivated

**Supply includes:**
- 1 rail,
- 2 retaining brackets,
- 8 screws.

---

**EMC shielding bracket**

Diameter changes are compensated in full by the spring of the EMC shielding bracket. To attach without using tools: Press the EMC shielding bracket against the cable shield and clip into the rail.

**Material:**
Sheet steel

**Surface finish:**
Zinc plated, passivated

---

<table>
<thead>
<tr>
<th>Width</th>
<th>Model No. SZ</th>
</tr>
</thead>
<tbody>
<tr>
<td>600 mm</td>
<td>2388.600</td>
</tr>
<tr>
<td>800 mm</td>
<td>2388.800</td>
</tr>
</tbody>
</table>

---

**Also required:**
EMC shielding bracket, see below.
Cable clamps for strain relief, see page 19.

<table>
<thead>
<tr>
<th>For shield diameter</th>
<th>Packs of</th>
<th>Model No. SZ</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 – 10 mm</td>
<td>10</td>
<td>2388.100</td>
</tr>
<tr>
<td>4 – 15 mm</td>
<td>10</td>
<td>2388.150</td>
</tr>
<tr>
<td>10 – 20 mm</td>
<td>10</td>
<td>2388.200</td>
</tr>
<tr>
<td>15 – 28 mm</td>
<td>10</td>
<td>2388.280</td>
</tr>
</tbody>
</table>
**Cable clamps**
For strain relief of cables on rail
SZ 2388.XXX, with plastic insert.

**Material:**
Sheet steel, zinc plated, passivated.

<table>
<thead>
<tr>
<th>For cable diameter</th>
<th>Packs of</th>
<th>Model No. DK</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 – 14 mm</td>
<td>25</td>
<td>7077.000</td>
</tr>
<tr>
<td>12 – 18 mm</td>
<td>25</td>
<td>7078.000</td>
</tr>
<tr>
<td>18 – 22 mm</td>
<td>25</td>
<td>7097.000</td>
</tr>
<tr>
<td>22 – 26 mm</td>
<td>25</td>
<td>7097.220</td>
</tr>
<tr>
<td>26 – 30 mm</td>
<td>25</td>
<td>7097.260</td>
</tr>
<tr>
<td>30 – 34 mm</td>
<td>25</td>
<td>7097.300</td>
</tr>
<tr>
<td>34 – 38 mm</td>
<td>25</td>
<td>7097.340</td>
</tr>
<tr>
<td>38 – 42 mm</td>
<td>25</td>
<td>7098.000</td>
</tr>
<tr>
<td>56 – 64 mm</td>
<td>25</td>
<td>7099.000</td>
</tr>
</tbody>
</table>

**Earth straps**
Choose from 6 ready-to-use earth straps in various lengths and cross-sections. For screws M6 and M8.

**Earth straps**

10 mm²
For configuring a reliable earthing connection with perfect contact.
- With ring terminals in M6 and M8 to match the earthing screw
- Length-optimised and ready to install.

<table>
<thead>
<tr>
<th>Cross-section mm²</th>
<th>Packs of</th>
<th>Model No. SZ</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>5</td>
<td>2564.000</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2567.000</td>
</tr>
<tr>
<td>16</td>
<td>5</td>
<td>2565.000</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2568.000</td>
</tr>
<tr>
<td>25</td>
<td>5</td>
<td>2566.000</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2569.000</td>
</tr>
</tbody>
</table>

**Earthing strap**
Tin-plated copper, in various lengths and cross-sections with press-fitted contact rings. Earthing straps counteract the current displacement effect at high frequencies, whilst at the same time offering highly flexible connection opportunities.

<table>
<thead>
<tr>
<th>For</th>
<th>Cross-section mm²</th>
<th>Length mm</th>
<th>Packs of</th>
<th>Model No. SZ</th>
</tr>
</thead>
<tbody>
<tr>
<td>M6</td>
<td>10</td>
<td>200</td>
<td>10</td>
<td>2412.210</td>
</tr>
<tr>
<td></td>
<td>16</td>
<td>200</td>
<td>10</td>
<td>2412.216</td>
</tr>
<tr>
<td>M8</td>
<td>25</td>
<td>200</td>
<td>10</td>
<td>2412.225</td>
</tr>
<tr>
<td>M6</td>
<td>10</td>
<td>300</td>
<td>10</td>
<td>2412.310</td>
</tr>
<tr>
<td>M8</td>
<td>16</td>
<td>300</td>
<td>10</td>
<td>2412.316</td>
</tr>
<tr>
<td>M8</td>
<td>25</td>
<td>300</td>
<td>10</td>
<td>2412.325</td>
</tr>
</tbody>
</table>

**Possible alternative:**
Earth straps, see above, or earthing straps, see below.
Basic EMC information

What is meant by EMC?
Electromagnetic compatibility (EMC) is the ability of an electrical appliance to operate satisfactorily in its electromagnetic environment without adversely affecting this environment, which may also contain other equipment. High packaging densities in electronic assemblies and ever-increasing signal processing speeds often cause faults in complex electronic equipment, measurement and control systems, data processing and transmission systems, and communications technology, which are attributable to electromagnetic influences. There are fundamental requirements for:
- Defined immunity to interference
- Prevention/reduction of interference emissions.

Legal foundations, standardisation
EMC legislation, as national implementation of European Directive 89/336/EEC, regulates the marketing, siting and operation of equipment which may cause electromagnetic interference or whose operation may be impaired by such interference. Since 1 January 1996, the compliance of a device or system with the protection requirements of EMC legislation must be documented by the CE symbol. The contribution of enclosures to the EMC of a device or system lies primarily in the shielding effect from field-bound interference, which in the case of Rittal enclosures is measured at external laboratories to VG 95 373, part 15 and documented in the corresponding attenuation diagrams. These diagrams facilitate qualitative statements in themselves. Testing of the finished enclosure, including installed equipment, whilst in operation is indispensable for compliance with and documentation of certain limits under international regulations (e.g. radio interference suppression in accordance with EN 55 011).
Technical foundations

**Basic terminology**

Electromagnetic influence is the effect of electromagnetic factors on circuits, appliances, systems or living creatures.

- **Interference source** refers to the origin of interference.
- **Potentially susceptible equipment** refers to electrical equipment whose function may be affected by interference factors.
- **Coupling** refers to the interaction between circuits, where energy can be transmitted from one circuit to another.
- **Interference** is the electromagnetic factor which may induce an undesirable influence in an electrical installation (interference voltage, current or field strength).

**Definition of immunity to interference**

An item of electrical equipment is said to be immune to interference if interference factors (up to a certain limit) do not lead to malfunctions:

- **Functional impairment**: A permissible impairment to proper functioning.
- **Malfunction**: An impermissible impairment to proper functioning. The malfunction ends when the interference factor subsides.
- **Functional failure**: An impermissible impairment to proper functioning and which can only be eliminated e.g. by means of repair.

**Emitted interference, interference model**

Electrical devices which operate in an electromagnetic environment with other devices may be both transmitters (sources of interference) and receivers (potentially susceptible equipment) of interference energy. The transmission of electrical energy from one circuit to another is known as coupling.

**Interference sources and interference**

Interference sources may be divided into:

- **Internal sources of interference**:
  - Artificial, i.e. technically induced

- **Internal sources of interference**:
  - Natural, e.g. lightning, electrostatic discharges
  - Artificial, i.e. technically induced.

In the case of technically induced interference sources, a distinction must be made between the effects of electromagnetic factors created and used for business purposes (such as radio transmitters, radar etc.), and electromagnetic factors which occur within the context of business or in the event of a failure which are not generated deliberately for the purpose of use (e.g. spark discharges on switch contacts, magnetic fields around heavy currents etc.).

Interference may be either continuous, periodic or randomly occurring and pulse-shaped.

- The most interference-intensive temporary events are caused in low-voltage networks by the switching of inductive loads, e.g. power tools, household electrical appliances, fluorescent lamps.
- The most dangerous overvoltages (in terms of level, duration and power content) are caused by deactivating fuses in the event of a short-circuit (duration in the millisecond range).
Electrostatic discharges
When solid materials rub against one another, electrostatic charges may arise which are rapidly discharged on conductive surfaces but which may persist for a long time on less conductive surfaces. Upon contact with conductive parts, the electrostatic voltages associated with such charges in non-conductors may cause interference or even destruction in electronic components as discharge current (conducted interference). Also, during discharge, an electromagnetic pulse is irradiated, representing field-bound interference. Electrostatic discharges from humans onto control components and enclosures are particularly significant. The voltages occurring in such cases may be up to 15000 V, with discharge currents of up to 5 A, and current rise rates of up to 5 kA/µs. The risk of malfunctions or damage is increased by poorly conductive floor coverings and low air humidity.

Influence mechanisms and counter-measures
A distinction may be made between the following coupling influences:
- Conducted interference
- Field-bound interference
  - Low-frequency field interference
  - Radiation interference (high frequency)

Conducted interference
refers to interference voltages and currents. The principal causes lie in the mechanical switching of electrical equipment (particularly inductive loads such as motors, transformers, throttling via electronic systems). Coupling of interference source and potentially susceptible equipment can occur via various “routes”: conductive, inductive, capacitive or wave interference are the relevant terms.

Field-bound interference (low frequency)
Very low-frequency currents cause a low-frequency magnetic field which may induce interference voltage or initiate interference via direct magnetic effects (magnetic memory in computers, monitors, sensitive electromagnetic test equipment such as EEG). Low-frequency electric fields of high intensity may be generated by low-frequency high voltages (high-voltage overhead cables), resulting in interference voltage (capacitive interference). Of practical significance are magnetic fields, the effects of which can be reduced via
- Shielded cables
- Shielding enclosures (the decisive material property is that of permeability, which is too low in the case of sheet steel; nickel iron, for example, is much better).
- Distance from the field source

Radiation interference (high frequency)
Interference can be reduced via:
- Shielded cables
- Shielding enclosures (Faraday cage!).
Electromagnetic interference (EMI)

**Enclosure/RF shielding**
High-frequency electrical currents and voltages in electronic circuits may initiate electromagnetic waves (e.g. mobile radio transmission stations, radar, as well as industrial high-frequency installations such as microwave drying, bonding and welding). These, in turn, may generate interference voltage in cables or directly in electronic assemblies via enclosure openings. Every metal enclosure already offers good basic shielding within a broad frequency range, i.e. attenuation of electromagnetic fields. High shielding attenuation levels in the frequency range above approx. 5 MHz can be achieved via special seals which conductively connect the conductive inner surfaces of doors and removable panels, roof and gland plates to the conductive sealing edges of the enclosure body or frame, largely in a slot-free manner. The higher the frequencies occurring, the more critical openings in the enclosure become.

**ElectroStatic Discharge (ESD)**
- Effects are both conducted and field-bound

- **Conducted**
  - Possible solutions:
    - Filters
    - Overvoltage protection

- **Field-bound**
  - Shielding possible via electrically conductive material, important factors:
    - Sealed cover
    - Standard enclosure made from sheet steel, stainless steel or aluminium
    - Large holes permissible

**Low frequency up to approximately 100 KHz**
- **Magnetic field**
  - Shielding possible via magnetically conductive material, important factors:
    - Not sheet steel!
    - Not aluminium!

**High frequency > 100 KHz**
- **Electrical field**
  - Shielding possible via electrically conductive material, important factors:
    - Sealed cover
    - EMC enclosures made from sheet steel/AlZn, stainless steel or Al
    - No holes permissible

- **Electromagnetic field**
  - Shielding possible via magnetically conductive material, important factors:
Basic EMC information

Practical EMC tips when handling components that emit interference

- With the inverters available on the market today, it is impossible to maintain a level of radio interference suppression without a radio interference suppression filter at the mains input. Line filters also boost a system's resistance to interference.
- Cables between the inverter and motor must be shielded:
  - Shield contact on both sides.
- Metallic components in the enclosure must have a large surface area and should be connected to one another with a high level of RF conductivity. Avoid surface finishes such as eloxal which have very high resistance levels.
- Relays, contactors and magnetic valves installed in the same circuit must be connected via arc extinguishing combinations or overvoltage-limiting components.
- Analog control leads should be shielded on one side and contacted inside the enclosure where possible. Ensure low-resistance connections across a large area!
- Digital signal cables should be shielded on both sides across a large area with low-resistance contact. In case of differences in potential, an additional equalising conductor should be laid parallel. Separable connections must always be equipped with metal-cased connectors!
- Avoid spare loops on all connection cables! These could result in RF short-circuiting of the above measures. Unassigned strands in the cable should be connected to potential equalisation at both ends.
- Unshielded cables in a circuit, i.e. outward and return conductors, should be twisted against symmetrical interference sources.
- Physically separate “hot” and “cold” cables at the planning stage. Pay special attention to the motor cable. The area around the shared terminal strip for the mains input and motor output is particularly at risk.
- The cable routing in an enclosure should be as close as possible to the reference potential; “free-floating cables” act as both active and passive antennae!
- When operating more than one inverter on a shared network, EMC problems are to be expected. System planners should integrate interference emission of high frequency as well as interference sensitivity amongst the frequency inverters into their concept from the outset, and take appropriate counteractive action.
**How do I interpret a shielding attenuation diagram?**

In all diagrams, the attenuation value of an enclosure is obtained from the anticipated interference frequency and the nature of the interference field (electrical field E, magnetic field H or electromagnetic field). For example, in the diagram below, the following attenuation values are obtained with a frequency of 200 MHz.

Point 1: Electrical field, high:
\[ a_1 = 50 \text{ dB} \]

Point 2: Electrical field, standard:
\[ a_2 = 25 \text{ dB} \]

In all diagrams, the level of attenuation “a” is shown on the Y axis (vertical) in the unit “dB”. This unit indicates the logarithmic ratio between the field in the environment and the field in the enclosure interior. The frequency band is entered on the X axis (horizontal) on a logarithmic scale. Attenuation “a” is obtained using the following equation:

\[
a = 20 \log \frac{E_0}{E_1} \quad \text{and} \quad a = 20 \log \frac{H_0}{H_1}
\]

where:
- index 0 is for unshielded values
- index 1 is for shielded values

---

**Material labelling**

**Enclosures with aluminium zinc** coatings are manufactured from hot-dip galvanized metal to DIN EN 10215.

**Material specifications of steel:** DX51D + AZ 100-B-C

**Material parameters of surface coating:**
- Alloy coating 100 g/m²
- Improved surface finish (B)
- Surface chemically passivated (C)

**Sendzimir zinc-coated mounting plates** are manufactured from continuously hot-galvanized metal to DIN EN 10 142.

**Material specifications of steel:** DX51D + Z 140-B-C

**Material parameters of surface coating:**
- Zinc coating 140 g/m²
- Improved surface finish (B)
- Coating implemented with a small flower of zinc (M)
- Surface chemically passivated (C)
Rittal International

Agencies worldwide

Argentina
Rittal S.A.
Av. Chile 6200, Palacios 81
1750, Ramón, Buenos Aires
Tel.: +54(11) 46-92-231
Fax: +54(11) 46-92-2319
email: info@rittal.com.ar

Australia
Rittal Pty. Ltd.
105, Coutts Rd.
Taren Point, NSW 2229
Tel.: +61(2) 9525 2676
Fax: +61(2) 9525 2602
email: info@rittal.com.au

Belgium
Rittal NV/Sa
1044-Budapest
Tel.: +36(1) 399 8000
Fax: +36(1) 399 8009
email: rittal@rittal.com

Bulgaria
Rittal CZ, s.r.o.
Plynárenská 1
1044-Budapest
Tel.: +42 0 912 07 61 07
Fax: +42 0 912 07 61 08
email: rittal@rittal.cz

Colombia
Rittal EMC range

Cyprus
Cyprus Controls Ltd.
Tel.: +357 25 29 19 19
Fax: +357 25 29 19 29
email: info@cypruscontrols.com.cy

Denmark
Dagestads A/S
Tilvej 10
9000 Aarhus C
Tel.: +45 5 07 32 44
Fax: +45 5 07 32 45
email: info@dagestads.com

Estonia
Rittal Eesti AS
Kära 1
51104 Tallinn
Fax: +372 611 33 13
email: info@rittal.ee

Finland
Rittal Oy
Korttaliitto 35
PL 134
00150 Helsinki
Tel.: +358 9 4 13 44 40
Fax: +358 9 4 13 44 40 1
email: info@keskusmitti.fi

France
France Rittal SAS
880, rue Marcel Paul
Z.A. des Grands Gordes
94070 Chatillon
FAX: +33 1 69 03 81 60
email: info@keskusmitti.fr

Germany
Rittal GmbH & Co. KG
Postfach 16 07 00
D-35736 Herborn
Tel.: +49 (06441) 1610
Fax: +49 (06441) 1610-219
email: rit@rittal.com

Greece
Rittal S.A.
Kiotari 11
14342 Néa Philadélfha, Athens
Tel.: +30210/27 17 975
Fax: +30210/27 12 398
www.rittal.de

Guatemala
INTEK
Ingeniería y Tecnología Vía 5 y Ruta 3, Zona 4 Esquina 10014, Guatemala, C. A.
Tel.: +502 322 1481
Fax: +502 322 4366

Hong Kong
Ranger
Enterprise Co. Ltd.
A Un, B/F, Block 1
Tai Ping Industrial Center
57 Ting Kau Road
Tel.: +852 2494 9228
Fax: +852 2494 9226
email: sales@ranger.com.hk

Hungary
Rittal Kereskedelmi Kft.
Ipoly Park 1.
H-1121 Budapest
Tel.: +36(1) 399 8000
Fax: +36(1) 399 8009
email: rittal.hu

Iceland
Rittal Ltd.
B垢iðgróðastraeti 16
Reykjavík
Tel.: +39 5 240 33 00
Fax: +39 5 240 33 41
email: smirn@smirn.is

India
Rittal India Pvt. Ltd.
Nos. 23 & 24
Indio Area
Veerupara
Doddaballapur
Bangalore 562 103
Tel.: +91(80) 76 22 03 00
Fax: +91(80) 76 22 03 34
email: rittal-india.india.com

Indonesia
PT Cuingk fuel Services
Wisma Budid, 2/F
Jakarta 12940
Tel.: +62 21 5266 4418 56 68
Fax: +62 21 5266 4400
email: electric@ctld-id.com

Egypt
Egypt Rittal E.A.
45, Alw al Darr Al Araba St.
Mohameddine, Giza
Tel.: +20 2 74 02 12
Fax: +20 2 74 82 276

Finland
Rittal Oy
Valimoti 35
PL 134
00150 Helsinki
Tel.: +358 9 4 13 44 40
Fax: +358 9 4 13 44 40 1
email: info@keskusmitti.fi

Israel
Rittal Electro System Ltds.
16, Hatsharon Street
South 29 P.O. Box 337
Industrial Park
Cesarea 39078
Tel.: +972 4 67 55 05
Fax: +972 4 67 55 35

Italy
Rittal S.p.A.
S.P. n.14 Rivoltana-Km 9,5
20060 Vignate (MI)
S.P. n.14 Rivoltana-Km 9,5
20060 Vignate (MI)
Tel.: +39(02) 95 36 02 09
Fax: +39(02) 95 36 02 10
email: info@rittal.it

Japan
Rittal K.K.
1-44-1, Shinbashi,
Kabuto-cho Minato-ku
Tokyo 105-0002
Tel.: +81(3) 6712 23 23
Fax: +81(3) 6712 23 27
email: rittal@rittal.co.jp

Kenya
Rittal Middle East FZE
Dubai/U.A.E.

Korea
Rittal Middle East FZE
Dubai/U.A.E.

Kuwait
Rittal Middle East FZE
Dubai/U.A.E.

Lebanon
Rittal Middle East FZE
Dubai/U.A.E.

Philippines
Enclosure Systems Incorporated
GE Phils Building
23rd Floor, Torre 11
Makati City 1231
Philippines
Tel.: +632 3 81 86 95
Fax: +632 3 81 86 95
email: guardon@ktn.net

Poland
Rittal Sp. z o.o.
ul. Witosa 6
05-825 Gdansk Marz.
Tel.: +48(58) 727 24 74
Fax: +48(58) 727 24 76
email: rittal@rittal.pl

Portugal
Rittal Systems Lda.
M. R. de Lima, 3.
11090 Beograd
Tel.: +381(1) 4 51 72 72
Fax: +381(1) 4 51 72 73
email: rittal@rittal.com

Publicis
Publicis
2291 Pasong Tamo
11090 Beograd
Tel.: +381(1) 4 51 72 72
Fax: +381(1) 4 51 72 73
email: rittal@rittal.com

La Urbina – 1073 Caracas
P. B. Calle 1 – 2
Edificio Centro Cyanamid,
Equipos y sistemas C. A.
Tel.: +998/71-132 08 56
Fax: +998/71-132 08 57
email: enclosures@rittal.com

Ritaona
Rittal K.K.
1-44-1, Shinbashi,
Kabuto-cho Minato-ku
Tokyo 105-0002
Tel.: +81(3) 6712 23 23
Fax: +81(3) 6712 23 27
email: rittal@rittal.co.jp

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