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DELTA Hybrid Repeater

Hybrid Repeater with Multi Diode Receiver

A new concept for DOCSIS 3.1 based FTTx networks

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What is a suitable migration path for future-oriented DOCSIS 3.1 networks?

In order to plan future and future-proof networks between the headend (Point of Termination, PoT) and the customer's home, a migration path is necessary at the DOCSIS 3.1 network level, which directly and cost-effectively connects customers to fiber optics without overbuild the coaxial footprint of cable network operators.

In the short and medium term, the existing coaxial (HFC networks) networks will continue to exist, but the not inconsiderable investments of the cable network operators in the existing networks will only be seen as an intermediate step towards a 100% fiber-optic expansion and the replacement of the coaxial networks. Today's investments in infrastructure and technology are designed in such a way that a subsequent conversion to optical fiber will be possible without great effort.

Today, we differentiate between the "Greenfields", which are the future new optical FTTx networks (see *figure 1*). There, data transmission can be easily realized via optical fiber and with the optical components designed for this purpose at the PoP (Point of Presence).

In contrast to this, we speak of the "Brownfields", the optical FTTx networks, which are connected to the existing HFC network. These areas with fiber optics can be connected to the existing coaxial network via electro-optical components.

In the course of the long-term reconfiguration of the HFC network in favor of an optical network, it is in the interest of cable network operators that the components of the "Brownfields" can be converted to optical/optical transmission and thus a purely optical network can be realized in perspective.

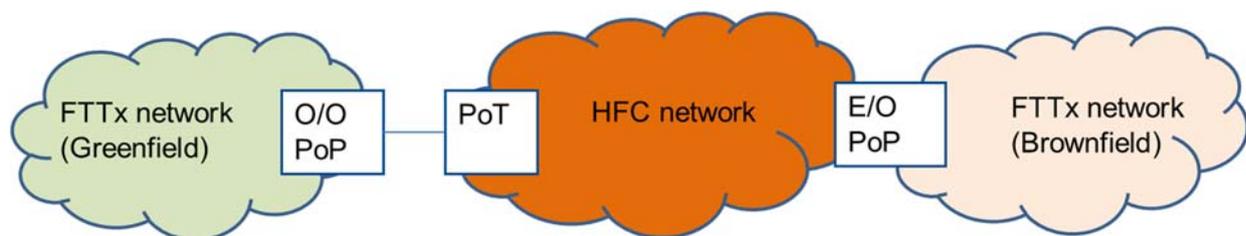


Figure 1: Scheme HFC – FTTx network

Development of a Hybrid Repeater with multi-diode receiver

With the market introduction of a Hybrid Repeater, DELTA Electronics is closing a gap in the product portfolio in which an active optical (O/O) and electro-optical (E/O) repeater has not yet been found in an outdoor housing.

With the Hybrid Repeater and the integration of a Multi Diode Receiver (MDR) into a compact die-cast housing of protection class IP65, DELTA Electronics aims at markets and installation situations where no laboratory or headend ambience is provided, e.g. for installations on masts, for installation in a street cabinet or in the basement of multi-family house complexes.

The Multi Diode Receiver (MDR) in which the entire fiber management is integrated has been completely new designed and can be clicked into the IP65 housing. According to the application, the appropriate MDR can be selected with 2, 4, 8 or 16 optical inputs so that up to 128 nodes or apartments can be connected to a Hybrid Repeater.



Hybrid Repeater in IP 65 class housing

- Designed for outdoor use
- IP class IP65
- Increase of CNR
- OBI is completely avoided
- Size 260 x 215 x 120 mm



Multi Diode Receiver (MDR)

- New design of fiber management box
- Plugable in IP65 housing
- Up to 16 optical ports
- Size 145 x 100 x 55 mm

Figure 2: IP65 housing and MDR

The Hybrid Repeater – a smart solution for different applications

The Hybrid Repeater is designed for a wide variety of applications and can be upgraded to future optical/optical networks.

The O-MISO (Optical-Multiple Input Single Output) from DELTA Electronics has been the starting point for the new development: an active optical repeater for signal splitting and signal processing in optical/optical networks. The consequent further development consisted in making this already very successful product in the 1 RU format also usable for outdoor use.

The Hybrid Repeater (E/O) was designed to upgrade the networks in the "Brownfields" mentioned above (see *figure 1*). As an active electro-optical repeater, it provides the signal splitting and processing in electro-optical networks (see *figure 3*).

Thus, successive line and distribution network amplifiers can be replaced in Hybrid-Fiber-Coax (HFC) networks and their number in the networks can be reduced by optical repeater which have a lower attenuation.

With the broadband expansion and expansion of the fiber optic network, the HFC networks will be smaller in the future. This circumstance is taken into account with the Hybrid Repeater (E/O) insofar as this device can easily be retrofitted to a Hybrid Repeater (O/O) and thus can continue to be used in optical/optical networks.

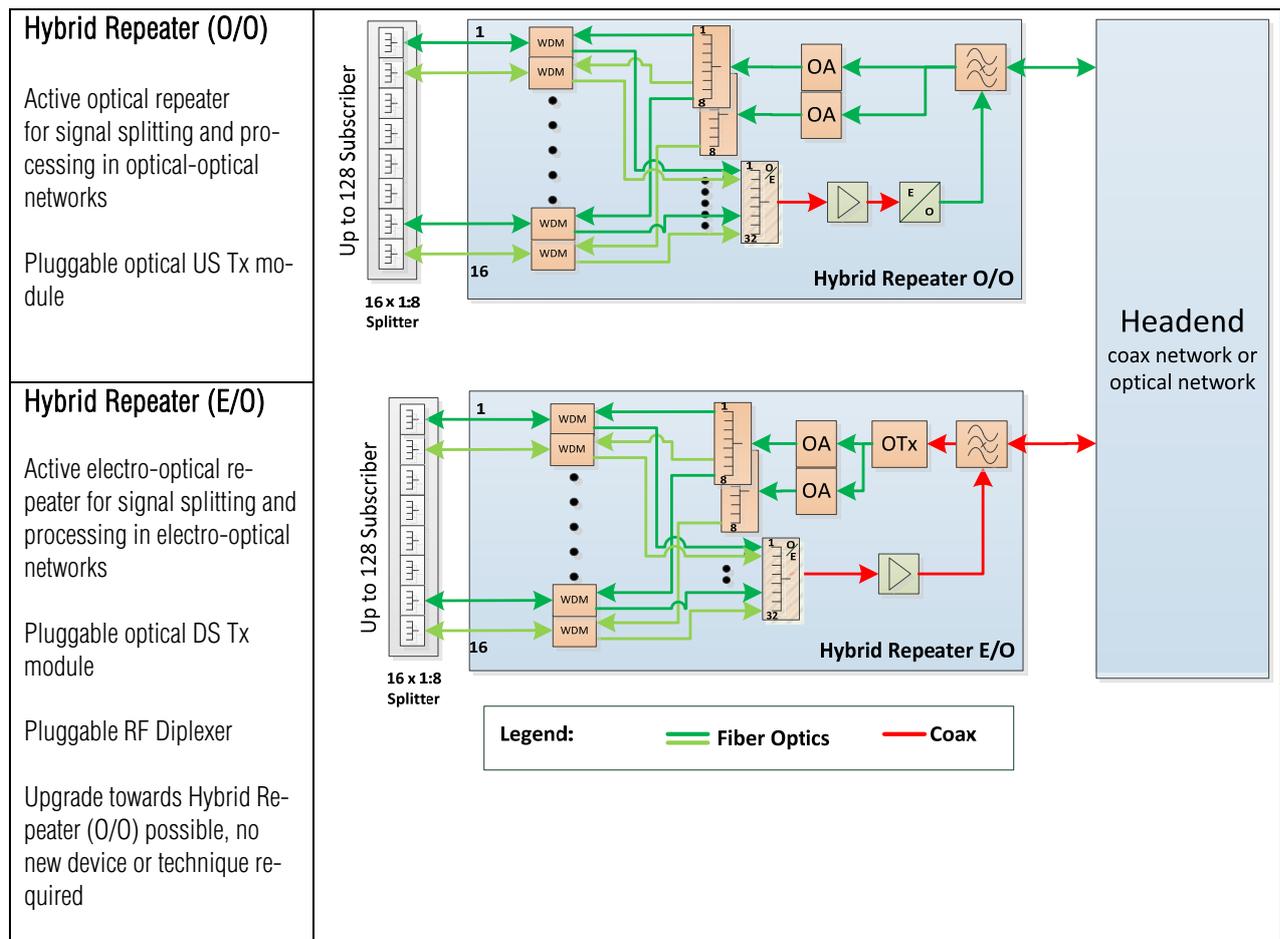


Figure 3: Hybrid Repeater (O/O) and Hybrid Repeater (E/O)

Innovative and flexible design reduces the installations efforts

In order for products to become "smart", flexible designs and concepts are necessary, which also pay off for the customers.

This has been perfectly implemented at the Hybrid Repeater - be it with the design of the housing and the MDR box or with regard to the service and maintenance-friendliness in the field.

The fibers are connected to the MDR box via LC / APC connectors. The pluggable MDR can be exchanged easily in the case of an upgrade or service. This naturally leads to a considerable reduction in service times in the event of an upgrade due to the possibility of a complete exchange.

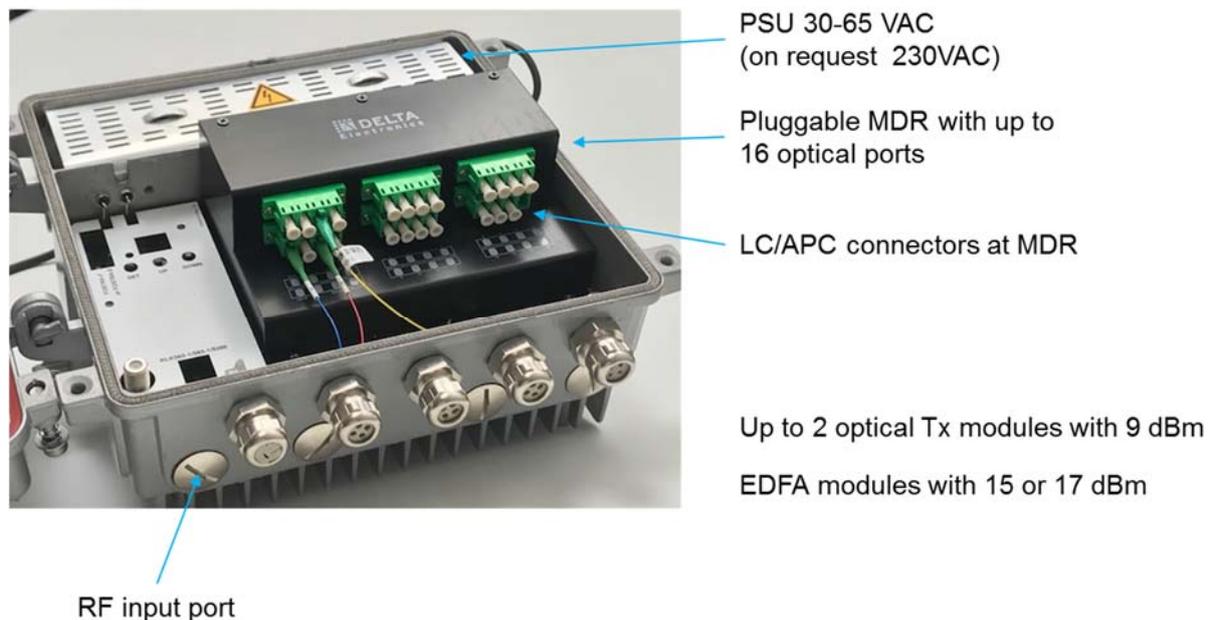


Figure 4: Structure of a Hybrid Repeater

Up to two pluggable optical downstream (DS) modules with an optical output power of 9 dBm per transmitter increase the optical DS budget and enable the connection of up to 32 nodes without EDFA modules. This allows a very cost-effective network design to be realized.

For the connection of up to 128 nodes, up to two EDFA modules can be used, optionally with 15 or 17 dBm optical output power.

Application Examples

Network upgrade to 1.2 GHz – Hybrid Repeater E/O instead of RF amplifier cascades

In general line and distribution amplifiers are used in a cascaded manner to supply certain parts of residential areas. Since more and more networks are upgraded to 1.2 GHz, to offer additional bandwidth, existing RF components like amplifiers / passives must be replaced.

But instead of investing in 1.2 GHz capable RF components why not switching to a solution based on DELTA's Hybrid Repeater E/O? It would not only be an investment in future driven equipment, but will immediately extend the coverage range supplied by one POP, due to the usage of fiber optics (see *figure 5*).

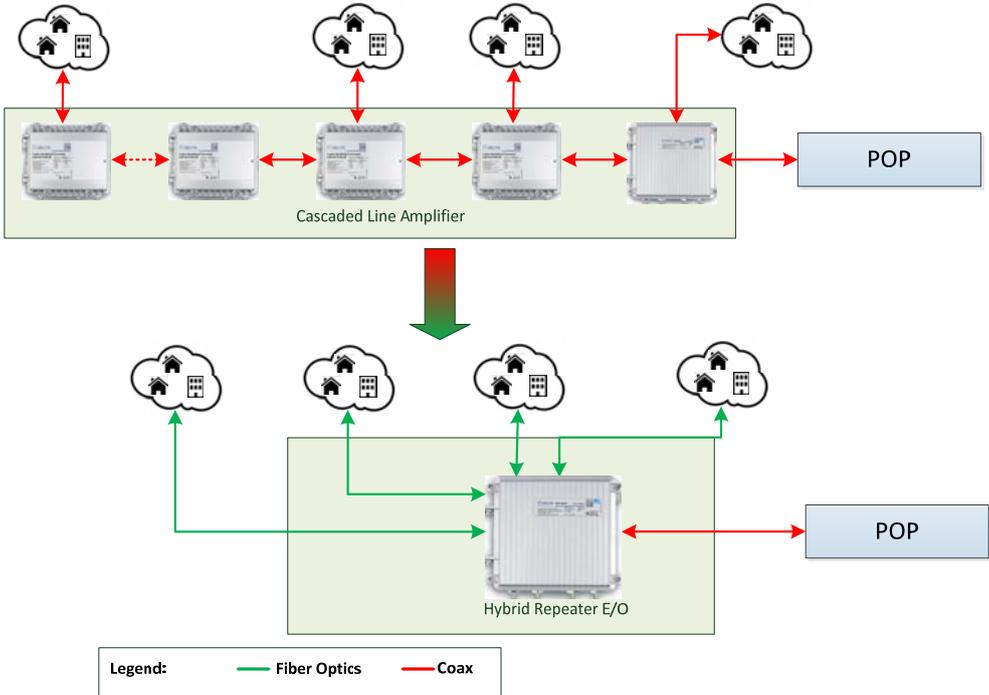


Figure 5: Hybrid Repeater E/O instead of cascaded RF amplifiers

Same applies to Greenfields, thus the Hybrid Repeater (E/O) can be used everywhere where extensions are scheduled and existing POP consists of coax based equipment, as shown in following example.

Connecting a Greenfield

Instead of extending the network by coax based RF technology a Hybrid Repeater E/O will be used to provide subscribers with high speed internet access and CATV as well.

Figure 6 shows corresponding level diagram. POP x feeds the Hybrid Repeater E/O by e.g. 30 analogue and 80 digital channels or full digital channel load, each carrier in a range of 70 – 80 dBµV. Due to the integrated 1:16 splitter and the external 1:4 splitter the signal will be attenuated by roughly 21 dB. To compensate this attenuation an internal EDFA (output power = 17 dBm) will be used, which results in approx. -4 to -5 dBm input power at the optical node, certainly depending on the distance between Hybrid Repeater E/O and optical node.

On the upstream side the optical node transmits with about +3 dBm, thus the input power at the Hybrid Repeater E/O is approx. -5 to -6 dBm. On its output there are 70 to 95 dB μ V/carrier available.

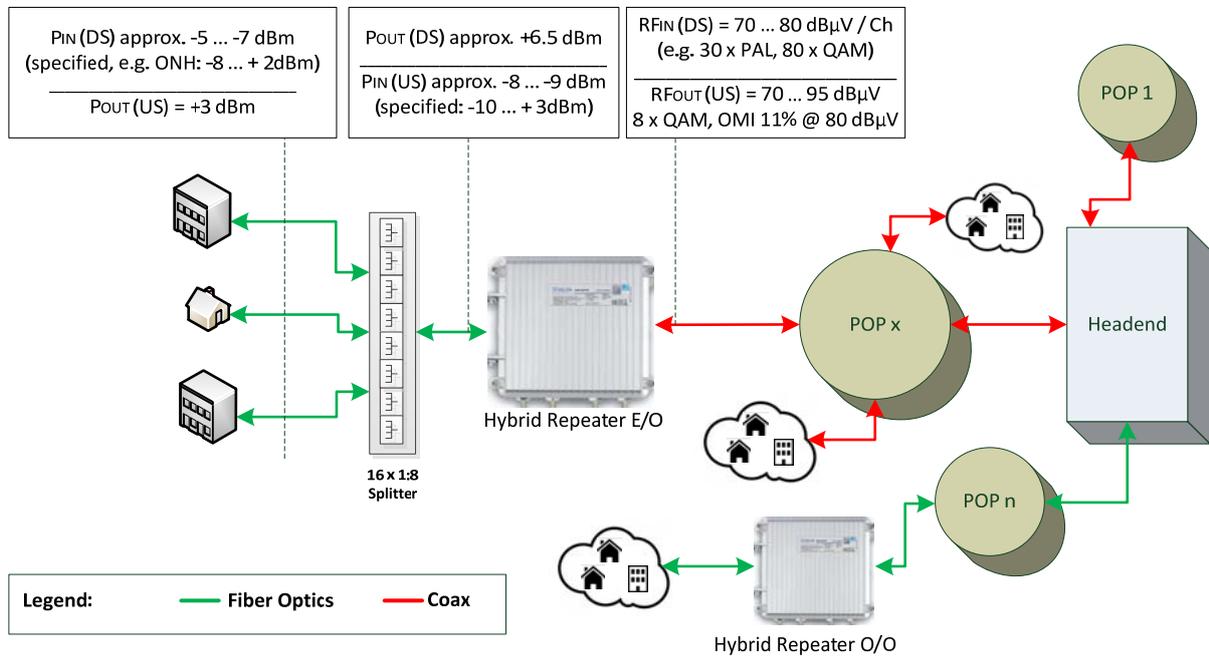


Figure 6 – Connecting a Greenfield via Hybrid Repeater E/O

Resume

With its new concept for DOCSIS 3.1 based FTTx networks and the launch of the Hybrid Repeater with multi-diode receivers (MDR), DELTA Electronics is precisely targeting the future requirements of the market and cable network operators.

With the Hybrid Repeater (O/O) the "Greenfields" as well as with the Hybrid Repeater (E/O) the "Brownfields" can be retrofitted for broadband expansion.

The modular design and configuration possibilities of the Hybrid Repeater with interchangeable components are based on the respective application. This opens up the possibility to equip the devices for future applications, thus minimizing investment in the long term.

Not unimportant costs and times for installation, upgrades and conversions can be reduced by intelligent designs. This is especially true for the MDR Box as a replacement component that minimizes installations, upgrade and service times.

With its Hybrid Repeaters, DELTA Electronics has launched technically very sophisticated and well-engineered products, which convince through smart design and high flexibility. The products of DELTA Electronics are developed and produced in Germany in order to ensure the highest product quality and delivery flexibility.

In addition, DELTA Electronics also offers support to plan and analyze networks, and thus ideally support cable network operators to prepare for the future of DOCSIS 3.1.