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R&M
Convincing cabling solutions

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Handling Change Sustainably



Dear Business Partners,

The latest issue of our customer magazine CONNECTIONS once again contains a range of articles featuring new products from R&M, trends in the world of communications, and projects with well-known customers, such as solutions for the new SBB operations control center in Olten, the Marina Port Vell in Barcelona, the new Formula 1 circuit in Sochi, the second largest branch of IKEA in Australia, the first skyscraper in Sofia, to name just a few. The lead story focuses on the digital revolution, which is having a permanent impact on our society, and impressively explains the ultrafast increase of data volume all over the world.

Changes and opportunities

The segments R&M is active in have undergone considerable change. Today, there are far more project-specific, customized communication solutions being realized than just a few years ago. On the technical side too, pioneering developments are under way. A high degree of flexibility is required to master this situation.

An appropriate way of dealing with change is now very much in place at our company. The process of internationalization at R&M started many years ago and has now proved its worth. Today, we are a global player managed with clear specifications from our headquarters in Switzerland. Without neglecting our inherent culture and corporate values, we will drive forward further internationalization. With closer proximity to the customer, a more immediate presence in the market and even faster implementation on site. With cross-border, dynamic in-house networks and processes.

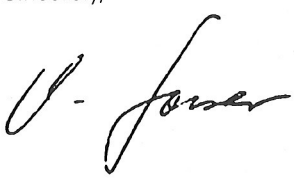
Absorbing currency pressure

After a successful anniversary year in 2014, we are now facing new challenges. We need to stay competitive at an international level without neglecting the core values of our brand – quality, innovation and customer proximity. The current appreciation of the Swiss franc is forcing export-oriented Swiss companies such as R&M to act accordingly. Back in 2011, we already had to face massive currency pressure, something we were able to counter successfully with targeted measures. Today we have well-balanced Supply Chain Management with all kinds of different local branches which can act fast and in a competitive manner on site. We will drive the internationalization of R&M forward, based on this experience.

After 13 years as CFO of R&M, I have decided to move to the holding level of the Reichle Group. Since April 1, 2015, I have been responsible for financial issues at the family holding and support the owners, Martin and Peter Reichle, in the further development of the company group. My successor as CFO at R&M is Patrick Steiner, who for many years successfully managed Accounting and Controlling. I wish him every success in this new task.

Now it only remains for me to thank you for the trust you have placed in our company and for the long-term collaboration.

Sincerely,



Martin Gasser | CFO

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Publication Details:
CONNECTIONS 48 | April 2015

Cover picture:
A highly networked world can only work with reliable infrastructure.

Publisher:
Reichle & De-Massari AG, Binzstrasse 32, CHE-8620 Wetzikon, Switzerland, www.rdm.com
E-CONNECTIONS: www.connections.rdm.com

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Layout: inch, Wetzikon, Natalie Schnetzler

Printing: Uhl-Media GmbH, D-Bad Grönenbach

Print run: 13000 copies

CONNECTIONS is published twice a year and can be ordered from the publisher.

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The Digital Revolution

All over the world people are talking about a new industrial revolution – the digital revolution. The number of objects around us that are permanently communicating with each other over the Internet is increasing all the time. And that in turn is leading to a rapid increase in the volume of data. Planners, installers and operators of data and communication networks can thus look forward to market growth in the coming years.

In 2022 there will be 14 billion devices connected with data networks worldwide – more than twice as many as today. Or at least that is what recent studies based on the in-depth examination of numerous evaluations and expert analyses by Machina Research and Bosch Software Innovations are telling us. The Gartner Group is actually forecasting 26 billion networked devices. The most familiar things that are going to be networked are cars: They are already interacting with their passengers today and will soon be communicating with traffic lights, street sensors and other cars. In buildings, sensors will be connecting the thermostats with electricity meters and home installations. In the logistics sector, RFID tags provide information about what is in packaging, on palettes and in containers. Modern kitchen installations with intelligent refrigerators and microwave ovens are already putting communication with the Internet to good use. And because each of these devices will have its own IP address, people are talking about the Internet of Things, IoT.

Hyperconnectivity

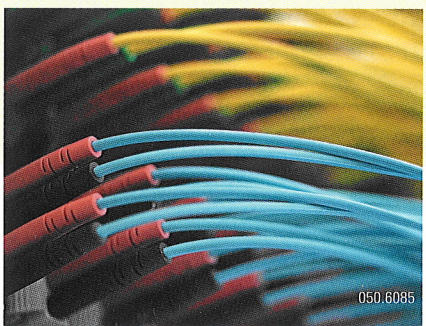
Then you have billions of smartphones, tablets and computers which are virtually permanently online. According to surveys by the OECD, an average household will have around 50 Internet-capable devices by 2022 – five times as many as today. The foresight researchers from Z_punkt in Cologne, Germany, have coined the term hyperconnectivity to describe this phenomenon.

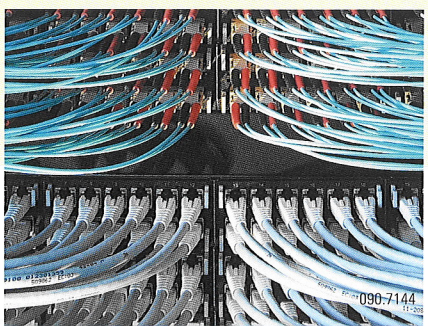
From the point of view of network planners, these are interactive systems

Five Tips for Planning Networks in the IoT Age

A profoundly networked world can only work with reliable infrastructure. Here, a few criteria and orientation aids for planning and product functions. They are based on decades of experience R&M has in the setting up of wide-area networks as well as in the installation of local data networks and structured cabling systems:

- The wired infrastructure should continue to be promoted as radio systems cannot deliver everything on their own. FO networks offer the greatest perspectives and the best performance. Due to the demand for local mobility, radio networks have to be promoted to the same extent or rather the wired networks have to be planned and prepared to ensure optimal radio coverage.
- The infrastructures should be standardized and universal. They have to include older generations of network technology. Ethernet, TCP/IP and RJ45 are solutions which will continue to be in use for a long time. Even the various DSL and PON generations of the broadband suppliers will continue to exist in parallel for some time yet and should be supported.
- Distribution platforms should be able to be adjusted to suit new situations in just a few easy steps. They should also be easy to scale. Network operators should only procure and install what is likely to be successful on the market and enable growth.
- The cabling and connectivity technology should be designed to be self-explanatory and repair-friendly. Even inexperienced installers should be able to master these technologies intuitively as there are not specialists everywhere.
- High product quality, faultless installation, permanent availability and loss-free signal transmission reduce the operating and maintenance costs of the networks. The total cost of ownership remains calculable. The networks are being built for the coming generations and must therefore be designed to suit long-term purposes.



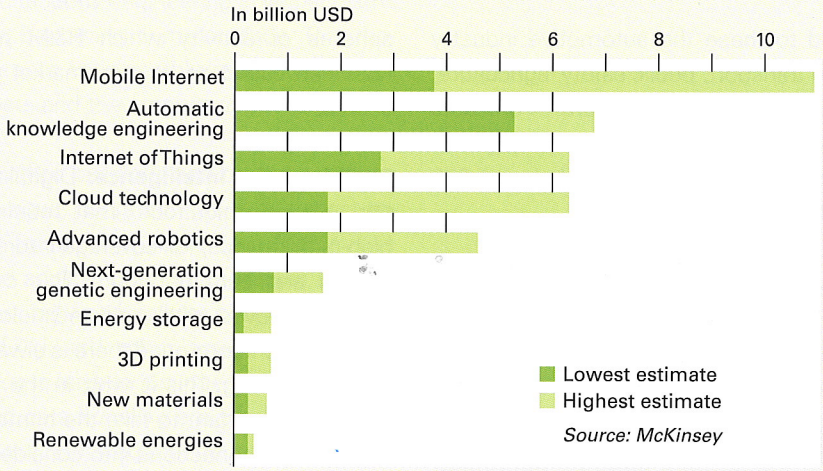




which are permanently communicating, whether wired or unwired. The whole process results in intelligent organisms which in part work autonomously in real time. But the term also refers to heterogeneous systems because it is often the case that nobody knows what exactly devices are going to communicate with in the future when they are undergoing development. So network technicians have to ensure their planning is farsighted and, in doing so, create reliable infrastructures which can cope with future data growth long term.

Because if you leave the data for video transmission out of the equation, the communication between devices and machines already accounts for more than 20 % of Internet data traffic today, according to many surveys. The Cisco Visual Networking Index maintains that IP data traffic increases at an annual rate of 21 %. Communication between machines in the IoT is in fact increasing by 84 %.

Estimated economic influence of digital technologies in 2025



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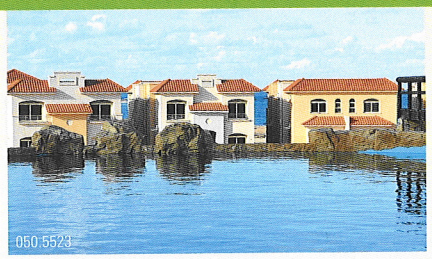
Networking going forward

There are several reasons why it is safe to assume that networking, and thus market growth, will continue. Retrofitting devices with sensors and embedded software to make them intelligent is becoming more and more affordable. Multifunctional microsensors now only cost somewhere between 50 cents and a few dollars. Miniaturization is also progressing. The tiniest of chips can already store entire web servers. This is how innovations such as goggles and wearables – digital systems on your wrist or in clothing – have come into being.

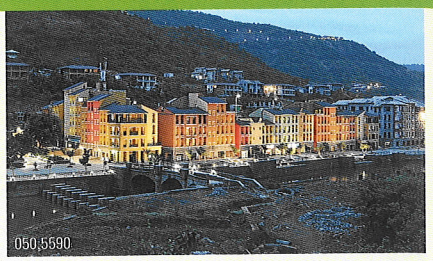
The basis for networking is now also unlimited: The new Internet protocol IPv6 can assign 340 sextillion (1 sextillion is 10^{36} or a 1 with 36 zeros) IP addresses. That means that every garbage can, every piece of packaging and every item of clothing can become part of the Internet.

And that in itself opens up enormous potential to various branches of industry for the coming years. IT developers, for example, must create the connection logic for the new devices and integrate monitoring and security functions. Crisp Research estimates the global market potential at around 160 billion euros by the end of 2016 in the IT branch alone.

The Internet of Things generates innumerable approaches for new products and services. Promising market sectors are industrial manufacturing and logistics, intelligent buildings and smart cities as well as utilities and energy.







An Expert Start to the IoT Era

R&M has decades of experience in setting up wide-area and access networks as well as in equipping local data networks and structured cabling systems. This experience is very much sought after in ambitious projects. Examples: Limmatfeld in Zurich, Telal and Madinaty in Egypt, the hill city Lavasa in India, and the city of dreams Serena del Mar in Colombia.

Consistent, flexible and convergent cabling solutions are in demand. The result of the extensive, wide project experience is the company's focus on five spheres of activity:

- Broadband coverage of the area
- Communication between machines
- Communication in mega cities
- Convergence of networks in interactive working worlds
- Smart grids, smart buildings and energy management

The R&M teams know how to combine old and new networks and media, making R&M the perfect infrastructure partner for the era of the Internet of Things. Technology and product development are resolutely geared to the demands of the IoT. R&M solutions are first choice when it comes to establishing seamless and permanently reliable connections between the most trivial "things" and the largest data centers.

With its expertise in installation, project planning and consulting, R&M helps partners in the market on their way to economically balanced, powerful, efficient and sustainable network infrastructures. Training, certification and long-term warranty programs from R&M support installers, planners, network operators and users when setting up and operating IoT infrastructures. This is how partners are turned into expert enablers so that they can act confidently in the trend toward digitalization.

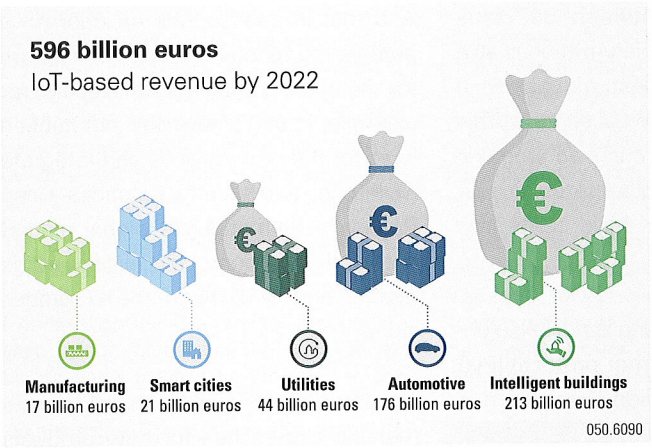
Add to these the automotive industry and transport, public safety, agriculture, medicine and healthcare. Forecasts suggest that the Internet of Things will achieve sales worldwide of almost 600 billion euros in 2022.

Five spheres of activity

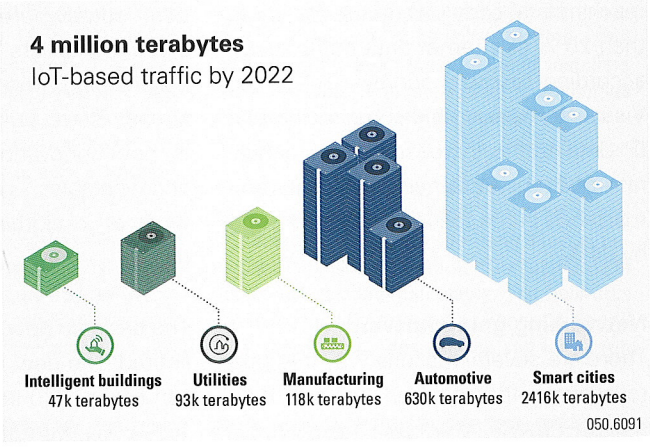
In this complex environment, it is a major challenge for planners, installers and operators of both public and private networks to keep track of things. They can, however, focus on five important spheres of activity which R&M has identified based on its own market research:

■ **Ubiquitous intelligence:** Digitalization will be ubiquitous. That requires high-performance, full-coverage Internet access and data networks. This cannot be achieved with radio technology alone. In the background there is always efficient cabling. This is why, in the future, it is important to take the number of network connections into consideration in every building project and every technical investment. In the planning phase, you may not know what they are going to be used for. But connections and sockets have a tendency of running out quickly.

■ **Machine To Machine (M2M) communication:** In the future, machines will be communicating more and more with each other in autonomous systems. Production managers have to be able to monitor and, if necessary, con-



Machina Research and Bosch have identified five key markets which, in just a few years, will generate 80 % of the potential sales volume of the Internet of Things: industrial manufacturing, smart cities, public utilities, cars and traffic, intelligent buildings.
Figures: © Bosch Software Innovations GmbH



Data traffic in the Internet of Things can grow to 4 million terabytes in 2022 according to forecasts by Machina Research and Bosch. Most data will be generated by applications in smart cities.

trol autonomous industrial facilities on the other side of the globe in real time over the Internet. Every package, every pallet, every product will be equipped with an interactive chip communicating status, function and destination. Which is why networks have to be consistent and highly resilient. The ideal case scenario would be to implement the standardized, proven Ethernet/IP concept as consistently as possible to avoid media discontinuities in the flow of information.

■ **Communication in mega cities:** In the future, many people will be living in densely populated agglomerations (see CONNECTIONS No. 47). They want to be using online services 24/7 wherever they are, whether for working or for pleasure, transmitting videos, keeping a check on their messages or telemonitoring their homes. The cellular phone network providers have to compress their radio cells to a few hundred meters in diameter and connect the base stations with powerful backhaul FO networks. Independently of this, city dwellers are more and more eager to have fiber optic connections with gigabit speed to the home and to the desk.

In new residential areas, the corresponding cabling can be incorporated from the beginning and set up in entirety from scratch. R&M has accompanied investors in several notable projects in the professional planning and coherent setup of integral infrastructures. Two examples: Lavasa in India and Telal El Alamein in Egypt.

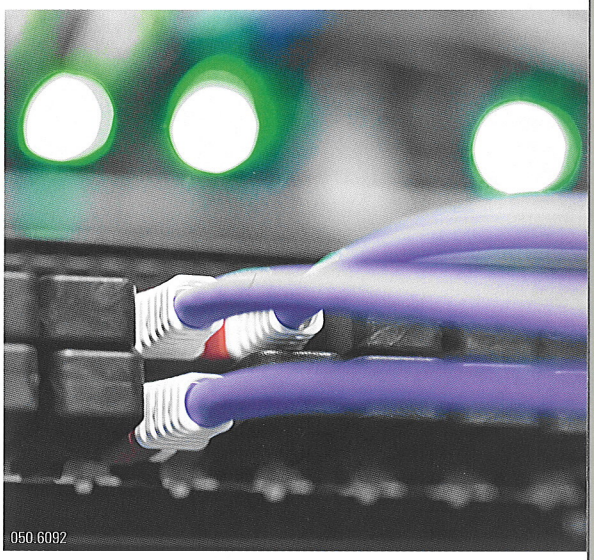
The challenges are much greater in towns and cities which have developed over time. If networks are to be set up and maintained here to cover IoT requirements, the cabling technology must be extremely adaptable. The networks can only be upgraded successively. Incredible flexibility and farsighted thinking are required from planning through logistics to installation. R&M has the corresponding expertise and cabling solutions to meet these challenges.

■ **Communication in interactive working worlds:** Professionals are working more and more from home as well as on the road with mobile devices. Protected high-speed connections between home, the office, the car and sports ground give people with more cerebral jobs the chance to organize their activities more flexibly. Collaborative working all round the world and simultaneous engineering in virtual teams are becoming commonplace. This represents an incredible reduction in both costs and the amount of travel.

In office buildings and on the company campus, users do, however, expect total freedom of movement for devices and applications. Which means the barriers between cellular phone networks, WLAN and other forms of network access have to disappear. Convergence and data bundling are the name of the game. Heterogeneous networks (HetNet) will have to offer multiple broadband access. Densified WLAN access points require backup from efficient cabling (see articles on pages 30 and 33).

■ **Smart grids and smart buildings:** The planet's resources are limited. Consumption of water, energy and raw materials can be managed far more efficiently with intelligent remote control.

Power grids become smart grids by transmitting digital control signals and consumption data between buildings, distribution stations and power stations. This too requires close-meshed, reliable communication infrastructures – including the necessary cabling. ■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From left to right:
Peter Meier, R&M Switzerland;
Jürg Lauber, project lead at the SBB infrastructure telecom division;
Hanspeter Digel, project lead at the SBB infrastructure telecom division;
Franco Suppa, divisional manager for installations at swisspro AG;
Beat Stucki, R&M Switzerland.



Ultra-Modern Network Infrastructure for Swiss Federal Railways

Punctual, precise, reliable …
The quality of Swiss Federal Railways (SBB) is legendary. Four operations control centers are now helping to further increase the railroad's performance. The example of the central operations control center in Olten shows just how high the demands being made on the network are.

For thousands of years now, Olten has been an important intersection when it comes to transport over the Alps and traffic along the northern side of the Swiss mountains. It became even more significant with the advent of the railway. Olten has a pivotal role for SBB as the railway hub between Basel, Bern, Zurich and the major alpine tunnels.

This is why Olten was an obvious choice for one of the four new operations control centers that are due to make Swiss rail traffic even more efficient over the next 100 years. SBB will be centering all tasks of daily rail operation in the four new operations control centers by 2016: scheduling, operation, control, monitoring and customer information. They will take the place of more than 100 remote control centers and stations.

Sustainability thanks to the 25-year system warranty

Building a new operations control center, which is to play such a significant role in railroad traffic, requires farsighted planning and specific system solutions. "The operations control center in Olten is designed for a useful life of 80 years," explains project manager Jürg Lauber. Some of the technology inside the building will be replaced after five years, but most of it will last for a period of 20 years. "For cabling, we assume a half life of 20 years," says Hanspeter Digel, project manager for information and communication technology.

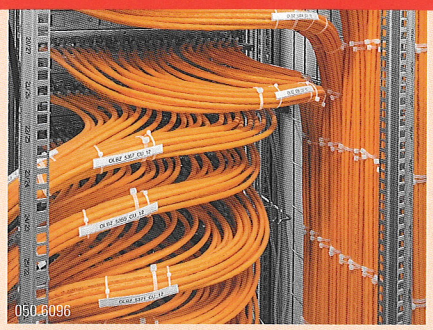
The 25-year system warranty from R&M exceeds these specifications. The supplier of copper and FO infrastructure was chosen on the basis of compatibility to installations at other sites. Hanspeter Digel: "This guarantees lasting and economic availability of all cabling components." The R&M solution also simplified the storage of spare parts.

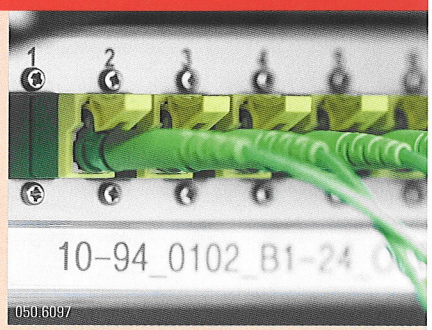
Maintenance-friendly

A further criterion in the evaluation was that the network should be maintenance-friendly. As the railway system has to work around the clock without interruption, all sources of error have to be excluded when the cables are being serviced or changed. All elements should be able to be handled intuitively, transparently and without any great need for tools.

"In the future, we are going to have to carry out more maintenance work during the day and during the week – in other words when everything is in full







R&M SYSTEM SOLUTION FOR THE OLTEN OPERATIONS CONTROL CENTER

The SBB operations control centers are highly complex facilities for the interregional control of Swiss rail traffic. The cabling for controlling the signals and switches as well as IT and communication technology are correspondingly sophisticated. The high level of operational reliability plays an important role. The requirements for protecting the railway system are as high as for data centers. The infrastructure of the Olten operations control center with computer rooms, 180 server cabinets, distributors and connecting lines features a redundant design. Backbone and access layer of the data network are based on FO cabling. Copper cabling connects the computer rooms with the frontend devices in the control room. Telecommunication is integrated in the Ethernet/IP network.

The installation included the following:

- **Provision of workplace infrastructure: 4000 links with 250 km Cat. 7 cable and 8000 Cat. 6_A modules**
- **Backbone: 600 VARIO*line* FO cables with 12 or 24 fibers, pre-terminated on one or both sides**
- **Distributors: VS83 bays for 19" with swivel frame**
- **1000 copper and 500 FO patch cords**

swing," says Jürg Lauber. In that sense, the quality, quick mounting technology and modularity of the R&M systems are of particular help. This is something that is also confirmed by Franco Suppa from swisspro AG, the company responsible for the installation.

SBB Operations Center Olten

People in Switzerland take the train more often than any other nationality in the world. SBB regulates the switches and signals for around 10 000 trains every day in its national network. These transport around one million people and approx. 200 000 tons of freight every year. Half a billion switching operations are necessary in the signal boxes every day to ensure that the trains reach their destinations safely. For just one train journey from Zurich to Bern, you need more than 200 000 functioning switching operations.

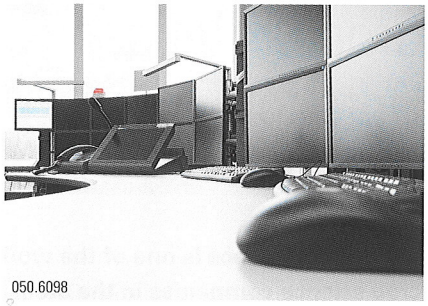
The new central operations control center in Olten started operation in November 2014 after a two-year construction period. SBB invested around CHF 100 million in this project. The new building is part of a long-term plan that was initiated in 2006 to optimize rail traffic in Switzerland to ensure that future traffic needs can be met professionally.

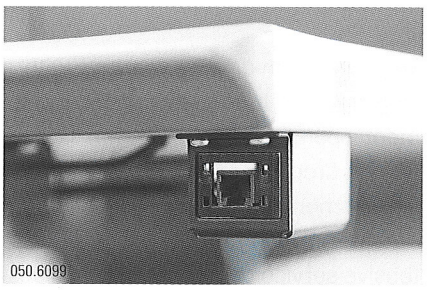
Olten is responsible for the railway system between Basel, Bern and Lucerne as well as the two alpine transversals, the Gotthard and Lötschberg tunnels. It operates more than 3000 switches and 2900 signals. The heart of the operations control center is the control room where there are as many as 100 workstations.

Customized design

Custom-made devices for the control room on the top floor of the operations control center were also on SBB's wish list. As many as 100 employees regulate rail traffic through central Switzerland. On their desks, all you will see are input devices and monitors. The systems – just like the servers, switches and other active devices – are on separate floors to avoid noise and waste heat at people's desks.

To make this possible, the tables had to be equipped with compact boxes that unite several connections. Within an extremely short time, R&M developed a suitable unit using the Cat. 6_A module. "Working out this specific solution together was of immense benefit to us," underlines Hanspeter Digel. He describes collaboration with R&M as being both exemplary and innovative. ■







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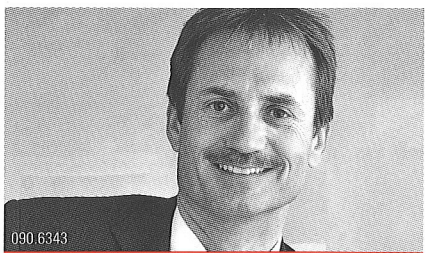

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Crop Protection Specialist Opts for Future-Proof Network

Bayer CropScience is one of the world's leading innovative crop science companies in the areas of seeds, crop protection and non-agricultural pest control.

The innovation-driven company with a long tradition in research and development operates in three business segments: Crop Protection, BioScience and Environmental Science – offering an outstanding range of products and extensive service backup for modern, sustainable agriculture as well as for non-agricultural applications.

It was important that they had a future-proof network, designed to operate for 15 to 20 years. The company wanted long-term passive infrastructure, in keeping with its policy of sustainable and farsighted planning. The project was to be completed in a short time, requiring precise planning and efficient, fast and simple installation.

High-performance connectivity

The IT team at Bayer CropScience was convinced that R&M's cabling was the best option to address the network requirements. R&M's network solution is future-proof, offers excellent transmission speeds and saves space. Other factors that convinced the client were the simple and user-friendly handling, top quality of the products and the security solutions available in our portfolio.



R&M provided Bayer CropScience with a Cat. 6_A UTP solution along with copper cables, shielded components, six-core multimode OFC and components. With R&M's network the company can ensure high-performance network connectivity and expect interruption-free connections.

> "R&M has helped us get a secure network with faster data transfer capabilities."
>
> Jagannath Patil, Head of IT Operations at Bayer CropScience

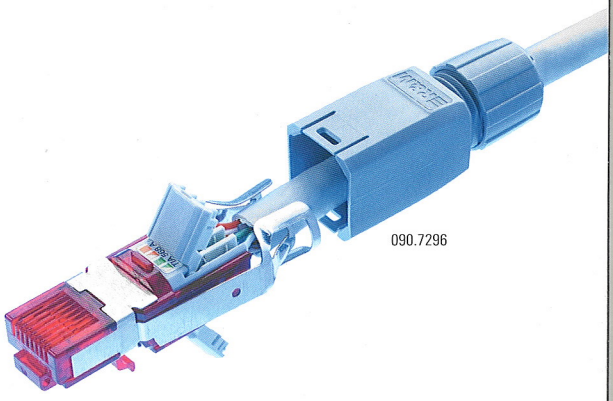
Within only a couple of months, it was possible to coordinate and deploy the cabling down to the very last detail together with R&M's planning and installation team. Bayer CropScience is impressed with the solutions provided by R&M and will continue the collaboration in future projects.

Jagannath Patil, Head of IT Operations at Bayer CropScience: "R&M has helped us get a secure network with faster data transfer capabilities. We can rely on the solution provided by R&M and this will also enable us to have a future-proof network as well." ■



Rajesh Rajan | R&M India
rajesh.rajan@rdm.com

FM45 Now Available as a Cat. 6_A Connector



Cat. 6_A is the magic formula for top performance in RJ45 copper connectivity technology. With its Cat. 6_A connection modules, R&M has demonstrated that this sophisticated technology is easy to install in the field. Now the company is introducing the Cat. 6_A solution for connectors.

The newly developed FM45 Cat. 6_A can also be wired on site at construction sites in a few easy steps. No special tools are required for assembly. Top-quality insulation displacement contact by R&M and the intuitive easy-lock wiring concept simplify error-free assembly in a revolutionary way.

Top-quality insulation displacement contact by R&M and the intuitive easy-lock wiring concept simplify error-free assembly in a revolutionary way.

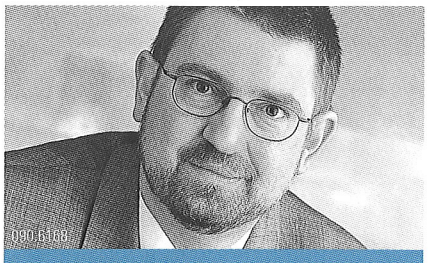
With the FM45 Cat. 6_A, installers and users can make full-fledged Cat. 6_A / Class E_A channels in virtually every environment. The field-mountable Cat. 6_A connector fulfills without restriction all requirements for network operation with 10 Gigabit Ethernet. For example, 10G channels can be installed as bulkhead connections – also referred to as switch links. The installation fulfills the specifications of the ISO/IEC 24702 for local data networks in industrial plants. Further classic areas of use for the field connector are structured office and building cabling systems and sophisticated home networks.

One key advantage of field-mountable solutions is the increase in flexibility. Connections can be positioned anywhere. Cables can be laid and connected to suit individual requirements. Moreover, the unsurpassed functional reliability of the FM45 connectors by R&M also has to be taken into account.

Insulation Displacement Contact, IDC, by R&M is based on decades of experience. Tin-coated IDCs guarantee the gas-tight, vibration-resistant and corrosion-protected wiring of copper conductors with tensile strength and long-term-stability. R&M's insulation displacement contacts show transmission values which are four times greater than the requirements stipulated in the IEC 60352-4 standard. And they can be rewired twenty times.

R&M is supplying the new FM45 Cat. 6_A with all the performance characteristics of the proven FM45 family. These include color coding, IP protection and compatibility with off-the-shelf shielded and unshielded cables with diameters of up to 8 mm.

In its basic version, the field connector complies with the requirements of the IP20 protection index and in the shielded version with all requirements of the IP67 protection index. In the case of the IP67 type, a sturdy round sleeve protects against penetration of dust and liquids. The FM45 Cat. 6_A can be used in environmental classes 2 and 3 in accordance with the MICE matrix (ISO/IEC 24702). ■



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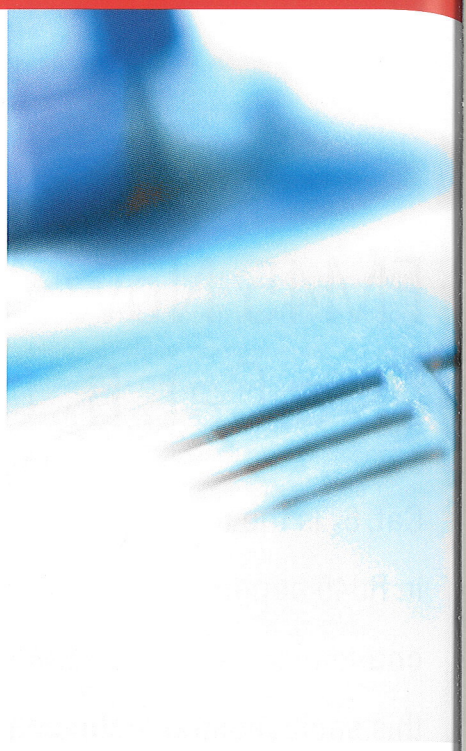


High-Tech Fort

From July 2015, Sofia will be able to boast its very first skyscraper: At 126 meters, the Capital Fort Business Center will be a new eye-catcher in the Bulgarian capital.

At 126 meters, the Capital Fort Business Center in Sofia is Bulgaria's very first skyscraper and thus a particularly prestigious building. Investor in the project is Fort Noks, a company with a strong position on the Bulgarian real estate market. In this venture, Fort Noks worked together with renowned partners well known for top performance in their respective areas.



New eye-catcher

The Business Center consists of two elements – a main tower and an office building that is about half its height. The two buildings together offer a usable space of around 80000 square meters. In addition to this the complex features an underground parking lot on two levels that provides space for 750 vehicles. Capital Fort is situated directly on one of the most important traffic links in downtown Sofia. With its 28-floor tower, it could well become a new landmark in the Bulgarian capital.

A range of uses

The two buildings of the Business Center not only provide extensive office premises but also a wide range of service facilities. These include a financial center, conference areas, restaurants and fast food outlets with a conservatory, shops, a fitness center, a special childcare area and a beauty salon.

Invisible strength

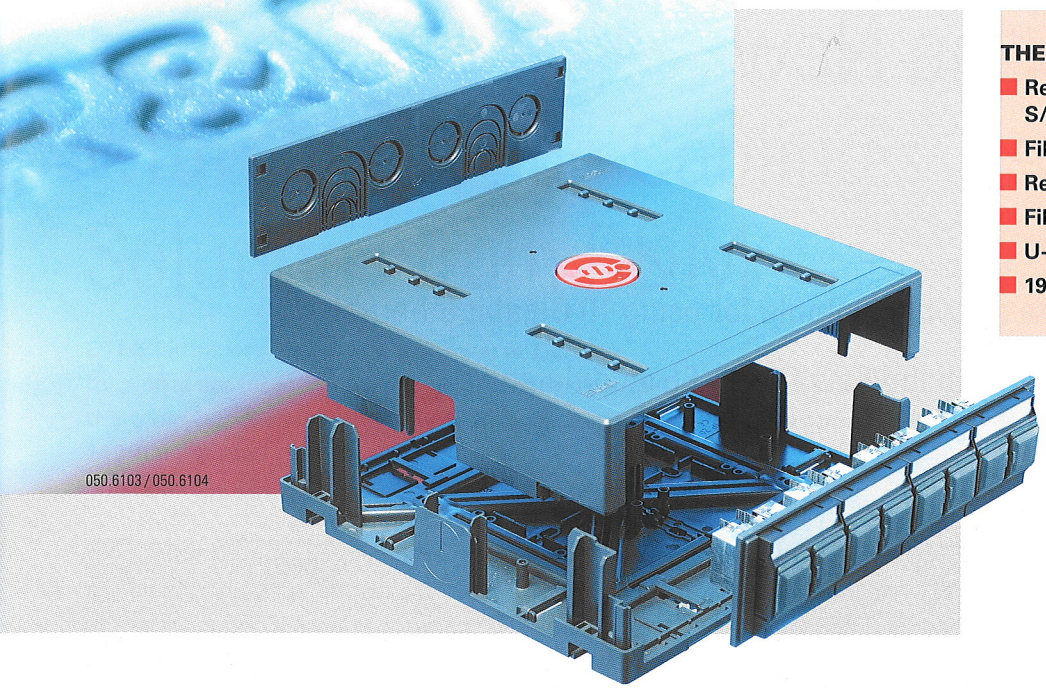
The investor was determined to create an outstanding project in every sense of the word. And in terms of its visible height, that has certainly been achieved. But a Business Center of this dimension also has to distinguish itself with hidden strengths: top-class technical infrastructure. The data cabling in particular has to be of superior quality when it comes to safety, speed and reliability.

Premium cabling

That is why Fort Noks required a partner that would be an expert consultant and provide the very best service as well as top-quality products in all phases of the project: from design and planning through realization to delivery, installation and warranty. In R&M, Fort Noks found a partner that could fulfill these requirements in full. R&M's success in the reference project Business Park Sofia certainly played a part in the Swiss company being awarded the Capital Fort contract.

Striking architecture

The project developer engaged in a collaboration with the globally active British engineering company Atkins for architecture and implementation. With almost 14000 employees worldwide, Atkins is responsible for renowned buildings such as the Burj Al Arab in Dubai and the Bahrain World Trade Center. Atkins commissioned the two Bulgarian companies A&A Architects and Lindner Immobilien Management to oversee the construction project on site.



THE R&M SOLUTION

- **Real10 cabling S/FTP 4P 750 MHz LSZH "light"**
- **Fiber Optic OS2 with 12 or 24 fibers**
- **Real10 C6 module, 100 x RJ45/s**
- **Fiber Optic Adapter SC Duplex PC**
- **U-Box**
- **19" communication racks**

The greatest challenge in terms of the data cabling was the complexity of the building: The many different user areas, such as office spaces, shopping mall, bank branches etc., all made their very own specific demands on the infrastructure. R&M provided a customized solution, tailored exactly to the requirements of the client and the various users.

High complexity

The greatest challenge in terms of the data cabling was the complexity of the building: The many different user areas, such as office spaces, shopping mall, bank branches etc., all made their very own specific demands on the infrastructure. R&M provided a customized solution, tailored exactly to the requirements of the client and the various users. The extensive experience of the local R&M team was particularly helpful in the consulting and project planning stages.

Full flexibility

R&M implemented a classic topology with a fiber-optic backbone and shielded horizontal 10GBASE-T copper cabling. The solution is based on the 3-connector model with U-Boxes as distributors (consolidation points). The U-Boxes bring compact flexibility to office cabling. The universal installation platforms with modular connector systems distribute communication, data and power cabling in raised floors and were configured to suit the different areas of the building. A concept entailing consolidation points gives users the greatest possible flexibility if the number of workstations needed, or indeed any other requirements, should change.

Outstanding prospects

The R&M cabling also serves as a basis for low-voltage applications, such as access monitoring, video surveillance, fire alarms etc. The concept thus complies with the EN 50173-6 standard (Information Technology – Generic Cabling Systems – Part 6: Distributed Building Services).

Capital Fort will be opened in the second quarter of 2015. Based on this outstanding reference, R&M is hoping to continue the successful collaboration with investor Fort Noks and acquire further key accounts on the Bulgarian market. ■



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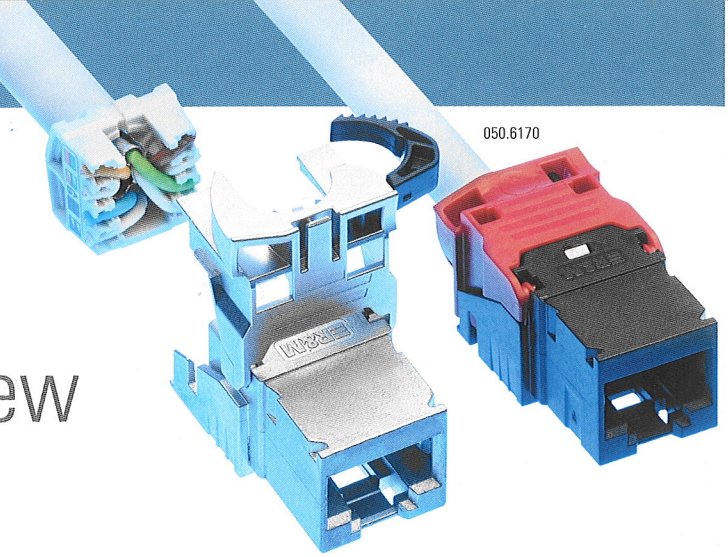
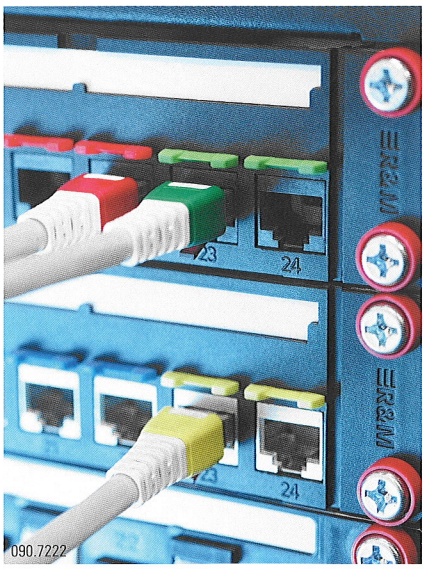


Cat. 6_A EL in the New 24 Port Panel

Want to set up a local data network suitable for using 10 Gigabit Ethernet in record time? No problem with the new Cat. 6_A EL module and new 24 Port Panel Cat. 6_A.

For installers, fast assembly is just as important as the functionality and quality of the products. This is why R&M is doing everything in its power to speed up and optimize installation processes. A key step here was the development of the RJ45 connection module Cat. 6_A EL. The innovation, launched in 2014, has already proved its worth (see the case studies presented on pages 24 and 25) and is enjoying increasing popularity.

The Easy Lock (EL) mechanism cuts termination down to just a few easy steps. Test installations have shown that a Cat. 6_A EL module can be wired with a shielded-pair cable in under a minute. R&M now offers a new wiring tool to make wiring even more convenient and faster. With a lever movement, the wiring block is inserted simply and precisely into the module housing. The contacting of the wires in the IDCs is easy and does not require any great strength.



If a project has to be implemented faster and even more smoothly, the module is combined with the 24 Port PC Panel Cat. 6_A. Just a quick flick of the wrist and the module is sitting snugly in the patch panel. The adapterless Easy Lock technique shortens the assembly process down to a record time. A further factor that makes for time-saving installation: With shielded cabling, the shield is automatically terminated.

This 1U platform with ports in one row is also a new development from R&M. It was designed for the structured office and building cabling of the 10-Gigabit era and for today's installation requirements. The installation depth of 100 mm gives installers plenty of space in the 19" distributor frame and furthermore makes installation in small 19" wall cabinets possible, simplifying cable management and facilitating a fast overview.

The 24 Port PC Panel Cat. 6_A can be combined with the AIM system R&M*inteliPhy*. The ports are consecutively numbered. Using the insertable labels, panels can be designated individually, and lines and services are easy to distinguish visually thanks to the color coding of the R&M Security System. This gives both users and administrators more time as they have a full overview of all ports at all times.

Naturally, faster installation cannot be allowed to negatively impact operational reliability and performance. The combination of Cat. 6_A EL module and 24 Port Panel Cat. 6_A exceeds – with correct assembly – all parameters required by the ISO/IEC 11801 Class E_A standard. The cabling system is thus ready for 10 Gigabit Ethernet. ■



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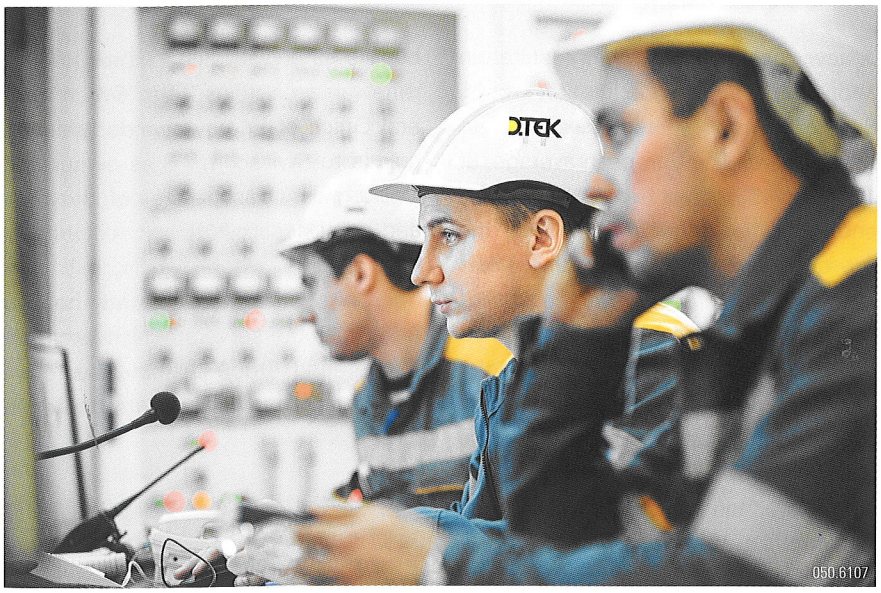
DTEK together with Convincing Cabling Solutions from R&M

DTEK is the largest energy company in Ukraine. Its plants are located throughout the country and the distances between them are hundreds of kilometers. The company today employs about 140 000 people.



"Today, IT in DTEK is a full business partner actively cooperating with all business areas. It helps to find and implement IT solutions that significantly improve the competitiveness of the company. It is essential that these solutions have a solid foundation."

Sergey Detyuk, CIO of DTEK



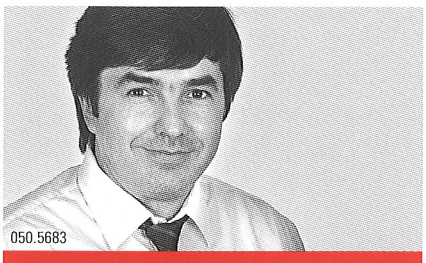
Taking into account the scope of the business and the fact that most of the buildings housing the enterprises were built many years ago, creating a modern network infrastructure has become a very important matter and something that is crucial to the future of the business. The energy company is planning on changing the internal infrastructure of more than 30 coal and energy companies by 2025.

THE R&M SOLUTIONS

- **Cat. 5e RJ45/u modules**
- **Cat. 5e RJ45/s modules**
- **Cat. 6 RJ45/s Real10 modules**
- **Cat. 5e U/UTP cables**
- **Cat. 6_A S/FTP cables**
- **FO cables (singlemode)**
- **FO cables (multimode)**

The energy holding has been awarded first place in the ranking of the most mature Ukrainian IT companies. Sergey Detyuk, CIO of DTEK: "Today, IT in DTEK is a full business partner actively cooperating with all business areas. It helps to find and implement IT solutions that significantly improve the competitiveness of the company. It is essential that these solutions have a solid foundation." Thus, structured cabling networks, featuring the Swiss quality standards of R&M, will play a major role in the process of implementing a long-term strategy for the development of the energy giant.

R&M equipment has successfully been implemented in several infrastructure modernization projects and has also been used in the installation of structured cabling systems in the Kiev and Donetsk offices of the corporate center, in the Dobropilskaya coal preparation plant and Burstyn thermal power plant. In addition, the project documentation for the construction of a corporate data center envisages the installation of a structured cabling system using R&M components. ■



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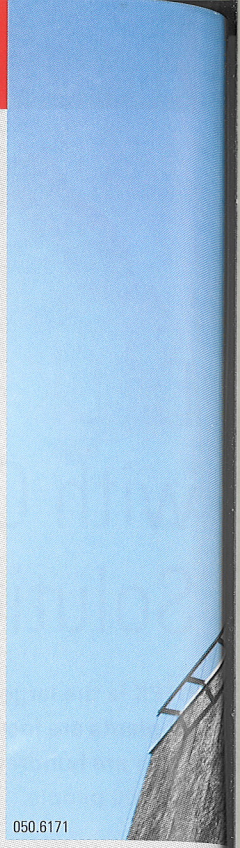
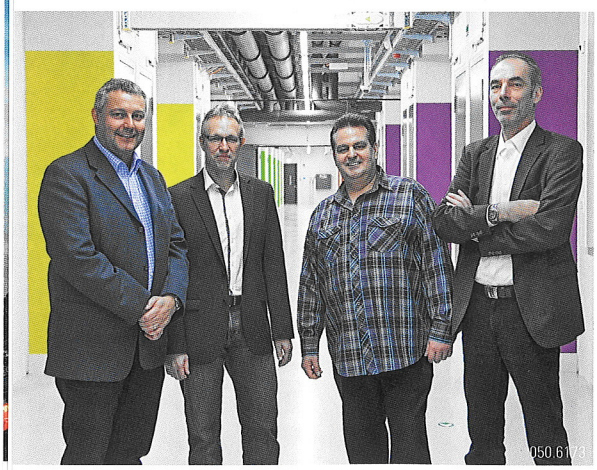
Swisscom Data Center Bern-Wankdorf: Award Winner



Winner of the Watt d'Or, Swisscom's new data center in Bern-Wankdorf is the first data center in Switzerland with Tier IV certification and one of the most exemplary in Europe. The entire copper cabling is from R&M.

To date the district of Wankdorf in Bern has been famous for its exclusive fairs at the Bernexpo or popular soccer games in the Stade de Suisse. But since September 2014, the district can boast another highlight of international acclaim: Swisscom's new data center. It is one of the most modern data centers in Europe and is exemplary in terms of safety, reliability and efficiency.

f. l. t. r.: Jürg Gerber, R&M Switzerland; Roland Probst, Divisional Head for the region of Bern at swisspro NW AG; Thomas Gygax, Data Center Hardware Services Swisscom (Switzerland) AG; Rudolf Anker, Head of Data Center Management Swisscom (Switzerland) AG



A new cooling concept has resulted in a top PUE* value of 1.2. In other words, 84 % of the energy used flows back into the IT power. The European average, at a PUE of 1.95, is just over 50 %. Cooling and ventilation require just 8 % of the power consumption – almost five times less than the European average.

The entire planning complied with the basic ecological philosophy of Swisscom. The data center does not operate any chillers. The building is cooled using recirculated air, supplemented in summer by the evaporation of collected rainwater. The waste heat heats the houses in the neighboring residential area. The non-interruptible power supply does not run on batteries, the manufacture and disposal of which are a burden on the environment, but on generators with centrifugal mass, called "no-break systems". Swisscom uses electricity from renewable sources.

First Tier IV data center in Switzerland

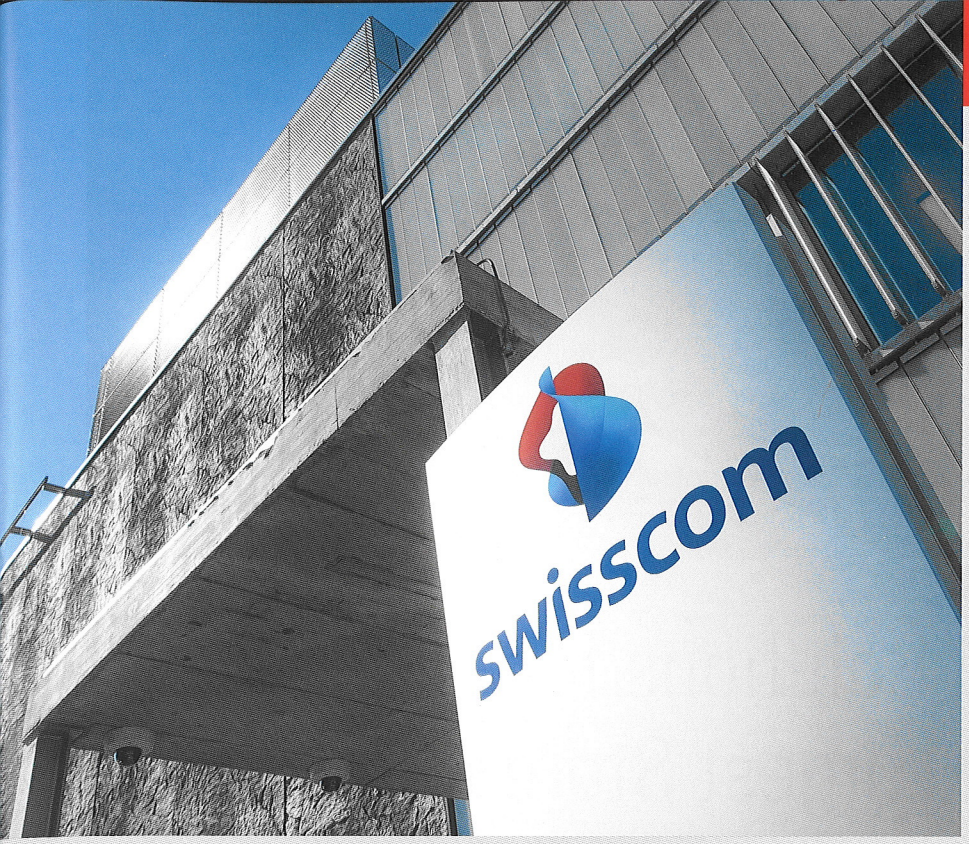
Rudolf Anker, Head of Data Center Management and project lead at Swisscom, and his team are proud of this recognition: "We were the first data center in Switzerland to receive not only Tier IV certification from the Uptime Institute for maximum failure safety, but also the Watt d'Or in the category renewable energies." The Swiss Federal Office of Energy awarded this accolade to Swisscom AG as owner and RZintegral AG as planner of the data center in January 2015.

The new data center currently houses around 5000 servers which are running around 10 000 customer systems. The connection to the data center in

SWISSCOM DATA CENTER BERN-WANKDORF

- **Owner: Swisscom Immobilien AG**
- **Planning: RZintegral AG**
- **Installation: swisspro NW AG**
- **Building volume: 54 000 m³**
- **IT usable space: 4000 m²**
- **Effectiveness: 84 %, PUE* = 1.2**
- **Non-interruptible power supply with no-break systems (centrifugal mass operation)**
- **Commissioned: September 2014**
- **Infrastructure: Four modules each with 600 kW power output, can be extended to seven modules. Around 10 000 customer systems are currently running on around 5000 servers.**
- **Cooling: Air circulation, use of waste heat, rainwater evaporation**

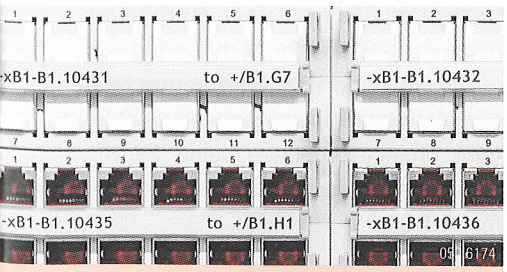
** PUE, Power Usage Effectiveness = result of the total facility energy divided by the power needed for IT equipment*





Zollikofen, where the data and processes are mirrored, provides additional security.

Swisscom combines high demands of operational reliability with the necessary flexibility. Thomas Gygax, Data Center Hardware Services at Swisscom (Switzerland) AG in Bern, says: "We have to be able to install all kinds of different server types of the current and next generation at all times and at every location. So we cannot afford to be limited by the network structure."







Well-thought-out network structure

The structure of the new HDB (Hybrid Delivery Bus) is effectively a full mesh topology in the core layer and a tree topology in the access layer. The access switches are in a central wire center.

This means every rack can be connected centrally and every network made available everywhere. This central solution requires "a lot of copper" as Thomas Gygax puts it. And indeed R&M provided both the equipment to create 11 500 links with 23 000 Cat. 6_A modules and the accompanying 280 kilometers of Cat. 7_A AWG 22 copper data cable for the Swisscom data center. Rolled out, this could pave the road from Geneva to Bern and on to Zurich. The customer opted for the R&M High Density solution because it is quite simply unsurpassed. But it was not only the 48-port HD Panel that won R&M the contract. Standard compliance, quality and the experience from other projects were all factors Swisscom considered important. R&M also quickly developed individual numbering for the module holders.

The project was of major significance to the installers, too. According to Roland Probst, Divisional Head for the region of Bern at swisspro NW AG, the high-density infrastructure was "a challenge and certainly not standard in the industry." And the result is impressive: "The error rate is virtually zero," explains Roland Probst.

Thomas Gygax is also satisfied with the measurement results in the short range and with the reserves over longer distances: "Due to the central connection, it can happen that a server rack is eight to ten meters from the wire center. Over these distances, we naturally also need absolutely perfect signal transmission." ■



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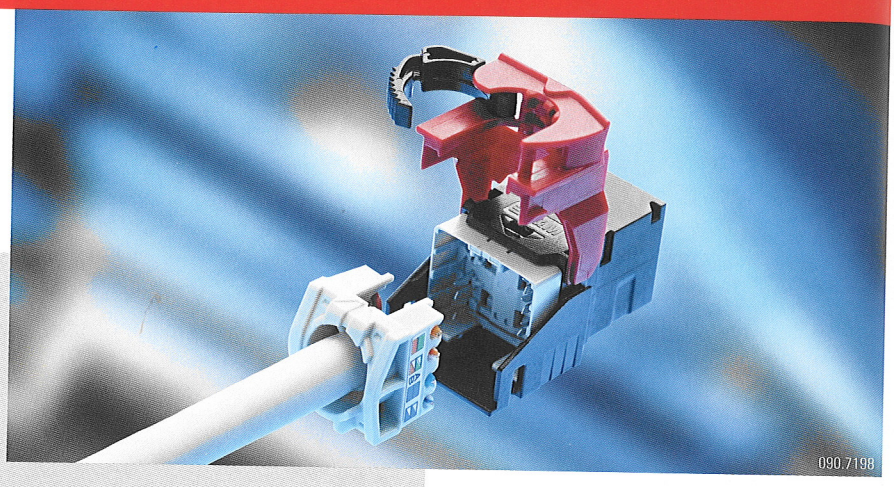

Modular R&M Solutions for IKEA's Second Largest Store in Australia

IKEA is a renowned manufacturer of ready-to-assemble furniture and is the world's largest furniture retailer. The Swedish company has 361 stores around the world which saw 821 million store visits by their customers over the last year alone.



Among the eight stores that IKEA has in Australia, the store in Sydney is the country's second largest, covering 28500 square meters, and will be opened in May 2015. The entire property covers 76000 square meters and comprises the showroom, market hall, 450-seat restaurant, children's play area and 818-vehicle parking lot.

R&M – working with its partner JCB Communications – won the opportunity to supply its latest Cat. 6_A EL module, alongside other products. The IKEA Sydney project had a critical timeline to be adhered to. CRS, a key R&M distributor in Australia, was able to meet the project's timelines thanks to a well-planned logistics process.

Given that IKEA's in-store layout keeps shuffling at different times of the year to accommodate its product range, it was important for the IT team to have the flexibility to re-arrange the network infrastructure as well. The solution that JCB Communications and R&M offered included consolidation points that were placed inside the ceiling so they did not interfere with the re-organization of the store layout.

R&M also supplied its new Cat. 6_A EL modules along with U/UTP LSZH cables for 1200+ points in the premises of the store. In addition, the dust covers (part of all R&M's connection modules) were deployed within surface-mount boxes supplied, which meant that the points were protected from any foreign particles and dust, thereby making their maintenance worry-free. In addition, the inter-cabinet ties were taken care of with a plug & play state-of-the-art MTP solution.

"The new Cat. 6_A EL was a breeze for our staff to install. The modularity and how seamlessly different R&M products integrate with each other was really great too. We're happy to have completed the installation as per the tight project schedule (using R&M)," says Mathew Capon, Project Manager for JCB Communications. ■





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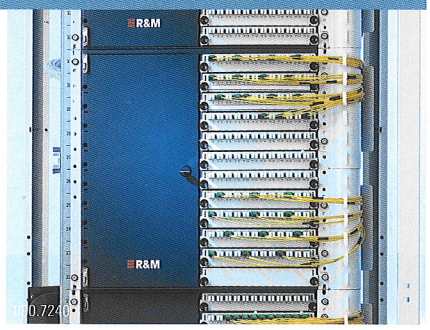


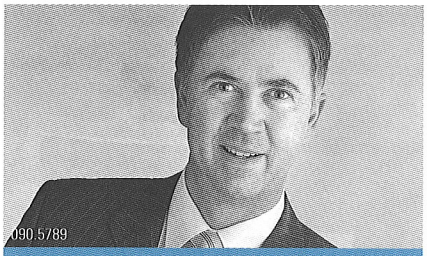
CombiMODULE Fits into 19" Racks

An extended range of possible uses for the CombiMODULE from the ODF SCM line from R&M: The new solution of the combined and pure splice solution is ideal for use in 19" infrastructures.

The SpliceMODULE accommodates up to 1152 spliced fiber connections and the CombiMODULE up to 576 Small Form Factor (SFF) or 288 Big Form Factor (BFF) plug connections and 576 splice connections.

The housing only occupies ten units in the 19" cabinet, representing a higher packing density of 17 % or eight fiber terminations per height unit in comparison to standard 1U patch solutions. Quick mounting technology facilitates modular expansion thanks to the fact that SCM trays and patch inserts can be retrofitted without any need for tools. Application possibilities include distributors in large buildings, in data centers or exchanges, and in street cabinets.

The two-part housing has room for any combinations of splice and patch units from the Single Circuit Management (SCM) system family. One splice unit can hold as many as 96 SCM trays for the separation of subscribers or loose tube cables. Up to twelve inserts for all types of coupling usual in the market can be accommodated in the patch unit. R&M also supplies inserts for splitter and CWDM solutions as well as providing a whole range of variations as pre-terminated solutions. ■



Patrick Schilter | Product Manager
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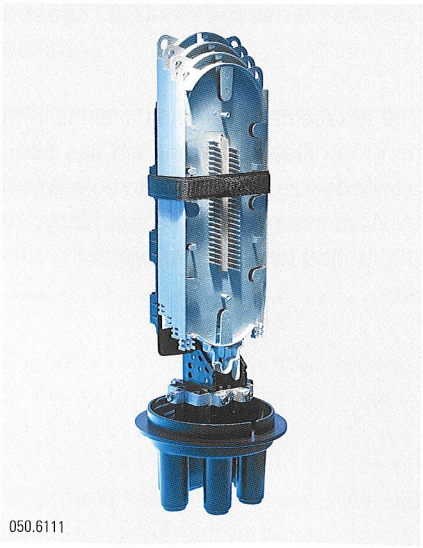
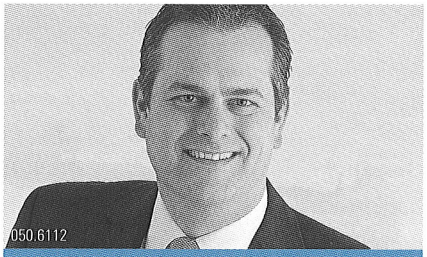
Splice Closure Program Adopted

In 2014, R&M successfully integrated Indian partner Advanced Fiber Systems Pvt. Ltd. (AFS) into the group. Now it's time for the next step: The proven AFS splice closure program is to be taken up into the range of FO network solutions available worldwide.



On the Indian market, AFS is well known as a supplier of top-quality fiber optic products for public networks. The partner in Bangalore has more than ten years of experience in manufacturing splice closures. In the R&M group, the proven, standard-compliant AFS range is now to be made available internationally. The GSC splice closures, as they are called, round off the R&M portfolio.

The GSC splice closures come in three sizes with four to 12 trays for 96 to 288 splice connections. The bending radius is compliant with international standards. An over-length storage for loose tubes is integrated. The sturdy plastic housing comes either with or without a valve and is designed for installation on masts, walls and in manholes. R&M supplies the splice closures ready for installation. The delivery scope includes shrink splice protection and shrink tubes for the one oval and four round cable ports. ■



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Elegant Skyscraper Shines over Warsaw

Poland's highest office complex – the Warsaw Spire – is more than an architectural masterpiece. The elegant skyscraper perfectly expresses the determined aspirations of the country. The cabling solution for the first tenant is outstanding, too.

The history of modern Europe is palpable here on Europe Square, at the very heart of Warsaw. Here, the Warsaw Spire, this iconic office complex, reaches high. The central tower is going to be 220 meters high in total when it is completed at the end of 2015. The outside facade – a tapered, two-part glass shell – spirals its way up to the sky.

Powerful landmark

The architects from the Belgian company Jaspers-Eyers did not just want to come up with another top-class office complex for their clients Ghelamco. They wanted to create a new, metropolitan living area – a unique architecture that would harmoniously combine effective working, business, communication, technical innovations and urban life. The chosen method of construction was energy-saving and climate-friendly. The building technology is to fulfill the highest environmental protection criteria of the BREEAM assessment and rating system, complying with the investors' aims.

Ghelamco and a group of four Polish banks are investing around EUR 250 million in the project – the largest investment volume known on the Polish real estate market.

The result: a powerful landmark for modern Poland and the dynamic economic region of East-Central Europe. The central tower with its glass shell will be 220 meters tall and have 49 floors. The two adjacent buildings are 55 meters high and have 15 floors. Overall the complex offers 100 000 square meters of space for offices, restaurants, shops, engineering rooms and lots more. The Warsaw Spire is thus one of the largest office complexes currently under construction in Europe.

The terrace between the buildings with its green areas and fountain has been planned as a public space to be enjoyed by Warsaw residents – something else that is new for an office complex of this size.

For more information on the project: http://warsawspire.pl/

Headquarters of Europe's Border Security

The complex includes the two 55-meter high adjoining buildings B and C which, as segments of a circle, correspond to the oval tower in the middle. The first tenant in building B is Frontex, the European Agency for the Management of Operational Cooperation at the External Borders of the Member States of the European Union (EU). It localized its new headquarters and data center here in the fall of 2014.

Frontex was looking for a multi-functional cabling solution for the infrastructure of its 14600 square-meter office area spread over ten floors – a solution that would satisfy the high-security requirements of the border security agency. The data center had to have plenty of space for servers which is why Frontex was looking for high-density, top-quality, parallel-optical interface technology.

And the agency found just what it was looking for in the current R&M portfolio. R&M had fitted out the previous headquarters which also meant Frontex was familiar with the products. The team worked like clockwork to professionally and punctually integrate the installation into the new building. The Warsaw-based R&M installation partner Techlab was once again able to demonstrate its expertise.

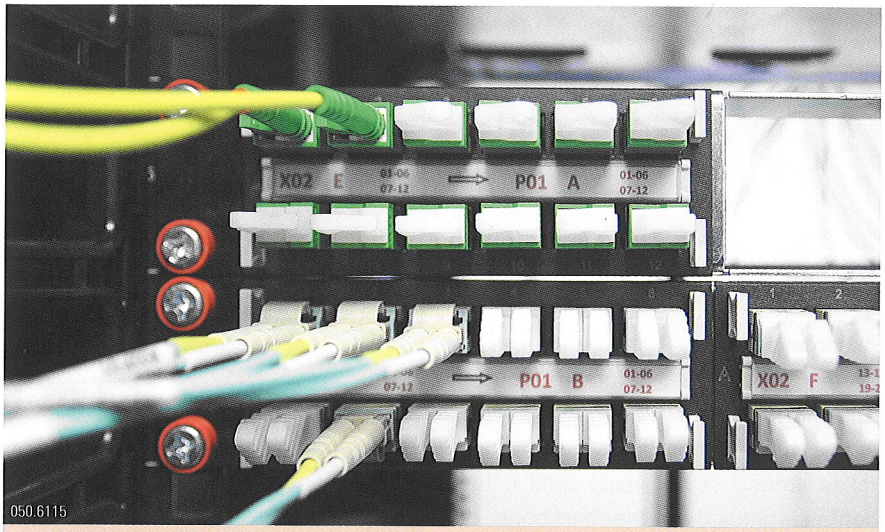
> The team worked like clockwork to professionally and punctually integrate the installation into the new building.

The reason for the special requirements of the data network: Frontex coordinates highly sensitive control and surveillance operations round the clock at the EU's external borders, particularly in southern and eastern Europe. While fulfilling its mandate, the agency provides training sessions and works closely with the customs authorities of the EU states. It is responsible for crisis prevention, database-aided risk analyses and particularly security research – with the aim of automating border control and protecting Europe more effectively against illegal immigration. ■

About Frontex:
http://frontex.europa.eu/

The Frontex network

The network in the headquarters of the European border security agency Frontex is based on the latest copper and FO portfolio from R&M. The high-density products as well as the MPO, LC duplex and Cat. 6_A connection solutions in particular make a contribution to secure operations. The aim was to build a network that would work without any interruption for ten years and that would provide smooth support for the multifarious tasks of the agency. Every day there is an incredible number of messages, data, images and videos to be processed.



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THE R&M DATA CENTER SOLUTION

- 150 HD fiber modules with MPO connections, OM4 and OS2 FO cabling
- 30 HD fiber modules with LC duplex outlets and splice connections
- 170 MPO cables
- 45 HD panels with Cat. 6_A modules
- 130 trunk cables with Cat. 6_A connections

THE R&M OFFICE CABLING SOLUTION

- 180 km Cat. 6_A copper cable
- 160 Cat. 6_A HD panels
- 3000 Cat. 6_A outlets
- 500 LC duplex outlets with OM4
- 80 HD fiber modules with LC duplex and splice connections
- 3 km OM4 and OS2 FO cables
- 500 pre-terminated FO cables for outlets


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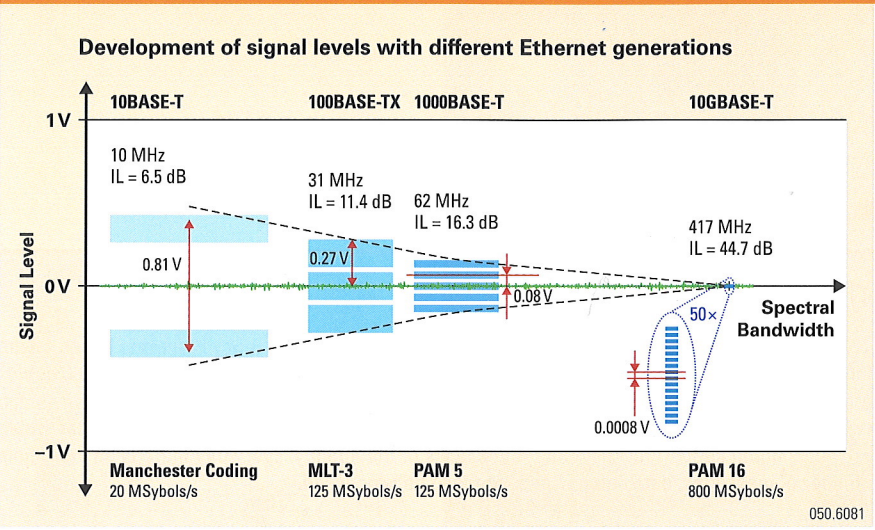

The higher the spectral bandwidth and the more complex the modulation technique, the smaller the amplitude steps a receiver has to distinguish at the end of the line. The smaller the difference between a 1 or 0, the more sensitive the transmission is to interference from outside (IL = Insertion Loss).

Getting to the Desk with 10 Gigabits

10GBASE-T is not shying away from horizontal office cabling: 10 Gigabit Ethernet via copper cables could become standard in new installations as early as 2016. What do planners and end users have to take into consideration?

According to an IEEE survey, it takes an average of four years for an adopted Ethernet standard to make itself felt in the data center core layer. And it takes around seven years until it becomes standard in the backbone of office cabling. After ten years, it finds its way into horizontal office cabling. For 10GBASE-T as defined in IEEE 802.3an, ratified in 2006, that means extensive use in the office environment over the next few years. And the breakthrough is not just theory: The current driver for 10 Gbit/s installations is the new WLAN standard IEEE 802.11ac specified up to 7 Gbit/s (see article on page 42). Further applications are expected.

That is why 10-Gigabit-capable Cat. 6_A cabling should be installed in office scenarios today. This would ensure that office cabling can support all forthcoming applications over its typical lifespan.

Stricter rules

There are various aspects to be considered in planning and in making decisions on investments: 10GBASE-T is faster than earlier transmission technologies, but it is sensitive to interference. 10GBASE-T reacts around one hundred times more sensitively than 1000BASE-T to external interference. Together with the loss of system reserves previously integrated, this will bring a number of changes to the rules of installation.

New parameters become important:

- **Transverse Conversion Loss (TCL),** the conversion of a symmetrical voltage into a common mode voltage at the input module itself. Due to mode conversion, TCL can cause additional near-end crosstalk (NEXT) – an effect that has not yet been taken into consideration in the standards.

- **Cable Dynamics,** the reduction of the data rate due to changes in transmission characteristics when cables are moved. The effect of servers being moved on a slide unit, resulting in an automatic resetting of the data rate or even a reboot, is notorious. And cables are always having to be moved in office environments.

R&M is a pioneer in investigating these effects and a leader in the development of 10GBASE-T-capable cabling solutions. They fulfill extended quality requirements and offer large reserves so that the effects described have no impact.

Standard conformity is an absolute must. That is not, however, sufficient to guarantee 10-Gigabit functionality in adverse conditions. Planners and end users should opt for solutions with reserves. R&M provides them as protected (STP) or unprotected (UTP) versions with the unique WARP technology. ■



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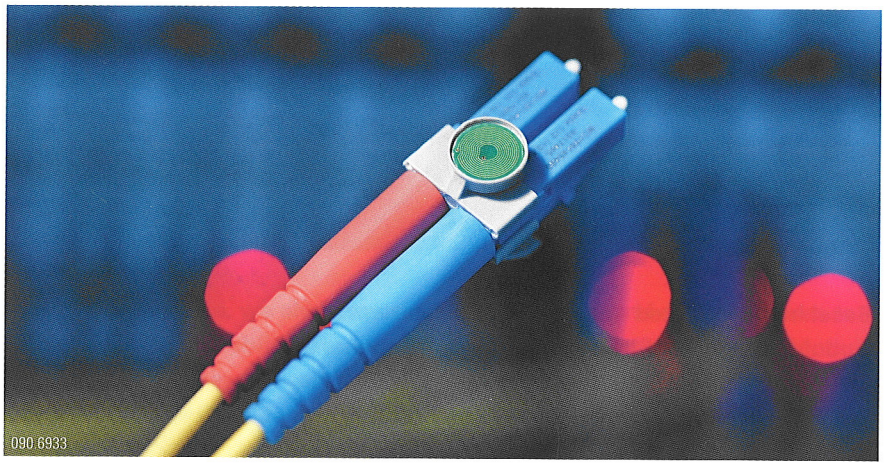
More Functionality for R&M*inteliPhy*

The latest generation of software for the network monitoring system R&M*inteliPhy* is massively extending the function range, making the management of even very large infrastructures simpler and clearer.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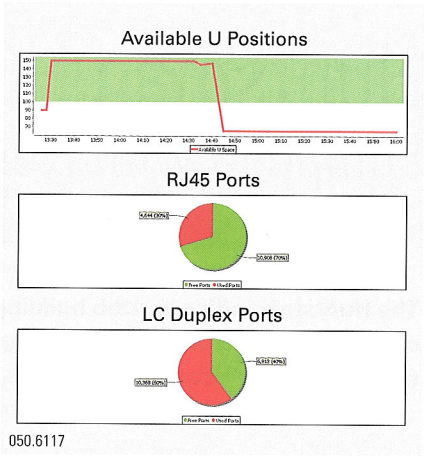

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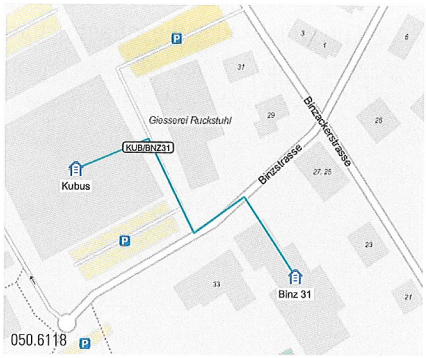
The new R&M*inteliPhy* 3.0 means further progress for Automated Infrastructure Management (AIM). Outstanding features are the multi-site function, the link to geographic information systems and the graphic reports.

The multi-site function supports the centralized management and monitoring of several sites. Network administrators and technicians thus have the infrastructure of all branches of a company under control without having to actually be on site as they can simply send jobs to distant sites online. This in turn relieves the burden on staff on site. The time involved in service call-outs thus becomes a thing of the past. The distant sites are linked in using encrypted standard Internet connections.

R&M*inteliPhy* 3.0 can be connected to either public or private geographic information systems (GIS). They are directly linked in to the GIS servers, making it possible to reuse existing digitized maps and other place-related data. Furthermore, the geography can be documented down to the very last detail. Network extension can be planned directly using the digital maps. This facilitates orientation and the professional documentation of campus and FTTH networks, ensuring sustainable and exact administration of the network.

Extensions were made to the graphic report functions of the network monitoring system. All reports can be freely configured so that users can compile exactly the information they require. Flexible charting functions display all important parameters at a glance and the graphic representation of time sequences permits trend analyses. ■



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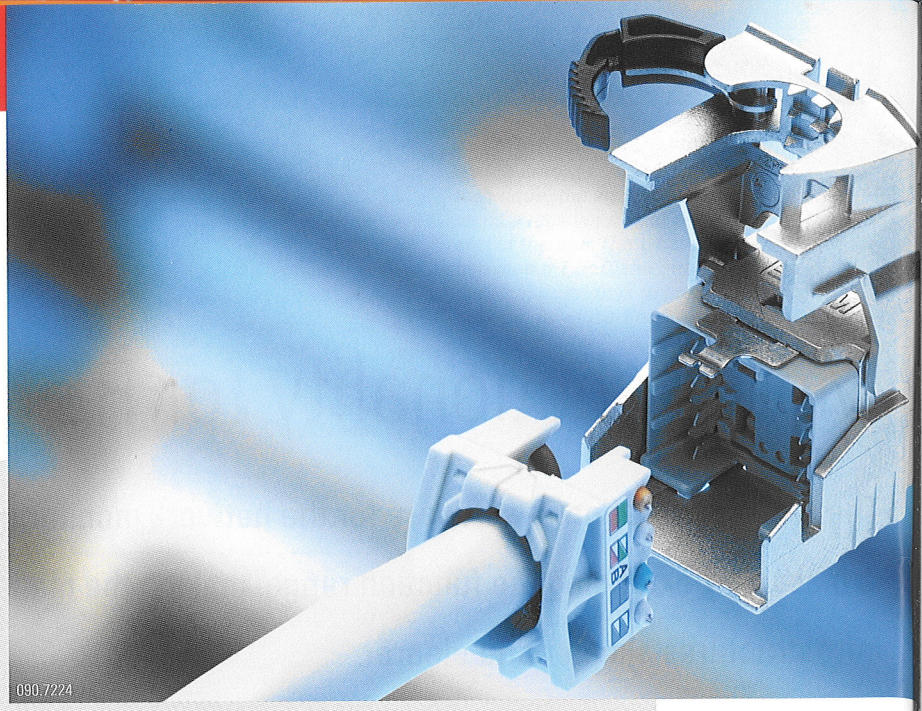
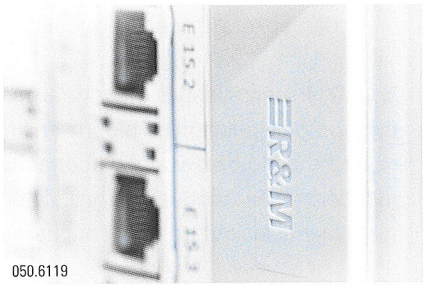
HUNTSMAN
Enriching lives through innovation

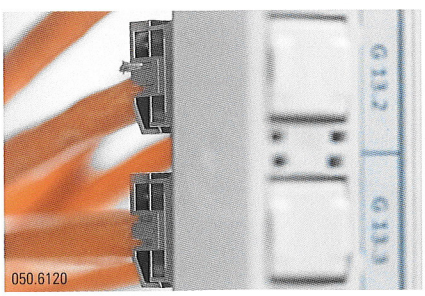


Huntsman HQ in Basel
Equipped with New Cat. 6_A EL Module

The Huntsman office and lab building in Basel has been fitted out with the first network completely based on the new Cat. 6_A EL module from R&M. Pioneering accomplishments are traditional here.

Chemical innovations from Basel have brought the world of technology on in leaps and bounds over the last 277 years. High-tech adhesives keep cars, airplanes, in fact virtually everything together. Epoxy resins protect microelectronics and major energy power supply plants. Paints and special plastics insulate facades, and optimize textiles and sports equipment. Many pioneering developments from Basel are associated with the names Ciba-Geigy, Sandoz and Novartis, specific divisions of which were integrated in the American Huntsman Group 10 years ago.





To consolidate the diverse activities – particularly development, marketing, sales and supply chain – at this chemicals site so rich in tradition, Huntsman decided to put all the Basel-based divisions and departments together. By the start of 2015, a central office and lab building had been fitted out accordingly. For years now, Huntsman has worked with local installation partner Schachenmann + Co. AG for all its building cabling issues.

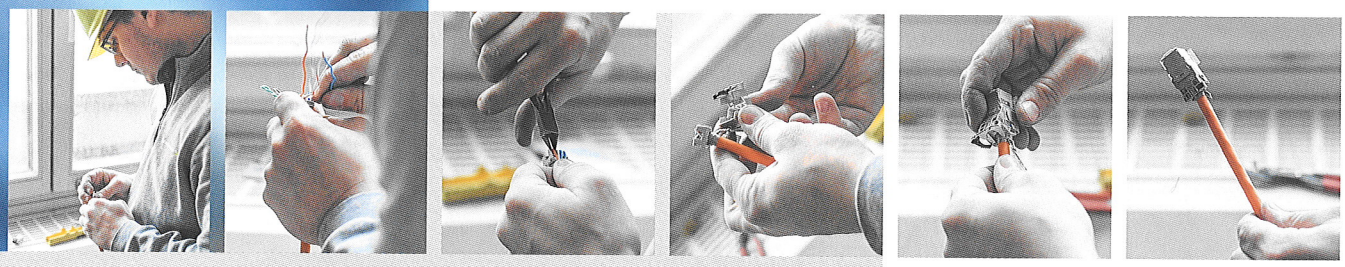
"For us, the choice was obvious: the current Cat. 6_A EL module from R&M – combined with shielded Cat. 7 cables. It met customer demands perfectly," explain project lead Markus Kempf and operational lead Rainer Helm from Schachenmann (see article facing).

The requirements were challenging: Newly structured building cabling was to be installed, but had to integrate existing components. Sticking to the demanding time frame and tight budget was mandatory. Ultra-fast Internet, Voice over IP and cloud computing all had to be supported.

"The consolidation of the divisions on one site was a challenge for us. But with the cabling solution from R&M and installation by Schachenmann, we ended up with exactly the infrastructure we need today," Franco Bizzini, Head of Facility Management at Huntsman, and his IT colleague Julio Giganto are pleased to confirm. ■



Schachenmann



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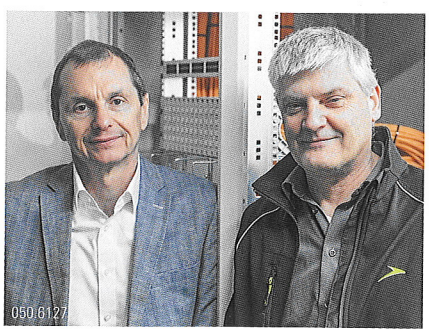
Schachenmann
Opts for Cat. 6_A EL

"If we have a choice, we always go for R&M solutions and when it comes to office and building cabling, we'll certainly be opting for the Cat. 6_A EL Module from now on!" Clear commitment of the Basel-based installation company Schachenmann + Co. AG after the Huntsman project.

For the very first time, a certified R&M installation partner has installed the innovative copper connection module Cat. 6_A EL in an extensive project (see article facing). Project lead Markus Kempf and operational lead Rainer Helm from Schachenmann + Co. AG (a company in the Swiss Burkhalter Group) were totally impressed with the experience they made. Both are forward-looking installers with decades of professional experience under their belts.

From left to right: Rainer Helm, operational lead; Markus Kempf, project lead Schachenmann + Co. AG



"The module is self-explanatory," sums up Rainer Helm. It can be terminated immediately after a brief set of instructions on the building site without the need for any special training. Young talent Yannick Kempf took care of the entire installation in the Basel pilot project. The 23-year-old is in his third year as an apprentice telematician and he wired hundreds of modules without a single error in just a few days.

Apart from parallel pliers, you don't need any special tools to terminate the shielded Cat. 6_A EL modules. Markus Kempf describes how it works: All you have to do is insert and cut the wires, slide the wire guide into the socket, press down the wiring cover and close the clamping ring. The connection is completed! Before the module is closed, you can check to see that everything has been installed correctly. "This makes the system highly reliable," says the installer.

Insulation displacement contact ensures safe termination. The wires are always in the right contacts thanks to the color coding and the clamping ring does away with the need for cable ties. The shielded version grounds itself automatically when the clamping ring is closed. "The time gained in assembly plays a major role. And even installers who have big hands find it easy to terminate the module," says Rainer Helm.

The measuring results also played a part in convincing the building cabling specialists from Schachenmann. Markus Kempf: "We measured all the links when the project was completed in February 2015. The signal quality and the attenuation budgets were excellent with values between 4.2 and 7.8 dB. There was no need for any rectifications. The installation meets all the wishes and requirements of the customer." ■



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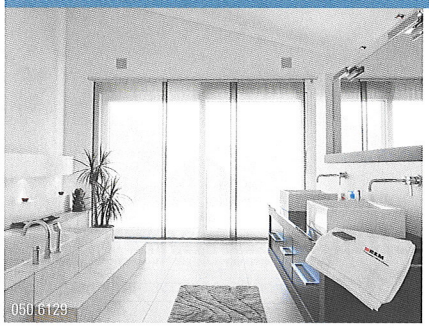



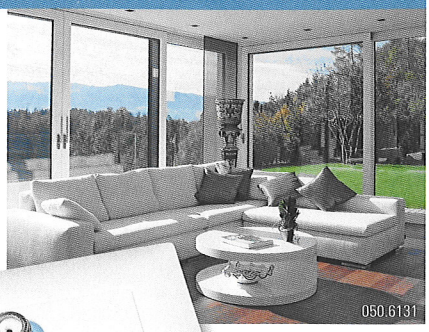



More Potential in the Home Network

The second generation of the R&M multimedia outlet is now on the market. It increases the potential of modern home networks and paves the way to new applications. It is now even easier to assemble and change individual components.

Whether twisted-pair copper cabling with RJ45 connections or coaxial cabling – installations in homes are constantly having to meet increasing demands. Users want to be able to use ever-faster online services at home. And they require more bandwidth for audio, video, HDTV, games, cloud services and the Internet of Things (IoT). R&M has thus further developed its Home-wiring System (HWS) and the multimedia outlet.

The multimedia outlet 2.0 is now even easier to install than its predecessor model. R&M has optimized the assembly technology, thereby saving time and money. The connection blocks for the RJ45 and coax connections are now separate. The modules are installed and removed from the front. That means the outlet stays in the wall if a module is changed. It is now more convenient and certainly faster for installers to take care of service tasks.

The multimedia outlet 2.0 is now even easier to install than its predecessor model. R&M has optimized the assembly technology, thereby saving time and money.

The outlet complies with the current 1200 MHz standard and also the forthcoming 1650 MHz generation making it usable long term. The coax side also fulfills the requirements of the MoCA 2.0 standard which defines the operation of HDTV and 3D TV using coax cabling. When adjusting attenuation or changing from the two-hole to the three-hole variant, all you have to do is change the front.

The RJ45 side can accommodate all R&M connection modules from Cat. 5u to Cat. 6_A EL. The modules are installed and removed in just a few easy steps. The home network can thus be adapted at any time to suit customer requirements. Even converting to a high-speed LAN with 10 Gigabit Ethernet at a later date is possible. The bottom line: Once installed, customers will be able to use the outlet for decades.

A further advantage of the multimedia outlet 2.0: It can be converted from an individual outlet to a loop outlet in next to no time. All you have to do is remove the termination resistor. ■



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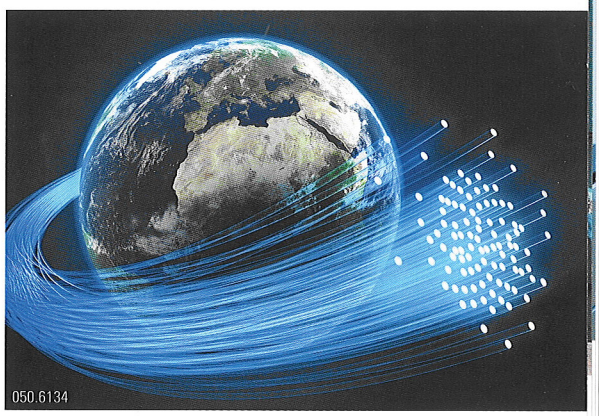
Fiber Optics: A Glance into the Future

Are fiber optics capable of even more? The fortieth ECOC gave us a glimpse of an exciting future. New multimode fibers are extending the range of usable wavelengths. Performance is exploding in the access networks with TWDM.

System	TWDM-PON (primary) PtP-WDM (optional)	
Data rate Per wavelength (λ) With 4 wavelengths	Downstream 40G (10 G × 4λ) Downstream 40G (10 G × 4λ) Downstream 10G (2.5 G × 4λ)	Upstream 40G (10 G × 4λ) Upstream 10G (2.5 G × 4λ) Upstream 10G (2.5 G × 4λ)
Split ratio	1:256	
Distance	40 km (without repeater)	
Coexistence	All legacy PONs (incl. RF video)	
Services	Supply to private subscribers and homes, business applications, mobile radio backhaul etc	

The NG-PON2 specifications compliant with ITU-T



The latest on multimode fibers

Multimode fibers are mainly used in data centers and for campus cabling. So far, multimode fibers of types OM3 and OM4 have been optimized to a wavelength of 850 nm. These are not terribly suitable for high-speed transmission on other wavelengths. The extension of the usable range to 950 nm is necessary to enable transmissions compliant with the future 400-GbE standard with CWDM (Coarse Wavelength Division Multiplexing).

New kinds of broadband multimode fibers were presented at the fortieth ECOC (European Conference on Optical Communications) in September 2014, held in Cannes, France. These cover the desired wavelength ranges and, furthermore, are fully compatible with the existing standards 40GBASE-SR4 (transmission length for OM4: 150 m or for OM3: 100 m) and 100GBASE-SR4 (transmission length for OM4: 100 m or for OM3: 70 m).

Channel no.	Wavelength range (nm)
1	850–870
2	875–895
3	900–920
4	925–950

CWDM channels of the new broadband multimode fibers. Transmission rates of 400 Gbit/s are possible. Source: ITU-T

NG-PON2 is coming

Singlemode fibers are used in passive optical access networks due to the long transmission links. PON performance is going to experience a massive increase in performance in the future due to TWDM – a combination of time and wavelength multiplex. This too was one of the key points made at the fortieth ECOC. Four wavelengths will each transmit 10 Gbit/s downstream, four others 2.5 Gbit/s each upstream. The wavelength plan envisages 1556–1603 nm for downstream and 1524–1544 nm for upstream. An excellent compromise for guaranteeing coexistence with G-PON, XG-PON1 and video transmission, and enabling a gradual extension to NG-PON2.

A further aspect: As a Raman source, TWDM upstream works like an amplifier on the TWDM downstream signals. The challenge will be to manufacture tunable transmitters and receivers at affordable prices. The concept also supports the superposition of up to eight wavelengths for point to point connections (PtP-WDM). This makes it possible to provide fast, latency-low channels for additional services in the local distribution network.

The standardization of the physical layer was completed with ITU-T G.989.1 and G.989.2 at the end of 2014, whereas the specification of the protocol layer (TC) in G.989.3 is still under development. First commercial NG-PON2 networks could go into operation as early as this year or next. ■



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R&M Middle East, Turkey and Africa has successfully completed a large scale deployment for Daman, the Middle East's leading specialized health insurer, which involved a comprehensive office cabling solution for the company's 18-floor Headquarters in Abu Dhabi.

With the new implementation, the health insurance specialist now has a state-of-the-art network infrastructure in place which it can leverage to deploy the latest IT applications and services.

Daman provides health insurance solutions to more than 2.4 million members in the UAE. The company is the partner of choice for a number of the country's most prominent organizations and multinational companies in various industries including oil and gas, aerospace, energy, construction, investments and media. Headquartered in Abu Dhabi and established in 2006, Daman offers a range of health insurance plans for both individuals and organizations and exclusively manages the Government's health program – Thiqa, for UAE nationals, and Abu Dhabi Basic Plan, for low-income expatriates.

As Daman rapidly expanded across the region, it found it needed to move to a new headquarters in Abu Dhabi. Having already utilized R&M's market-leading structured cabling solutions in its offices and branches across the UAE, the insurance provider was solidly convinced of the benefits that R&M's products offered. Daman noted the unmatched Swiss quality, reliability and modularity as being decisive benefits offered by R&M's solutions.

"We already shared a very good relationship with R&M and were solidly convinced by the quality of their solutions and the professionalism of their team. When it came to laying the cabling infrastructure for our new headquarters that would be the vital backbone to all our IT systems, the decision to go with R&M was straightforward," says Pradeep Ghosh, IT Project Consultant at Daman.

> "We already shared a very good relationship with R&M and were solidly convinced by the quality of their solutions and the professionalism of their team."
>
> Pradeep Ghosh, IT Project Consultant at Daman

While the insurance provider had utilized R&M's Cat. 6 solution for the cabling in its older offices, it now had increasing demands for bandwidth.

Daman Equips New Abu Dhabi Headquarters with Future-Ready Network Cabling from R&M



This required a solution which could effortlessly deliver 10GbE connectivity. It was decided that R&M's Cat. 6_A ISO solution would be utilized instead of the TIA Cat. 6_A which is often deployed. This was on account of the solution's compliance with the more stringent ISO/IEC 11801 Class E_A link standard which guarantees higher performance, quality and reliability. R&M's Cat. 6_A solution has enabled Daman to gain superior performance, an outstanding security margin for signal transmission, and wide performance scope for demanding applications. A notable feature is the solution's ability to support transmission frequencies of up to 650 MHz, which is considerably higher than the 500 MHz specified by the Cat. 6_A standard.

Daman also utilized R&M's OM3 FO cabling for fiber backbone connectivity which is suitable for the current 10 GbE application requirements and will also allow the insurance specialist to migrate seamlessly to 40 GbE and even 100 GbE. The company spared no expense and utilized a raised floor design in its office layout. The modularity of R&M's cabling solutions proved to be an invaluable asset.

"We now have a system that exceeds our current expectations of performance and reliability. With R&M, we have a robust platform upon which we can now rapidly deploy applications and scale our services with confidence," explained Pradeep Ghosh.

Designed to implement R&M*inteliPhy*

Daman has ensured that its new cabling investment is completely future-ready. The entire solution has been designed and deployed with the intention of implementing the R&M*inteliPhy* Automated Infrastructure Management (AIM) solution in the next phase of the project. The solution will enable continuous monitoring of each and every cable connection. This will provide easy and automated management of the cable infrastructure while also delivering an unmatched level of security as unauthorized connections will be immediately detected. During this phase, Daman will also be able to exploit the future-proofing design benefits that R&M has incorporated into its products. R&M*inteliPhy* is fully retrofittable and uses R&M's standard patch panels and patch cords. It also utilizes high-density panels, which will enable Daman to easily migrate from 10 GbE to 40/100 GbE without distributing the cabinet structure or changing the AIM components.

As the implementation was executed by R&M's certified integration partner, Daman will also be able to avail of the company's 25-year system warranty on the implementation. ■



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Getting WLAN Right

Reliable wireless communication needs carefully planned wired infrastructure. And there are plenty of good reasons why.

The mobile receipt of data over WLAN is now standard in modern buildings. In the third quarter of 2014 the enterprise WLAN segment grew 9.7 % in comparison to the same quarter of the previous year[1] according to a report by the International Data Corporation (IDC). With IEEE 802.11ac, the new standard for wireless local networks, a further increase is to be expected. This second WLAN wave will enable even faster data connections with a data rate of max. 7 gigabits per second (see glossary on page 33).

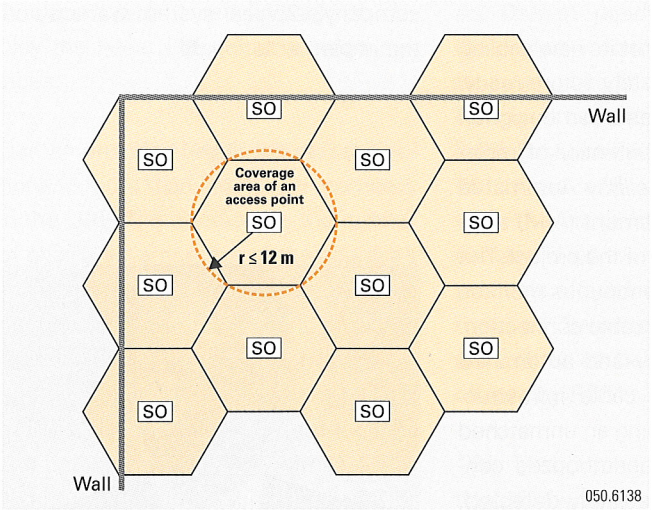
A fact which naturally prompts the question: Are we soon going to reach the point where we no longer require fixed cabling in offices? No, because even WLAN access points are usually connected using structured cabling. And what's more, there are several good reasons why we should not allow all communication to take place over the airwaves. All network subscribers of one radio cell share the maximum WLAN data rate. And that slows down traffic. Besides, the maximum rate is virtually impossible to realize in practice. Data that travels by cable is usually faster, more reliable and easier to protect than in the WLAN. Which is why wired transmission is preferable for business-critical applications.

But WLAN is nevertheless a mandatory feature of modern office buildings. If, however, you are counting on saving cabling, you will have to think again: Realistic planning demonstrates that full WLAN coverage in fact leads to even more cabling because the cabling for the WLAN is a separate network in the building, coexistent with workplace cabling, whose connections are to be installed at the optimal positions for access points, e. g. on the ceiling.

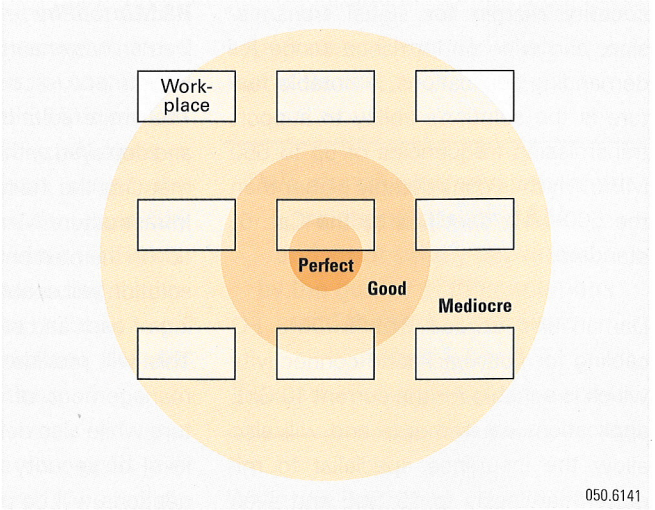
Selecting the right cabling

In the case of modern WLAN products (compliant with IEEE 802.11ac), the data rate required on the cable side is more than 1 Gbit/s. Access points therefore have to be connected either with several 1000BASE-T ports, resulting in an increased amount of cabling, or with one 10GBASE-T connection.

The recently announced transmission technology NBASE-T, which enables 2.5 Gbit/s or 5 Gbit/s over Cat. 5/6 is a possible interim solution. But that is unlikely to suffice long term because



Honeycomb structure compliant with EN 50173-6, Amendment B. SO = service outlet. The coverage radius of a radio cell will be considerably less than twelve meters in future.



Degree of coverage of a single radio cell. For the workplace directly under the access point, the field strength relations are perfect to guarantee a maximum data rate. The many workplaces with mediocre field strength relations slow down data throughput.



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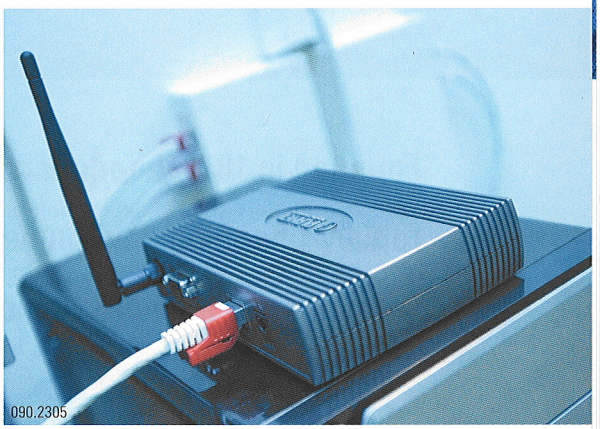
WLAN access point with R&M Security System: "Patch Guard" for preventing unauthorized disconnection of the RJ45 connector



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IEEE is already discussing 802.11ax which is forecast to multiply the possible data rate.

No compromises should be made when it comes to new installations: They should be designed for 10GBASE-T. After all, the cabling usually lasts several times longer than the average life cycle of an end device. And there is already proven technology available for it: Cat. 6_A. And R&M is a leader in this segment.

Planning the right honeycomb structure

WLAN planning is frequently dealt with once the cabling infrastructure has been completed because precise details of use cannot be defined until late on in the project or possibly change over time. So initially it is important to prepare as flexible a basic structure for the WLAN as possible.

Cabling compliant with the honeycomb structure presented in EN 50173-6[2], Amendment B, is successful in this respect. This involves the space to be covered by the WLAN being equipped with RJ45 outlets at regular intervals, e. g. on the ceiling, for the later connection of the access points. What is crucial in deciding the future effectiveness of this cabling is choosing the correct honeycomb radius which is relative to the cell size of the WLAN. Alongside the future changes in technology, influencing factors, such as the concentration of workstations and changes in use, have to be taken into consideration. This is why long-term planning of installations is so important and why the honeycomb radius should be kept as small as possible.

Capacity-based WLAN planning common today features lots of small radio cells. They are operated with correspondingly low performance to prevent interference with adjacent cells and to ensure a high data rate per subscriber. The maximum honeycomb radius of 12 meters prescribed in the standard, or rather the resulting distance between access points of 21 meters, has to be viewed as outdated. Today WLAN manufacturers are issuing recommendations for the distance between access points in the workplace of 14 meters (honeycomb radius of 8 meters). With those figures likely to decrease.

Using cabling compliant with EN 50173-6 with a suitable honeycomb radius will ensure the requirements for fast, affordable, flexible and requirements-oriented WLAN implementation. ■

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[1] http://www.cablinginstall.com/articles/2014/11/idc-enterprise-wlan-growth.html, published January 19, 2015

[2] EN 50173-6:2013 Information technology – generic communication cabling systems – Part 6: Distributed building services



050.5749

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Only the Very Best for Ericsson in India

Founded in 1876, headquartered in Stockholm, Ericsson is a world leader in the rapidly-changing environment of communications technology, providing equipment, software and services to mobile and fixed network operators all over the globe.

Present in over 180 countries, an estimated 40 % of all global mobile traffic passes through Ericsson's equipment. With more than 35 000 granted patents, they have one of the industry's strongest patent portfolios. Ericsson has a significant presence in India with its telecom equipment and services supporting several telecom providers in the country as well as around the globe.

R&M bagged the opportunity to supply its Cat. 6 cabling solution including patch cords, connection modules, installation cables, face plates, multimode OM3 and singlemode fiber cables, and accessories for Ericsson's new facilities and test labs in key Indian cities such as Bangalore, Kolkata, and Gurgaon. There have been several orders and the total number of nodes R&M has installed is over 52 000.

> Ericsson is currently expanding its operations in India across various locations and continues to use R&M's solutions.

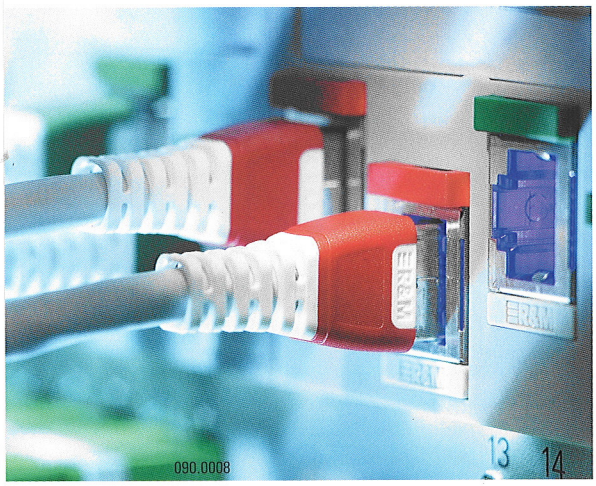
Ericsson sought the best quality structured cabling solutions that would ease the strain on the company's network and would perform long term without any hassles. The emphasis on quality and durability was critical to the networking system.

Top quality and great convenience

After a thorough evaluation, the Ericsson team chose R&M to build the cabling infrastructure for the lab. R&M's proposed solution had a strong emphasis on a future-proof network that would support expansion plans in the years to come. The quality, quick assembly and ease of handling were also key in Ericsson's decision to install the R&M solution. R&M's team made routine checks to make sure the project could be completed on schedule, safely and successfully.

With R&M's system warranty of 25 years, Ericsson's test labs can research the future of telecom securely and confidently. R&M's solution allows the company to have a flexible, high-capacity network to provide excellent support for loss-free data transmission.

Ericsson is currently expanding its operations in India across various locations and continues to use R&M's solutions because of the company's strong association with R&M's sales and technical personnel. ■





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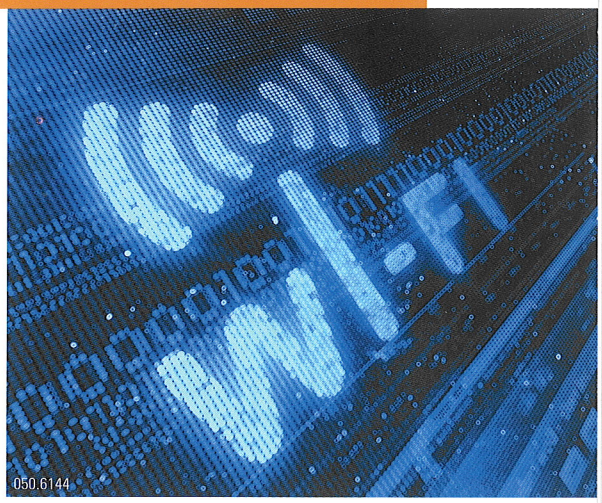

Glossary of Transmission Technology

WLAN Wave2: The Determining Parameters

The WLAN standard IEEE 802.11ac was ratified in 2014. First products are now available but are not yet tapping the full potential. What are the important parameters when it comes to making full use of "Wave2"?

Unlike wired media, WLAN technologies have no fixed data rates. Rather the performance is influenced by the parameters frequency range, bandwidth, SNR, guard interval and spatial streams. It depends not only on the environment and installation, but also on the capabilities of the access points and terminal equipment.

Frequency range: WLAN technologies use license-free frequency ranges. Whereas with the previous 802.11n standard WLANs worked in the 2.4-GHz band, with the 5-GHz band as an option, 802.11ac requires all equipment to support both bands. The 5-GHz band is wider and not as highly frequented as the 2.4-GHz band. The range is shorter with 5 GHz so that the spectrum can be better reused.

Bandwidth: An individual WLAN channel can have different bandwidths. With 802.11 it is 20 MHz and 40 MHz in the 2.4-GHz band, 20 MHz, 40 MHz, 80 MHz and optionally 160 MHz in the 5-GHz band. In an interference-free environment, wider channels allow higher data rates. However, with large bandwidths there are fewer non-overlapping channels available for other access points. Narrower channels are better than wide channels that interfere with each other.

SNR (signal-to-noise ratio): The signal-to-noise ratio decides on the modulation method the devices "work out" for themselves. Modulation methods that transfer a lot of bits per time unit offer high data rates but are also susceptible to interference. 802.11ac supports between 1 bit/symbol in BPSK (binary phase shift keying or binary phase modulation) and 8 bits/symbol in 256-QAM (quadrature amplitude modulation). The modulation methods are designated as MCS 0 to MCS 9 (modulation and coding scheme).

Guard interval: A delay between two transmissions to allow interfering echoes to subside. The default value is 800 ns; in channels with short echoes, it is possible to change that value to 400 ns.

Spatial streams: Communication can take place simultaneously at the same frequency without any interference with several transmitting and receiving antennae. The number of spatial streams increases the possible data rate. ■

Data rates for different 802.11ac configurations

MCS	Lowest rates Mb/s 20 MHz channel, 1× SS		Channel width	Spatial streams	Highest rates Mb/s 160 MHz channel, 8× SS	
	Long GI	Short GI			Long GI	Short GI
0	6.5	7.2			468.0	520.0
1	13.0	14.4		× 2 for 2 SS	939.0	1040.0
2	19.5	21.7		× 3 for 3 SS	1404.0	1560.0
3	26.0	28.9	× 2.1 for 40 MHz	× 4 for 4 SS	1872.0	2080.0
4	39.0	43.3	× 4.5 for 80 MHz	× 5 for 5 SS	2808.0	3120.0
5	52.0	57.8			3744.0	4160.0
6	58.5	65.0	× 9.0 for 160 MHz	× 6 for 6 SS	4212.0	4680.0
7	65.0	72.2		× 7 for 7 SS	4680.0	5200.0
8	78.0	86.7		× 8 for 8 SS	5616.0	6240.0
9	86.7	96.3			6240.0	6933.3

***MCS:** Modulation and Coding Scheme; **SS:** Spatial Stream; **GI:** Guard Interval.*
Source: IEEE, Aruba Networks and others



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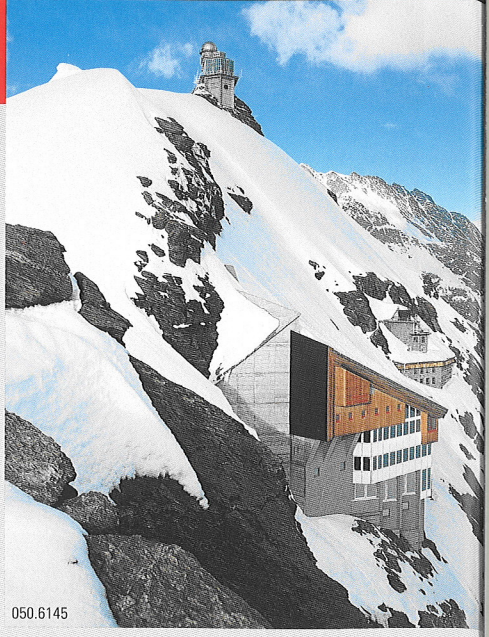
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Jungfraujoch: Installation under Extreme Conditions

The Jungfraujoch – affectionately known as the Top of Europe – has now added a further pioneering deed to its list of attributes. Since 2014, the communication infrastructure of this Swiss tourist attraction has been completely digitalized.



From left to right:
Jürg Gerber, R&M Switzerland;
Urs Berger, Brunner + Imboden AG;
Heiri Früh, Jungfraubahnen Management AG

How do you go about extending the existing high-performance network of the Jungfrau railway in Europe's highest railway station? And how do you cope with the extreme alpine conditions? Urs Berger and his team of installation engineers from Brunner + Imboden AG successfully mastered this adventuresome challenge in April 2014 – helped on the way by R&M and other partners.

Since then, the destination between the summits of the Eiger, Mönch and Jungfrau has been executing all communication and information tasks over IP. All over IP is what Jungfraubahnen Management AG was demanding of the new LAN cabling installation. The hundreds of thousands of tourists from all over the world who go up to the platform every year on the cog-wheel railway to admire the magnificent world of mountains and glaciers can now also benefit from the advantages of the digital age on the "Top of Europe".

A genuine alpine sensation

More than a century ago, courageous Swiss workmen and engineers created this genuine alpine sensation. They drilled a seven-kilometer-long tunnel through the rockface of the Eiger and constructed an electrically operated cog-wheel railway which climbs 1400 meters over a total distance of 9.34 kilometers. Industrialist Adolf Guyer-Zeller, from the Zurich Oberland, was the initiator and investor behind the Jungfrau railway. He was overjoyed with this pioneering accomplishment in railway history that led to the opening of the railway on August 1, 1912. In its very first year of operation, there were 75 percent more passengers than had been anticipated.

The Jungfrau railway and the viewing platform on the Jungfraujoch have retained their magical attraction to this day. To increase the attraction even further, Jungfraubahn Management AG commissioned a number of changes that were started in 2012. The stream of visitors can now enjoy better connections between the station, Sphinx Hall and Ice Palace: "Alpine Sensation"


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The Jungfrau railway network

The network infrastructure was adapted to suit today's requirements as part of the modernization of the Jungfraujoch mountain station – very much in line with the credo "All over IP". All electronic devices run over the local data network. One hundred phone and 200 LAN connections were installed on site. The R&M cabling solution comprises more than 5000 connections for railways, ski lifts, chair lifts and the tourist infrastructure. FO cabling has been used as backbone since the year 2000 – also from R&M (see CONNECTIONS No. 22).

The Jungfraujoch enables access to the mobile networks of three providers. A connection is even guaranteed in the railway tunnel. A new, two-story engineering room is used as HQ for the communication infrastructure. It is connected with 20 network cabinets and distributor halls.



Swiss engineering – Swiss sustainability

The Jungfrau railway is a prime example of courageous, pioneering and perfect Swiss engineering. Its initiator was the experienced industrialist, financial expert and textile dealer Adolf Guyer-Zeller from the Zurich Oberland region, close to Wetzikon where R&M has its HQ. The courageous pioneer thought it all up during a mountain hiking tour at the tender age of 54. He won the bidding war and started construction in the summer of 1896. The railway was opened on August 1, 1912, the Swiss National Holiday. For more information see www.jungfrau.ch.

Alongside the station and a research station there are now two restaurants for individual and group travelers on the Jungfraujoch at 3454 meters above sea level. The group restaurants with a view of the glacier can be used for seminars with up to 240 participants. There is a lift to the Sphinx viewing platform at 3571 meters. Further attractions are the Ice Palace, the two experience worlds Alpine Sensation and Snow Fun as well as the Lindt Swiss Chocolate Heaven of Swiss chocolatier Lindt & Sprüngli.

Sustainability has always been a top priority on the Jungfraujoch. Everyone is determined to treat nature and the environment with as much care and respect as possible. Solar cells provide the electric power. The building's waste heat is reused in entirety. Eleven million liters of water are required every year. Melt water covers virtually half that requirement. Fresh water is pumped up through an insulated penstock and mixed with the melt water. The waste water is taken through a 20-km-long pipe to Grindelwald where it is cleaned.

is the name given to this adventure trail. The restaurants were also extended. And part of the project entailed adapting the network infrastructure to suit today's requirements.

Extreme working conditions

The challenges of this cabling project were without doubt unique. The Jungfrau railway itself was used to transport the construction material. Because the railway has a very limited transport capacity, 80 percent of the installation work had to be completed in the very short span of eight weeks between mid-February and mid-April 2014. It was a bleak time, winter with extreme weather conditions and gusts of wind of up to 200 km/h.

The logistics coordination could be nothing short of perfect. Planned delivery times and quantities had to be adhered to precisely. Some of the installation material had to be packed in a weatherproof fashion in interim storage facilities outside the buildings.

Managing human resources was an equally major challenge. The human body works 25 % less well at 3454 meters altitude in comparison to sea level. This had to be taken into consideration accordingly in the planning.

The installation engineers worked regularly for four days in a two-shift operation and stayed overnight in group rooms on the Jungfraujoch. Collegiality and team spirit were an absolute must. Urs Berger, project lead at Brunner + Imboden AG, visited the construction site at least once a week – just traveling there took nearly four hours each time.

brunner+imboden
elektro telematik

His main task was to coach and motivate the employees – no doubt in the way Adolf Guyer-Zeller must have motivated the workers more than 100 years ago for a period of 16 years.

Jungfraubahnen Management AG was full of praise when the installation work was completed. Electro telematician Heiri Früh: "The products, consulting and service from R&M were perfect and always met the special project requirements. The installation was a major challenge under the given circumstances. The space available on site was very limited. Installation partners Brunner + Imboden really did do a very good job." Additional projects such as a Sky Lounge are already in the planning stage. ■



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Packet Loss – the Performance Killer

Data centers are currently caught up in the virtualized computing storm. Their networks have to continue to develop quickly to keep pace with new demands. And that in turn means greater demands on cabling.

Alongside classic data traffic between client and server, servers in data centers are now communicating more with one another. If in this challenging environment a link to a physical server cannot come up with the goods in terms of performance, this naturally has an effect on all virtual machines and applications running on the server. Bit errors and packet loss can have dramatic effects. Alongside routers and switches, cabling is one of the most important factors influencing throughput and latency.

For example: Let's assume we have a server with a 10G network card, a 10G Ethernet network with three hops and

HPNC solution from R&M shows peak performance with 40/100 GbE

Network performance can be increased by avoiding packet loss. Cabling too must make a contribution to this aim, something which is entirely possible as benchmark tests by R&M illustrate.

In 2014, R&M, together with Xena Networks, subjected the High Performance Network Connectivity (HPNC) solution for data centers to some severe testing. The testing focused on operation with 40 Gigabit Ethernet (GbE). In April 2015, R&M demonstrated the first fully functional link with 100 GbE, which had been set up as a 4×25 Gigabit link in accordance with the latest standards.

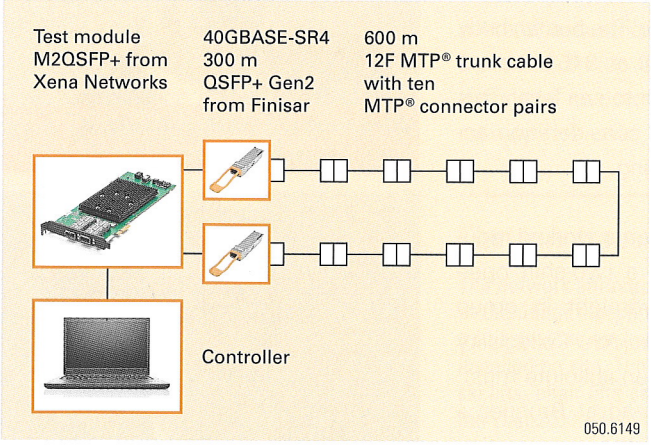
The 40G Bit Error Rate Test (BERT) focused on the transmission quality of a 600-meter cabling link operated constantly for 16 hours. Parallel optical connection technology from R&M was used: OM4 multimode fibers and ten MTP®[1] connectors. Randomly selected modules of the type QSFP+ Gen2 by Finisar[2] were used as 40GBASE-SR4 transceivers.

The test result sounds like a world record: absolutely no packet loss.

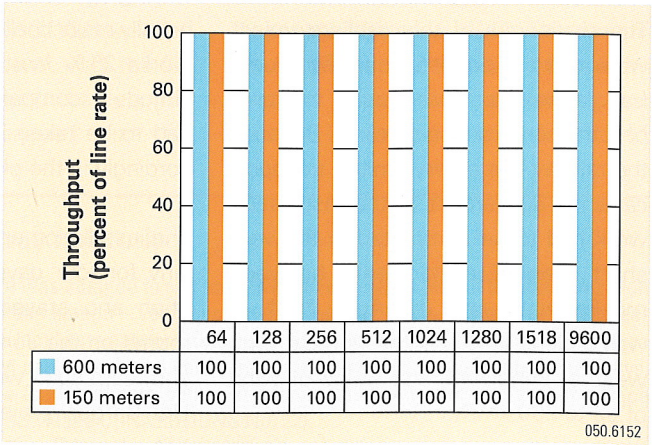
R&M thus specified 330 meters using OM3 cabling and 600 meters using OM4 cabling each with four MTP® connectors. This means data centers can create links which exceed the 100 meters for OM3 or 150 meters for OM4 currently specified in IEEE 802.3ba 40GBASE-SR4.

Around 60 % of the typical investment costs can be saved in comparison to the use of singlemode cabling on the 600-meter link.

[1] MTP® is a registered trademark of the company US Conec.
[2] Finisar a registered trademark of the company Finisar Corporation.

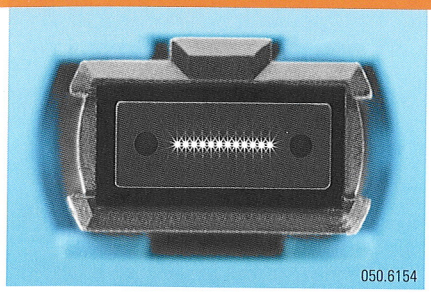


BER test setup for 40GBASE-SR4 with 600 m OM4 cabling and ten MTP® connector pairs

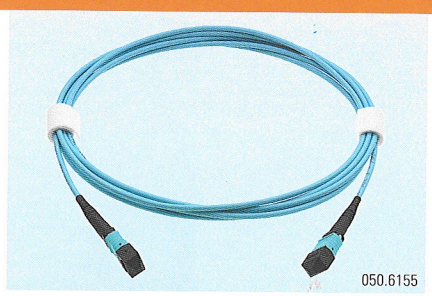


	64	128	256	512	1024	1280	1518	9600
600 meters	100	100	100	100	100	100	100	100
150 meters	100	100	100	100	100	100	100	100

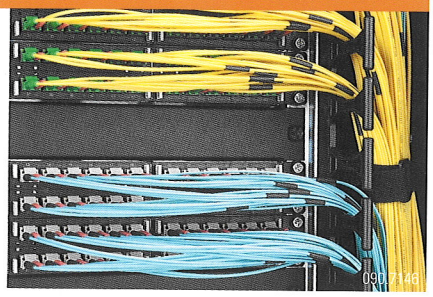
Test result: maximum throughput in accordance with RFC 2544 with 40 Gbit/s line rate and zero loss tolerance for 150-meter and 600-meter OM4 links



MPO/MTP® connectors from R&M



Trunk cables from R&M with MPO/MTP® connectors



High Performance Network Connectivity (HPNC) – for R&M an essential factor for the success of data centers in the age of clouds and virtualization

another server with a 10G network card. The application is going to transmit data with the following TCP settings:

- Bandwidth = 10 Gbit/s
- TCP window = 375 kB
- Max. segment size = 1460 bytes
- Delay = 0.3 ms RTT

With these settings, the throughput fully utilizes the underlying 10G network. If just 0.1 % of the packets are lost, the throughput drops to 1 Gbit/s – a tenth of the network bandwidth actually available!

Packets sent but not immediately acknowledged by the recipient are resent by the sender. In an environment of virtualized systems, packet loss and the corresponding retransmission timeouts can lead to system response times of more than a second. Naturally, a totally unacceptable state of affairs.

Bit errors often remain undetected

These "slowers up" often remain undetected. Technicians do test their installations to see that they are adhering to the projected network requirements. Individual optical measurements, such as measuring IL and RL, usually capture and integrate the test signal over a period of 300 milliseconds. The optical pulses of a 10, 40 or 100 Gigabit Ethernet application are, however, only 100 picoseconds long – 3 billion times shorter. Conventional test methods cannot resolve any optical phenomena, such as reflection or modal noise, that take place at bit level. For this purpose, BERT (Bit Error Rate Test) measurements are taken at R&M.

The bottom line: Ultimately, anything you can possibly do to avoid bit errors and packet loss, even in terms of network connectivity, must be done. R&M pursues this goal with its High Performance Network Connectivity (HPNC) range. ■

Current trends in data center cabling

- Migration to 10, 25, 40 and 100 Gigabit Ethernet
- Extension of the parallel optical connection technology
- Conversion from three-tier to mesh structures
- Introduction of leaf-spine or fat-tree networks, network fabrics

Driving forces for the change in data centers

- Virtualization
- Private cloud
- Mobile working
- Video on demand
- Software & storage as a service
- Social media
- File sharing
- Online collaboration
- Voice over IP
- Unified communication
- Video conferencing
- High frequency trading

Poor quality of the connectors, fiber optics and cable installation

▼

Higher insertion and return loss, increased modal and reflection noise

▼

Additional intersymbol interference

▼

Higher bit error rate

▼

Increased packet loss (frame damage in the case of fiber channels)

▼

More retransmissions (and timeouts in the case of fiber channels)

▼

Lower data throughput/ increased latency

▼

Increased susceptibility to overload

▼

Deterioration in network performance

The chain of cause and effect shows the relationship between connectivity quality and network performance.

See the whitepaper "An Introduction to High Performance Network Connectivity" at http://www.rdm.com/en/desktopdefault.aspx/tabid-207/333_read-6175/



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R&M at New Sochi Autodrom



The new Russian motor racing circuit, which had to satisfy all F1 requirements, was built at the Olympic Park in Sochi, scene of the 2014 Winter Olympics.

The Sochi Autodrom was officially opened on September 20, 2014. The circuit naturally complies with all international standards and was completed by a team of highly professional construction workers. The first races were held on October 10–12, 2014 and welcomed Formula 1 back to Russia for the first time since before the revolution period.

After the Sochi Autodrom was named Motorsport Facility of the Year at the 2014 Professional MotorSport World Expo in Cologne, Germany, representatives of the winning team and the award's chairman of the jury shared their reactions on the event.

Hermann Tilke, Designer Sochi Autodrom: "This was probably the most challenging project that everybody involved has ever had. A big Formula 1 project inside a huge Olympic project. At the end, we were all working as a team and furthermore we became friends."

Sergey Krylov, Deputy Director Sochi Autodrom: "I would like to thank everyone involved for making it possible to develop the Sochi Autodrom and bring the Formula 1 Grand Prix back to Russia. Prior to the construction of the Sochi Autodrom, motorsports in Russia had been lacking world-class circuits for a long time."

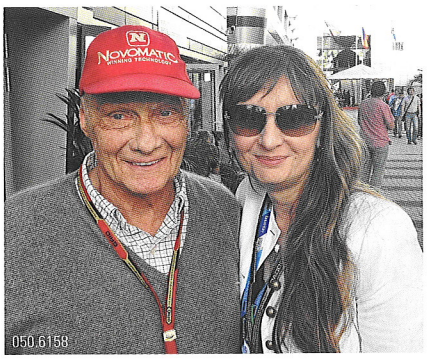


The track looks very much like the Homebush Street Circuit in Sydney, where the V8 Supercar Championship and Sydney 500 races are held. The project's chief architect Hermann Tilke, a German engineer who has designed numerous Formula 1 motor racing circuits, describes this track as quite challenging even for experienced professionals, as it is possible to reach speeds close to 300 kilometers per hour on straights and 200 kilometers per hour while driving round bends. The track is 5848 meters long, 13–15 meters wide and has 18 bends. The stands have a seating capacity for 42 thousand people.

One of the main challenges of this project was the creation of the multimedia facilities which are intended to give every spectator the chance to experience the atmosphere no matter where they are. Dozens of cameras and hundreds of commentators have to work as a single fully integrated entity.

The multimedia system consists of 45 kilometers of fiber optic cable and 150 kilometers of copper cable. More than 200 distribution points, providing 8000 optical connections and 2500 Cat. 6 connections, were installed. This network provides the facility with the required level of access and data security, and supports the work of information and technological services.

Izabella Andrianova, General Director for Foreign Relations and Corporate Affairs at Stroi International (the construction company that built the Sochi Autodrom): "R&M products are known for their quality and technical characteristics. The service provided by the Russian partners was extremely important as it ensures the project's future success. In conditions of fierce competition, we gave preference to the RdM Distribution company – the Russian partner of the manufacturer R&M." ■



Izabella Andrianova and Niki Lauda, three-time F1 World Champion

For more information take a look at: sochiautodrom.ru/en/



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Future 100 Gbit/s Technologies

Faster, denser & more affordable: Particularly in data centers, the increasing volume of data traffic requires better optical Ethernet solutions. And the new IEEE 802.3bm standard is making that possible.

IEEE 802.3bm specifies the physical layer for optical transmission with 40 Gbit/s and 100 Gbit/s (100GBASE-SR4). The standard is likely to be published in the spring of 2015. 100GBASE-SR4 provides for a transmission over four multimode fibers in both directions, each with 25 Gbit/s. This means that fibers that were already laid for 40GBASE-SR4 in compliance with IEEE 802.3ba can still be used. The ranges: 70 m with OM3 and 100 m with OM4 fibers.

The Gigabit-Ethernet-Link model in compliance with IEEE is used as a fundamental tool to engineer the link power budget and the channel performance for 100GBASE-SR4. The optical link is defined between the PMD interfaces (TP1 to TP4 in the figure). The model computes the channel insertion loss, system margin and power penalties induced by physical effects, chromatic and modal dispersion, intersymbol interference (ISI), mode partition noise (MPN), extinction ratio, relative intensity noise (RIN) and modal noise (MN).

New: CAUI-4 interface

A new 100G attachment unit interface was introduced with the IEEE P802.3bm draft called CAUI-4. It defines the interfaces between the host IC and the optical transceiver module for chip-to-chip/chip-to-module applications. The four optical lanes directly map the four electrical lanes.

FEC with multimode

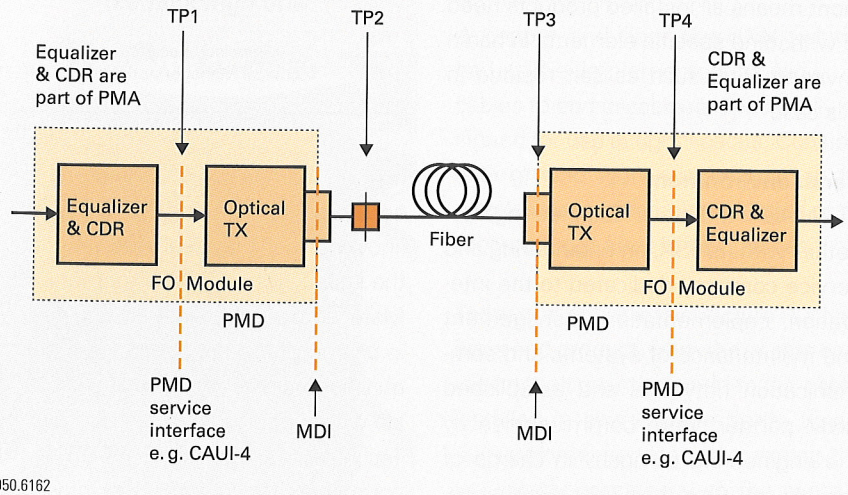
Forward Error Correction, FEC, reduces transmission errors on noisy communication channels. For this purpose, the signal is coded redundantly (with additional information) on the sender side. This in turn means that a certain number of errors can be detected and eliminated on the receiver side.

In next-generation 100-Gbit/s Ethernet, FEC will also support the low power, low cost 100-meter multimode solution. For example, the FEC technique RS (528, 514, 7, 10) will improve the signal power budget of the 100GBASE-SR4 and CAUI-4 connections by 2.25 dB or 4.19 dB respectively, in order to achieve the bit error rate of 10^{-12} without complex modulation techniques.

The interplay between optics and electronics is important in the further improvement of performance going forward to 100 Gbit/s Ethernet. R&M has just the right expertise to make this happen. ■

References
www.ieee802.org/3/bm/

Interface model for fiber optic connections



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PMD: *Physical Medium Dependent*
PMA: *Physical Medium Attachment*
MDI: *Medium Dependent Interface*
TP: *Test Point*
CDR: *Clock Data Recovery*
Source: IEEE



050.5584

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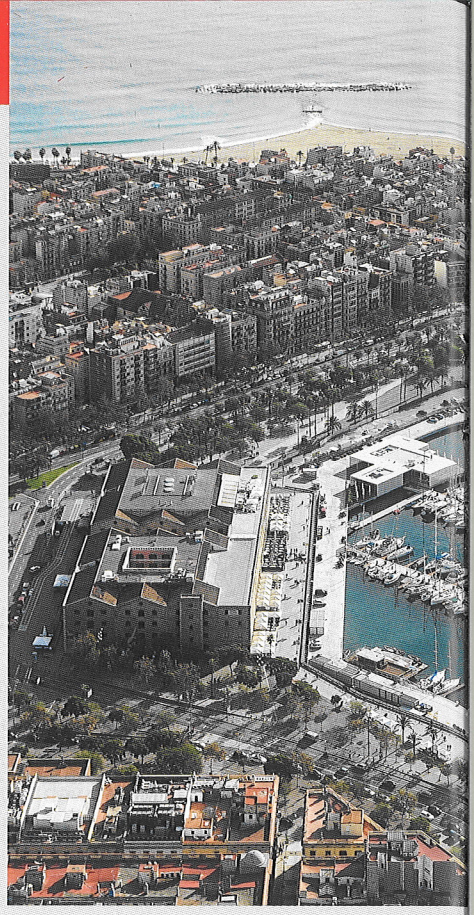

R&M Gives Marina Port Vell Top Data Infrastructure for Open Sea Clients

Marina Port Vell is a world-class home port for superyachts, perfectly positioned in the heart of Barcelona. Originally built for the 1992 Olympic Games, the marina has recently undergone a multi-million euro transformation, meaning it can now facilitate 148 berths for yachts up to 140 meters.

The on-site five-star facilities ensure owners, guests, captains and crew have everything they need to enjoy the best in safety, security, comfort and entertainment while benefiting from all the services and amenities that a city can offer. As one of the world's genuine city-center marinas, it also has the best of Barcelona and Catalonia on its doorstep with Mediterranean hotspots and islands just a short cruise away.

"Salamanca Group" holds the marina concession until 2036. With the clear goal of providing excellent services, one of the key areas identified was the IT infrastructure and, among others, data networks. The hostility of the environment means all installed products need to withstand specific elements in harsh environments, such as salt residue in this case.

Harsh environment

CLAMASA Industrial Engineering, together with IEAISA, an engineering and service company dedicated to the integration, implementation, management and maintenance of systems and communication networks and established R&M partner, were commissioned by the engineering company in charge of the project. Based on past experience,

> "The R&M product portfolio can cater to all project demands, supplying everything in terms of both quality and the ability to install in difficult environments and tight spaces."
>
> Francisco Escane,
> Technical Manager at IEAISA

IEAISA was quick to prepare a project proposal featuring R&M products, knowing that they really do function in the specified type of environment. Raúl Mata López, an industrial engineer, is in charge of the project and has been a qualified partner for several years now. He was supported by Francisco Escane, Technical Manager at IEAISA. The two companies worked together closely to



design the necessary infrastructure to provide IT services at the port. "The R&M product portfolio can cater to all project demands, supplying everything in terms of both quality and the ability to install in difficult environments and tight spaces. That is why R&M was our obvious choice as soon as we studied the marina's requirements specified by CLAMASA Industrial Engineering," explains Francisco Escane.

WHY R&M?

- **Best products for harsh environments**
- **Good customer relations**
- **Installation adaptability**
- **Customized product adaptation**



Best solutions

The requirements for improving the service offerings were a physical IP connection to the yachts, the deployment of an IP67 outlet mechanized in each of the vessels as well as the deployment of a global infrastructure of copper wiring that could tolerate the salt together with a fiber backbone that could take care of all customer services.

A copper and fiber CarrilDIN solution had to be implemented to allow the cables to end in cabinets specifically designed for use in tight spaces. Considerable ground work was needed in the development and implementation of the project to get fiber to the cabinet.

Today, the entire infrastructure is a luxurious end product, from the yachts coming from all over the world to the cables installed in every single berth. Luxurious customer service and materials that are mostly engraved with the name of the port on each of the cable installations give the customer even more exclusiveness.

The entire infrastructure is based on a shielded Cat. 6_A solution that can withstand harsh environments. This complete solution from R&M means the port is perfectly equipped to work with the best sea clients by offering the best technological services. ■



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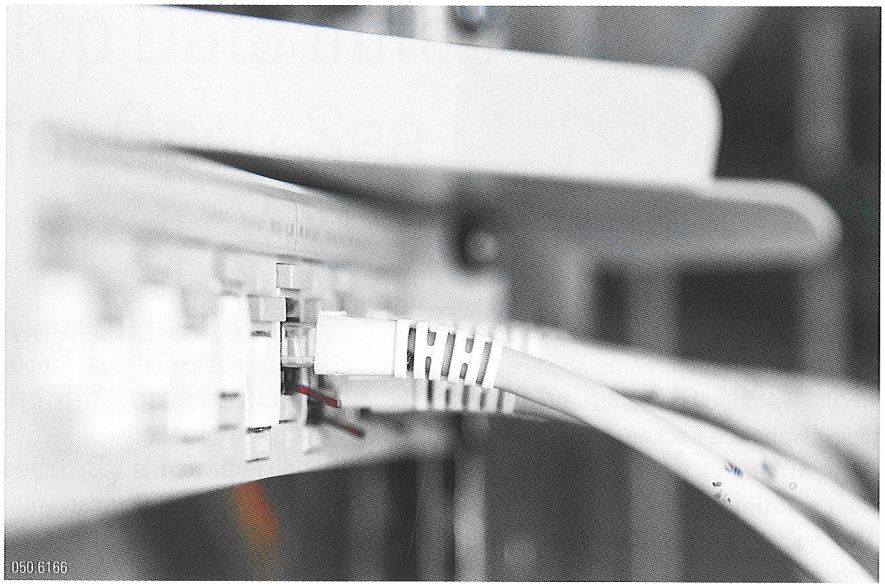
40GBASE-T: Battle of the Systems

Things are really hotting up on the road to 40GBASE-T. The IEEE group 802.3bq is aiming to adopt its new standard this year. But which connectivity technology will succeed in asserting itself at the end of the day?



The cornerstones for 40GBASE-T are already in evidence. The focus is on data center infrastructure which will inevitably have to migrate to 40 Gigabit Ethernet over the next few years. Fiber optic or Twinax cabling could provide the necessary capacity. But traditional twisted-pair copper cabling remains the less expensive and more flexible solution – preferably with the universal, handy RJ45 format for connectivity technology. Consequently 40GBASE-T is the order of the day. The IEEE specifies one transmission channel with two connectors limited to 30 meters.

Experts are more or less in agreement that channels should be limited to 30 meters with two connectors. The transmission frequency is to be raised to 1600 MHz – with leeway up to 2000 MHz. The organizations IEEE, ISO/IEC and TIA are working concurrently on specifications for classes, categories, channels and connectors. In some areas they will define different parameters, particularly for crosstalk – with corresponding consequences for channel performance.

The focus of the current debate is the future Category 8. TIA sees this as all-inclusive. ISO/IEC differentiates: Class I channel with Cat. 8.1 components and Class II channel with Cat. 8.2 components. The difference between Class I and Class II is that Class I requires the well-known and reliable RJ45, whereas Class II allows three different faces based on the ARJ45®, GG45® and Tera® connector systems introduced with Cat. 7_A.

These three connector systems are not compatible with each other or with RJ45. And this is something of a dilemma for the user. As the overwhelming majority of device ports will continue to use RJ45, Class II cabling will require hybrid patch cords.

The bottom line from the standpoint of R&M: There isn't really any alternative to universal, top-quality RJ45 solutions.

The bottom line from the standpoint of R&M: There isn't really any alternative to universal, top-quality RJ45 solutions. For the time being, RJ45 will remain number 1 – for 40GBASE-T, too. ■



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You are bound to know the feeling of breathing deeply after going through a stressful time, when you suddenly realize you have time for yourself, for relaxing.

Breathing

Breathing is the key to life – no living organism can do without it. Human beings breathe in and out several thousand times a day, most of the time fully unaware of what they are doing. We breathe deeply when we are happy; our breathing falters when we are shocked or frightened and is closely connected with the nervous system. It gets totally out of sync when we are in pain, dealing with difficult circumstances, stress or inner conflicts over a long period of time.

You are bound to know the feeling of breathing deeply after going through a stressful time, when you suddenly realize you have time for yourself, for relaxing. It is a wonderful feeling of freedom and relaxation.

Unconscious breathing arrest

My breathing faltered recently when a skier not far away from me got torn away by an avalanche. Luckily, the skier got off lightly but I am still very aware today of that feeling of a sudden breathing arrest, when my heart was in my mouth.

Reduced breathing in extreme situations

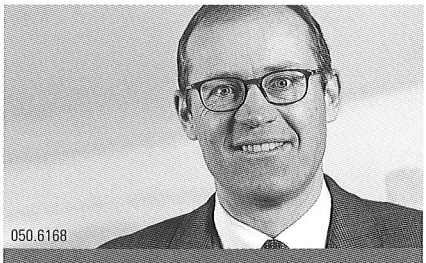
Experienced deep sea divers put their breathing to the test without oxygen. They dive down to a depth of 185 m and stay under water for more than eight minutes – without breathing. Others climb the highest mountains in the world without oxygen and often experience altitude sickness that can cause hallucinations. In extreme situations such as these, our brain does no more than just tick over and the body switches to survival mode.

The breath indicator

Today we have a wide range of measuring tests which document our health: for example ECGs, MRIs and X-rays. Without in any way denying the usefulness of these progressive methods, we should also try to listen to our body's own measuring devices. The simplest and least expensive measuring device that is always available to us is the way we breathe – a very sensitive measuring instrument which, in its own way, notifies us of both short-term and long-term malaise.

Breathing easy

I hope you too take the chance to listen to your breathing as a kind of personal sensor. And at the same time I hope you enjoy many moments of the deep and easy breathing you feel when you are extremely happy. ■



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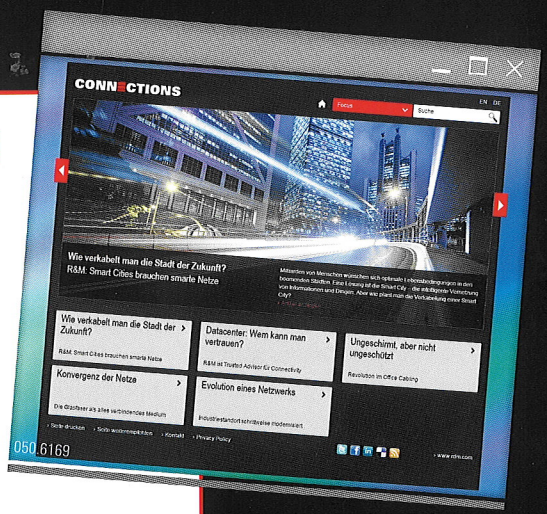

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