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Whitepaper Rittal TS IT network and server enclosure



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### **Executive summary**

Server enclosures represent the backbone – the key unit – of the data centre. Even if the main concern is for sensitive active components such as servers, switches, memory systems and UPS units during operation: enclosure systems ensure that sensitive electronics components are housed stably. In addition, they take cooling, power and connectivity precisely to the right positions for the hardware. They serve as an interface to the cooling concept employed and permit an insight into the actual state of the data centre through intelligent management features. They can also facilitate asset management and increase availability by means of appropriate extensions.



#### Figure 1: Server and network enclosures form the basis of the data centre

Racks are constant features in every data centre. They usually last longer than the upgrades of server and network technology; they are often only changed when major structural alterations are made. Modifications to the racks and all the subsequent adjustments to the climate control technology and power supply also represent significant cost factors. This makes it even more important to identify key factors and to adapt them to individual requirements during the selection process. Finally, a 19" rack not only has to safely accommodate current but also future generations of servers.

Data centre operators should therefore not only keep an eye on the price of an enclosure solution. There is a world of difference between manufacturers' concepts, even during installation. An inexpensive enclosure that takes twice as long for the construction team to assemble will force up labour costs, unlike a well thought-out, installation-friendly (and largely tool-free) solution. If power distribution and cable ducts can be only be installed at the cost of losing height units (U), space is lost and more racks might need to be purchased than in an enclosure like the Rittal TS IT, which accommodates such elements in the zero-U space.

Cooling the installed devices is also highly important. In principle, a 19-inch enclosure must be adapted to the existing or planned cooling solution. Regardless of whether the climate control system in the room is used via the raised floor or a rack or a bayed climate control system, the 19-inch enclosure must be provided with the appropriate interfaces so that it can connect seamlessly to the cooling solution. As always, the rule is this: Long-term investments require a large measure of advance planning, in which the emphasis must be on the respective individual requirements.

## Introduction

If you look inside a server room or data centre, you will see enclosures – lots of them. Not just any enclosures, but in particular those in the internationally standardized 19-inch format. These enclosures have the tasks of stacking the built-in hardware in a mechanically secure way, of accommodating the cables needed for guiding the power and data in and out, of allowing sufficient air exchange for cooling, as well as protecting access to the front and back and only allowing access to authorized persons. Over the last 80 years that 19-inch enclosures have been around, the number of requirements has led to some remarkable developments. As an enclosure specialist, Rittal has contributed numerous innovations and concepts that are now regarded as standard.

It all began with the telephone. Around 1911, equipment for the telegraph lines and signalling was installed in early versions of the rack. No standard existed back then. However, there was such a standard as early as 1934. Aside from the different screw diameters, these early 19-inch racks already very largely corresponded to the enclosures used today. The 19-inch (48.26 cm) dimension refers to the usable width for servers and other equipment inside the enclosure. The entire enclosure is wider; frequent external dimensions are 600, 800 or 1000 mm. Sockets, cables or air ducts can be accommodated in the space to the right and left of the 19-inch level.



#### Figure 2: At 42 U, the 19-inch rack system reaches a height of about two metres

The 19-inch rack system is standardized for good compatibility (EIA 310-D, IEC 60297 and DIN 41494 SC48D). The front panels of the racks are multiples of one height unit (U), equivalent to 1.75 inches (approx. 4.445 centimetres). Full-height nineteen-inch enclosures are usually 42 units high; together with floor stand and frame, they reach a height of two metres. Nowadays, 19-inch enclosures are available in almost every industry, ranging from

industrial plants, via marine navigation, traffic engineering, and medical equipment to the light and sound control systems in event technology.

Depending on the purpose of the application, the interior installation differs drastically from that seen in the IT world. But here too, one 19-inch enclosure is not the same as another. Even the question of whether servers or switches should be accommodated inside, in other words, whether it is a server enclosure or a network enclosure, calls for a number of adjustments.

For one thing, servers require the full 19-inch width of the enclosure, while some network equipment may only be ten inches wide. On the other hand, the cooling airflow always flows from the front to the rear in servers – the fan inside the hardware front sucks air in at the front and blows it out at the back. This is not possible for switches with a high port density,

because in such cases, the front is populated by RJ-45 jacks. Switches, routers and other network equipment usually blow in and out to the side. The next difference is in cable management. Servers are connected to power, networking, fibre channel, and control components from the rear. The cables are congregated at the back, have different thicknesses and need to be routed separately in the rack. In contrast, network equipment is generally connected from the front, and the thick cable bundles of several dozen CAT 6e cables must be able to enter into and out of the enclosure such that their minimum bending radius is not undershot.

It is clear that the IT equipment in the enclosure cannot be viewed in isolation. In addition to the numerous cable connections, cooling is also needed. Given the current trend of operating large blade servers with virtualization platforms in the racks, power losses of 25 kW and more are quickly achieved. The heat generated must be dissipated; the more effectively that occurs, the cheaper it will be for the company that operates it. A 19-inch enclosure thus requires a cooperative relationship towards cooling. It must match be mechanically suitable and, if possible, also be able to influence the controls. Secure and seamless transitions between the two elements are even more important now that many cooling concepts guide cold water into the server rack.

Of course, it would be possible to purchase and install one's own type of enclosure, whether server, network or a mixture of both. However, this has disadvantages, in almost every area. Ordering is more complicated because the products are different ones with different accessories. Their means of construction varies, and the tools and perhaps the dimensions may also differ. The shelves of one enclosure will probably not fit in another enclosure so that two lots of spare parts must be kept. The solution is obvious: An enclosure system for all possible applications in the data centre. An enclosure system that is not a compromise but which perfectly meets the specific needs of the data centre operator. And of course, an enclosure system that fits perfectly to the other components of the data centre's IT infrastructure, such as cooling, management and power supply: An enclosure system such as the Rittal TS IT.

# Core components of the Rittal TS IT 19-inch enclosure system



The TS IT follows in the footsteps of the TS 8, one of the most successful enclosure systems in the IT industry. Its successor, the TS IT, can do everything that the TS 8 could – but it can do many things better. For one thing, it can support loads of up to 1500 kg despite tool-free adjustment. Other system accessories, including component shelves and cable ducts can also be fastened using the new and time-saving snap-in technology, without ratchets or open-end wrenches. Labelled height units and pitch patterns over

the depth of the enclosure make it easier to adjust the 19-inch spacing between levels. The interior size is not limited to 19 inches, alternative construction dimensions (21", 23", and 24") can be easily implemented through lateral off-setting.

#### Network or server



Flexibility in terms of dimensions makes it easier to use as an enclosure for network technology. Whether it is copper or glass fibre, Ethernet or fibre channel, the TS IT has room for everything. New Ethernet technologies such as 10 GB or 40 GB (with their higher demands on wiring) can be used. The distribution concept of the wiring can also be

freely selected. Because the wiring can be routed both via the roof, from side or from the base, top-of-the-rack configurations are easily possible, as are top-of-the-row or middle-of-the-row.

#### **Flexible applications**



The IT enclosures also display flexibility when it comes to cooling the devices installed. Under certain circumstances, heat dissipation via a fan on the sheet metal roof is enough in low performance requirement situations. Rittal offers perforated doors with high air permeability to the room air-conditioned cooling so that the enclosure is always suitable for the chosen cooling concept. Tightly closing doors are available if closed air circuits are formed. If higher burdens need to be dealt with, cooling by cold

water via Rittal LCP (Liquid Cooling Package) systems can be used. Depending on the LCP model, the necessary heat exchangers can be used instead of the rear door (LCP hybrid) or on the side of the enclosure (LCP rack, LCP Inline).

#### Many options for expansion



Depending on the purpose, the user can choose from a large range of installation accessories. In addition to a variety of shelves, drawers and tools for cable management, Rittal offers everything related to monitoring, power supply and asset management within the TS IT rack. The use of uninterruptible power supplies (UPS) increases the availability of the

power supply. In such a case, the enclosure must be sufficiently ventilated, for example, by perforated front and rear doors.

The PDU or PSM manage the connection of the server to the power supply, and (using an RFID antenna and appropriate tags) Dynamic Rack Control (DRC) measures which height units are occupied in the rack by which hardware, and how to the assignment can be changed. Rittal's CMC (Computer Multi Control) III serves as an intelligent controller unit that can evaluate sensors for the environmental parameters and can control the locking systems in the rack.

## Rittal TS IT – the components in detail

#### Mechanical features and standard dimensions

Even if it looks as if a 19-inch enclosure only consists of a rack with walls and doors, many years of practical experience have gone into these work-horses of the data centre. Rittal has been offering enclosure systems for a quarter of a century, customers can choose from a variable modular system in series production technology and series production quality. A system enclosure is not only a mechanical shell, because the TS IT allows for its use as a network rack and as a server rack; it also forms the basis of a high-availability infrastructure solution. And the most important thing is that such a basis has to be stable.

The TS IT is approved for a total load of 15,000 N (or 1,500 kg) without any additional screw joints. This is made possible by the newly developed depth stays that transmit the load to the TS frame. Tool-free assembly is rare to find in a 19-inch enclosure, simply because high loads have to be borne. In the TS IT, the quick-release fasteners with snap-in technology save time during assembly and make subsequent conversion easier. This also applies for accessory components. For instance, the new intelligent power strip (PDU) from Rittal can be mounted quickly and easily in the zero-U space of the rack by means of quick-release fasteners. For added safety, the tool-free installation accessories (cable duct, air baffle plate, cable route and floor holder) can also be screwed tight as an option. Suitable holes are

integrated as standard. Without any tools, the slide rails, component shelves, telescopic slides and more are snapped into the rear sections and are hooked into the front sections. The mounting angles are adjustable at the front in a grid (15 mm; 30 mm with RFID). If you want to adjust the 19" levels, you only have to release the quick fastener and then lock it in the correct position again.



**Figure 3:** Continuously adjustable mounting angles make device installation easier The rear mounting angles can be infinitely positioned, so every possible 19" spacing is feasible. All positions are marked and numbered sequentially, there is no longer any need to count the suitable distances. Through lateral offsetting, asymmetric interior installation is possible, for example, in order to separate power and network cables from each other. Alternative construction dimensions are also possible. In addition to the classic 19" format, other widths will also have to be accommodated in the rack in special cases. In the telecommunications sector, 23" is one commonly used format, while 21" or 24" are also found. Tool-free assembly is also used with other elements of the rack. The side panel is divided: Only the upper side panel is hung in, then the lower side panel is inserted, all this without screw-joints, and well suitable for one-man installation. The quick-release fasteners of the side panel are equipped with an integrated closure and have an additional internal locking system for increased security.

Even if current standard server enclosures are characterized by the 19" form factor for rackmounted devices, rack dimensions are certainly not rigidly specified. Enclosures are always specified by outer width and outer depth. Only the installation height is stated in U. A typical enclosure, for example, would be 42 U, 600  $\times$  800 mm. This means that the enclosure has a useful grid of 42 U, and on the other hand an outer width of 600 mm and an outer depth of 800 mm. The useful inner width and inner depth vary from manufacturer to manufacturer and must be taken into consideration. The enclosure height can also differ. When it comes to the maximum use of the space column, the full 42 height units (HU), i.e.

two metres, are the right choice. However, enclosures of 1.2 (24 HU) or 1.8 meters height (38 U) are also available if customers need them. Similar to the height, the depth of an enclosure depends on the on-site requirements. If network components in particular need to be installed, depths of 600, 800 or 1000 mm are typically called for with widths of 800 mm. If servers are mainly used, widths of 600 and 800 mm and depths of 800, 1000 and 1200 mm are needed. Variability is an especially critical factor when it comes to the spacings of the floors and rail systems. Servers are available in various heights, the spacings range from 1 height unit (1.75" = 4.445 cm, the so-called "pizza box") to up to eight height units for blade servers. Future server generations could be even higher.

#### **EMC** and earthing concept

In an age of processor clock frequencies in the gigahertz range, electromagnetic compatibility (EMC) is an important aspect of any IT housing solution. Unfortunately, it is very difficult to classify the enclosure itself, without any inner workings, as being EMC-compatible. The question of whether a 19-inch enclosure is compliant with the common EN 55022, Class B, EN 50081/82, IEC 801-3 and ETS 300 132 standards can only be answered when it is in use. There are no standardised EMC requirements for empty enclosures. However, every metal enclosure already provides a good basic shielding effect against electromagnetic fields over a wide frequency range. Good electromagnetic compatibility is characterised by the fact that radiation from the environment is blocked, and unwanted outward radiation is reduced. This means that environment disturbances are avoided and no security-relevant data can be listened to via sensitive radio-frequency aerials.



Figure 4: A variety of earthing measures provide a good shielding effect

There are a number of measures available to improve this shielding effect as much as possible. Very good RF screening can be achieved by the slot-free conductive connection of all exterior enclosure surfaces to each other. From this perspective, a fully welded enclosure would indeed be ideal, but very impractical. In reality, compromises are needed that can allow for removable panels and movable doors. In addition, each 19-inch enclosure has cutouts for mounting elements, climate control measures or viewing areas. In practice, the enclosures thus use large-area, conductive, low-inductance connections between all the

conductive exterior surfaces of the enclosure. EMC earthing straps are ideal, rather than round-rectangular conductors. Another important aspect is the potential equalization of the cable screens at the entry point, best with a 360° all-round contact. EMC gland plates and EMC cable glands can result in additional attenuation effects.

Electromagnetic compatibility essentially depends on the earthing concept. A high conductivity of all the metallic components, regardless of whether the customer uses painted or galvanised 19" rails is crucial for safety. The TS IT offers the option of potential equalization in accordance with EN 60950 as a standard feature. Its accessories kit includes corresponding conductors of 4-mm<sup>2</sup> cross-section and a central earthing point for linking to the house connection. The rails are connected via the tool-free clip fastener, so that they make a direct contact to the depth stays of the 19" interior installation, thus ensuring potential equalization. The surfaces in the 19-inch enclosure can be painted or galvanized. Painted surfaces require more effort to make contact. Tooth lock washers or dedicated conductors must then ensure that the contact for the earthing is made securely. Galvanized surfaces, which can be used *per se* as contact surfaces, do make things easier. However, there has been a discussion in the past about microscopically small zinc particles ("whiskers") that split off from the coating and can penetrate into the hardware through the air turbulence. There, they can cause shorting on the circuit boards or between the pins of the digital circuits. In practice, however, such problems are extremely rare. All the surfaces of the enclosure frame and interior installation within the TS IT are dipcoat-primed (RAL 9005) as a precaution and integrated in the potential equalization through corresponding contact elements. Thus there is no chance whatsoever of whiskers forming. All covering parts such as doors, side panels and roof elements are dipcoat-primed and additionally powder coated in RAL 7035.

#### Modular baying and cabling concepts

Just how the frames are placed always depends on the user's circumstances. Spatial requirements, cabling concepts, grouping by applications or departments are all possible criteria for deciding which enclosures should be placed in which arrangement. A 19-inch enclosure must be able to meet such demands in a flexible way. When it comes to network equipment, the end-of-the-row (EoR) and middle-of-the-row (MoR) positions are frequently used. In the first case, the enclosure is at the end of the row, in the second case in the middle, with cables that lead to the left and right. It has to be possible to introduce a large number of cables into the enclosure, securely supported and distributed in a structured way.



#### Figure 5: Cable routing and cable clamps in the TS IT

A 19-inch enclosure should therefore offer several cable entry options: via the roof, laterally, or from the ground. Different requirements also arise depending on the media used. Copper cable or fibreglass, Ethernet or fibre channels place different demands on the bending radius, and on the strength and the diameter of the cable entry guides and cable passages. New technologies such as 10 Gbit, 40 Gbit or 100 Gbit should also be manageable in order to be ready for the future, even if these systems are not yet in use.

#### Doors and rear panels

When it comes to 19-inch racks, doors are not all the same. Space is always tight in a data centre; the operators try to fit in as many enclosures in a confined room. Nevertheless, accessibility from the front and rear must be maintained. This is all the more important because the narrow rows need to be cleared quickly by staff in an emergency, so that the extinguishing system can start up. With Rittal's TS IT the rear doors of the standard enclosures are all divided from a height of 1800 mm and equipped with 180° hinges in order to keep these escape routes as large and as accessible as possible. Escape routes from the enclosure are possible in both directions, because the doors open flat to the adjacent enclosures. This is ideal for data centres with narrow maintenance aisles, as well as for installations in small spaces.



#### Figure 6: Rittal offers both perforated and non-perforated doors for the TS IT

The doors feature comfort handles for semi-cylinder locks on the front and rear sides. That means that they are already prepared for the use of individual locks. There are glazed doors to the rack climate control and perforated doors for room temperature control with 85% free space within the perforation – an as yet unprecedented degree of opening to facilitate the necessary air throughput. The closed design of the TS IT rack also has sufficient tightness of seal for it to be suitable for use in conjunction with gas extinguishing systems. Even the two-piece rear doors offer a higher degree of perforation than the one-piece doors of the predecessor model DK TS. With a door size of 800 x 2000 mm, the real free area is about 1 m<sup>2</sup>. The amount of ventilation space gained is over 45 % more than with the DK TS.

#### Locking systems

Nineteen-inch enclosures protect the hardware installed in them from a variety of hazards. This includes unauthorized access, a sensitive issue in the data centre. Not all enclosures hold equally vital components or data, which is why different locking options are important. A variety of mechanical and electronic locking systems are available from Rittal, as well as different sizes of simple handles without locks. There is thus is both a comfort handle for semi-cylinder locks and a mechanically coded lock, as well as a comfort handle with an electromagnetic lock for the CMC III monitoring system. Besides performing numerous monitoring tasks, the CMC (Computer Multi Control) can also be as an operational control unit. The door handle and the doors are constantly monitored, and unauthorized access is immediately reported. Access can be remotely controlled. Similarly, access control can be personalised using a numerical code or a transponder card. This way it is possible to trace how long a particular person had access to the rack. A combination for the "four-eyes" (double-checking) principle, in which two people have to perform identification at the same

time, is also possible.

#### TS IT and containment concepts

With more and more powerful components inside the server, as well as network technology, cooling has a crucial role to play in the selection of enclosures. Essentially, the enclosure has to be adjusted, depending on the nature of the proposed climate control system and it has to meet the conditions specified. A distinction can be made between space-based or a rack-based cooling systems. If the entire room is cooled, the enclosure must be permeable for the cooling medium, and the heated air from the terminal devices must be fed to the cooling device as simply as possible. To this end, the enclosure fronts are highly perforated in order to provide a large, free-flow area. Within the enclosure, the free flow paths around the components that need to be cooled should be minimized or shielded off completely. This prevents the cold air flowing past, unused. Free spaces within the assembly level can be closed off by blanking plates, for example.

In contrast, rack-based climate control demands a circuit between the component to be cooled and the climate control unit that is as closed as possible. The individual enclosure suites are divided into climate zones when entire enclosure suites are typically installed in data centres. Whether this is cold or hot aisle cooling depends on whether cooled room air or hot waste air circulates in the aisles between the enclosure suites. The enclosure design is usually closed in such cases. However, the closed front usually has a glazed door for status control purposes. Individual openings within the enclosure serve only to ensure the targeted supply with cooling medium.



#### Figure 7: Containment is an important component of any energy efficiency measure

A TS IT is optimally designed to be combined with an enclosure. It is, so to speak, the interface to the aisle containment concept and can form either a cold or a hot aisle. Rittal's Liquid Cooling Package (LCP) cooling system fits seamlessly to the TS IT, so creating the conditions for an efficient enclosure, installed without any great effort. Of course, the TS IT can also be operated with a room climate control system. Rittal also offers cooling solutions for these. In any case, the secret of efficiency is to seal off the air passages as well as possible. Cold air may only be exposed to the object to be cooled, while hot air, on the other hand, must only be exposed to the cooling system. What must be avoided at all costs is the mixing of hot and cold air on the paths through the data centre - this leads to a so-called "air short circuit". Many users also heed this advice within the room itself. However, separation must be consistently maintained within the rack. A wide range of accessories with which the air can be channelled in the rack without the loss of any height units is available for the TS IT. The cable routing remains unaffected and most accessories can be moved as needed and adapted to any changes within the rack. Rittal offers magnetically coated sealing strips for the attachment of installation components within the mounting level, which can be positioned as required to optionally close any existing but unused rows of holes. Air baffle plates, which provide multiple mounting positions, depending on the interior installation and in combination in the baying arrangement, permit the all-round containment of the mounting level between the hot and cold aisles. Despite the containment, the flexible lateral termination via brush systems permits the installation of accessories such as rail systems between the two areas.



#### Figure 8: Magnetically coated sealing strips seal off unused rows of holes

#### Base assembly and roof

Air routing also plays an important role in the roof of the 19-inch racks, although other aspects such as cable entry do represent important considerations. The multifunctional roof of the TS IT is fitted with brush strips across the entire depth of the enclosure to allow lateral cable entry; there is also a cable clamp directly behind the brush strip. The depth stay of the TS IT can be used for cable clamping, directly beneath the brush strip and over the entire depth. In addition, a cut-out already exists for a fan module to the active and passive climate control.

As far as the introduction of cable and air flow is concerned, the same requirements apply for the base assembly. This is also reflected in the new base of the Rittal TS IT that can be mounted without the use of tools. Besides the levelling feet, it can take rollers, mounting rails and cable routing elements. The gland plate can be ordered as a complete modular set or as individually configured single modules.



Figure 9: Cables can be introduced into the flexible base assembly in a number of ways

#### Interior installation and the necessary accessories

The days when simple cable ties were sufficient for the wiring harnesses in the rack are long gone. Today, applications demand cable management panels, cable fingers, cable ducts, and guides for cable routes. An ideal rack can combine the different guides and accommodate them in a space-saving way in the zero-U-space, i.e. on the left or right between the actual 19" mounting frame and the side panels. Where the cables run into the server rack, the openings must be wide enough to facilitate easy installation. Sealing by brush strips is also necessary to prevent cold or warm air escaping at the wrong place and so undermining the cooling strategy. Through the tool-free assembly of the accessories, the Rittal TS IT offers advantages in assembly time, and facilitates later changes to the installation plan. The very extensive range of accessories for the interior of the rack is also useful.

Integrated pitch patterns help in easily determining the distance between levels. This way, one can position the installation modules without difficulty. The rack also has height unit labels at the front and rear that can be read from the front. In addition to stationary and pullout shelves, fixed and variable-depth slide rails and drawers also are available for the 19inch level. Users have even more choices when it comes to cable management accessories. There are cable managers that ensure minimum bending radii, guide rings, shunting rings, cable routing bars, cable ducts, shunting panels, channels, cable glands, cable routes, a variety of clamps and Velcro fasteners. This allows every cabling task in the rack to be performed professionally and safely.



#### Figure 10: A wide range of accessories makes the interior installation of the TS IT easier

Additional accessories make it easier to work within the rack. Thus, simple multiple sockets are available for the zero-U space next to the 19-inch level. They can be fastened without tools thanks to snap-in closures. Recess mounted lights illuminate the work area in the normally sparsely lit data centre. For working with servers on site, Rittal's product range also includes an extendable monitor/keyboard unit, from which a TFT monitor, laid flat pops up when the drawer is pulled out.

## Components for the complete solution

#### **Dynamic Rack Control (DRC)**

A 19-inch rack can accommodate a large variety of individual components. The overview and management of the built-in devices is a never-ending task, especially in larger data centres. Using the Dynamic Rack Control (DRC) accessories system, administrators can gain an exact overview of the rack assignment through highly accurate RFID technology. RFID tags on the devices inserted report a wealth of data to the management console without contact, via an RFID antenna bar. This simplifies planning, deployment, and troubleshooting in the data centre.



#### Figure 11: Dynamic Rack Control supports asset management by means of RFID

The configurable tags can store numerous pieces of key data, such as maintenance intervals, hardware equipment and the applications or services deployed in the devices, and they automatically transmit this data to the management software in the course of the detection process. Thanks to the tags, the information "follows" the terminal device, even if it is moved to a different place in the rack or to another server rack in the data centre. The high-precision RFID antenna for the TS IT Rack from Rittal forms the basis of Dynamic Rack Control. It is capable of reliably assigning RFID tags to any mounting hole of a height unit (1/3 U). The antenna can be ordered or retrofitted as a configuration feature when ordering a TS IT. A well-thought-out fastening specification simplifies installation, without the need for any time-consuming adjustment work.

#### Distribution of power to the terminal devices

Intelligence is also called for when distributing power. Each device in the rack requires a separate power supply (and with redundant connection, even two power supplies are needed). This first requires enough sockets in the rack. Nowadays, the connections are usually made through power distribution units (PDUs). Rittal offers two suitable systems for this. The intelligent power strips of the PDU International series offer up to 48 slots, and can perform numerous additional tasks, depending on the model. PDUs with measuring functions provide data on power consumption in order to assess the data centre's energy efficiency. Other models can also switch the connected loads on and off. Intelligent power distribution units (PDU) thus make it possible to store programmed recovery scenarios, so that servers and equipment boot up one after the other in a controlled sequence. Like most Rittal accessories, the PDUs can be mounted in the zero-U space quickly and without any tools. There, they are ideally positioned to distribute the power cables in the rack, without occupying any space on the 19-inch level.



#### Figure 12: Rittal PDU International with up to 48 slots

The second system, the modular PSM busbar system, is mounted laterally next to the 19inch level, where it assumes basically the same purpose as the PDU International. Thanks to the modular design, users themselves decide which and how many plug-in modules the rail is to be equipped with. Different levels of intelligence can also be selected in the PSM busbar system.



#### Figure 13: Rittal's PDU Series PSM – with its modular design

In conjunction with the Rittal CMC III, managed modules offer further convenient functions. These include the event-controlled switching of the outputs and current measurements for individual sockets. The switchable modules also feature sequential reconnection following a power outage. Versions are available for all the important connector types used in the data centre.

#### Control with CMC III

Fire, water, burglary – these are just a few of the threats from which companies have to protect their server racks and data centres. Meanwhile, all the commonly used network management systems integrate physical parameters and issue warnings if there are any deviations from the setpoint. In order to obtain data for these parameters, users can access the CMC III (Computer Multi Control) comprehensive monitoring system. The CMC III system collects numerous essential statistics via an intelligent bus system. There, they are then available for further processing by the network management system. However, the CMC III also acts independently, automatically initiating countermeasures and triggering alarms or notifying previously specified contact persons, for example. Two sensors are integrated in the CMC III itself: An infrared sensor detects whether the enclosure door is open or closed, an additional sensor monitors the temperature in the rack.



#### Figure 14: Sensors and switch units can be connected to each other with the CMC III.

Rittal offers a very wide range of sensors and switch units that can be connected to the CMC III. The range includes infrared access sensors, leakage and smoke detectors, digital inputs and outputs, as well as humidity and airflow sensors. These cover all the relevant physical parameters needed for monitoring server racks and data centres. The CMC III can be mounted in a number of different ways, depending on the user's situation. In addition to a 19-inch rack, in which up to three units can fit side by side, there is also a mounting frame for mounting directly on the frame. Assembly and disassembly can be performed without any tools. Also, the system automatically initializes newly connected sensors by Plug-and-Play, which further simplifies set-up. The user can manage all the functions via a graphical Web interface. Thresholds can be defined clearly, and the specified actions can be checked at a glance when the limits are exceeded or have not been met.

#### Fire detection and fire extinguishing in the TS IT enclosure system

The IT components housed in the TS IT always represent a separate fire load. It is important to continuously monitor the enclosure for a possible fire. Rittal offers the EED III (Early Fire Detection) system to monitor up to five bayed, closed server enclosures. This system continuously draws in air through a pipe system, or from the server racks, and guides the air to two smoke detectors of different sensitivities. If the smoke detectors detect any turbidity, a pre-alarm and main alarm will be generated accordingly.

Both the alarms, as well as the fault signals in the system itself can be transmitted directly to the CMC III monitoring system via the newly integrated CAN-Bus interface of the EFD III. Often however, the mere recognition of the problem is not enough because it is not possible to ensure 24/7 that an adequately rapid response can be made to avert greater damage. It is also advisable to incorporate automatic extinguishing in addition to monitoring. With the DET-AC III, Rittal offers both the monitoring and active extinguishing of fire in a TS IT.



#### Figure 15: Monitoring and active extinguishing by the Rittal DET-AC III

A DET-AC III is installed in the upper third of the 19-inch level of the TS IT enclosure, and only takes up one height unit (U). Fires are fought with the chemical extinguisher medium NOVEC<sup>™</sup>1230. The extinguisher medium is stored in the tank in liquid form, and flows into the enclosure as a gas. Extinguishing is performed largely by the heat being removed from the flame. The extinguisher gas is non-conductive and leaves no residue. This means that no damage arises to the hardware in the TS IT.

To build up a concentration in the TS that is sufficient for extinguishing, and to maintain this concentration for as long as possible, the extinguishing system must be inserted in the closed version of the TS IT. Both a closed roof panel and a base assembly with a sealing profile for cable entry are available for this application. The extinguishing systems must not be used in a ventilated or cooled TS IT enclosure where air is exchanged with the surroundings. The use of the fire alarm and extinguishing system is possible in combination with cooling systems that have a closed internal circuit, such as the Rittal LCP or the Rittal IT roof-mounted cooling unit.

A fire can flare up again, even if it has been extinguished, as long as the energy source or the causes of the fire have not been suppressed. The more densely the enclosure is populated, the longer its concentration for extinguishing is maintained (holding time). The longer the holding time, the longer the enclosure is protected from a renewed flare-up of the fire; the server can then be shut down in a controlled way and the power source switched off.

If a number of bayed TS IT enclosures are to be extinguished, DET-AC III slaves are used as supplementary units to the DET-AC III Master. These contain the extinguisher medium for one enclosure each and only take up one U per enclosure. Up to five enclosures in total can be monitored and extinguished. All three units have a CAN-bus interface for direct connection to the CMC III; administrators thus have a better overview of the operations and of the status of the extinguishing system. Alarms that have been triggered can also be taken over in the management software that controls the CMC III. Without this link, all the

messages are only output locally on the extinguishing system's display. In addition, the systems are tested by the VdS technical authority.

For many administrators, water in the data centre is the biggest nightmare. Although further precautions are obviously needed to protect against massive flooding, a server or network enclosure should at least be able to endure smaller amounts of water. The TS IT can provide a degree of protection up to IP54 if the ambient conditions call for it. For this purpose, a special version is available with a closed roof plate, a one-piece rear door, a completely closed base assembly, and one-piece, screw-fastened side panels.

Climate control capacity is often mistakenly equated with IP54. However, an IP protection class only tests for the penetration of foreign bodies and moisture into the interior of the rack. However, heat exchange with the environment is important in order for a rack to be suitable for climate control. In industrial environments, this can be done with the corresponding components, in spite of the high leak-tightness due to separate circulation systems.

Under IT-friendly environmental conditions, this is even possible with a lower protection class by using the proper climate control components, for example, the use of an IT climate control unit and the temperature-based control of the incoming and outgoing air.

## List of abbreviations

CAN	-	Controller Area Network
CAT 6e	-	Category 6e – a performance class for network cables
CMC	-	Computer Multi Control
DRC	-	Dynamic Rack Control
EFD	-	Early Fire Detection
EMC	-	Electromagnetic Compatibility
EoR	-	End-of-Rack
Gbit	-	Gigabit
U	-	Height Unit
HF	-	High Frequency
IP	-	International Protection (protection class)
ISO	-	International Organization for Standardization
IT	-	Information Technology
LCP	-	Liquid Cooling Package
MoR	-	Middle of the Rack
PDU	-	Power Distribution Unit
PoE	-	Power over Ethernet
PSM	-	Power System Module
RAL	-	A standardized colour system
RFID	-	Radio-Frequency Identification
SNMP	-	Simple Network Management Protocol
UPS	-	Uninterruptible Power Supply

## Rittal – The System.

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