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Vectoring – Turbocharger for Data Lines

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**R&M**
Convincing cabling solutions



Increased Performance in the Access Network

The idea is fascinating: Copper can do more. What a stroke of luck for network operators and their customers. A new era in the broadband system.

The reliable twisted pair cabling in the last mile of the access network is in fact suitable for transmitting high frequency signals. Innovative technology boosts the data stream. Vectoring is the process that overcomes the limits of previous xDSL technologies. Downstream data transmission rates of 50 to 100 megabits per second are possible.

Internet services and telecommunication companies can now offer their customers a further evolutionary advance. Additional market potential can also be tapped at many locations. Rising demand justifies investments in outside plant equipment. Network operators can quickly expand the reach of a broadband system to fit existing needs.

An essential prerequisite for vectoring is to expand fiber optic networks up to distributors deployed far forward. They are located in residential areas, on streets, in large buildings or on industrial premises. We designate these arrangements as follows:

- Fiber to the Street (FTTS)
- Fiber to the Curb (FTTC)
- Fiber to the Building (FTTB)

This interface between new fiber-optic infrastructure and existing copper infrastructure is where modular cabling solutions from R&M close every gap in no time at all.

The big challenge is to connect myriad existing copper wires as quickly, reliably and compactly as possible to the optic fibers via an optical-electrical converter (digital subscriber line access multiplexer or DSLAM for short). With the VS Compact system from R&M, mastering this task is a breeze.

Technologies and bandwidths	Network topology
FTTC/copper Vectoring: 50 – 100 Mbit/s	
FTTS/copper Vectoring: 100 Mbit/s G.fast: 200 – 500 Mbit/s	
FTTB/copper Vectoring: >100 Mbit/s G.fast: >500 Mbit/s	
xPON GEAPON: 62 Mbit/s – 1 Gbit/s GPON: Upstream < 2.5 Gbit/s Downstream < 1.2 Gbit/s 10G-EPON: < 210 Gbit/s	
FTTH P2P 100 Mbit/s – 1 Gbit/s	



Innovation for the Last Mile

Achieving a full-coverage system with the best possible broadband offerings is the big goal of the telecommunication industry. The manufacturers of active components are proceeding step by step in their development of higher-performance systems for the Last Mile. In the current era, vectoring is the innovation with the most favorable ratio of capital expenditures to operational expenditures. Further evolutionary steps such as G.fast will draw even more performance out of copper conductors.

Vectoring is an internationally standardized expansion of VDSL2 (ITU-T G.993.5). It allows bit rates to be increased to 100 Mbit/s on all the copper twisted pairs of a cable harness. The vectoring hardware in the outdoor DSLAM and in customer premises equipment (CPE) attenuates far-end crosstalk (FEXT). Digital signal processing can calculate VDSL signal interference and subsequently compensate for it. Complex algorithms and special channel coding are used for actively suppressing interference. The vectoring systems that have been established since 2013 can bridge distances of up to 500 meters.

Vectoring covers all twisted pairs in a cable harness, so the connection rate can be increased. More participants receive more bandwidth and better services. Network operators gain a larger number of satisfied customers.

A major advantage: The copper wires remain in operation from the last distribution point in the access network or from the DSLAM location to the subscribers. This greatly reduces the investment costs for network operators.

A major challenge: The distributors must be converted or replaced, so they can serve as bridges between the copper wires and the optical fibers. A power supply is needed to operate the converters and the active components. The conversion pertains to the countless splitters, splice closures and housings in vertical shafts and on poles, building entry points, mounting bays, etc.



System Solutions – with Added Value

R&M is a complete provider with a consistent system approach to fiber-optic and copper technology. As such, it is also accompanying the network operators into the vectoring era. Our joint task is to supply the customers with reliable and affordable broadband infrastructures.

To this end, R&M provides modular systems that are as easy as can be to install. Drawing on our experience, we jointly plan competitive individual sets of equipment for the distributor sites plus reliable copper connection solutions. They extend the life cycle of established copper infrastructures in access networks and boost earnings.

The distribution and connection technology from R&M is designed to be congruent from the central office to the customer's premises. That means they can be deployed flexibly, seamlessly and intelligently to meet the needs of the given market and site. Users also retain all options when selecting network architectures and expansion strategies. The modularity principle makes the systems easy to scale and open to up-and-coming technologies. In other words, partners invest only in what they really need.

Only the best is good enough for high-performance broadband networks. The passive infrastructure – Layer 1 – has to be absolutely reliable. It must team up uncompromising quality with sturdy construction and simple handling. Its assembly must be efficient, user-friendly and logical... all minimum prerequisites for preventing errors and interruptions in the network from the very outset. The noticeable boost in productivity is just as essential. All these aspects were key to the development of the VS Compact system.

You too can benefit from the added value of high performance R&M products and top quality. Use the advantages of modular designs and place your trust in our experience. Our practical and innovative systems for data and communication networks are of the finest quality. We have been selling them successfully for 50 years as a consistent and independent supplier.

— Fiber
— Copper

Get More

More efficiency

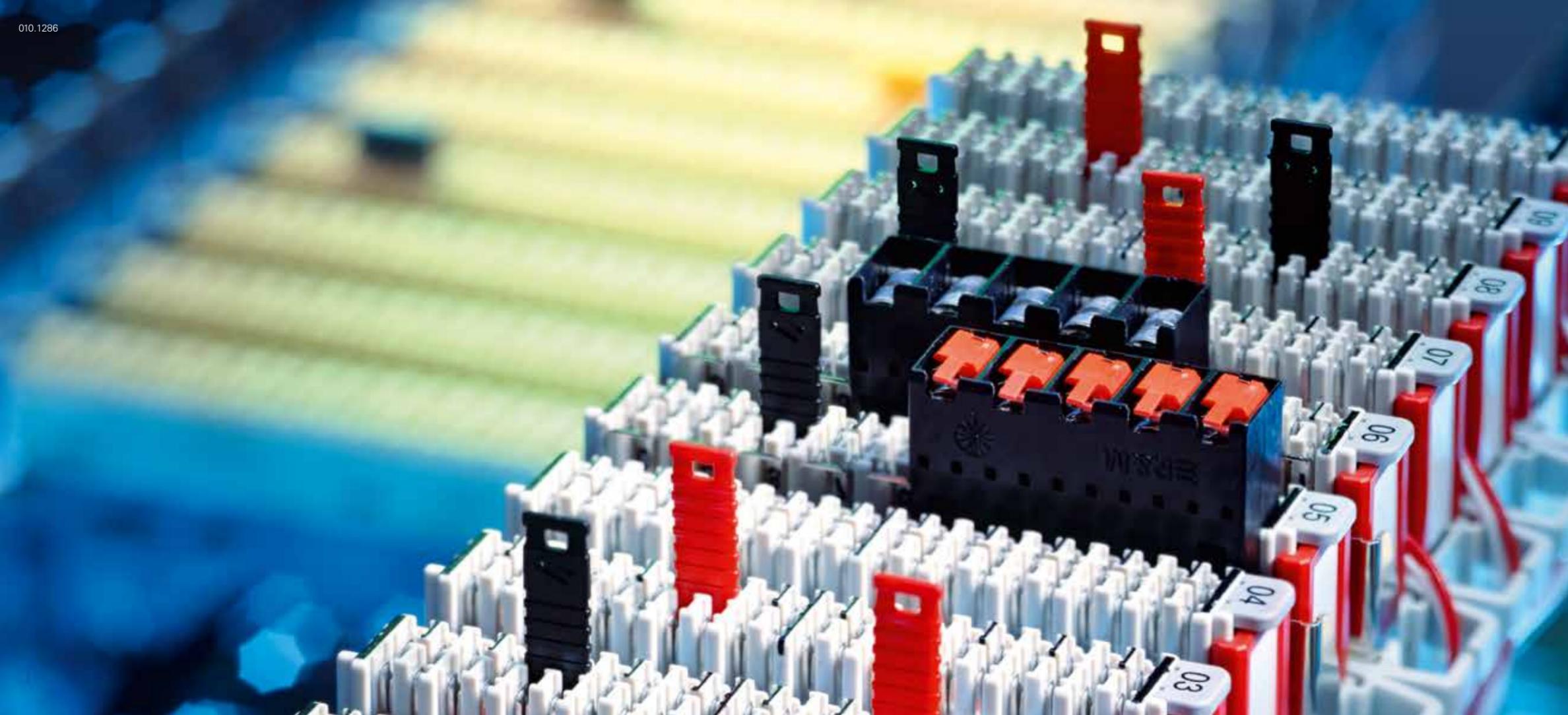
- Higher packing density for smaller distributors
- Fast to install, easy to expand
- Testing and maintenance involving no interruptions

More profitability

- Use of existing infrastructures
- Inexpensive to upgrade bandwidth
- Compatible with systems from other companies

More security

- Reliable copper connection solution
- Stable contacting for the long term
- High quality overvoltage protection



Modular Connectivity Technology

It is important for network operators that the roll-out of vectoring systems succeeds effortlessly. The conversion of the distributors to hybrid technology must be able to be done as efficiently as possible and not involve protracted network interruptions. Installation in the field and connection or reconnection of the existing copper twisted pairs must be able to be carried out in a time-saving, convenient and flawless manner. Further requirements: Minimal space requirements, easy to retrofit, high level of reliability. The products from R&M meet these needs and offer further advantages for network operators.

The system solution: VS Compact

VS Compact is a connection system from R&M suitable for use as a universal platform for successfully launching the vectoring era. The core component is the VS Compact connection module, which has proven itself millions of times in actual practice. R&M supplies models for 8 to 25 twisted pairs.

Beyond that, the modular VS Compact range also consists of:

- Protection magazines and protection plugs
- xDSL network components
- Housings for outdoor and indoor distributors
- Distribution frames, patch panels, mounting profiles and Inserts for 19" racks.

With this portfolio, distributors can be easily set up, converted and expanded in accordance with the modular principle in an individual way suitable to each location. In addition, VS Compact can be integrated in any non-R&M systems as well. It satisfies the pertinent international and national standards and is compatible with the in-house standards of the network operators.

Solutions for fiber optic termination and the transition from the fiber optic side to the copper side are part of this program. R&M has also developed a remote powering solution for distributors in the field.

Get More

- Ingenious quick mounting technology
- Unsurpassed packing density
- Highest quality of transmission
- Easiest integration of splitters
- Easy changeover to hybrid technology
- Modular design for easy retrofit or extension



High Packing Density – Excellent Protection

VS Compact connection modules from R&M are ideal for fast, reliable wiring of twisted pairs and for the administration of subscribers. The modules can be installed in no time in housings, distribution frames, adapters and mounting profiles.

The range consists of modules for 8, 10, 16, 20 and 25 twisted pairs (TPs). This scaling is akin to the outputs of most line cards, which simplifies the assignment of conductors.

The packing density of 4200 TPs/m² is unsurpassed internationally. It is about 30% higher than the figures for comparable conventional modules. The grid sizes of VS Compact modules: 17.5 or 20 and 25 mm. Even more compact is the VS Slim module for 10TPs with a grid size of 10 mm. This model allows the packing density to be doubled yet again compared to the standard module. It is especially suitable for cross connect projects and is easy to integrate in existing holders.

Quick and convenient handling. This also holds true for control, protection and safety measures for the VS Compact copper connection system from R&M.

Interfaces for quick, interruption-free measurement or jumpering of conductors are located on the front side for easy access. This simplifies servicing and testing. High-performance protection equipment can also be inserted in the front, an approach that saves space and protects against vibration.

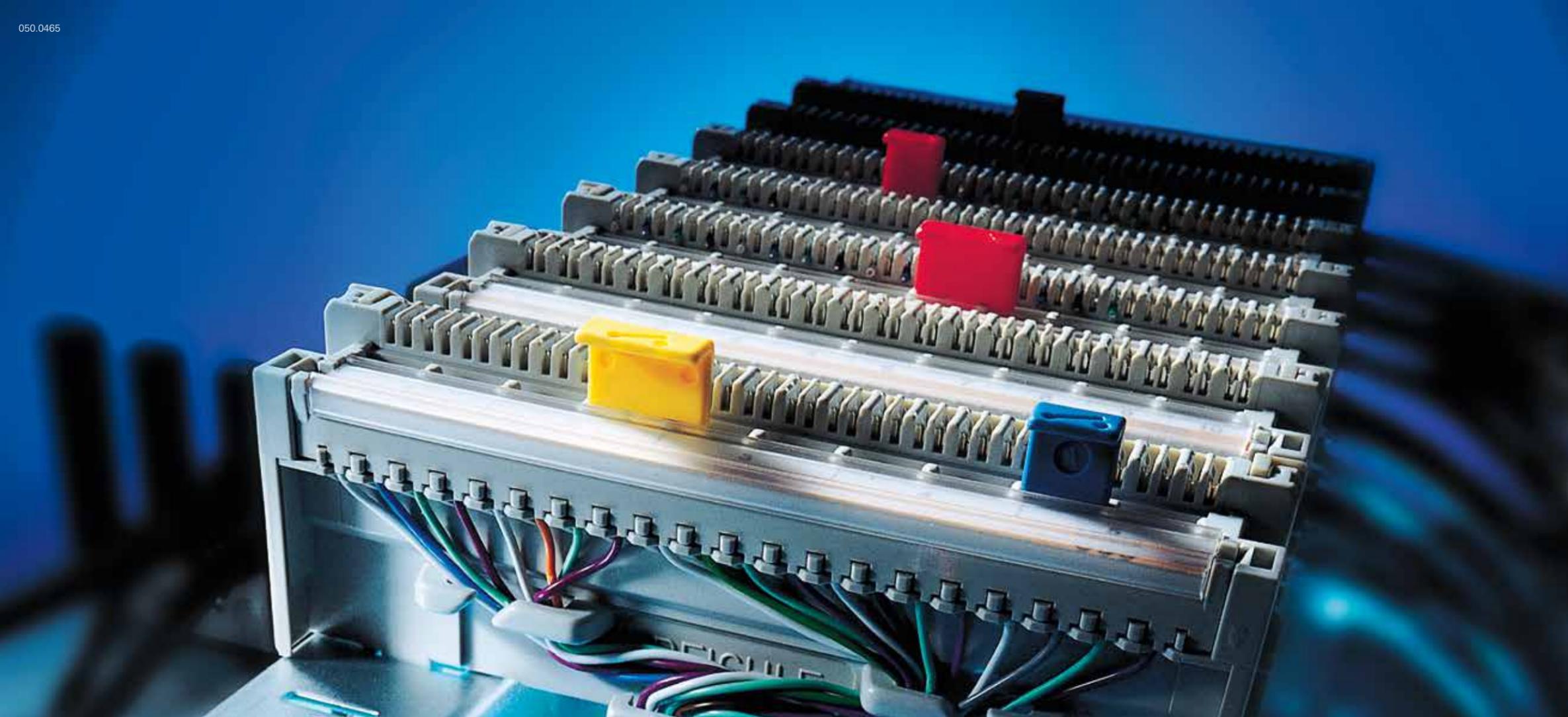
R&M offers the handy primary protection magazine in sizes for 1 and for 5TP contacts. They are delivered equipped or not equipped. This allows network operators also to implement specific requirements. As standard equipment, R&M uses high-quality three-electrode arresters that can be changed in a flash.

The advantage is that the interface for overvoltage protection is on the cable side. As a result, overvoltages are prevented in the disconnection contact. The protection equipment stays plugged-in during maintenance procedures. That saves time, protects against errors and facilitates monitoring.

All housings and components for copper cabling are suitable for decades of use in outside plants. The housings developed by R&M are climate-proof and lockable as well as being resistant to shock and UV radiation. They protect the connections reliably against penetration of dust and splashing water. R&M ensures compliance with the requirements of IP protection index 54.

Get More

- Up to 30% higher density
- Fast and easy handling
- Reliable and protected connections
- Easy maintenance



Cutting Costs with Remote Powering

Vectoring requires active equipment standing outside in the field or at the subscribers' premises. The vectoring converters are operated with up to 40 W. How is this equipment provided with power? Is a non-interruptible power supply assured on site?

One alternative to a conventional voltage supply is remote power feeding. Network operators can use existing copper wires for supplying power. R&M has a simple solution to implement this idea and calls it "Remote Power Feeding." Distributor systems are fitted with special modules that conduct power to the existing copper wires of the phone network, thereby supplying the active equipment with electricity. The connection modules from the VS standard range are produced as orange components for these applications, so every technician knows one thing immediately that electricity is flowing here.

The outputs for the remote power units at the subscriber's premises can be switched from the main distributor to the subscriber side if need be. The power feed to the devices can be disconnected individually if work is being done on the system. All necessary safety features have thus been integrated to enable Remote Power Feeding to be operated hazard-free.

Another important link in the chain is the fiber optic termination for the active equipment in the distributor. Two crucial requirements for efficient installation are a small footprint and ease of integration in existing housings. The solution from R&M is the compact fiber optic termination from the Venus FML.

It has the advantage of an extremely compact design that combines multiple functions in a single component:

- Incoming cable fixed in place
- Storage at rear for excess lengths of loose tubes
- Splice area for up to 12 fibers
- Adapter panel for reliable, simple connection of the active equipment.

A cover protects the adapters, pigtails and splices from dust, splashing water and mechanical loads. The click-in fastener simplifies the installation of the cover. It can be sealed at two points to boost protection against tampering.

Get More

- Remote Power Feeding ready
- Orange connection module for increased safety and easy identification
- Compact fiber termination kit makes it easier to upgrade existing copper infrastructure

