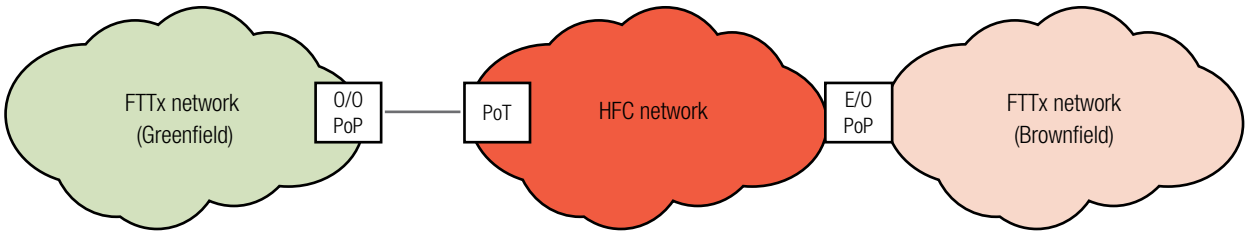

# The new DELTA Hybrid Repeater

The first active and outdoor-capable Hybrid Repeater used in electro-optical networks designed for easy upgrade to optical-optical networks.

DELTA Electronics

# THE DELTA HYBRID REPEATER
## for future oriented DOCSIS 3.1 networks

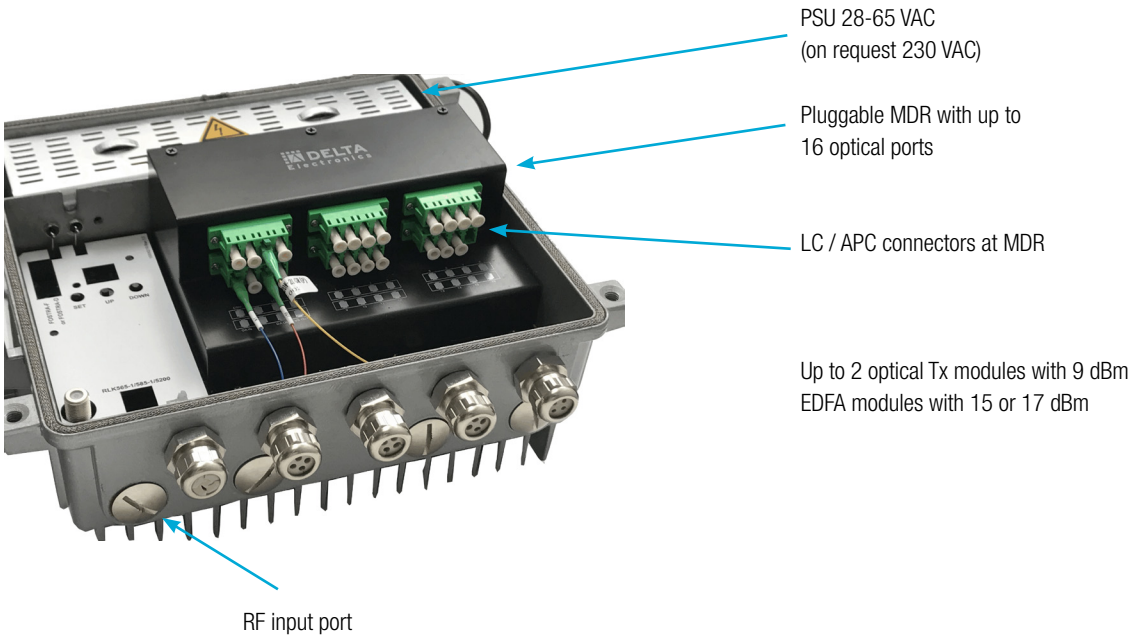
The DELTA Hybrid Repeater ensures a suitable migration path and cost-effectively connection of customers to fiber optics without overbuilding the coaxial footprint of cable network operators.




**The DELTA Hybrid Repeater:**

- Connects optical FTTx networks (Greenfields / Brownfields) to existing coaxial HFC networks cost-effectively
- Extends range of deployed FTTx networks
- Provides a suitable migration path towards 100% fiber-optic expansion

**Innovative and fexible design reduces installation efforts**




**The DELTA Hybrid Repeater:**

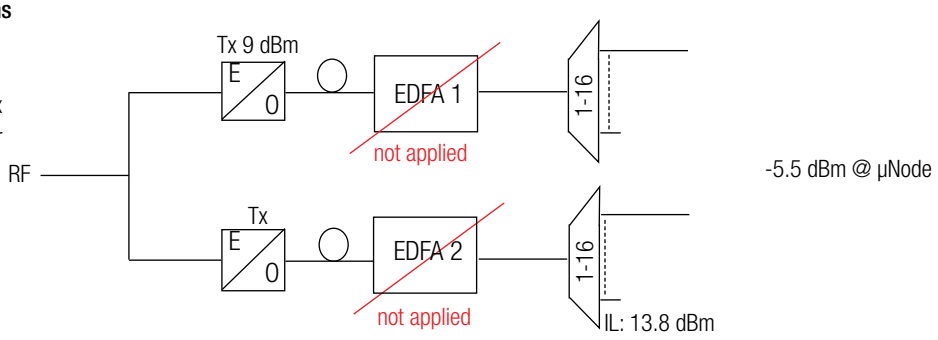
- Easily exchange of MDR box in case of upgrade or service
- Reduction of service times and user-friendly

# THE DELTA HYBRID REPEATER

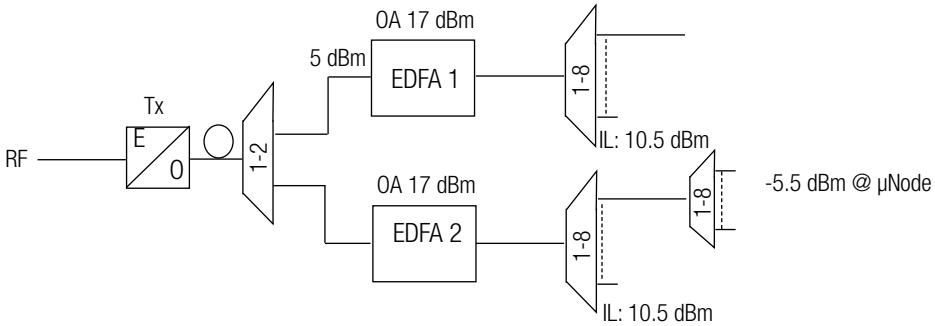
## for future oriented DOCSIS 3.1 networks

**Various settings fitting various applications**

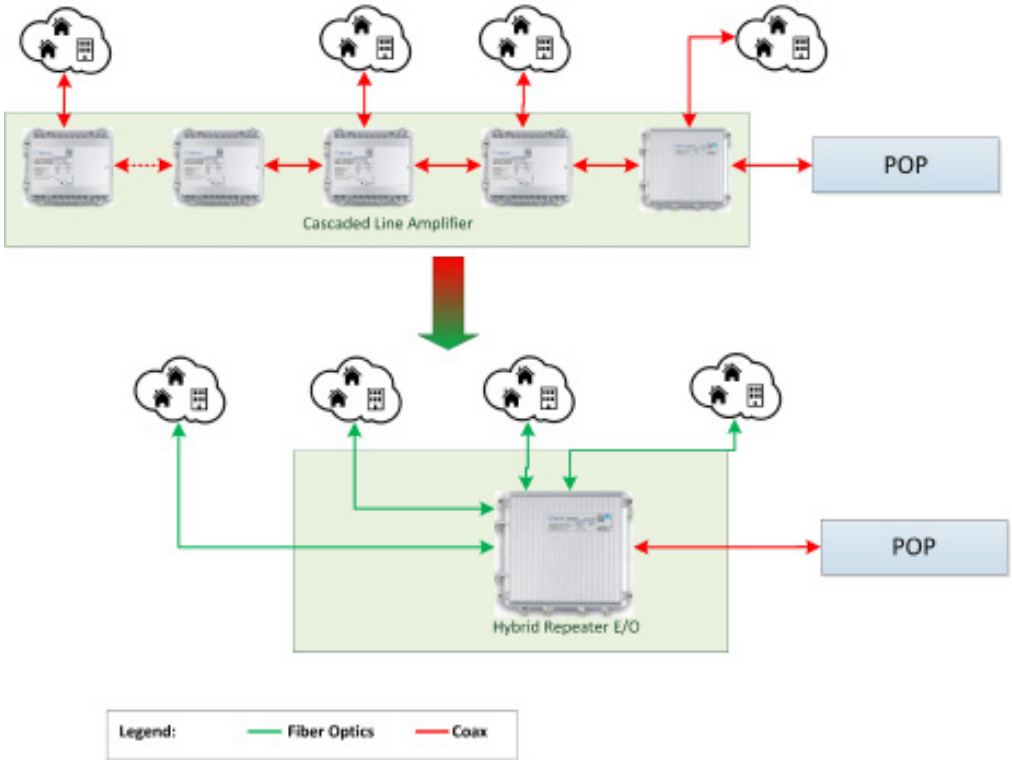
- Pluggable optical DS module with 1 or 2 Tx
- 9 dBm optical output power per transmitter
- Increasing optical DS budget by 3.7 dB
- Up to **32** nodes **without** EDFA module
- Cost-efficient design




- Up to 2 pluggable EDFA modules
- Optical output power 15 or 17 dBm
- Power consumption per module 2.3 W
- Up to 64 nodes per EDFA module
- In total up to 128 nodes




**Application example: Hybrid Repeater in Brownfield**




**The DELTA Hybrid Repeater:**

- Replaces cascaded line amplifiers
- Increases range of PoP through fiber optics
- Reduces number of optical repeater with lower attenuation

# THE DELTA HYBRID REPEATER

## for future oriented DOCSIS 3.1 networks

**Housing IP 65 plus MDR**

**Compact die-cast housing**

- Safety class IP65
- Designed for outdoor applications
- Size 260 x 215 x 120 mm
- Avoids OBI totally
- Increase of CNR

**Multi Diode Receiver (MDR)**

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

**General features**

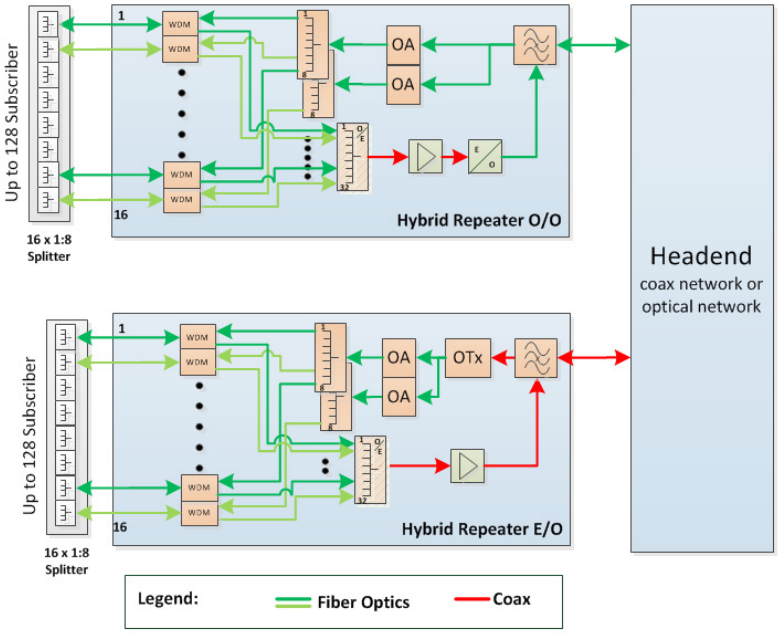
- 2,4,8, or 16 optical entry ports
- High gain or standard gain version selectable
- Enables connection of up to 128 nodes/apartments
- Downstream: XFP EDFA module with 15/17 dBm optional

**Hybrid Repeater (O/O)**

- Active optical repeater for signal splitting and processing in optical - optical networks
- Pluggable optical US Tx module

**Hybrid Repeater (E/O)**

- Active electro-optical repeater for signal splitting and processing in electro - optical networks
- Pluggable optical DS Tx module
- Pluggable RF diplexer
- Upgrade towards Hybrid Repeater (O/O) possible, no new device or technique required



OHR [xx] - [xx] - [x] - [OA xx] - [R] - [x]

| Split factor | Optical transmitter module | Fiber connector | Optical Amplifier | Powering | Monitoring |
|---|---|---|---|---|---|
| 2; 4; 8 or 16 | Upstream module (O-MISO):<br>61: 1610 nm<br>47: 1470 nm<br>51: 1510 nm<br>59: 1590 nm<br><br>Downstream module (Inverted node):<br>RF: 1x Tx on 1550 nm<br>RF2: 2x Tx on 1550 nm | S: Single patch cable<br>M: MPO plug | OA 15: 1x EDFA 15 dBm<br>OA 17: 1x EDFA 17 dBm<br>OA 25: 2x EDFA 15 dBm<br>OA 27: 2x EDFA 17 dBm | - : Local powering<br>R: Remote powering | -: FOSTRA-F prepared<br>FOSTRA: FOSTRA F integrated |

| Type | Item No. | Description |
|---|---|---|
| OHR 2-61-S-R | 57003515 | Optical Hybrid Repeater O/O, Tx. 1610nm, FOSTRA-F prepared |
| OHR 4-47-M-OA15-R | 57003581 | Optical Hybrid Repeater O/O, Tx. 1470nm, MPO plug, FOSTRA-F prepared, EDFA 15dBm |
| OHR 4-51-M-OA15-R | 57003580 | Optical Hybrid Repeater O/O, Tx. 1510nm, MPO plug, FOSTRA-F prepared, EDFA 15dBm |
| OHR 4-59-M-OA15-R | 57003579 | Optical Hybrid Repeater O/O, Tx. 1590nm, MPO plug, FOSTRA-F prepared, EDFA 15dBm |
| OHR 4-61-M-OA15-R | 57003576 | Optical Hybrid Repeater O/O, Tx. 1610nm, MPO plug, FOSTRA-F prepared, EDFA 15dBm |
| OHR 4-61-S-OA15-R | 57003516 | Optical Hybrid Repeater O/O, Tx. 1610nm, FOSTRA-F prepared, EDFA 15dBm |
| OHR 8-47-M-OA17-R | 57003584 | Optical Hybrid Repeater O/O, Tx. 1470nm, MPO plug, FOSTRA-F prepared, EDFA 17dBm |
| OHR 8-51-M-OA17-R | 57003583 | Optical Hybrid Repeater O/O, Tx. 1510nm, MPO plug, FOSTRA-F prepared, EDFA 17dBm |
| OHR 8-59-M-OA17-R | 57003582 | Optical Hybrid Repeater O/O, Tx. 1590nm, MPO plug, FOSTRA-F prepared, EDFA 17dBm |
| OHR 8-61-M-OA17-R | 57003577 | Optical Hybrid Repeater O/O, Tx. 1610nm, MPO plug, FOSTRA-F prepared, EDFA 17dBm |
| OHR 8-61-S-OA17-R | 57003517 | Optical Hybrid Repeater O/O, Tx. 1610nm, FOSTRA-F prepared, EDFA 17dBm |
| OHR 16-61-S-OA17-R | 57003390 | Optical Hybrid Repeater O/O, Tx. 1610nm, FOSTRA-F prepared, EDFA 17dBm |
| OHR 2-61-S | 57003661 | Optical Hybrid Repeater O/O, Tx 1610nm, FOSTRA-F prepared, local powered |
| OHR 16-61-S | 57003658 | Optical Hybrid Repeater O/O, Tx 1610nm, FOSTRA-F prepared, local powered |
| OHR 16-61-S-OA 17 | 57003660 | Optical Hybrid Repeater O/O, Tx 1610nm, FOSTRA-F prepared, EDFA 17dBm, local powered |
| OHR 2-RF-S-R | 57003563 | Optical Hybrid Repeater O/E, RF input level 70-80 dbµV, FOSTRA-F prepared |
| OHR 4-RF-S-R | 57003533 | Optical Hybrid Repeater O/E, RF input level 70-80 dbµV, FOSTRA-F prepared |
| OHR 8-RF-S-R | 57003518 | Optical Hybrid Repeater O/E, RF input level 70-80 dbµV, FOSTRA-F prepared |
| OHR 16-RF-S-R | 57003564 | Optical Hybrid Repeater O/E, RF input level 70-80 dbµV, FOSTRA-F prepared |
| OHR 8-RF-S | 57003662 | Optical Hybrid Repeater O/E, RF input level 70-80 dbµV, FOSTRA-F prepared, local powered |
| OHR 16-RF-S | 57003659 | Optical Hybrid Repeater O/E, RF input level 70-80 dbµV, FOSTRA-F prepared, local powered |

# THE DELTA HYBRID REPEATER (O/O)

## Electrical and general data

| Type | | min. | typ. | max. | Remarks |
|---|---|---|---|---|---|
| Operating Voltage by remote feeding | V ~ | 28 | | 65 | 230 V on request |
| Power consumption | W | | | | Without EDFA |
| OHR 1x4 Splitter | | | 4.5 | | |
| OHR 1x8 Splitter | | | 5 | | |
| OHR 1x16 Splitter | | | 6.3 | | |
| Protection Class | | | II | | direct feeding |
| Operating voltage, internal | V DC | | 9 | | NVD housing |
| Indication Power ON | | | LED, green | | |
| Operating temperature | °C | -20 | | +55 | |
| IP Klasse | | | IP 65 | | |
| Dimensions B x H x T | mm | | 260 x 215 x 120 | | |
| Weight | kg | | 3.5 | | |
| Fiber Connector | | | LC/APC | | |
| RF Connectors | | | F-female | | |
| Conformity | | | CE | | |

## TECHNICAL DATA - DOWNSTREAM AND UPSTREAM

| Downstream transparent | | min. | typ. | max. | Remarks |
|---|---|---|---|---|---|
| Optical wavelength | nm | 1540<br>1530 | 1550 | 1560<br>1570 | Standard λ DS<br>Extended λ DS |
| Integrated WDM Filter 1550 nm/CWDM | | | Yes | | |
| Attentuator DS passive splitter | dB | | | | |
| OHR 1x4 | | | 8.0 | 8.5 | |
| OHR 1x8 | | | 11.0 | 11.5 | |
| OHR 1x16 | | | 14.0 | 14.5 | |
| Optical Input Power | dBm | | | 22 | |
| Optical Input Return loss DS | dB | 45 | | | |
| with FOSTRA-F: Optical Receiver Diode Type | | | PIN | | |
| with FOSTRA-F: Decoupling Attentuation | dB | | 0.3 | 0.5 | |
| with EDFA: Optical Input Power Range | dBm | 0 | +3 | +6 | |
| with EDFA: Optical Output Power (total) | dBm | 15 | | 17 | |
| with EDFA: Power consumption | W | | 2.5 | 3.0 | |

| Upstream Active Combiner | | min. | typ. | max. | Remarks |
|---|---|---|---|---|---|
| Input: Optical Receiver Diode Type | | | PIN | | |
| Input: Optical Input Wavelength | nm | 1240 | | 1620 | Standard without λ 1540 - 1560<br>Extended without λ 1530 - 1570 |
| Input: Optical Input Power Standard gain | dBm | -3 | | +3 | high gain selectable |
| Input: Optical Input Return Loss US | dB | 45 | | | |
| Output: Optical Transmitter Diode Type | | | DFB | | Laser Class 1 |
| Output: Optical Output Wavelength | nm | 1605 | 1610 | 1615 | 18 CWDM λ available |
| Output: Optical Output Power | dBm | | +6 | | |
| Output: Laser turn-on time | nsec | | CW | | continuous mode |
| Transmission Characteristic: Frequency range | MHz | 12 | - | 204 | for DOCSIS 3.1 |
| Transmission Characteristic: Flatness (at one input) | dB | | ±0.5 | ±0.75 | |
| Transmission Characteristic: Level Drift between Inputs | dB | | ±0.75 | ±1.0 | |
| Transmission Characteristic: Testpoint for OMI control | dBµV | 75 | | 82 | 75dBµV ≙ 6% OMI<br>82dBµV ≙ 15% OMI |
| Transmission Characteristic: Optical input dynamic range, adjustable with Micro-Controller | | | | | |

# THE DELTA HYBRID REPEATER (E/O)

## Electrical and general data

| Typ | | min. | typ. | max. | Remarks |
|---|---|---|---|---|---|
| Operating voltage | V ~ | 28 | | 65 | remote feeding<br>230 V on request |
| Power consumption | W | | 10 | 10.5 | |
| Length of Power Cable | m | 1.3 | 1.5 | | |
| Mains plug | | | Euro | | |
| Protection class | | | II | | direct feeding |
| Operating voltage, internal | V DC | | 9 | | |
| Indication Power ON | | | LED, green | | |
| Operating temperature | °C | -20 | | +55 | |
| IP Class | | | IP 65 | | |
| Dimensions B x H x T | mm | | 260 x 215 x 120 | | NVD housing |
| Weight | kg | | 3.5 | | |
| Fiber connector | | | LC/APC | | |
| RF connector | | | F-female (PG 11 in housing) | | |
| Conformity | | | CE | | |

## TECHNICAL DATA - DOWNSTREAM AND UPSTREAM

| Downstream | | | Value | Remarks |
|---|---|---|---|---|
| HF Features | RF Bandwidth | MHz | 85 ... 1218 | RF Attentuator 10 dB |
| | RF Input Level | dBµV | 70 ... 80 | |
| | RF Flatness | dB | +/- 1.5 | |
| | Cablesimulator | dB | 0 ... 16 | |
| | Return loss | dB | >18 | |
| | CSO/CTB | dB | >60 | |
| | Link Noise Figure | dB | <20 | |
| | RF Input Connection | | Standard F-Connector, 75 Ω | |
| | RF Test point | | available for each Tx module | |
| Optical Features | Optical Wavelength | nm | 1550 | |
| | Type of modulation | | direct | |
| | Optical Output Power, only Tx | dBm | 9 | 4 dBm integrated |
| | Attentuator DS passive splitter | | | |
| | 1x2 | dB max. | 3.7 | |
| | 1x4 | dB max. | 8.5 | |
| | 1x8 | dB max. | 11.5 | |
| | 1x16 | dB max. | 14.5 | |
| with EDFA | Optical Input Power Range | dBm | +7 ... 0 | depends on EDFA module |
| | Optical Output Power | dB | 15.0 | |
| | Power consumption | W | 2.5 | |

| Upstream | | min. | typ. | max. | Remarks |
|---|---|---|---|---|---|
| Optical Input wavelength | nm | 1260 | | 1620 | without λ 1540 - 1560<br>MDR with standard<br>or extended filter |
| Optical Input Power Standard gain | dBm | -3 | | +3 | high gain -10...-4 dBm selctable |
| Optical Input Return loss US | dB | 45 | | | |
| Optical Receiver Diode type | | | PIN | | |
| Frequency range | MHz | 12 | - | 204 | depends on plugged diplexer |
| Flatness | dB | | | ±0.5 | TP for calibration |
| Test Point | dB | | -20 | | adjustable: 0.5 steps |
| RF output level | dBµV | 70 | | 95 | |

FOSTRA and Monitoring with DOCSIS Modem 3.1 optionally

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