

GOING FUTURE TODAY.



# IP Head-ends & FTTX/FTTB Networks

Solutions for network operators



# Solutions for IP Head-ends & FTTX/FTTB networks



*We offer complete system solutions.  
Consult us!*

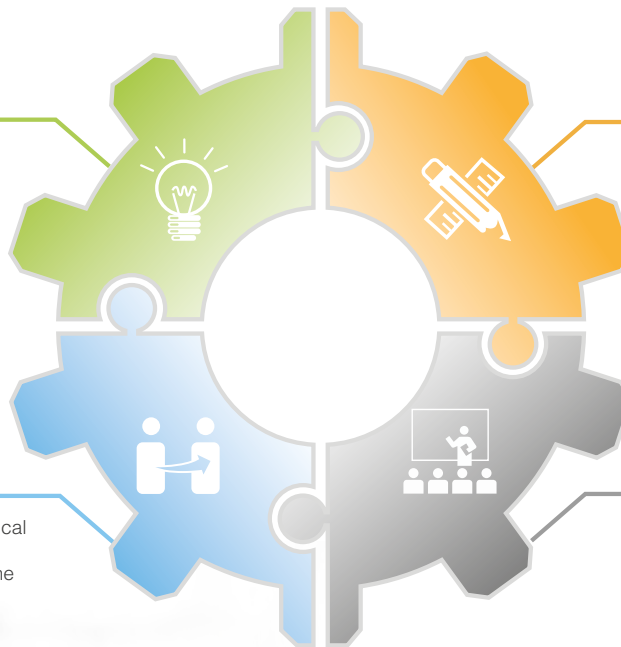


## Service & Training – our promise

High professional IP Head-end technology and Optical Networks require special attention regarding planning, extraordinary individual set-up requirements, go-live or maintenance status. We are your service partner for the complete process starting from conceptual system consulting, pre-configuration, on-site and off-site engineering. You can also have a special training on IP and Optical Network Technology. Just contact our competence center and explain your needs – we will organize an individual training for you. Trust us for your systems!

### Consulting

You have a special project and need additional knowhow? You are in need of a system upgrade, a special Head-end System Planning or Fibre Network Design? Just contact us. Together we will discuss your needs, clarify questions, scope and point out special features.



### Planning

According to your needs we will start a professional project planning and setup of an individual system landscape, a complete broadcasting network solution from head-end to subscriber. IP Master Head-end, Sub Head-end or Optical Access Network? We will take care with our planning department.

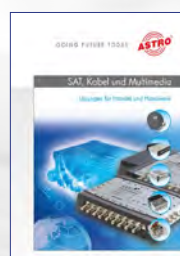
### Support

Make yourself free from all technical operations. We take over pre-configuration services until the final installation of the complete Head-end and Optical Network environment: Ready to start your operations. Our team of specialists will take over 24/7 support if requested by you. Our Maintenance and Repair Services cover a wide range of products.

### Training

Head-end systems and Fibre Networks require special knowhow in engineering, configuration and maintenance. We offer individual trainings for your team to be capable in managing all aspects of up-to-date IP and Optical transmission technology.

## SAT, Cable TV and Multimedia



We also offer products for SAT, Cable TV reception and Multimedia. Please visit our online catalogue: [www.astro-kom.de/en](http://www.astro-kom.de/en)

# Overview of product portfolio

## Carrier Class Edge products



## Combining, active SAT distribution, head-end accessories



## RF-Video-Overlay and transmission



## FTTX data solutions



## FTTX RF amplifiers and fibre nodes



# IP Head-ends and FTTH/FTTB networks



## Index

### A

ALGXCAR series.....	page 80
AOA series.....	page 111
AOCWDM.....	page 82
AOC.....	page 110
AOCC.....	page 112
AOCP-125.....	page 112
AOCP-250.....	page 112
AOFC.....	page 110
AOSLGX series.....	page 80
AOSPLC1 series.....	page 78
AOSPLC2 series.....	page 79
AOW PON series.....	page 83

### C

CPE-HES 3106.....	page 92
-------------------	---------

### F

FBT-HES.....	page 92
FTTX Toolcase.....	page 111

### L

LGH 2000.....	page 46
---------------	---------

### O

OAMP series.....	page 66
ODMTX-1310 series.....	page 60
ODMTX-1550 series.....	page 58
ODMTXe.....	page 58

ODMTX-M.....	page 62
OEMTX-1550 series.....	page 56
OFN45 series.....	page 98
OFN50 series.....	page 100
OFN100 series.....	page 102
OFN200 series.....	page 104
OFN400-FR.....	page 106
OHPA series.....	page 68
OHPAo series.....	page 76
OHPA-S series.....	page 70
OHPA-WDM series.....	page 72
OHPA-WDM-S series.....	page 74
OLT-V5824G.....	page 88
ONU H660RW.....	page 90
ORRX.....	page 64
OSW-21 AC.....	page 81
OSW-21 DC.....	page 81

### U

U 100-230.....	page 18
U 100-48.....	page 18
U 100-C.....	page 19
U 116.....	page 28
U 118.....	page 28
U 118-X.....	page 28
U 124.....	page 32
U 125.....	page 32
U 144-X.....	page 20
U 148-X.....	page 22
U 158.....	page 34

U 159.....	page 36
U 160.....	page 38
U 164-X.....	page 24
U 168-X.....	page 26
U 174.....	page 40
U 194.....	page 42
U 224-230.....	page 30
U 224-48.....	page 30
U 911 - U 946.....	page 45
U 960.....	page 44
U KF.....	page 46

## IP Head-end

<input type="checkbox"/> Carrier Class Technology - the U series	10
<input type="checkbox"/> Carrier Class Edge Components	12
<input type="checkbox"/> Combining	44
<input type="checkbox"/> Active SAT splitters	45
<input type="checkbox"/> Accessories	46
<input type="checkbox"/> Application examples	47

## 08

## Optical transmission

<input type="checkbox"/> Why choose optical transmission?	52
<input type="checkbox"/> RF-Video-Overlay & transmission	54
<input type="checkbox"/> RF-Overlay application solutions	84
<input type="checkbox"/> FTTX data solutions	86
<input type="checkbox"/> FTTX data application solutions	94
<input type="checkbox"/> FTTX RF-Receivers and Fibre Nodes	96
<input type="checkbox"/> Fibre nodes application solutions	108
<input type="checkbox"/> Optical accessories	110
<input type="checkbox"/> Optical SAT-IF distribution	113

## 50

## Appendix

<input type="checkbox"/> Technical appendix	114
<input type="checkbox"/> About ASTRO	115
<input type="checkbox"/> Contact	116

## 114

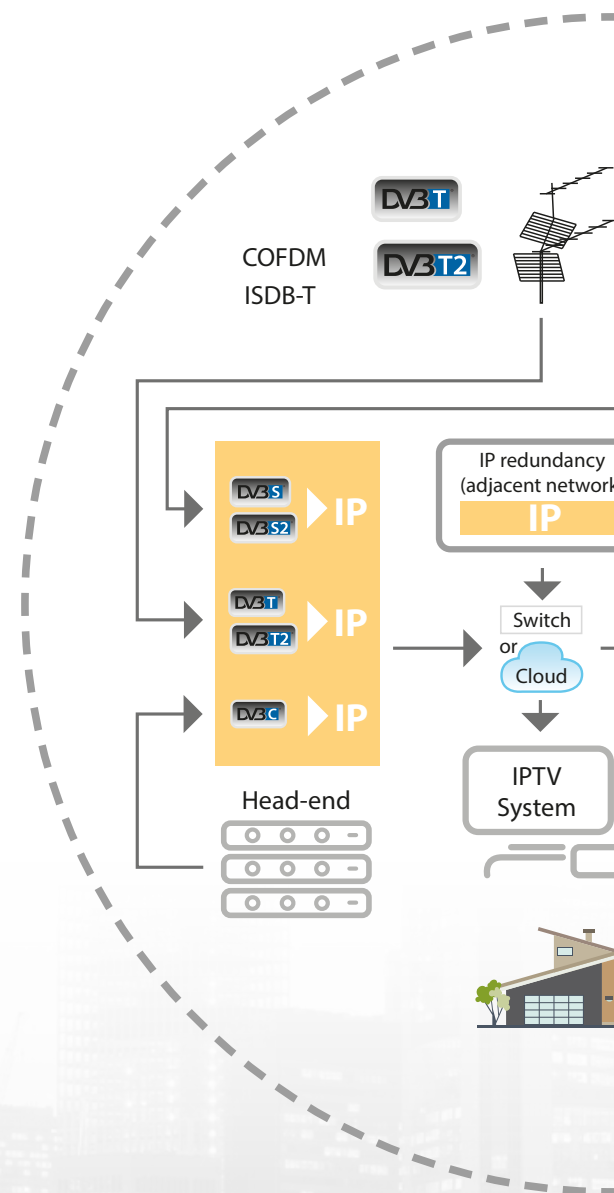
# Complete solutions for IP Head-end

## IP based signal processing

The ASTRO U series has already been installed successfully for more than 10 years in cable networks all around the world. The longtime experience and the success of this technology motivates us, to proceed on this path and to keep developing the U series even further. The close relationship to our customers helps us to achieve this – it drives us to push on new ideas together with our development department. An up to date IP / PAL module's look may be close to a module from the early days, but more features and improvements have been implemented constantly – inspired by our customers! This impact becomes most obvious considering the development of our IP / QAM technology. The new U 159 is a completely new device with unexpected signal processing capabilities. Apart from the well known, transparent conversion of input signals it now offers possibilities to multiplex input signals before they are modulated into a QAM channel. Besides that a signal density of up to 192 QAM channels per rack unit remains still unsurpassed in the market. And the hardware of the device offers even more resources for translating new ideas into action!

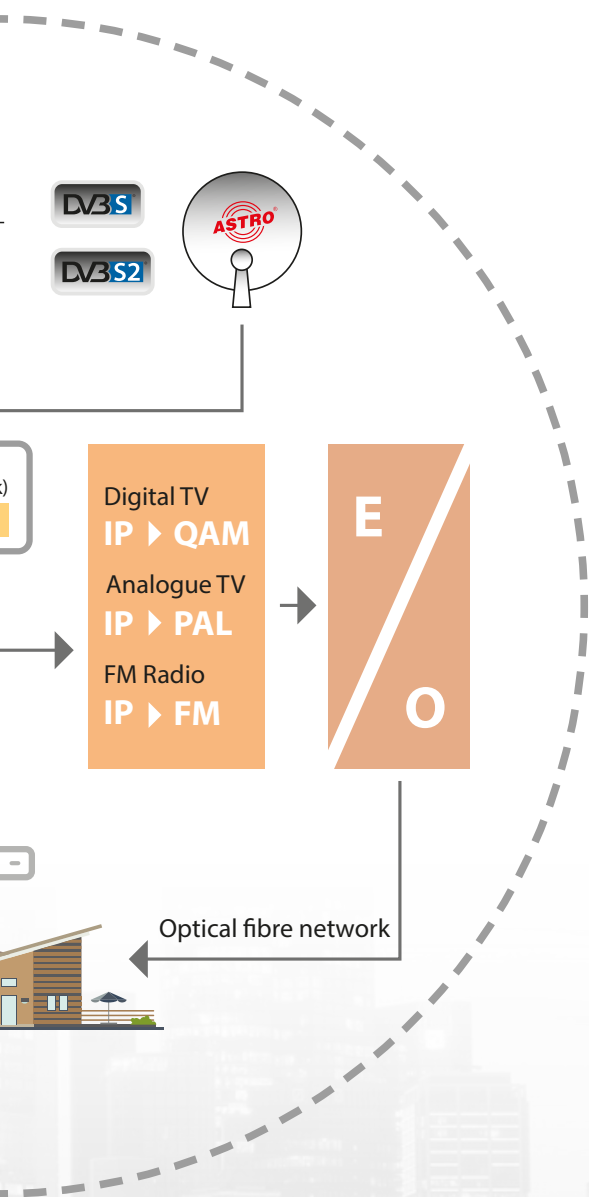
## Optical transmission technology

How does the outstanding signal quality of your ASTRO head-end find its way to your customers? To achieve this, a mature transmission technology is required, offering best link performance at a great price/performance ratio. These characteristics are combined in optical transmission technology from ASTRO. Besides direct and external modulated transmitters – building the gateway between the high frequency world and optical transmission technology – we also offer convenient optical amplifiers for bridging large distances or enabling high splitting factors. Located at the subscribers in your FTTX network, you will also need optical nodes. ASTRO offers a wide range of devices for different operation purposes: exclusively for CATV reception, with or without data services, or with WDM filter for extracting data in G(E)PON networks. You will also find passive components for connecting devices and fibres in our brochure. And if not? Don't hesitate to call us!



**Complete solution should be more details, you can't see the cable in the inputs, should see a photo of a cable and connector normally for QAM and Analogue, maybe to put more antennas in the drawing.**

# & Optical Fibre Networks



## Streaming of DVB-x to IP

- reception of DVB-S(2), DVB-T(2), DVB-C and ISDB-T
- support of multistream transponders
- descrambling with multichannel decoding
- streaming IP SPTS and IP MPTS
- multiplexing of input streams, service filter
- up to 24 transponders per 19" rack unit



Direct Digital by ASTRO

## Conversion of IP to QAM, PAL, FM

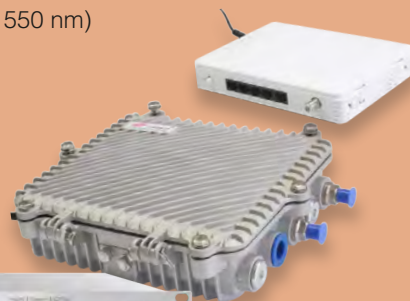
- IP to QAM, COFDM and ISDB-T for digital TV
- IP to PAL, NTSC and SECAM for analogue TV
- IP to FM for analogue radio services
- outstanding signal parameters
- sophisticated redundancy concept



Direct Digital by ASTRO

## TV signal into optical fibre network

- complete range of optical products
- transmitters (1310 / 1550 nm)
- EDFAs
- nodes
- splitters
- CPE
- WDM



## Modular solutions for high density signal processing

The U series offers a complete, adaptive solution for IP signal processing with modular architecture. It features easy configuration and maintenance via web browser interface as well as a maximum of operating stability by utilizing redundant power supply and elaborate redundancy mechanisms.



- **19 Inch base units**

To ensure maximum operating stability, the base units of the U 100 series can be equipped with redundant power supply. Apart from that each U 100 base unit can house up to three modules.

- **Management Controller**

The U 100-C controller in conjunction with the web browser-based configuration makes the management of your IP head-end via an IP address comfortable.

- **IP Streamers**

You want to convert DVB-S2, DVB-C, DVB-T or DVB-T2 input signals into IP? The streamers of the U series offer up to 4 or 8 IP multicast groups, making it possible to generate up to 12 resp. 24 streams per rack unit.


- **Signal converters with integrated IP frontend**

You need COFDM, PAL / NTSC, QAM or FM output signals? The U series will offer the complete range. And every module has its own IP frontend.

- **Descrambler**

The U 194 module processes up to 4 transport streams (4 x IP > 4 x IP) and supports multi-service-descrambling.



**Direct Digital**  <sup>®</sup> The Direct Digital® Technology developed by ASTRO allows for outstanding signal parameters independent from temperature and aging. Additional system resources, maximum flexibility in configuration as well as high-end video- and audioparameters set new benchmarks.





# IP Head-end Technology

## Where to find what?

<input type="checkbox"/> <b>Carrier Class Technology - the U series</b>	<b>10</b>	<input type="checkbox"/> <b>Combining</b>	<b>44</b>
Base units and modules at a glance	11	Features and technical data	44
<input type="checkbox"/> <b>Carrier Class Edge Components</b>	<b>12</b>	<input type="checkbox"/> <b>Active SAT splitters</b>	<b>45</b>
Overview	12	Features and technical data	45
The U 100 redundancy concept	16	<input type="checkbox"/> <b>Accessories</b>	<b>46</b>
U 100 modules (features and technical data)	18	Channels selective filters	46
		Mounting cabinets	46
		<input type="checkbox"/> <b>Application examples</b>	<b>47</b>



# Carrier Class Technology - the U series

The U series head-end components were designed and developed for professional applications in largest cable networks. All devices of this series are built in 19" technology and some are equipped with redundant power supply units or can be updated with redundant power supply optionally.

## Carrier Class Edge Technology

The U 100 series is a modular designed IP head-end concept. The base unit can house up to three modules that can optionally be operated with redundant power supply. Hardware and software both offer all mechanisms, that contribute to ensure the best operational signal availability.



## Combining

For combining of head-end signals ASTRO offers active and passive components. The U 960 can be equipped with splitters according to customers needs. The redundant power supply is achieved either via separate power supply units or by remote feeding via RF jack.




## Active SAT splitters

The U 9xx SAT distribution field can be ordered in different variations. 1 x 1 in 16 or 2 x 1 in 8, in 75  $\Omega$  or 50  $\Omega$  implementation – anything is possible. Furthermore these units can be integrated into the ASTRO bus system making it possible to do a remote configuration of attenuation and slope. It is as well possible to supervise the LNC current consumption.



## What does „Direct Digital“ mean?

**Direct Digital**  by ASTRO. Direct Digital features the completely digital modulation of output signals. In addition the new technology on an FPGA basis leads to outstanding signal parameters, independent of temperature and aging. The modulator is realized as software solution with many positive effects. Changing the standard of an output signal is done by programming the module via Web GUI. No tuning of hardware is required.

## Why are RTP and FEC recommended?

RTP (Real-time Transport Protocol) is important to evaluate the quality of the link between signal source and receiver. Every transmitted Ethernet frame gets an increment number according RTP. As a result the receiver is able to recognize missing or reordered frames. Any packet loss is only recognized but not repaired. To fix the packet loss FEC (Forward Error Correction) is mandatory. The FEC assort the arriving Ethernet frames to a matrix and calculates column and line sum. The size of the matrix can be determined in the web GUI and is decisive for the additional overhead of the FEC packets. The "weakest" FEC is able to correct up to 5 missing or corrupt frames in series and produces an overhead of 11% including RTP. RTP is mandatory to set-up an FEC, so both features belong together. In ASTRO IP receiving and transmitting devices RTP and FEC is included without additional license fees.

## Base units and modules at a glance

Type	Description	Page
<b>Carrier Class Edge Technology</b>		
U 100-230	Base unit for mounting up to 3 modules of the U 1xx series Input voltage 230 V AC in connection with the U 100-SNT power supply unit	18
U 100-48	Base unit for mounting up to 3 modules of the U 1xx series Input voltage - 48 V DC	18
U 100-C	Management-system for U 100 base units and signal converters	19
U 144-X	DVB-S2 to IP streamer 4-way converter, 4 standard DVB-S2 input signals via 4 input jacks into 4 IP multicast groups with 4 CI slots	20
U 148-X	DVB-S2 in IP streamer 8-way converter, 8 standard DVB-S2 input signals via 4 input jacks into 8 IP multicast groups	22
U 164-X	DVB-C, DVB-T or DVB-T2 to IP streamer 4-way converter, 4 standard DVB-C, DVB-T or DVB-T2 input signals via 4 input jacks into 4 IP multicast groups with 4 CI slots	24
U 168-X	DVB-C, DVB-T or DVB-T2 to IP streamer 8-way converter, 8 standard DVB-C, DVB-T or DVB-T2 input signals via 4 input jacks into 8 IP multicast groups, FTA	26
U 116	IP to PAL converter with MPEG 4 support (H.264/AVC Level 4.1 HP), HD to SD downscaling, optional AC-3 4-way converter, 4 IP multicast groups to 4 standard PAL programmes	28
U 118	IP to PAL converter with MPEG 4 support (H.264/AVC Level 4.1 HP), HD to SD downscaling, optional AC-3 8-way converter, 8 IP multicast groups to 8 standard PAL programmes	28
U 118-x	IP to PAL converter with MPEG 4 support (H.264/AVC Level 4.1 HP), HD to SD downscaling 8-way converter, 8 IP multicast groups to 8 standard PAL programmes	28
U 224-230	IP to PAL converter with MPEG 4 support (H.264/AVC Level 4.1 HP), HD to SD downscaling 24-way converter, 24 IP multicast groups to 3 x 2 x 4 standard PAL programmes, input voltage 230 V AC	30
U 224-48	IP to PAL converter with MPEG 4 support (H.264/AVC Level 4.1 HP), HD to SD downscaling 24-way converter, 24 IP multicast groups to 3 x 2 x 4 standard PAL programmes, input voltage - 48 V DC	30
U 124	IP to FM converter 16-way converter, 4 IP multicast groups to 2 x 8 standard FM programmes	32
U 125	IP to FM converter 40-way converter, 16 IP multicast groups to 2 x 20 standard FM programmes	32
U 158	IP to QAM converter 8-way converter, 8 IP multicast groups to 8 standard QAM channels	34
U 159	IP to QAM converter 64-way converter, 64 IP multicast groups to 64 QAM channels	36
U 160	IP to DVB-C converter 24-way converter, 24 IP multicast groups to 2 DVB-C2 systems	38
U 174	IP to COFDM converter 4-way converter, 4 IP multicast groups to 4 standard COFDM channels	40
U 194	IP to IP descrambler 4-way descrambler, 4 transport streams, multi-service-descrambling, 4 CI slots	42
<b>Active and passive combining</b>		
U 960	Passive combining network distribution of input signals in the frequency range 5 to 1000 MHz	44
<b>Professional SAT distribution</b>		
U 911 - 946	Active SAT splitters 2 SAT-inputs into 8 outputs at a time or 1 SAT-input into 16 outputs	45

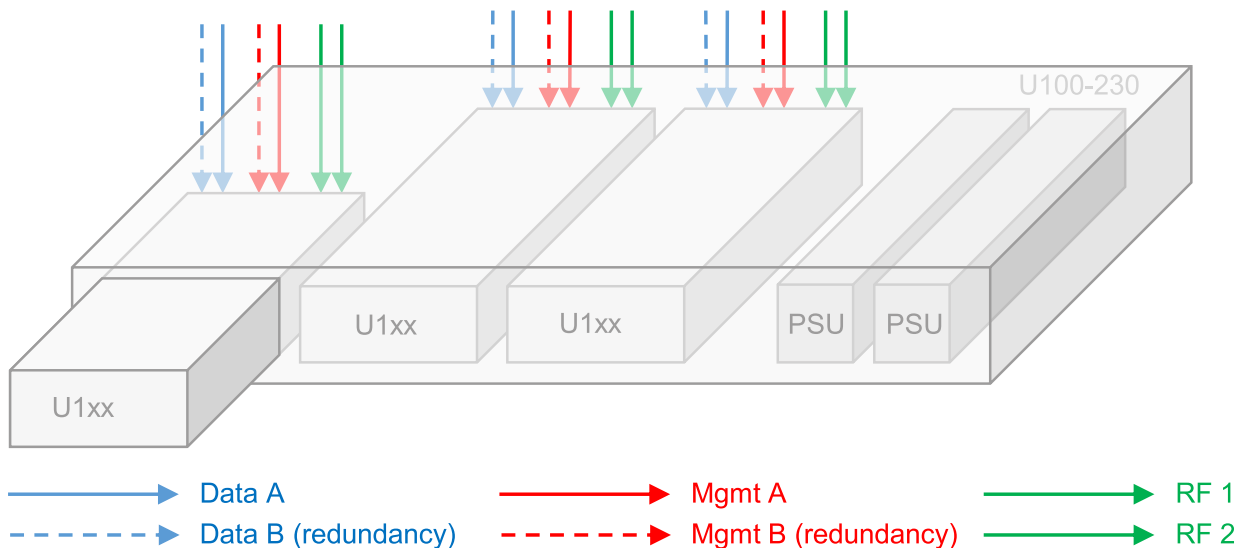
# Why choose the U 100 series?

## A modular built IP head-end concept for any demand

The U 100 Edge series has been developed on the basis of many years of experience gained from the operation of IP head-ends for processing CATV signals from IP data streams.

The series is based on a hardware model which is completely new from the ground up. The experience, gained in major IP content over IP projects, enabled ASTRO to consider operating conditions in large IP backbone networks.

Thus, in addition to outstanding transmission parameters, the U 100 series also offers sophisticated redundancy and replacement switching mechanisms to reach the greatest possible signal performance availability.



## Easy configuration / operation

- user friendly configuration via web browser - no proprietary software needed for managing the system
- constant menu structure of configuration interface for each module
- LEDs indicate operation and errors on each module



## Easy installation

- easy mounting of the base unit in 19 inch cabinets
- passive backplane enables a quick exchange of the signal converters
- all active components integrated into the signal converters
- wiring remains unaffected, even if different types of converters will be used

## Maximum reliability

- redundant power supply
- short down-time in case of malfunction: every module has redundant network interfaces for network management and data connection
- effective redundancy switching options in case of link failure, source failure or device failure
- 2 data ports per signal converter
- IGMPv3, RTP and FEC without additional license fees

## High end performance

- three plug-in modules per 19 inch height provide high signal density
- signal converters offer outstanding signal parameters by Direct Digital ®
- low power consumption per channel

## Easy service handling

- HOT SWAP service
- compact design allows easy spare part handling
- Log file output via web interface
- Remote access to your U 100 head-end by ASTRO support team

### Are there any features with additional license costs?

All major features of the ASTRO U 100 series are included. Features like UDP/RTP and FEC at the IP receiving side are included as well as programmable time-sharing of output channels and information ticker for PAL programs. These are some examples. The only feature with additional costs is the transport stream analyzer.

### How do updates work and what are the costs for updates?

In general, updates are available on the ASTRO firmware server. These updates can be downloaded to a local computer and then an update can be started. The update file might also be stored on the U 100-C management module and the firmware will be uploaded directly or time-controlled to the module. The third possibility is the download via FTP server directly to the module. Standard firmware updates are free-of-charge. Those standard updates include bug fixes or general improvements of the firmware.

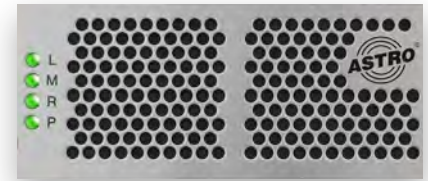
# U 100 base units

The U 100 base unit serves as the chassis for the various signal converters, providing space for three signal converters and two power supply units within a single rack unit. Each slot is equipped with a temperature-controlled fan and the replaceable rear panel offers two management and two data ports as well as the output of the CATV signals via two F sockets.

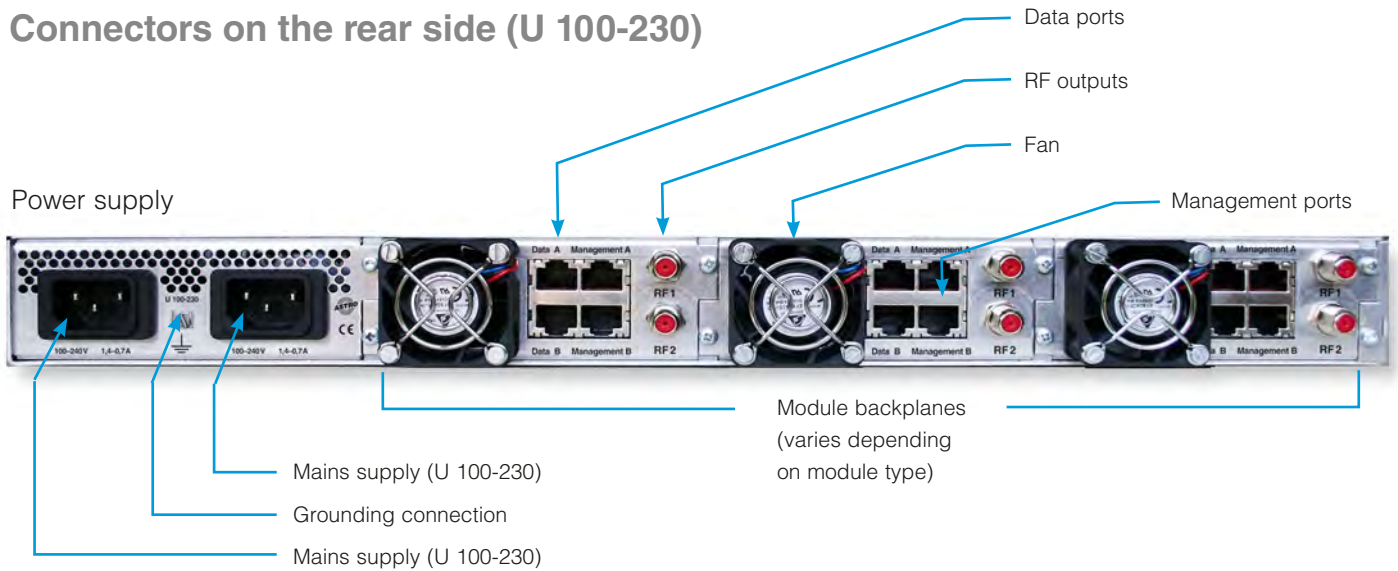
Order no.: 380 101 (for U 100-230)

## Status display for slots

L = left  
M = middle  
R = right  
P = power supply



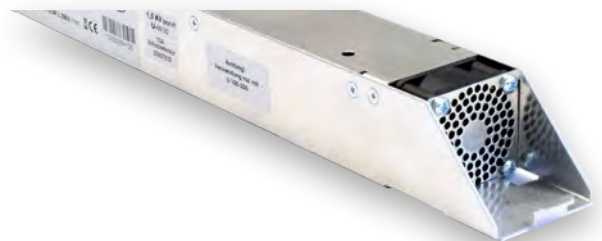
## Connectors on the rear side (U 100-230)



## The U 100-SNT ECO power supply unit

The U 100-SNT power supply is required to operate the U 100-230 base unit. Minimum one power supply is needed, while two U 100-SNT enable a redundant supply of the base unit and are recommended to avoid signal loss due to mains power failures.

Order no.: 380 109



## Base unit for 48 V power supply

The U 100 base unit is also available for -48 V DC power supply. In this case the redundant power supply can be provided by a battery system or any other 48 V power supply unit and no further power supply units are needed inside the U 100-48 base unit.

Order no.: 380 100 (for U 100-48)



## U 960 combining network

For distribution of input signals ASTRO offers a 19 inch rack device with individual mounting subject to customer request. It is available with 16 or 28 inputs and can be assembled with 2-way, 3-way, 4-way or 8-way splitter.

Order no.: 380 179 (16 inputs); 380 198 (28 inputs)



The ASTRO IP head-end modules handle all output signals distributed in standard CATV networks: QAM, PAL, COFDM and FM. Based on the proven Direct Digital ® system, all the signal converters provide outstanding parameters. For generating IP signals, different types of IP streamers are available. These are equipped with DVB-S2 or DVB-C/T2 frontends and offer high signal density.

## IP front end included

One special feature of the signal converters is the inclusion of the IP frontend in each slide-in module. Consequently, each module has its own independent IP receiver unit and operates separately from the other modules inside the base unit. In this way, it is possible to limit any failure of an IP frontend to only a single module, meaning that the effects of an error are far less serious compared to a system which has only a single IP interface shared by all the signal converters.

## Configuration kept safe on SD card

System parameters are stored on SD card. If the signal converter must be replaced, the SD card plugged into the old module can now be inserted in the new module, allowing the previous configuration to be automatically migrated. Thanks to this feature, the spare equipment can be set in operation quickly on site without any need for service staff to reconfigure the system.

## Easy front panel operation



Control and data wheel, menu switch

Display of management IP addresses, data IP addresses, status messages, etc.



## What is the output alignment in the different converters with CATV output?

There are different alignments of output signals depending on the type of modulator. The U 116 IP to PAL and U 174 IP to COFDM converters offer 4 output channels transmitted in 2 pairs via 2 F-female outputs. The difference between start and stop frequency in one pair of output channels can be 32 MHz, or with other words: 2 channels can be left unused between two output channels. The U 118 IP to PAL and U 158 IP to QAM converter offer 8 output channels transmitted in 2 quartets via 2 F-female outputs. Those 4 channels per output have to be adjacent channels. An independent processing of the output channels is possible with the U 124 IP to FM converter but via 2 F-female outputs.

## What is the field of application for the output channel filter?

Any modulator causes broadband noise, no matter how sophisticated the hard- and software is designed. Especially if a huge number of output channels shall be combined, this broadband noise accumulates at the combined output. To cut off this noise, the optional output channel filter can be installed to the signal converter. This leads to a significant improvement of the S/N at the combined output. The ASTRO modulators have one separate signal path to lead the signal via the channel output filter. This means that the modulator stays fully frequency agile.

## Why are there so many IP interfaces for each signal converter?

The ASTRO U 100 series offers several physical interfaces to enable all possible redundancy mechanisms and to configure different receive paths. To reduce the impact of a lost input signal to a minimum, redundant data interfaces are mandatory. For different concepts of remote access it is also necessary to provide redundant management interfaces. These interfaces can be used, but they don't have to be used. The disadvantage of a slightly more time-consuming cabling effort can be neglected, compared to the benefit of high signal stability and different remote access options.

## Can I use different types of signal converters in one base unit?

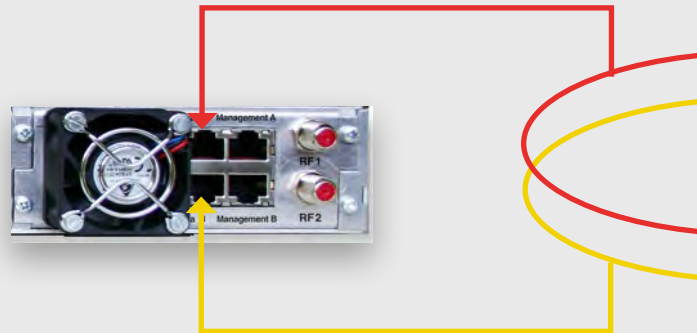
Any type of U 100 series signal converter can be used in the U 100-230 or U 100-48 base unit. They can be operated in any mixture without limitations. The only thing to be considered is the type of backplane which is installed to the corresponding slot. The backplane is part of the delivery of any signal converter.

# The U 100 redundancy concept

The U 100 series offers **all possible redundancy options** like link redundancy, source redundancy and device redundancy. Want maximum reliability? - Choose the U 100 series and you'll get it!

## Link redundancy

- Requirement for real link redundancy are **two independent data interfaces**.
- If one signal feed fails, the redundant data interface must take over the operation.
- ASTRO U 100 series devices offer fully redundant data interfaces, independently configurable.
- Switching between interfaces can be done manually or automatically with configurable priorities.
- The redundant signals can be configured in hot stand-by or cold stand-by.
- Thanks to the link redundancy concept every device and link in-between the master head-end and the regional head-end is covered.
- In case of hot stand-by, the redundant link and source is monitored permanently to ensure an error-free operation after switching over.

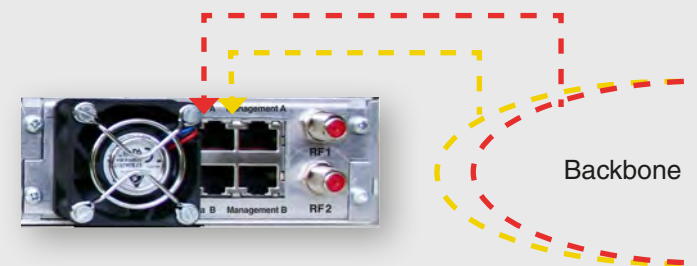


IP RX1 Channel Settings

Property	Data A (eth2) 1G					
Primary Receive IP:Port	232	20	100	71	10000	Priority 12 Highest/Hot
Primary Source Select	0	0	0	0		
Secondary Receive IP:Port	0	0	0	0	0	Priority 0 Off
Secondary Source Select	0	0	0	0		<input checked="" type="checkbox"/> like Data A
Tertiary Receive IP:Port	0	0	0	0	0	Priority 0 Off
Tertiary Source Select	0	0	0	0		

## Source redundancy

- Requirement for source redundancy are **at least two independently configurable IP receivers per data interface**.
- If the primary signal source fails, the IP receiver must listen immediately to the secondary source.
- ASTRO U 100 series devices even offer **three (!) configurable IP receivers per data interface**.
- This enables the operator to have two sources feeding the backbone and one local source for emergencies.
- The redundant signal sources can be configured in hot stand-by or cold stand-by.
- In case of hot-stand-by, the redundant link and source is monitored permanently to ensure an error-free operation after switching over.



IP RX1 Channel Settings

Property	Data A (eth2) 1G					
Primary Receive IP:Port	232	20	100	71	10000	Priority 12 Highest/Hot
Primary Source Select	0	0	0	0		
Secondary Receive IP:Port	0	0	0	0	0	Priority 0 Off
Secondary Source Select	0	0	0	0		<input checked="" type="checkbox"/> like Data A
Tertiary Receive IP:Port	0	0	0	0	0	Priority 0 Off
Tertiary Source Select	0	0	0	0		

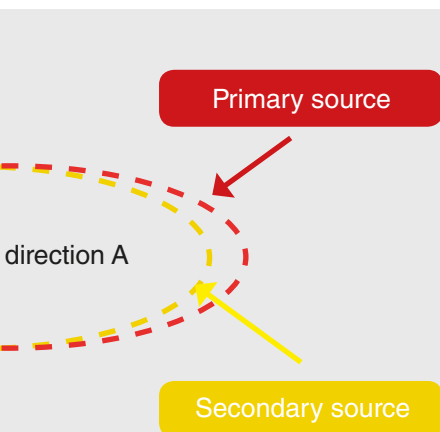


Backbone direction A



Backbone direction B

Data B (eth3) 1G					Priority
232	20	100	71	10000	11 Higher/Hot
0	0	0	0	0	Priority
0	0	0	0	0	0 Off
0	0	0	0	0	Priority
0	0	0	0	0	0 Off
0	0	0	0	0	Priority
0	0	0	0	0	0 Off



Data B (eth3) 1G					Priority
232	20	100	71	10000	11 Higher/Hot
0	0	0	0	0	Priority
0	0	0	0	0	0 Off
0	0	0	0	0	Priority
0	0	0	0	0	0 Off

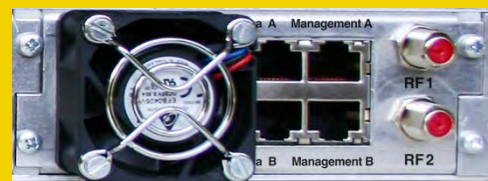
## Device redundancy

- Requirement for device redundancy is **spare equipment inside the working head-end** and the U 100-C controller.
- This spare equipment must be connected to the same signal sources like the working equipment.
- A device is considered as spare equipment by the controller if the RF ports are switched off.
- The switching-over to the spare equipment can be made manually or automatically in case of certain events.

working U 100 module



redundant U 100 module



### Replace

Base	Slot	Module	Status	Message	Monitoring	Replace Options
1	1	U174	ok	lock is logged in	ok	
1	2	U114	ok	lock is logged in	ok	Base 2 / Slot 2
1	3	U100-C	warning	Supply13V: 0V,Supply1V2: 0V,Supply2V5: 0V,Supply3V3: 0V	warning status	
2	1	U124	ok	lock is logged in	ok	
2	2	U158	ok	lock is logged in	ok	
2	3	U114	off	lock is logged in	ok	



# Base units

## FOR MOUNTING U 100 MODULES

U 100-48

U 100-230



Backside of U 100, 230 V version:



Backside of U 100, 48 V version:



- power and signal supply for modules of the U 100 series
- can carry up to 3 modules of the U 100 series
- output signals are separately led out via F-jacks
- optional redundant power supply available
- status indication for signal converters and power supply units
- horizontal air flow allows compact installation

It is mandatory to use guide rails in the 19 inch rack. As these guide rails are different for each 19 inch rack supplier, they are not in the scope of delivery of U 100 base units.



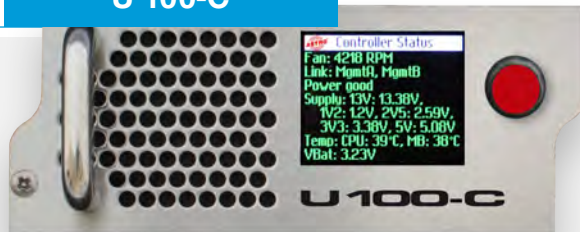
The power supply units for the U 100-230 base unit are not included in the scope of delivery and must be ordered separately.

Type		U 100 - 48	U 100 - 230
Order number		380 100	380 101
EAN-Code		4026187611064	4026187611149
Common data			
Voltage supply	[V]	- 48	110...240
Voltage supply tolerance	[%]	10	
Supply frequency		DC	50 - 60
Effective power consumption	[W]	depends on number of modules assembled (see operating manual, chapter: "Calculation of effective and apparent power consumption at mains")	
Apparent power consumption	[VA]		
Maximum permissible current draw at mains	[A]	3	1,6
complete current of all converter modules at the internal intermediate voltage	[A]	3	3
Internal intermediate voltage (I48)		Input voltage - 2.4	47
Dimensions		19" / 1 RU	
Ambient temperature	[°C]	0...+45	

# Management controller module

## SYSTEM MANAGEMENT FOR U 100 SIGNAL PROCESSORS

### U 100-C



```

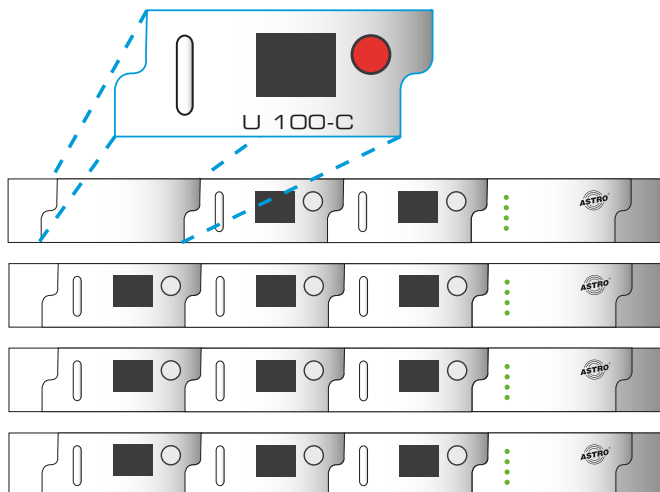
Controller Status
Fan: 4218 RPM
Link: MgmtA, MgmtB
Power good
Supply: 13V: 13.38V
       1V2: 1.2V, 2V5: 2.58V
       3V3: 3.38V, 5V: 5.08V
Temp: CPU: 39°C, MB: 38°C
VBat: 3.23V
    
```

Backplane:



- umbrella management system for the complete U 100 head-end
- management via **one** IP address
- required for switched N + 1 device redundancy
- provides many functions for configuring and servicing the U 100 series
- comfortable rack view with status display of all installed U 1xx components
- scheduled updates
- user friendly configuration via web browser interface
- monitored fan

The U 100-C is an overall management system for the U 100 series with many interesting features for network operators. It features a comfortable rack view of the complete system, time controlled updates and it can initiate automatic redundancy switching in case of malfunctions.



Type		U 100-C
Order number		380 103
EAN-Code		4026187131739
Network interfaces (passive routing to U 1xx)		
Protocol		IEEE802.3 Ethernet, RTP, ARP, IPv4, TCP/UDP, HTTP, SNMP, IGMPv3
Common data		
Power consumption	[W]	27
Dimensions		19", 1 HE
Ambient temperature	[°C]	0...+45

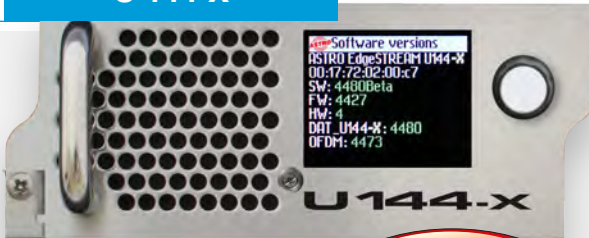


# Streamer modules

SIGNAL PROCESSING: DVB-S2 → IP

## U 144-X

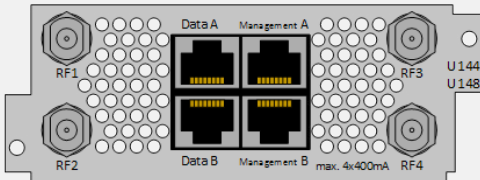
4 x DVB-S2 to IP, up to 4 DVB-S2 transponders



without front cover:



Backplane:

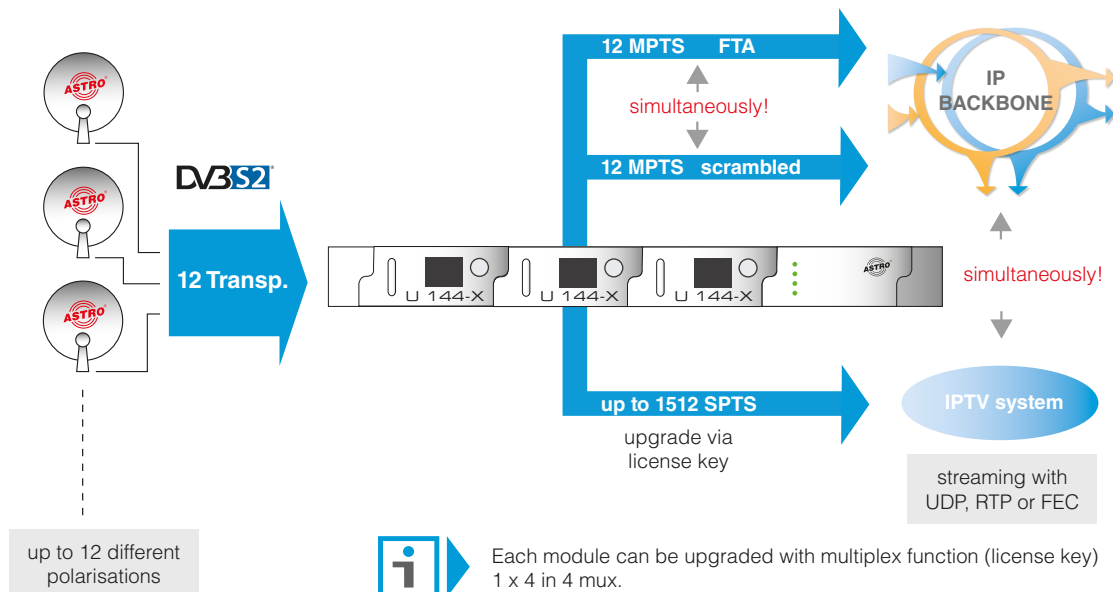


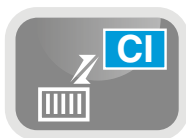
- plug-in module for U 100 base unit
- 4 physical signal input jacks
- for processing of 4 DVB-S2 signals into IP multicast groups (4 MPTS, 504 SPTS)
- up to 4 DVB-S2 transponders
- up to 12 streams per rack unit
- multiplexing of four input transponders to four output streams (license afforded)
- support for Multistream Transponders
- 4 cascable CI slots with multi channel decryption
- APSK support
- tuners with DiSEqC control
- monitored fan



Ultra-dense streaming of DVB-S2 in IP with descrambling

APPLICATION EXAMPLE





Type		U 144-X
Order number		380 138
EAN-Code		4026187194475
Number of DVB-S2 input signals		4
Number of DVB-S2 transponders		4
Number of IP output streams		8 (4 FTA and SCR each) MPTS, 504 SPTS (SPTS license afforded)
Interfaces		
Management		2 x 100 Base-T Ethernet (RJ 45)
Data		2 x 1000 Base-T Ethernet (RJ 45)
Protocols		IEEE802.3 Ethernet, RTP, ARP, IPv4, TCP/UDP, HTTP, SNMP, IGMPv3
Transportstream Encapsulation		
Protocols		UDP, UDP / RTP, 1-7 packets, FEC
Packet length	[Bytes]	188 / 204
DVB-S demodulator		
DVB-S modulation		QPSK; 8PSK; 16APSK; 32APSK
Input frequency range	[MHz]	950 - 2150
Input level	[dBμV]	40 - 80
SAT-IF input	[Ω]	75, F-jack
Reflection loss	[dB]	≥ 10
Input symbol rate	[MS/s]	max. 45,0 (depends on DVB-S2 Modulation)
DVB-S Roll-off-factors		0,20 ;0,25; 0,35
DVB-S LDPC		1/2; 1/3; ¼; 2/3; 2/5; 3/5; 4/5; 5/6; 8/9; 9/10 (depends on DVB-S2 Modulation)
Viterbi decoding (according DVB standard)		1/2; 2/3; 3/4; 5/6; 7/8; automatically / manually
DiSEqC Control		<input checked="" type="checkbox"/>
CI interfaces		
CI slots		4 x (front access)
Supported modules	excerpt (others on request)	Alphacrypt, Aston Conax, Dreamcrypt, Entavio CAM, GkWare BISS CAM, Homecast CAM, ICECrypt, Ideto Access, Kid CAM, Mascom Cryptoworks, Matrix CAM, Mediaguard Canal Digitaal, Nagravision, Oasis CAM, PCMCIA CAM, Premiere, Worldcam, TechniCam Beta2, Technicrypt, TPS, Reality CAM, SMI, Universal CAM, Viaccess, Videoguard CAM
Connectors		4 x PCMCIA
RF inputs		
Connectors	[Ω]	75, 4 x F-jack
Common data		
Current consumption at 48 V	[mA]	530
Power consumption at 36 - 60 V	[W]	25
Input voltage	[V]	36 - 60
Dimensions		1 HU, 19 inch
Ambient temperature	[°C]	0 ... +45



# Streamer modules

SIGNAL PROCESSING: DVB-S2 → IP

## U 148-X

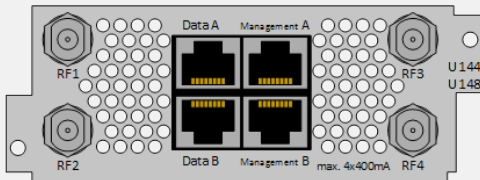
4 x DVB-S2 to IP; up to 8 DVB-S2 transponders



now with **Multiplexing**

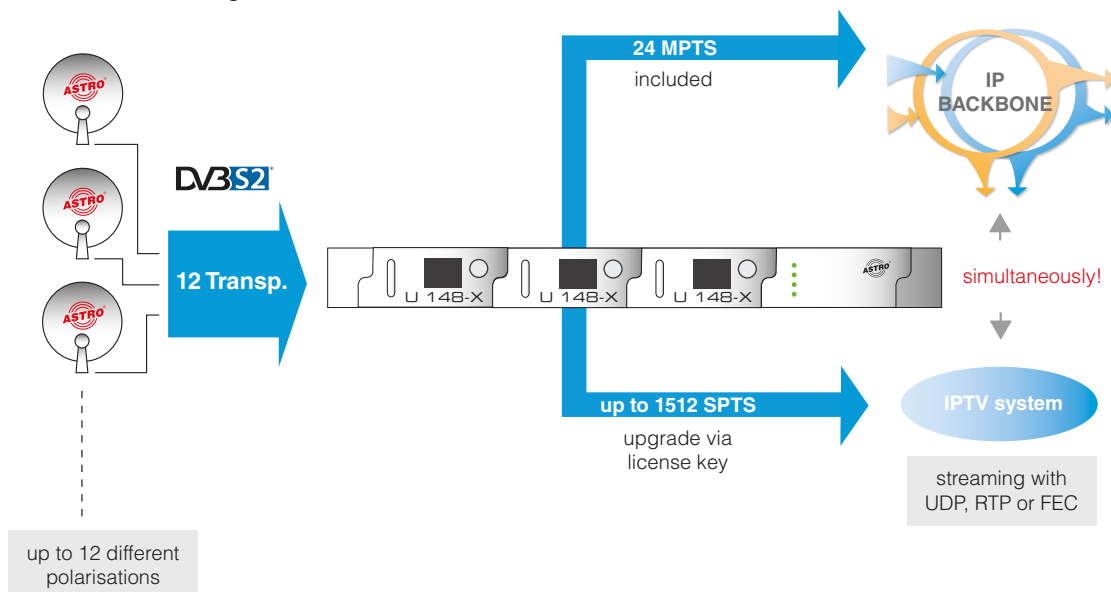
- plug-in modules for U 100 base unit
- 4 physical signal input jacks
- for processing of 8 DVB-S2 signals into IP multicast groups (8 MPTS, 504 SPTS)
- up to 24 streams per rack unit
- multiplexing of four input transponders to four output streams (license afforded)
- support for Multistream Transponders
- APSK support
- tuners with DiSEqC control
- monitored fan

Backplane:



Ultra-dense streaming of DVB-S2 in IP

APPLICATION EXAMPLE





Type		U 148-X
Order number		380 139
EAN-Code		4026187194482
Number of DVB-S2 input signals		4
Number of DVB-S2 transponders		8
Number of IP output streams		8 MPTS, 504 SPTS (SPTS license afforded)
Interfaces		
Management		2 x 100 Base-T Ethernet (RJ 45)
Data		2 x 1000 Base-T Ethernet (RJ 45)
Protocols		IEEE802.3 Ethernet, RTP, ARP, IPv4, TCP/UDP, HTTP, SNMP, IGMPv3
Transportstream Encapsulation		
Protocols		UDP, UDP / RTP, 1-7 packets, FEC
Packet length	[Bytes]	188 / 204
DVB-S demodulator		
DVB-S modulation		QPSK; 8PSK; 16APSK; 32APSK
Input frequency range	[MHz]	950 - 2150
Input level	[dBμV]	40 - 80
SAT-IF input	[Ω]	75, F-jack
Reflection loss	[dB]	≥ 10
Input symbol rate	[MS/s]	max. 45,0 (depends on DVB-S2 Modulation)
DVB-S Roll-off-factors		0,20; 0,25; 0,35
DVB-S LDPC		1/2; 1/3; ¼; 2/3; 2/5; 3/5; 4/5; 5/6; 8/9; 9/10 (depends on DVB-S2 Modulation)
Viterbi decoding (according DVB standard)		1/2; 2/3; 3/4; 5/6; 7/8; automatically / manually
DiSEqC Control		<input checked="" type="checkbox"/>
RF inputs		
Connectors	[Ω]	75, 4 x F-jack
Common data		
Current consumption at 48 V	[mA]	580
Power consumption at 36 - 60 V	[W]	28 per module
Input voltage	[V]	36 - 60
Dimensions		1 HU, 19 inch
Ambient temperature	[°C]	0 ... +45

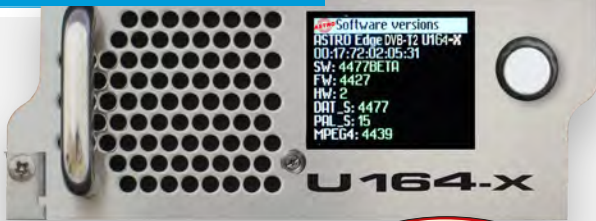


# Streamer modules

SIGNAL PROCESSING: DVB-C / DVB-T / DVB-T2 → IP

## U 164-X

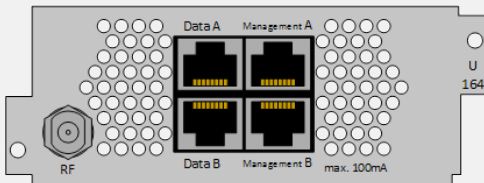
4 x DVB-C, DVB-T or DVB-T2 to IP



without front cover:



Backplane:

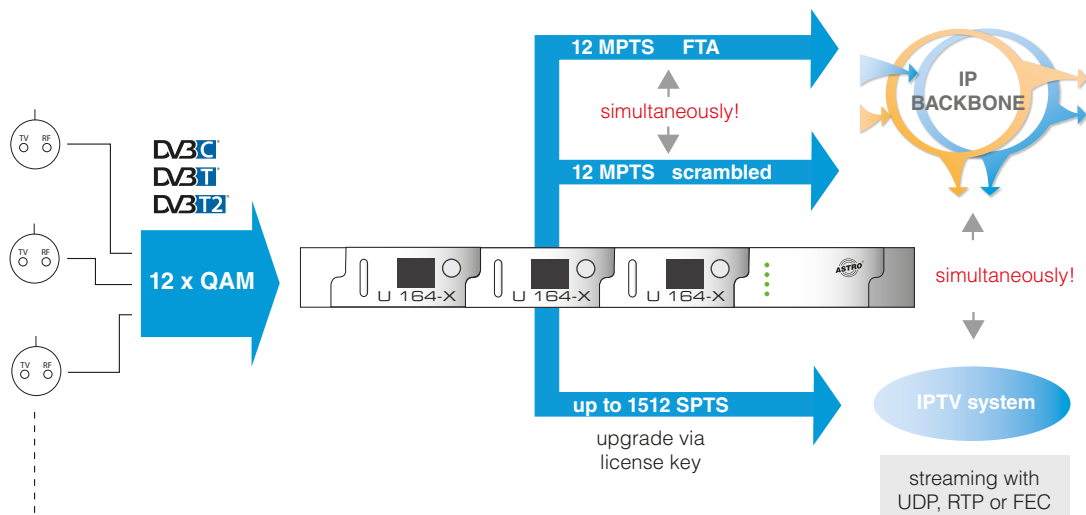


- plug-in module for U 100 base unit
- one physical signal input jacks
- for processing of 4 DVB-CT2 signals into IP multicast groups (8 MPTS, 504 SPTS)
- up to 12 streams per rack unit
- multiplexing of four input transponders to four output streams (license afforded)
- 4 cascadable CI slots with multi channel decryption
- monitored fan



Ultra-dense streaming of DVB-T/T2 and DVB-C in IP with descrambling

APPLICATION EXAMPLE

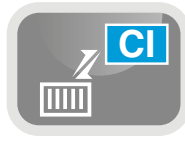


up to 12 QAM channels allocated via up to 3 F-connectors



Each module can be upgraded with multiplex function (license key) 1 x 1 in 4 mux.





Type		U 164-X
Order number		380 167
EAN-Code		4026187194499
Number of DVB-CT2 input signals		4
Number of DVB-CT2 tuners		8
Number of IP output streams		8 MPTS (4 FTA and SCR each), 504 SPTS
Interfaces		
Management		2 x 100 Base-T Ethernet (RJ 45)
Data		2 x 1000 Base-T Ethernet (RJ 45)
Protocols		IEEE802.3 Ethernet, RTP, ARP, IPv4, TCP/UDP, HTTP, SNMP, IGMPv3
Transportstream Encapsulation		
Protocols		UDP, UDP / RTP, 1-7 packets, FEC
Packet length	[Bytes]	188 / 204
DVB-C demodulator		
Frequency range	[MHz]	47 - 862
Input data rate	[Mbaud]	0,5 - 7
Modulation modes (accord. DVB-standard)		QPSK, QAM16, QAM32, QAM64, QAM128, QAM256
Input symbol rate	[MS/s]	1,8 - 7,2
DVB-T demodulator / DVB-T2 demodulator (Scrambling of L1 post signalling; conforms to ETSI EN 302-755 v1.31)		
Frequency range	[MHz]	47 - 862
Modulation		DVB-T: 4-, 16-, 64-QAM; DVB-T2: 4-, 16-, 64-, 256-QAM DVB-T2 scrambling of L1 post signalling
Guardinterval		DVB-T: 1/4; 1/8; 1/16; 1/32; DVB-T2: 1/4; 5/32; 1/8; 5/64; 1/16; 1/32; 1/64; 1/128
FEC		DVB-T: 1/2; 2/3; 3/4; 5/6; 7/8; DVB-T2: 1/2; 3/5; 2/3; 3/4; 4/5; 5/6
FFT-Mode		DVB-T: 2k, 8k; DVB-T2: 1k, 2k, 4k, 8k, 16k, 32k
Bandwidth	[MHz]	DVB-T: 6; 7; 8; DVB-T2: 5; 6; 7; 8
Remote voltage supply		5V, typical, 100mA, switchable
Input symbol rate	[MS/s]	DVB-T: 6, 7, 8; DVB-T2: 5, 6, 7, 8
CI interfaces		
CI slots		4 x (front access)
Supported modules	excerpt (others on request)	Alphacrypt, Aston Conax, Dreamcrypt, Entavio CAM, GkWare BISS CAM, Homecast CAM, ICECrypt, Ideto Access, Kid CAM, Mascom Cryptoworks, Matrix CAM, Mediaguard Canal Digitaal, Nagravision, Oasis CAM, PCMCIA CAM, Premiere, Worldcam, TechniCam Beta2, Technicrypt, TPS, Reality CAM, SMI, Universal CAM, Viaccess, Videoguard CAM
Connectors		4 x PCMCIA
RF inputs		
Connectors	[Ω]	75, 4 x F-jack
Common data		
Current consumption at 48 V	[mA]	590
Power consumption at 36 - 60 V	[W]	28,5 per module
Input voltage	[V]	36 - 60
Dimensions		1 HU, 19 inch
Ambient temperature	[°C]	0 ... +45



# Streamer modules

SIGNAL PROCESSING: DVB-C / DVB-T / DVB-T2 → IP

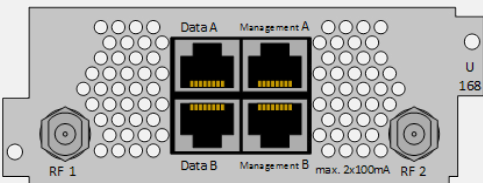
## U 168-X

8 x DVB-C, DVB-T or DVB-T2 to 8 x IP



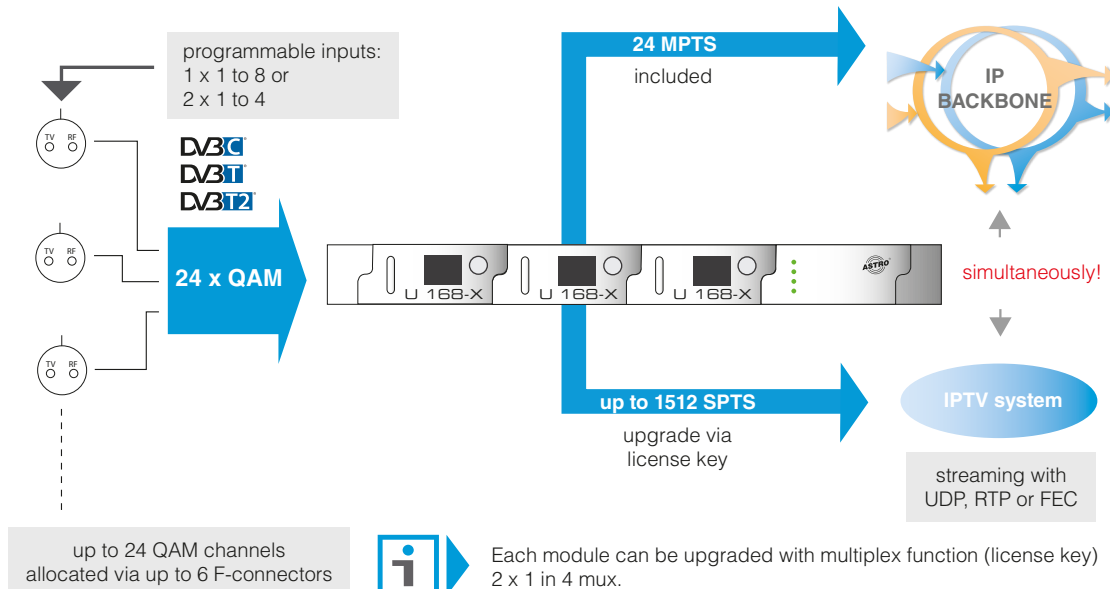
- plug-in module for U 100 base unit
- 2 physical signal input jacks
- for processing of 8 DVB-CT2 signals into IP multicast groups (8 MPTS, 504 SPTS)
- up to 24 streams per rack unit
- multiplexing of four input transponders to four output streams (license afforded)
- monitored fan

Backplane:



APPLICATION EXAMPLE

Ultra-dense streaming of DVB-T/T2 and DVB-C in IP





Type		U 168-X
Order number		380 172
EAN-Code		4026187194505
Number of DVB-CT2 input signals		4
Number of DVB-CT2 tuners		8
Number of IP output streams		8 MPTS, 504 SPTS
Interfaces		
Management		2 x 100 Base-T Ethernet (RJ 45)
Data		2 x 1000 Base-T Ethernet (RJ 45)
Protocols		IEEE802.3 Ethernet, RTP, ARP, IPv4, TCP/UDP, HTTP, SNMP, IGMPv3
Transportstream Encapsulation		
Protocols		UDP, UDP / RTP, 1-7 packets, FEC
Packet length	[Bytes]	188 / 204
DVB-C demodulator		
Frequency range	[MHz]	47 - 862
Input data rate	[Mbaud]	0,5 - 7
Modulation modes (accord. DVB-standard)		QPSK, QAM16, QAM32, QAM64, QAM128, QAM256
Input symbol rate	[MS/s]	1,8 - 7,2
DVB-T demodulator / DVB-T2 demodulator (Scrambling of L1 post signalling; conforms to ETSI EN 302-755 v1.31)		
Frequency range	[MHz]	47 - 862
Modulation		DVB-T: 4-, 16-, 64-QAM; DVB-T2: 4-, 16-, 64-, 256-QAM DVB-T2 scrambling of L1 post signalling
Guardinterval		DVB-T: 1/4; 1/8; 1/16; 1/32; DVB-T2: 1/4; 5/32; 1/8; 5/64; 1/16; 1/32; 1/64; 1/128
FEC		DVB-T: 1/2; 2/3; 3/4; 5/6; 7/8; DVB-T2: 1/2; 3/5; 2/3; 3/4; 4/5; 5/6
FFT-Mode		DVB-T: 2k, 8k; DVB-T2: 1k, 2k, 4k, 8k, 16k, 32k
Bandwidth	[MHz]	DVB-T: 6; 7; 8; DVB-T2: 5; 6; 7; 8
Remote voltage supply		5V, typical, 100mA, switchable
Input symbol rate	[MS/s]	DVB-T: 6, 7, 8; DVB-T2: 5, 6, 7, 8
RF inputs		
Connectors	[Ω]	75, 2 x F-jack
Common data		
Current consumption at 48 V	[mA]	710
Power consumption at 36 - 60 V	[W]	34 per module
Input voltage	[V]	36 - 60
Dimensions		1 HU, 19 inch
Ambient temperature	[°C]	0 ... +45



# Signal converters with IP front end

SIGNAL PROCESSING: IP → PAL / NTSC / SECAM

## U 116

4 x IP to 4 x PAL / SECAM / NTSC with MPEG 4 support (H.264/AVC Level 4.1 HP)



Backplane:



- plug-in module for U 100 base unit
- U 118: for processing of up to 8 IP multicast groups of a Gigabit Ethernet MPEG TS in 8 standard PAL programmes
- U 116: for processing of up to 4 IP multicast groups of a Gigabit Ethernet MPEG TS in 4 standard PAL programmes
- PAL programmes are led through as two pairs of adjacent channels
- outstanding signal parameters by Direct Digital technology (Video-S/N: typ. 66 dB; residual carrier accuracy: 1 %)
- optionally available output channel filters (U-KF) allow for maintaining the high signal quality even after combining
- user friendly configuration via web browser
- monitored fan



## U 118

8 x IP to 8 x PAL / SECAM / NTSC with MPEG 4 support (H.264/AVC Level 4.1 HP)

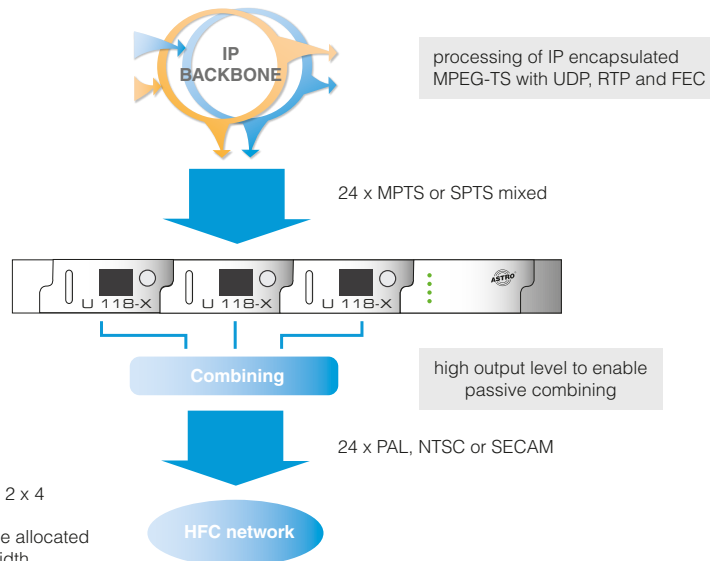


## U 118-x

as U 118 but PAL modulator with 2 x 4 channels on 80 MHz bandwidth

APPLICATION EXAMPLE

IP to analogue



Each module delivers 2 x 4 output channels. The 4 channels can be allocated within 80 MHz bandwidth.



Type		U 116	U 118	U 118-X
Order number		380 117	380 122	380 127
EAN-Code		4026187141059	4026187191955	4026187192815
Maximum number of IP input signals		4	8	8
Maximum number of PAL output signals		4	8	8
<b>Network interfaces (passive routing to U 1xx)</b>				
Management		2 x 100 Base-T Ethernet (RJ 45)		
Data		2 x 1000 Base-T Ethernet (RJ 45)		
Protocol		IEEE802.3 Ethernet, RTP, ARP, IPv4, TCP/UDP, HTTP, SNMP, IGMPv3		
<b>Transport stream editing</b>				
TS Decapsulation		UDP, UDP / RTP, 1-7 packets, FEC		
Packet length	[Bytes]	188 / 204		
<b>Decoding</b>				
Video		H.264/AVC Level 4.1 HP, MPEG-2 MP@HL		
Audio		MPEG-1/2 Layer 1/2, (HE-)AAC, AC-3* / Dolby Digital (Plus) optional		
Data		Teletext, VPS, WSS, Teletext subtitles, DVB Subtitling		
<b>PAL modulator</b>				
Connectors	[Ω]	75, 2 x F-jack		
Frequency range	[MHz]	47 - 862, digital modulation	47 - 862, digital modulation, 2 x 4 channels on 80 MHz bandwidth	
Output level	[dBμV]	118	112	
Return loss	[dB]	≥ 14		
Spurious frequency dist.	[dB]	≥ 60		
Stereo cross talk	[dB]	> 55		
Residual carrier accuracy	[%]	1		
TV standard		PAL B/G, D/K, M, N, SECAM, SECAM L, A2/NICAM, NTSC mono		
Video-signal to noise ratio	[dB]	typ. 65	typ. 63	
<b>Common data</b>				
Current consumption at 48 V	[mA]	660	890	850
Power consumption at 48 V	[W]	32 per module	40 per module	
Input voltage	[V]	48		
Dimensions		1 HU, 19 inch		
Ambient temperature	[°C]	0 ... +45		

\*) AC-3 only supported by U 116 (AC-3), order number: 380 118; U 118 (AC-3), order number 380 123 and U 118-x (AC-3), order number 380 128



# Signal converters with IP front end

SIGNAL PROCESSING: IP → PAL / NTSC / SECAM

U 224-230

U 224-48



- fully integrated device for the conversion of IP signals to PAL / NTSC TV programmes
- for the conversion of up to 24 IP Gigabit Ethernet multicast groups to 3 x 2 x 4 standard PAL programmes
- each four analogue programmes can be played out in a range of 80 MHz
- WSS, Teletext, VPS, ticker insertion, RTP, FEC, IGMPv3, MPEG4 H.264/AVC level 4.1, HD in SD downscaling
- versions with AC-3 audio decoding available (see data sheet)
- outstanding parameters thanks to Direct Digital technology
- power supplies have to be ordered **seperately** (one for operation, two for redundant voltage supply)
- user-friendly configuration via web interface
- fans integrated to the management

Backside of U 224-230:

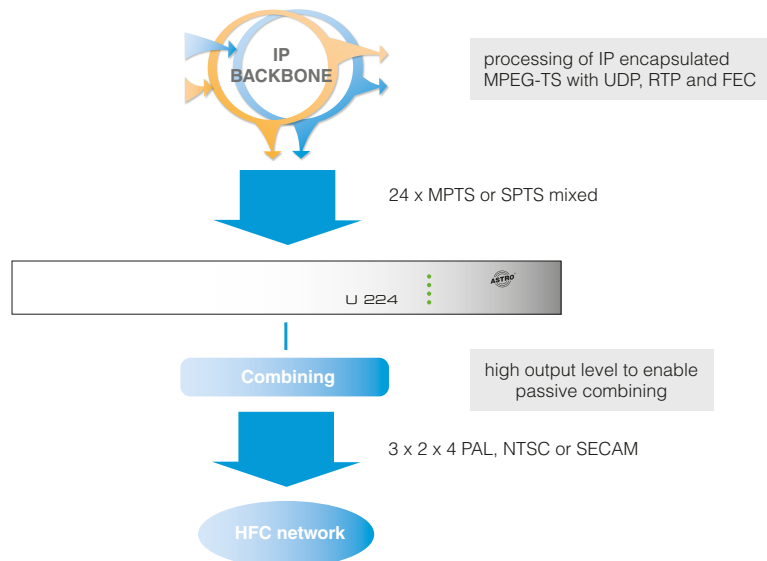


Backside of U 224-48:



APPLICATION EXAMPLE

IP to analogue





Type		U 224-230	U 224-48
Order number		380 227	380 228
EAN-Code		4026187194635	4026187194727
<b>Network interfaces (passive routing to U 1xx)</b>			
Management		3 x 100 Base-T Ethernet (RJ 45)	
Data		3 x 1000 Base-T Ethernet (RJ 45)	
Protocol		IEEE802.3 Ethernet, RTP, ARP, IPv4, TCP/UDP, HTTP, SNTP, IGMPv3	
<b>Transport stream editing</b>			
TS Decapsulation		UDP, UDP / RTP, 1-7 packets, FEC, SPTS, MPTS	
Packet length	[Bytes]	188 / 204	
<b>Decoding</b>			
Video		H.264/AVC Level 4.1 HP, MPEG-2 MP@HL	
Audio		MPEG-1/2 Layer 1/2, (HE-)AAC, AC-3*	
Data		Teletext, VPS, WSS, Teletext subtitles, DVB Subtitling	
<b>PAL modulator</b>			
Number of channels		up to 24	
Connectors	[Ω]	75, F-jack	
Frequency range	[MHz]	47 - 862, digital modulation	
Output level	[dBμV]	maximum 104	
Return loss	[dB]	≥ 14	
Spurious frequency dist.	[dB]	≥ 60	
Stereo cross talk	[dB]	> 55	
Residual carrier accuracy	[%]	1	
TV standard		PAL B/G, D/K, M, N, SECAM, SECAM L, A2/NICAM, NTSC mono	
Audio standard		A 2, A 2+, A 2-, Nicam	
Video-signal to noise ratio	[dB]	≥ 60	
<b>Common data</b>			
Input voltage	[V]	100 - 240 (50 / 60 Hz)	
Input power consumption	[W / VA]	130 (@ 2 redundant power supply units)	
Dimensions		1 HU, 19 inch	
Ambient temperature	[°C]	0 ... +45	

\*) AC-3 is only supported by U 224-230 AC-3 (Order number 380 230) and U 224-48 AC-3 (Order number 380 229)



# Signal converters with IP front end

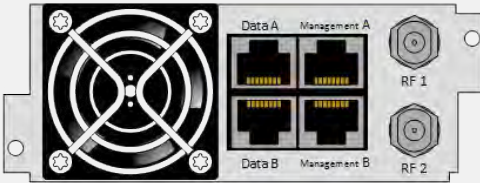
SIGNAL PROCESSING: IP → FM

## U 125

4 x IP to 2 x 20 FM programmes



Backplane:



## U 124

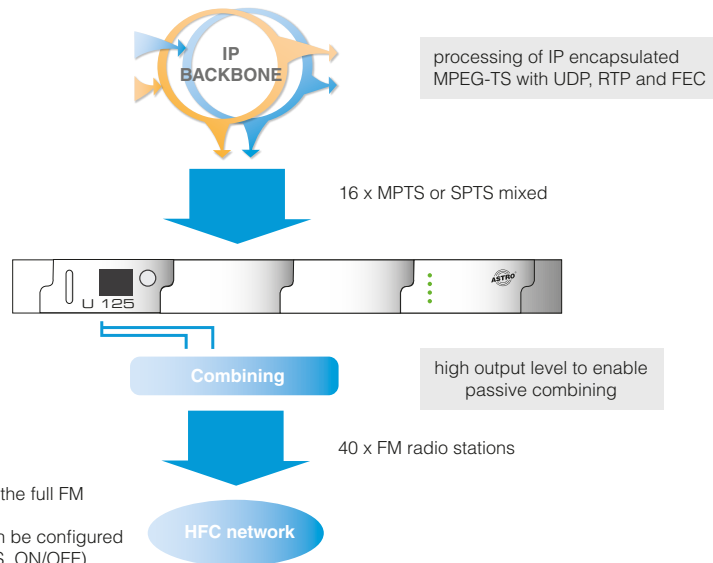
4 x IP to 2 x 8 FM programmes

- plug-in module for U 100 base unit
- U 124: for processing of up to 4 IP multicast groups of a Gigabit Ethernet MPEG TS into 2 x 8 standard FM programmes
- U 125: for processing of up to 16 IP multicast groups of a Gigabit Ethernet MPEG TS into 2 x 20 standard FM programmes
- FM programmes are led through as two groups consisting of 8 programmes
- outstanding signal parameters by Direct Digital technology
- static and dynamic RDS are supported (radiotext, PTY, PS and CT)
- user friendly configuration via web browser
- monitored fan



APPLICATION EXAMPLE

IP to FM radio





Type		U 124	U 125
Order number		380 124	380 125
EAN-Code		4026187611118	4026187191337
<b>Network interfaces (passive routing to U 1xx)</b>			
Management		2 x 100 Base-T Ethernet (RJ 45)	
Data		2 x 1000 Base-T Ethernet (RJ 45)	
Protocol		IEEE802.3 Ethernet, RTP, ARP, IPv4, TCP/UDP, HTTP, SNMP, IGMPv3	IEEE802.3 Ethernet, RTP, ARP, IPv4, TCP/UDP, HTTP, SNMP, IGMP, SSL, RADIUS
<b>Transport stream editing</b>			
Decapsulation		UDP, UDP / RTP, 1-7 packets, FEC	
Packet length	[Bytes]	transparent (188 or 204 packets)	
<b>Decoding</b>			
Input signal		4 x MPEG-2 TS	16 x MPEG-2 TS
Audio		MPEG 1 Layer 2, Stereo	
<b>FM modulator</b>			
Connectors		2 x F-jack	
Output signal		2 x 8 FM stereo channels with RDS	2 x 20 FM stereo channels with RDS
Output frequency	[MHz]	87,5 - 108, digital modulated, 10 kHz steps	
static		TP / PI / PS 8 x 8 signs	
dynamic		Pi / Radiotext / PTY / PS / CT / MS	
Output level	[dBμV]	114	
Intermodulation distance	[dBc]	> 60	60 @ 114 dbμV; 65 @ 112 dbμV
Return loss	[dB]	> 14	> 18
Signal to noise ratio	[dB]	> 64	> 65
Unweighted signal to noise ratio	[dB]	> 70	
Preemphasis	[μs]	50	
Stereo cross talk attenuation	[dB]	60	
Harmonic factor	[%]	< 0,05	
Frequency range	[dB]	< 1	
<b>Common data</b>			
Current consumption at 48 V	[mA]	680	920
Power consumption at 36 - 60 V	[W]	25,5 per module	39 per module
Input voltage	[V]	36 - 60	
Dimensions		1 HU, 19 inch	
Ambient temperature	[°C]	0 ... +45	

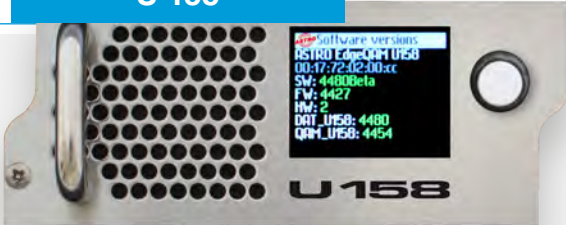


# Signal converters with IP front end

SIGNAL PROCESSING: IP → QAM

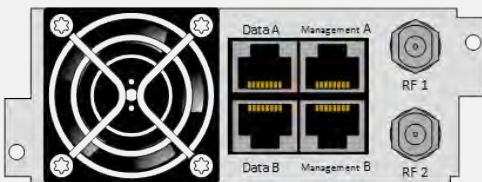
U 158

8 x IP to 8 x QAM



- plug-in module for U 100 base unit
- for processing of up to 8 IP multicast groups of a Gigabit Ethernet MPEG TS in 8 standard QAM channels
- QAM channels programmes are led through as four adjacent channels
- outstanding signal parameters by Direct Digital technology
- NIT and LCN processing integrated
- optionally available output channel filters (U-KF) allow for maintaining the high signal quality even after combining
- user friendly configuration via web browser
- monitored fan

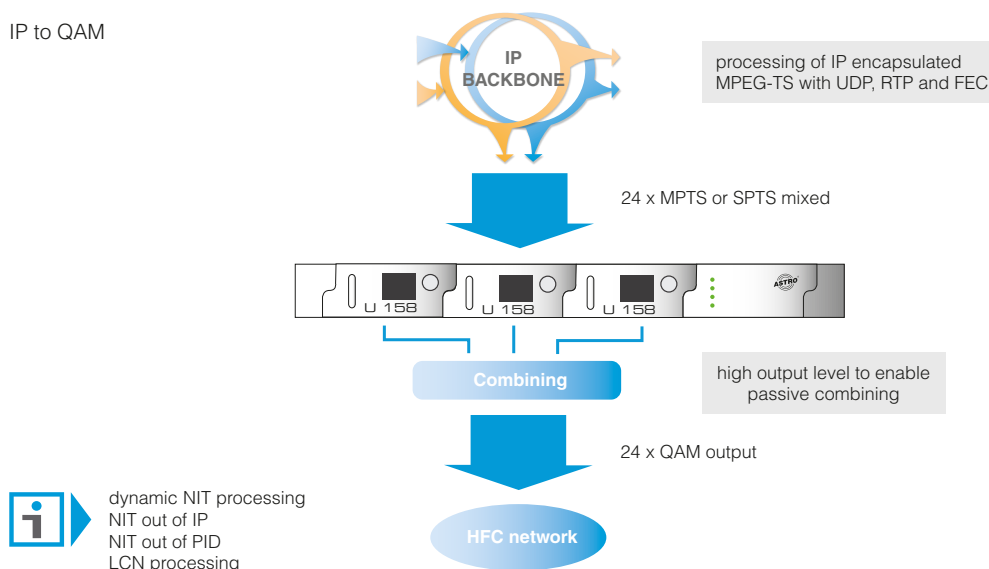
Backplane:



Direct Digital  by ASTRO

APPLICATION EXAMPLE

IP to QAM





Type		U 158
Order number		380 158
EAN-Code		4026187131852
<b>Network interfaces (passive routing to U 1xx)</b>		
Management		2 x 100 Base-T Ethernet (RJ 45)
Data		2 x 1000 Base-T Ethernet (RJ 45)
Protocol		IEEE802.3 Ethernet, RTP, ARP, IPv4, TCP/UDP, HTTP, SNMP, IGMPv3
<b>Transport stream editing</b>		
TS capsulation		UDP, UDP / RTP, 1-7 packets, FEC
Packet length	[Bytes]	188 / 204
<b>QAM modulator</b>		
Modulation		16-, 32-, 64-, 128-, 256-QAM
Signal processing		according DVB standard
Spectrum shape (cos-roll-off)	[%]	15
FEC		Reed-Solomon (204, 188)
Data rate adjustment		<input checked="" type="checkbox"/>
PCR-correction		<input checked="" type="checkbox"/>
NIT-handling, PID-remapping		<input checked="" type="checkbox"/>
Output symbol rate	[Msymb/s]	3,45 - 7,5 (for 2 adjacent channels)
Bandwidth	[MHz]	4 - 8 depending on output symbol rate
Gross data rate	[Mbit/s]	55,2
MER (Equalizer)	[dB]	≥ 44
<b>RF modulator</b>		
Connectors	[Ω]	75, 2 x F-jack
Frequency range	[MHz]	47 - 862, digital modulation
Output level	[dBμV]	114
Return loss	[dB]	> 14
Spurious frequency distance	[dB]	> 60
<b>Common data</b>		
Current consumption at 48 V	[mA]	680
Power consumption at 36 - 60 V	[W]	28 per module
Input voltage	[V]	36 - 60
Dimensions		1 HU, 19 inch
Ambient temperature	[°C]	0 ... +45

# Signal converters with IP front end

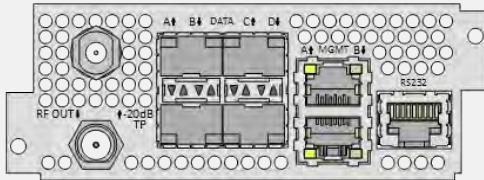
SIGNAL PROCESSING: IP → QAM

**U 159**

64 x IP to QAM



Backplane:

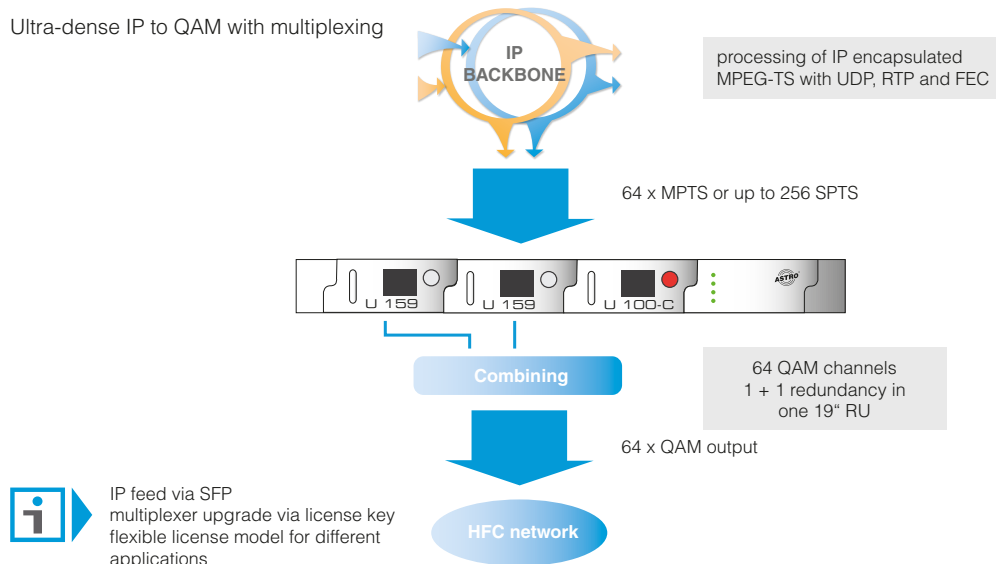


- plug-in module for U 100 base unit
- for processing of up to 64 IP multicast groups of a Gigabit Ethernet MPEG TS into 64 QAM channels
- 192 QAM channels in one 19 inch RU
- QAM Annex A & B, RTP, FEC, IGMP, SNMP
- each QAM channel frequency independent
- Multiplexing - Generation of QAM channels out of different input signals
- outstanding signal parameters by Direct Digital technology
- user friendly configuration via web browser
- monitored fan

Direct Digital  by ASTRO

APPLICATION EXAMPLE

Ultra-dense IP to QAM with multiplexing





Type		U 159
Order Number		380 159
EAN-Code		4026187193270
Network interfaces (passive routing to U 1xx)		
Management		2 x 1000 Base-T Ethernet (RJ 45)
Data		4 x SFP (1000 Base-X or SGMII)
Input Bitrate per Data Port	[Mbit/s]	1000/1000/900/750 @ 1/2/3/4 Ports
Protocol		Ethernet, ARP, IPv4, IPv6, UDP, RTP, TCP, HTTP(S), SNTP, SNMP v2c/v3, Syslog, IGMP v2/v3, MLD v1/v2
Serial		1x RJ 45, 115200 kbit/s, 8N1
Transport Stream Processing		
TS Decapsulation		UDP, UDP/RTP, 1-7 packets, FEC (SMPTE 2022-1, -2)
Packet Length	[Bytes]	188
Data rate adjustment		<input checked="" type="checkbox"/>
PCR-Correction (< 500 ns acc. DVB)		<input checked="" type="checkbox"/>
NIT Handling		static, NIT from PID, dynamic
QAM-Modulator		
Modulation		16-, 32-, 64-, 128-, 256-QAM
Signal processing		DVB EN 300 429, ITU J.83 Annex A/C
Spectrum shape cos-roll-off	[%]	12, 13, 15, 18
FEC		Reed-Solomon (204, 188) Code
Symbol rate	[Msymb/s]	1 - 7,14
Channel Bandwidth	[MHz]	1,12 - 8 (depends on symbol rate)
Maximum number of channels		64
Maximum bitrate per output channel	[Mbit/s]	52,64
Phase error dynamic	[°]	0,3
MER (Equalizer)	[dB]	≥ 44
Shoulder attenuation	[dB]	> 56
RF-Modulator		
Connectors	[Ω]	75, 2 x F-jack (1 x RF, 1 x Test point -20 dB)
Frequency range	[MHz]	47 - 1006, digital modulation
Frequency drift	[kHz]	< 10
Output level	[dBμV]	114/111/108 @ 16/32/64 Channels
Intermodulation distance	[dB]	> 60
Return loss	[dB]	> 14
Spurious frequency distance	[dB]	> 60
Intercarrier Signal-to-Noise ratio	[dB]	> 60
Common data		
Current consumption at 48 VDC	[mA]	830
Power consumption	[W]	45
Input voltage	[V]	36 - 60 VDC or 230 VAC
Dimensions		1 RU, 19 inch
Ambient temperature	[°C]	0...+45



# Signal converters with IP front end

SIGNAL PROCESSING: IP → DVB-C2

**U 160**

2 x IP to 2 x DVB-C2



- plug-in module for U 100 base unit
- for processing of up to 24 IP multicast groups of a Gigabit Ethernet MPEG TS into 2 DVB-C2 systems
- multiple transportstream
- multiplexing of data slices
- FEC: LDPC and BCH
- OFDM modulation
- 2 x 8 MHz / 1 data slice or 2 x 16 MHz / 3 data slices
- RTP, IGMPv3
- broadband notch placing
- user friendly configuration via web browser
- monitored fan

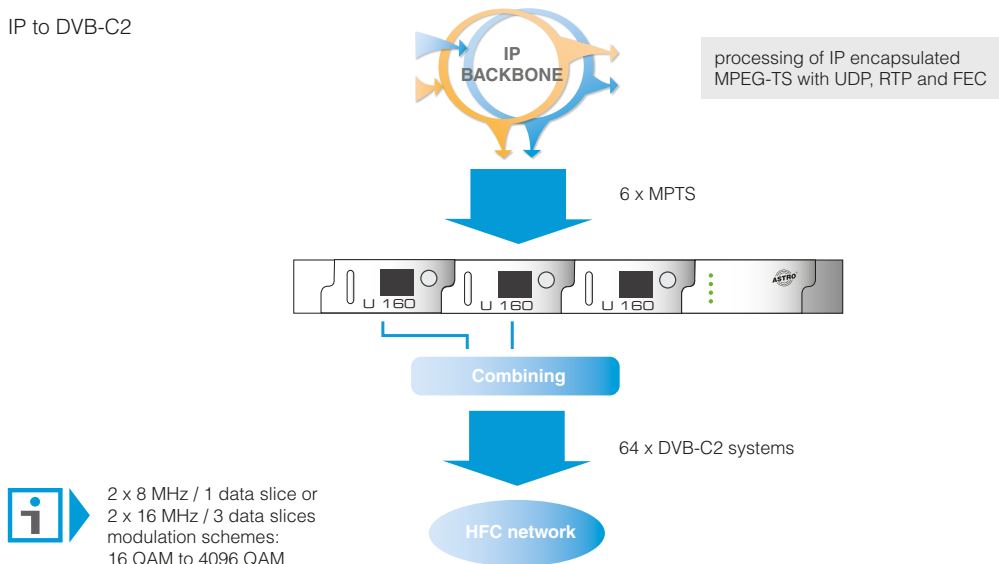
Backplane:



**Direct Digital**  by ASTRO

APPLICATION EXAMPLE

IP to DVB-C2



2 x 8 MHz / 1 data slice or  
2 x 16 MHz / 3 data slices  
modulation schemes:  
16 QAM to 4096 QAM



Type		U 160
Order number		380 160
EAN-Code		4026187161088
Interfaces		
Management		2 x 100 Base-T Ethernet (RJ 45)
Data		2 x 1000 Base-T Ethernet (RJ 45)
Protocols		IEEE802.3 Ethernet, RTP, ARP, IPv4, TCP/UDP, HTTP, SNTP, IGMPv3
Transportstream Encapsulation		
Protocols		UDP, UDP / RTP, 1-7 packets, FEC
Packet length	[Bytes]	188 / 204
DVB-C2 demodulator		
Input interface		Transportstream
Coding Modes		static
FEC		LDPC, BCH
Interleaving		Bit, time and frequency
Modulation		OFDM
Bandwidth	[MHz]	16
Guard interval		1/64 or 1/128
Modulation schemes		16 QAM to 4096 QAM
FEC Frame		64 800 bits or 16 200 bits
Data Slices		1-3
Physical Layer Pipes		Single PLP per Data Slice
Narrowband Notches		<input checked="" type="checkbox"/>
Broadband Notches		<input checked="" type="checkbox"/>
RF modulator		
Connectors	[Ω]	75, 2 x F-jack
Frequency range	[MHz]	47 - 862
RF output level	[dBμV]	114
Return loss	[dB]	> 14
Spurious frequency distance	[dB]	> 60
Common data		
Current consumption at 48 V	[mA]	680
Power consumption at 36 - 60 V	[W]	28 per module
Input voltage	[V]	36 - 60
Dimensions		1 HU, 19 inch
Ambient temperature	[°C]	0 ... +45

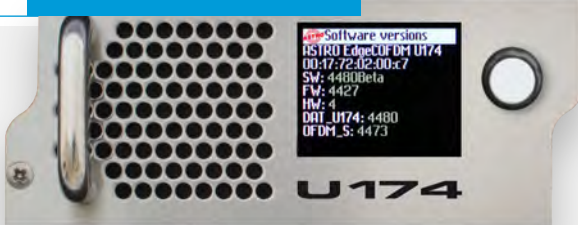


# Signal converters with IP front end

SIGNAL PROCESSING: IP → COFDM / ISDB-T

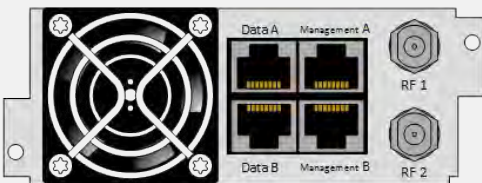
4 x IP to 4 x COFDM

U 174



- plug-in module for U 100 base unit
- for processing of up to 4 IP multicast groups of a Gigabit Ethernet MPEG TS into 4 standard COFDM channels
- COFDM channels are led through as two adjacent channels
- outstanding signal parameters by Direct Digital technology (MER:  $\geq 43$  dB; shoulder attenuation:  $\geq 56$  dB)
- RTP, FEC, IGMPv3
- optionally available output channel filters (U-KF) allow for maintaining the high signal quality even after combining
- user friendly configuration via web browser
- monitored fan

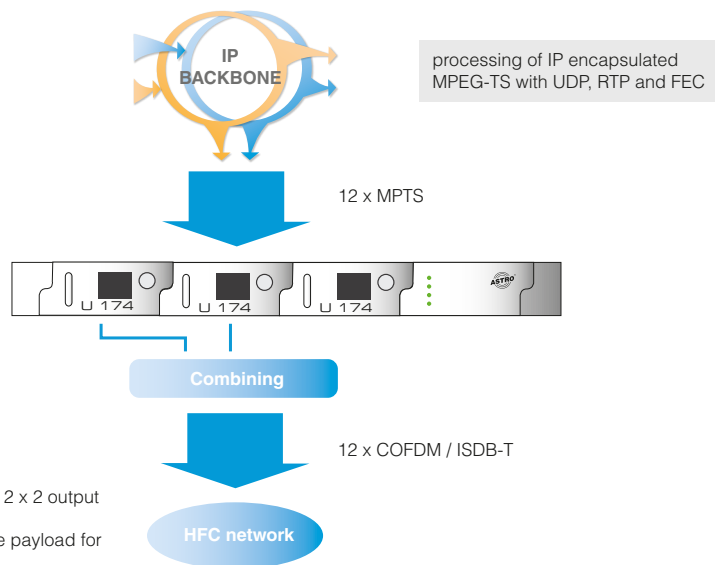
Backplane:



Direct Digital  by ASTRO

APPLICATION EXAMPLE

IP to COFDM / ISDB-T



each module delivers 2 x 2 output channels  
PID filter to reduce the payload for output channels





Type		U 174	
Order number		380 174	
EAN-Code		4026187611026	
Network interfaces (passive routing to U 1xx)			
Management		2 x 100 Base-T Ethernet (RJ 45)	
Data		2 x 1000 Base-T Ethernet (RJ 45)	
Protocol		IEEE802.3 Ethernet, RTP, ARP, IPv4, TCP/UDP, HTTP, SNMP, IGMPv3	
Transportstream editing			
TS capsulation		UDP, UDP / RTP, 1-7 packets, FEC	
Packet length	[Bytes]	188 / 204	
COFDM modulator		ISDB-T	DVB
COFDM Mode		2k, 4k, 8k	2k, 8k
Carrier modulation		QPSK, DQPSK, 16-, 64-QAM	QPSK, 16-, 64-QAM
Bandwidth	[MHz]	6, 7, 8	6, 7, 8
Maximum gross data rate	[Mbit/s]	30,980	31,668
Signal processing		accord. ARIB STD-B31 Ver. 2.2-E1 ("Time Interleaver", "Hierarchical transmission" und "Auxiliary channel" are not supported)	accord. DVB standard
FEC		Reed-Solomon (204, 188) code, convolutional code	Reed-Solomon (204, 188) code, convolutional code
Coding rates		1/2, 2/3, 3/4, 5/6, 7/8	1/2, 2/3, 3/4, 5/6, 7/8
Guard intervals		1/4, 1/8, 1/16, 1/32	1/4, 1/8, 1/16, 1/32
Data rate adjustment			<input checked="" type="checkbox"/>
PCR-correction (< 500 ns accord. DVB)			<input checked="" type="checkbox"/>
NIT-Handling (static)			<input checked="" type="checkbox"/>
PID Remapping			<input checked="" type="checkbox"/>
PID Filtering		Drop or Pass PID-Filter	
MER (Equalizer)	[dB]	≥ 43	
Shoulder attenuation	[dB]	> 56 (< 700 MHz); > 54 (≥ 700 MHz)	
HF modulator			
Connectors	[Ω]	75, 2 x F-jack	
Frequency range	[MHz]	47 - 862, digitally modulated	
Frequency deviation	[kHz]	< 10	
Output level	[dBμV]	114	
Intermodulation distance	[dB]	> 60	
Return loss	[dB]	> 14	
Spurious frequency distance	[dB]	> 60	
Common data			
Current consumption at 48 V	[mA]	680	
Power consumption at 36 - 60 V	[W]	28 per module	
Input voltage	[V]	36 - 60	
Dimensions		1 HU, 19 inch	
Ambient temperature	[°C]	0 ... +45	

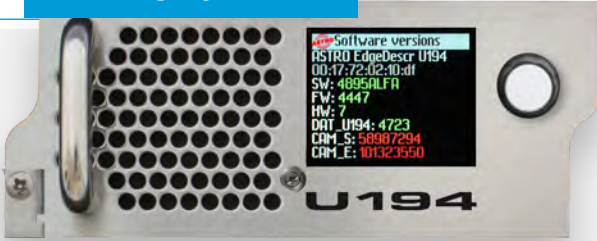


# Descrambler

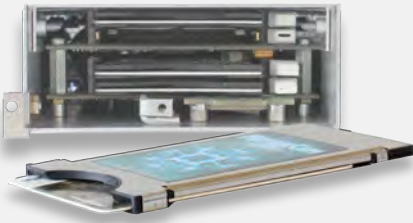
SIGNAL PROCESSING: IP → IP

4 x IP to 4 x IP

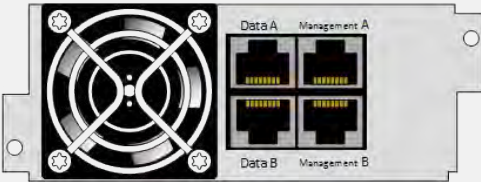
U 194



without front cover



Backplane:

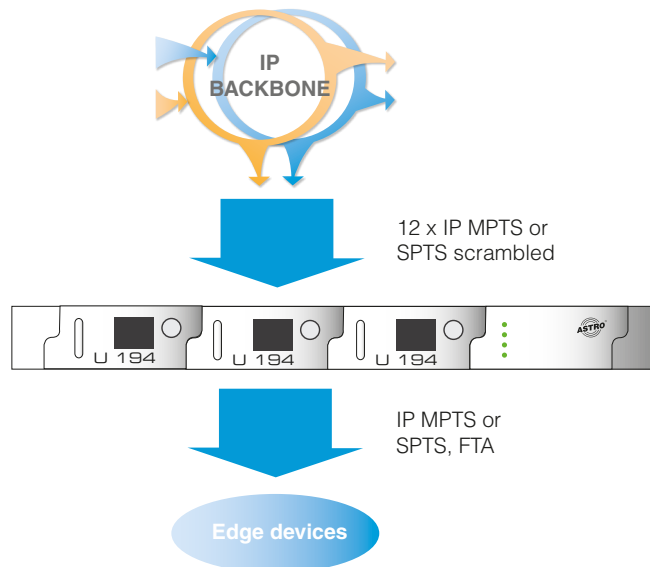


- plug-in module for U 100 base unit
- 4 CI-slots; independent / cascadable
- 4 transport streams
- Multi-Service-Descrambling
- decryption level: service based, PID based
- RTP, FEC, IGMPv3
- user friendly configuration via web browser
- monitored fan

Direct Digital  by ASTRO

APPLICATION EXAMPLE

IP to IP descrambler





Type		U 194
Order number		380 161
EAN-Code		4026187161095
<b>Network data interfaces</b>		
Interface type		100FD/1000Base-T Ethernet IEEE 802.3
Protocol		IP v4, ARP, UDP, RTP, ICMP, IGMPv2
Connector		2 x 8p8C "RJ-45" (redundant)
TS Receiver		4 x (unicast / multicast)
TS Transmitter		4 x (unicast / multicast)
<b>CI interfaces</b>		
CI slots		4 x (front access)
Supported modules	excerpt (others on request)	Alphacrypt, Aston Conax, Dreamcrypt, Entavio CAM, GkWare BISS CAM, Homecast CAM, ICECrypt, Ideto Access, Kid CAM, Mascom Cryptoworks, Matrix CAM, Mediaguard Canal Digitaal, Nagravision, Oasis CAM, PCMCIA CAM, Premiere, Worldcam, TechniCam Beta2, Technicrypt, TPS, Reality CAM, SMI-T, Universal CAM, Viaccess, Videoguard CAM
Connectors		4 x PCMCIA
<b>Transportstream</b>		
TS encapsulation		UDP/IP, RTP/UDP/IP, FEC
TS type		MPTS
TS functionality		Receiver, decode, and transmit up to 4 MPTS via IP
<b>Control and Management</b>		
Interface type		100FD/1000Base-T Ethernet IEEE 802.3
Features		Element control via HTTP/Web-GUI, SNMP traps for integration with network management systems (NMS), software update via FTP or TFTP
Protocol		IP v4, ARP, UDP, TCP, ICMP, HTTP, SNMP v2c, FTP, TFTP, DNS, DHCP, SNTP
Connectors		2 x 8P8C "RJ-45" (redundant)
<b>Common data</b>		
Current consumption at 48 V	[mA]	605
Power consumption at 36 - 60 V	[W]	24,3 per module
Input voltage	[V]	36 - 60
Dimensions		1 HU, 19 inch
Ambient temperature	[°C]	0 ... +45



# Passive Combining

## PASSIVE COMBINING NETWORK

**U 960**



- for distribution of input signals in the frequency range 5 - 1000 MHz
- individual mounting subject to customer request

Type		U 960
Order number		380 195
EAN-Code		4026187680152
Impedance	[Ω]	75
Frequency range	[MHz]	5 - 1000
Screening	[dB]	> 100
Connectors	[dB]	F-jacks

can be assembled with:

2-way splitter		
Through loss	[dB]	3,8 ± 0,5
Isolation	[dB]	> 24
Return loss	[dB]	> 21
3-way splitter		
Through loss	[dB]	6,5 ± 0,5
Isolation	[dB]	> 24
Return loss	[dB]	> 22
4-way splitter		
Through loss	[dB]	7,5 ± 0,5
Isolation	[dB]	> 23
Return loss	[dB]	> 23
8-way splitter		
Through loss	[dB]	11,2 ± 0,5
Isolation	[dB]	> 29
Return loss	[dB]	> 21
Common data		
Housing		19", 1 HE
Ambient temperature	[°C]	0...+50

# Active SAT splitters

FOR DISTRIBUTION OF SAT POLARISATIONS

## U 911 - U 946



19-inch rack-version  
attenuation and slope adjustable via HE  
programming software, completely remote  
maintenance, transmission of system-error  
indication

Type	U 911	U 912	U 914	U 915
Order number	380 192	380 212	380 214	380 215
EAN-Code 4026187...	...651435	...002749	...651909	002763
Connectors	[Ω]	In- and outputs: F-jacks, 75		

Type	U 921	U 922	U 924	U 925
Order number	380 221	380 222	380 224	380 225
EAN-Code 4026187...	...735180	...002787	...735173	002800
Connectors	[Ω]	In- and outputs: SMA-connectors, 50		

Type	U 931	U 932	U 934	U 935
Order number	380 231	380 232	380 234	380 235
EAN-Code 4026187...	...002824	...002831	...002855	...002862
Connectors	[Ω]	Inputs: SMA-connectors, 50 & Outputs: F-jacks, 75		

Type	U 941	U 942	U 944	U 945
Order number	380 241	380 242	380 244	380 245
EAN- Code 4026187...	...002886	...002893	...002916	...002923
Connectors	[Ω]	Inputs: F-jacks, 75 & Outputs: SMA-connectors, 50		

Common data					
Inputs / Outputs		2 x 1 in 8		1 x 1 in 16	
Num. of power suppl. 230 V / 28VA		2	1	2	1
Remote current	[ma]	350	350	350	350
LNB voltage	[V]	16	16	16	16
Input frequency range	[MHz]	950 - 2150			
Input level value	[dBμV]	85			
Through loss	[dB]	0 ± 2			
Isolation	[dB]	> 40			
Level control (0,5 dB steps)	[dB]	0...-15			
Equalizer	[dB]	0 / 7 ± 1			
Frequency range insertion loss in 36 MHz bandwidth in nominal frequency range	[dBss] [dBss]	< 1 < 2			
Return loss Inputs / Outputs	[dB]	≥ 12 / ≥ 14			
Output isolation	[dB]	> 20			
Testpoints (1 per polarization) Value output isolation	[dB]	10			
Return loss	[dB]	12			

\* maximum 1,5 A, depending on power supply and internal securing



# Accessories

## CHANNEL SELECTIVE FILTERS, MOUNTING CABINETS



### U-KF

Order number: 380 ...  
(Please order with specified  
output channel.)  
Channel range: 47 - 862 MHz

- channel selective pluggable output filter module for maintaining the outstanding output parameters even after combining
- for U 1xx signal converters



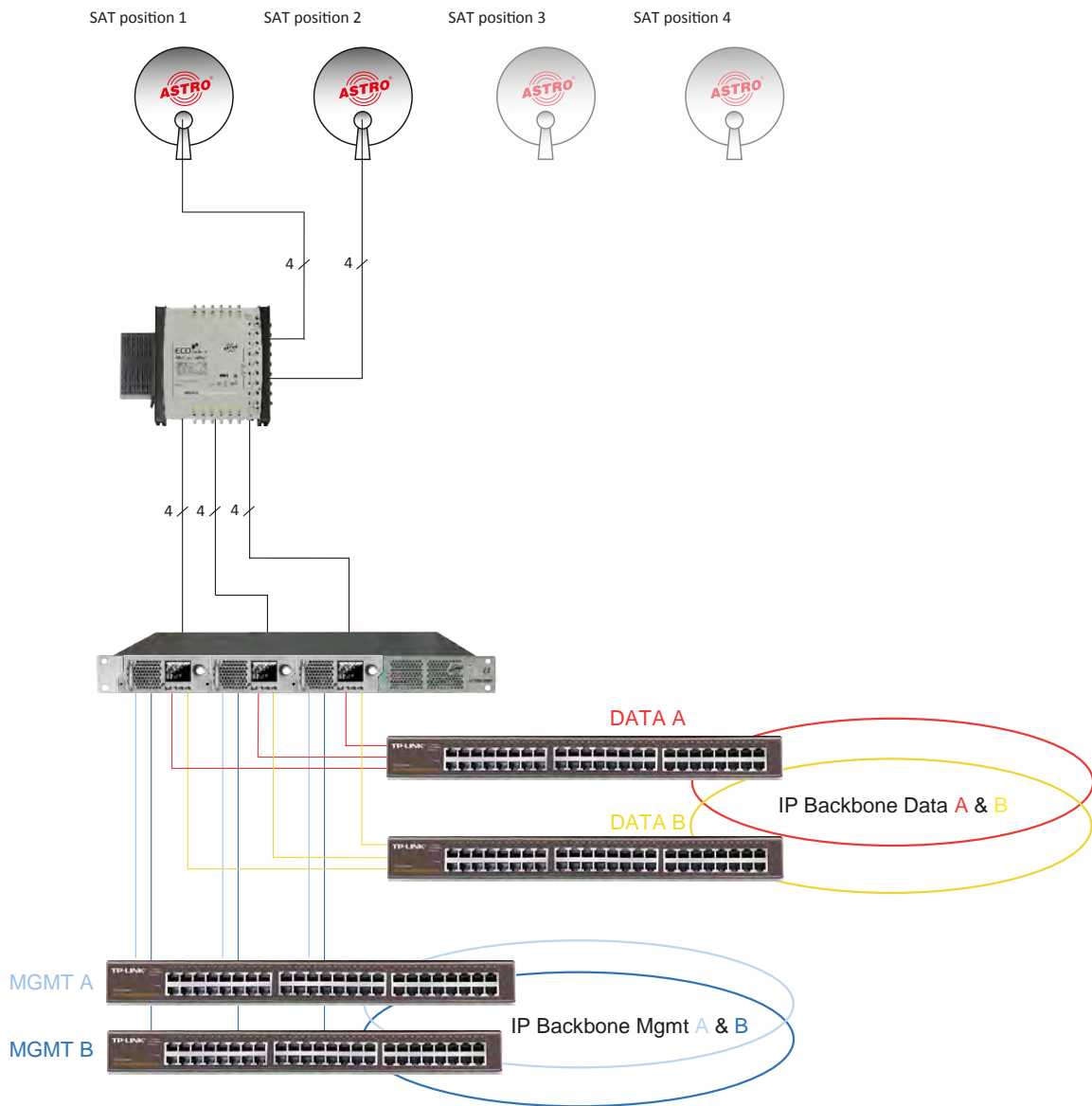
### LGH 2000

Order number: 189 931  
EAN-Code: 4026187591731

- protective housing made of 1,2 mm sheet steel with PURAL-coating 7032
- eight pre-punches that can be tweaked out if required for cable feed
- ventilation grills for good ventilation
- uniform locking safety lock
- delivered with particle board for mounting
- 19" rack, 600 x 2000 x 600 mm, 42 RU
- including power distribution

# Application solutions

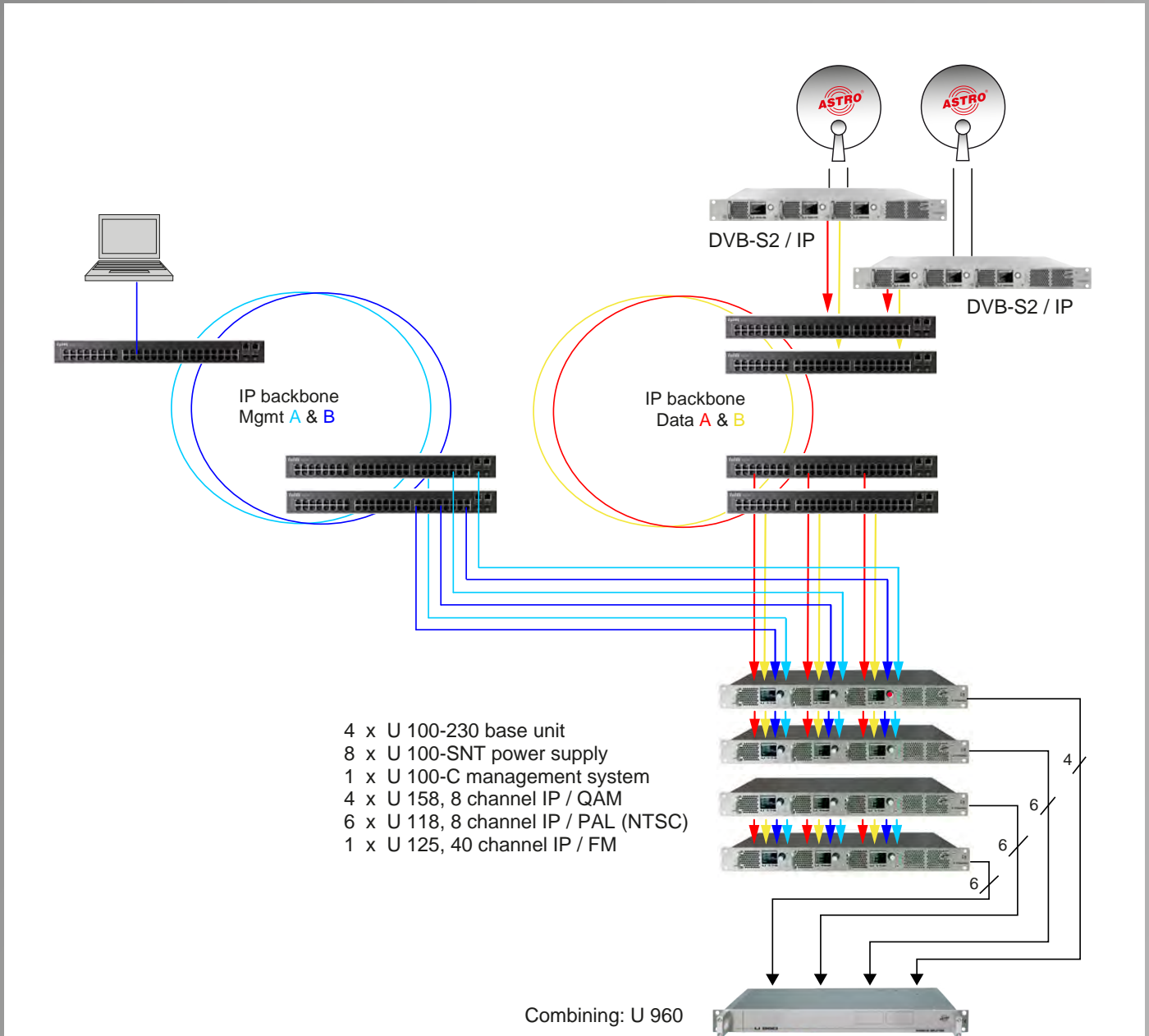
## Streaming of DVB-S2 input signals to IP with Descrambling



- 12 x DVB-S2 to IP with multichannel decryption
- high signal density with 12 streams per RU
- support of UDP/RTP and FEC
- up to 4 satellite positions with 16 input multichannel thanks to DiSeqC 2.0 support
- fully integrated to the ASTRO U 100-C management system

# Application solutions

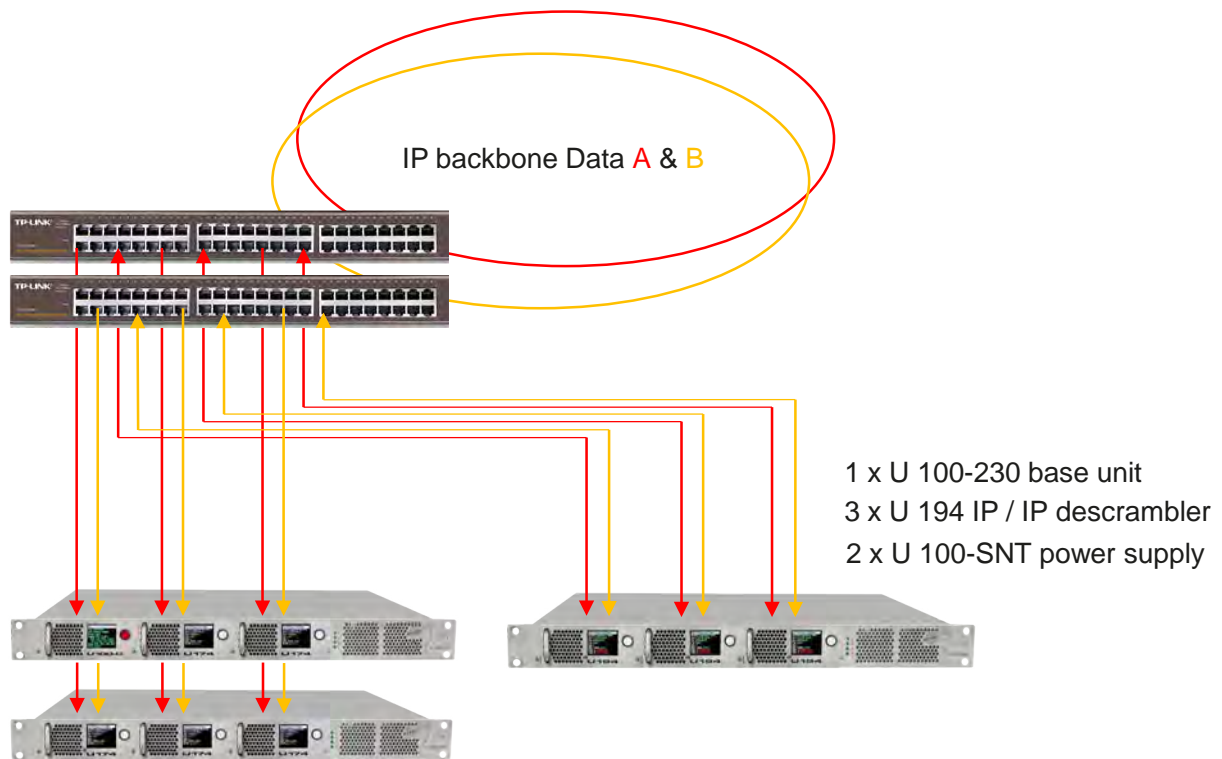
IP head-end: 32 x IP / QAM, 48 x IP / PAL, 40 x IP / FM with fully redundant network structure for management and data connections



- conversion of 32 QAM channels, 48 PAL, SECAM or NTSC channels and 40 FM stations out of IP multicast groups
- only 4 19 inch rack units required
- compatible to any other Video-over-IP equipment encapsulating MPEG-TS to IP, according applicable standards



## IP head-end: 20 x IP/COFDM, 12 x IP in / IP out Descrambling



2 x U 100-230 base unit  
5 x U 174, 4 channel IP/COFDM  
1 x U 100-C, management system  
4 x U 100-SNT power supply

- descrambling of 12 streams per rack unit
- multiservice descrambling
- cascable CI slots

## Solutions for FTTX/FTTB and hybrid networks

FTTX and FTTB will be the dominating access technology in the future. All over the world the last mile to the customer is built more and more fibre oriented. ASTRO has strong commitment to provide professional End-to-End fibre based solutions, with main focus on broadcasting for Satellite & Video Networks, last mile data technologies and FTTX RF-Overlay devices. Combined with its professional head-end technology, ASTRO will be able to supply complete network solutions from central station to final customer.

Based on different transmission technologies, such as RF-Overlay combined with Data solutions (GPON or Ethernet, optical satellite transmission solutions for MDUs, DOCSIS compliant products, passive optical products, tools and CPEs), ASTRO has suitable products for a large scale of different network providers, such as City Operators, Telcos, Cable Operators, Building Developers etc.

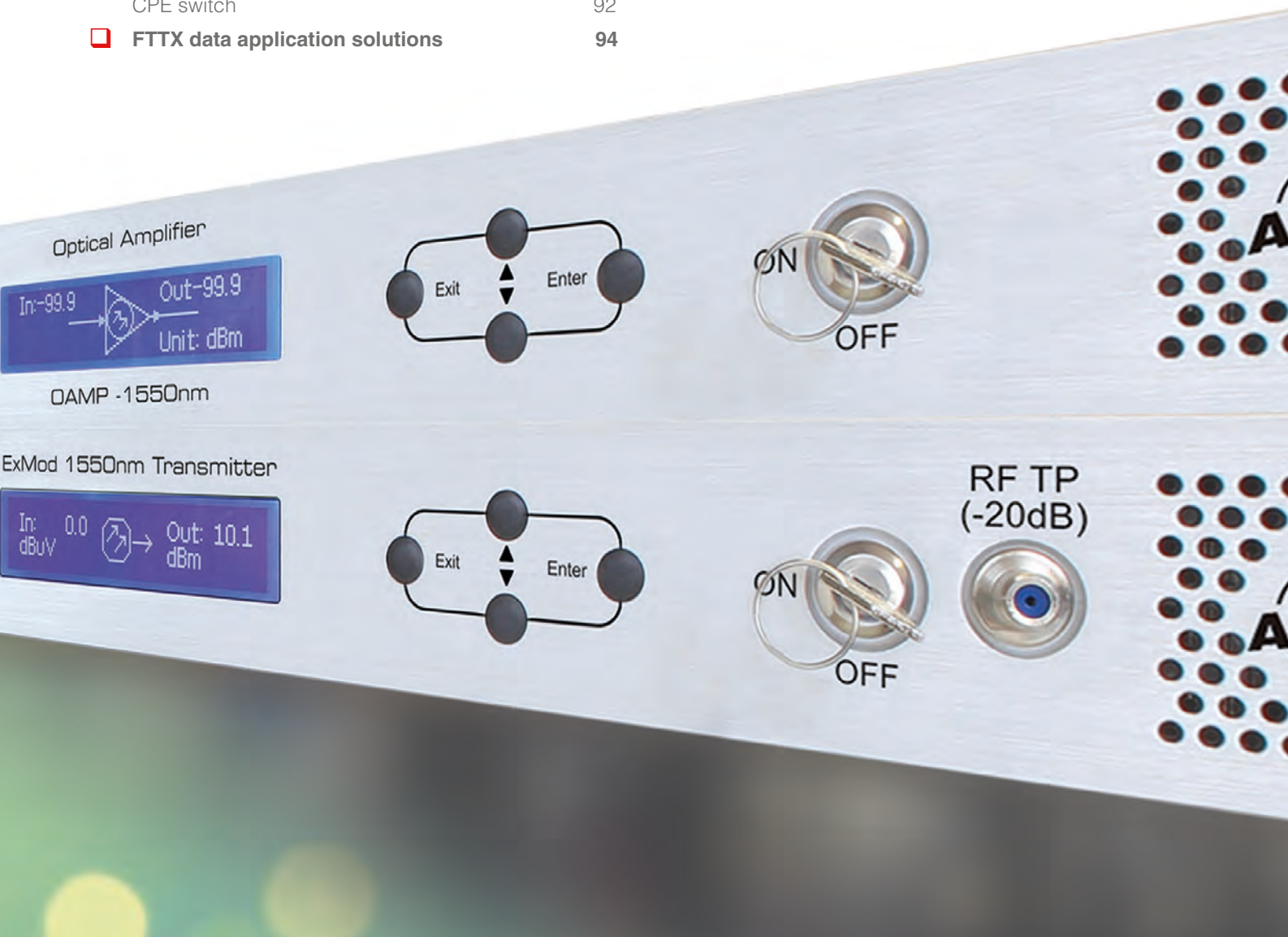
- **Optical SAT-IF Distribution**  
for receiving several satellite positions or polarizations via a passive fibre optical network
- **19 inch Optical Transmitters**  
converting RF Signals to fiber links. Applications are long and short distance transmission and FTTX/FTTB Networks for RF-Overlay
- **19 inch Optical Amplifiers**  
link amplifiers for amplifying the 1550 nm optical broadcasting signal to the next optical HUB, or providing a multiport amplifier to feed the signal to a large number of FTTX/FTTB customers
- **Optical Splitters and Filters**  
such as optical splitters, optical multiplexers, optical filters
- **GPON OLTs and ONUs**  
used for transmission of high speed data via a Passive Optical Network (PON) to a number of users, providing the great benefit of fibre saving infrastructure, since all services (also TV broadcasting) are combined to one single fibre and the PON network can be split to several cascaded optical splitters
- **CPEs for Point-to-Point Ethernet (PtP)**  
for providing an optical Ethernet PtP link with RF-Overlay to the customer
- **Optical Receivers and Fibre Nodes**  
for FTTX/FTTB/FTTC applications, either for RF-Video-Overlay or DOCSIS compliant networks.



# Optical Transmission Technology

## Where to find what?

<input type="checkbox"/> <b>Why choose optical transmission?</b>	<b>52</b>	<input type="checkbox"/> <b>FTTX RF-Receivers and Fibre Nodes</b>	<b>96</b>
<input type="checkbox"/> <b>RF-Video-Overlay &amp; transmission</b>	<b>54</b>	FTTH / FTTB mini receivers	98
External modulated transmitters	56	Compact FTTX receivers for CATV	100
Direct modulated transmitters	58	Compact receivers for CATV	102
Optical return path receivers	64	Die-cast housing fibre nodes	104
Optical amplifiers	66	Node with redundant forward/return path	106
Splitters, Multiplexers, Demultiplexers	78	<input type="checkbox"/> <b>Fibre nodes application solutions</b>	<b>108</b>
Optical switches	81	<input type="checkbox"/> <b>Optical accessories</b>	<b>110</b>
<input type="checkbox"/> <b>RF-Overlay application solutions</b>	<b>84</b>	<input type="checkbox"/> <b>Optical SAT-IF distribution</b>	<b>113</b>
<input type="checkbox"/> <b>FTTX data solutions</b>	<b>86</b>		
OLT routers	88		
ONU router	90		
CPE switch	92		
<input type="checkbox"/> <b>FTTX data application solutions</b>	<b>94</b>		



# Why choose optical transmission technology?

## General advantages of optical fibre technology

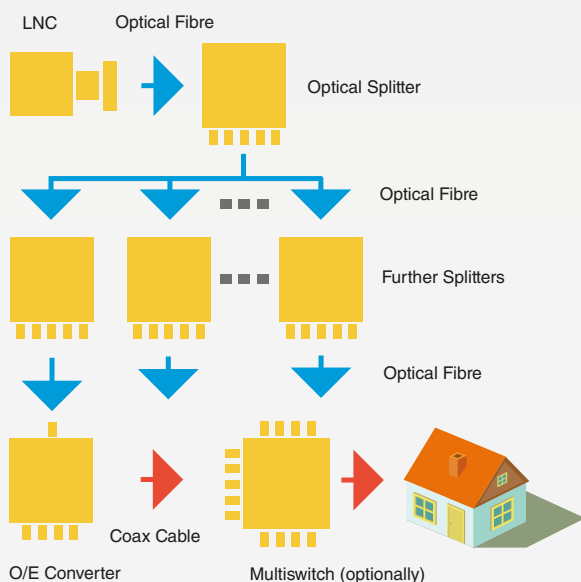
- highest bandwidth in signal transmission
- simultaneous delivery of multiple services
- signals can be transmitted with low attenuation via large distances; big housing estates can be supplied by only one central antenna, placed at an unobtrusive location to provide aesthetically pleasing results
- low installation effort by using ready-for-use cabling (less cabling required in comparison to coax technology)
- good electromagnetic shielding: optical fibre can be placed side by side with electrical cable within one cable conduit
- best reliability; resistant against water (corrosion) and chemicals
- resistant to environmental influences
- galvanic isolation of optical fibres makes potential equalisation dispensable (which is mandatory in coax networks)
- LSZH (low smoke zero halogen) classification; low smoke zero halogen cable reduces the amount of toxic and corrosive gas emitted during combustion

## Optical transmission technology - how it works

Applying optical transmission technology to TV broadcasting and data communication can be done in different ways:

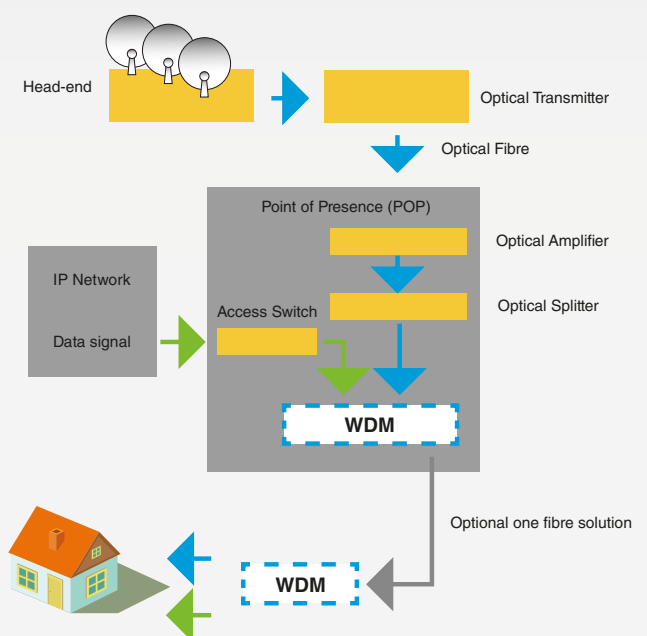
### Optical SAT-IF distribution

The principle of SAT distribution via optical fibre is quite simple: A special, optical LNC transforms the received signal directly coming from the parabolic antenna into waves of light. The distribution of that optical signal is then achieved by the use of prefabricated, optical fibre, available in different lengths. Further distribution of the optical signal can be done by optical splitters so that a high signal level can be obtained even over large distances. At the end of the line opto/electro converters transform the optical signal back into a SAT-IF signal (see figure below).



### Optical Ethernet (example)

Another way to distribute TV and data signals via optical fibre is to send a signal coming from an optical head-end to an optical transmitter which is then processed in a „Point Of Presence“ (POP) via an optical amplifier and optical splitters. An incoming data signal - sent from an IP network via an access switch - can then be transmitted to the end user together with the optical signal via a two cable solution. As well, both signals can optionally be fed together via a WDM and sent to the user via a one cable solution (see figure below).



## Optical transmission - a future technology

### The change of infrastructure

As we know, the copper based networks have nearly reached the edge of their life time. When we look back in history, the first coaxial or twisted pair networks were built in the 60's or 70's and many of them are still in use. Since operators fear the cost of re-building the last mile connecting the customer, many access networks are still based on telephone wires or coax cable, which were installed something like 30 to 40 years ago. In many countries the fibre installation has already reached 100 % of the last mile. This is due to the fact, that most of them build the fibre in an aerial installation, which is the cheapest and fastest method to bring high performance internet and broadcasting to the customers. In countries where underground installation is applied and this is the required method to lay the cables or ducts, the cost for replacing the old copper based networks and providing a new pure fibre infrastructure (most likely with Mini-Ducts) is still under discussion. Once the tube or Mini-Duct pipes are installed, the providers are using this fibre infrastructure with big success. One doesn't need to be a fortune teller to predict that the fibre infrastructure will be the final network topology for any provider in the world, no matter there is underground or aerial installation. It is just a matter of time and of competition between the network providers to speed up this scenario.

### Unlimited bandwidth capacity

Unlike Coax or Twisted Pair Access Networks, fibre networks provide the huge benefit to have a nearly unlimited bandwidth capacity and do not require any active equipment (like every 300 m using a coaxial amplifier). Selecting a pure fibre access technology and calculating the energy saving aspect, the investment in building the complete fibre based access network can be compensated with the saving in electrical energy over the lifetime of the fibre network. Of course energy cost will be a main factor in the future, and with the fibre infrastructure the provider will have the huge benefit of a "zero energy network" from the last active point in the field towards the final customer.

### A mature concept

Another key issue is, that devices in optical transmission technology are getting more and more mature. The first available optical transmission products and fibres (around the 80's) were simply too expensive to apply this technology for the access network. Due to this fact the expensive devices and fibres were mainly used in fibre optical backbone environment (e.g. fibre optical transmission for transatlantic communication or IP backbone).

## Products for every application scenario

With devices from ASTRO, the customer gets the very best and most reliable technology with a cost efficient price/performance ratio. The complete optical product portfolio will enable ASTRO's customers to get the different optical solutions from one stop shop:

### RF-Overlay and transmission



> page 54

### FTTX data solutions



> page 86

### FTTX RF-Receivers & Fibre Nodes



> page 96

### Optical SAT-IF distribution



> page 113

# RF-Video-Overlay and transmission

## Modern Access Networks - a case study in optical transmission

### Data technologies for FTTX deployments

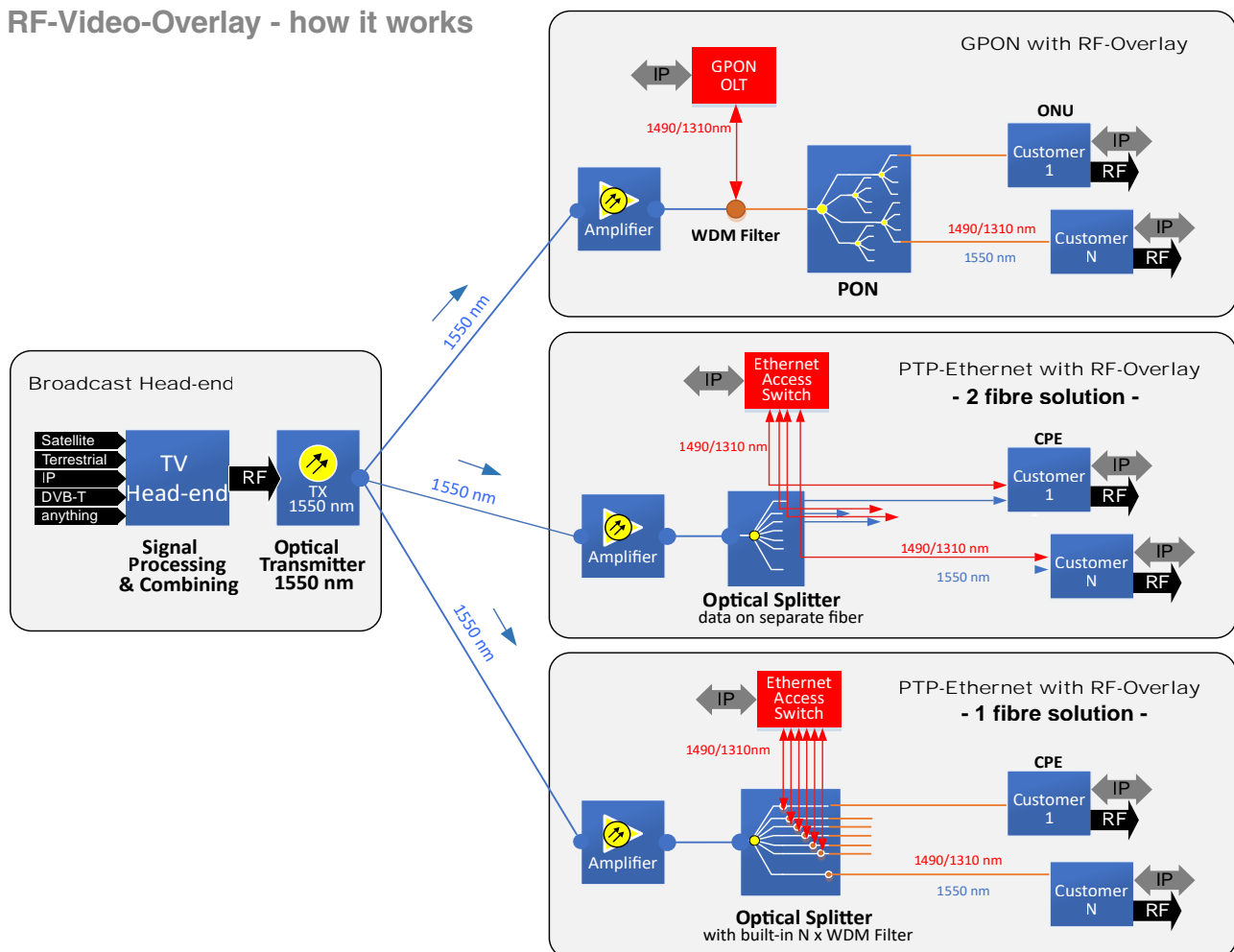
Today's modern access networks are built as pure fibre optical installations. This is due to bandwidth requirements, which are foreseen for today's and future applications and also the price benefit compared to a traditional coaxial or twisted pair network. The fibre network is predicted to be sustainable in relation to bandwidth requirements for the next 3 - 5 decades at least.

There are 2 different main stream data driving technologies in the market for pure FTTX deployments (and we talk here about pure FTTX installation and not about hybrid technologies like VDSL, HFC, etc.):

- Point-to-Point Ethernet (PtP-Ethernet)
- Passive Optical Network Topologies (GPON/GEAPON etc.)

Both technologies can be combined with the mature broadcast RF-Overlay technology, using a 3rd wavelength (1550 nm) or a separate fibre to the Customer Premise Equipment (CPE).

### RF-Video-Overlay - how it works



For RF-Overlay ASTRO provides all the key components, such as optical transmitters, optical amplifiers, passive optical devices and also Customer Premise Equipment. In combination with the optical Data Access Solution such as GPON, with the ASTRO products the provider is ready for both worlds, the IP future and the UHD future.

## IPTV and the growth of bandwidth demand

Many „IP minded people“ predict, that future TV will be only IP-based, since IP is dominating. IPTV will be a big success story in the coming years. There is no doubt about it, due to several nice features like “on-demand” or using the standard IP infrastructures for TV sets or Set Top Boxes. For providers IPTV is a big advantage, when established a Peer to Peer Network with full control and monitoring of the final customers. For example customer profile shaped commercials and other user profile oriented advertisements can be offered. One more big point pro IPTV is the direct contractual relation between supplier and end user, as for broadcasting the supplier often deals with the building developer or owners, but not with the end user itself.

When it comes to bandwidth requirements for future TV products, such as 4K or even 8K (UHDTV), up to now the only solution is to keep the IPTV bandwidth growing in the same scale as required by the TV standard. The best video compression technologies cannot compensate the increased bandwidth requirements that much. This could cause a big competition in providing such Ultra High Definition TV between IPTV providers and traditional broadcasting TV providers (such as SAT- or Cable Operators). Traditional broadcasting operators are using a Frequency Multiplex Technology, which provides realtime UHD TV in a well-known and mature way to its users.

## RF-Overlay - a possible solution

IPTV providers have to find a way to send this enlarged bandwidth for future TV standards through the IP traffic, without investing billions in the „IP backbone bottle neck“. One solution could be using the RF-Overlay technology. RF-Overlay provides the video broadcasting pipe in parallel to the IP pipe. This enables customers to enjoy the best of both worlds - the IPTV and the broadcasting world. The big advantage for the provider is the relief of all the users using the broadcasting pipe and not using the IP pipe for TV. This will save a tremendous capacity in the IP domain. One more benefit is: If one provider invested already in a fibre network, it can easily be expanded on relatively low budget with this broadcasting pipe.

Thinking 4K UHD, we have to assume a poor IP realtime data rate of around 40 Mbit/s (depending on the compression codec). For 8K UHD a realtime data rate of something like 80 Mbit/s. This kind of TV usage could be easily broadcasted in the Frequency Multiplex Method with mature digital TV standards such as DVB-C or DVB-T; a technology used by broadcasting operators since many years. Digital-TV with DVB-C or DVB-C2 is for the Video-Overlay transparent to transmit via a so called 3rd optical window (1550 nm) and does not affect any data service such as PtP-Ethernet or any PON based technology. One example of use is that future major sport events will be recorded and transmitted in 4K UHD TV. UHD TV set sales are growing in double digits' percentage each year and in the next years most of the end users will have the possibility to watch 4K or even 8K UHD TV on their TV sets. Therefore the providers must be prepared to deliver high bandwidth consuming TV streams in the near future.

### AGC

Automatic Gain Control guarantees a constant RF output power within a pre-defined optical input range. If the optical level at the input is within this AGC range, the RF output is kept stable.

### CWDM

Coarse Wavelength Division Multiplexing; up to 18 different wavelengths can be multiplexed on one single fibre using a CWDM filter. Wavelength range from 1270 nm .. 1610 nm (Ch1 to Ch18) in distances of 20 nm. Center Wavelength is nominal value +1 nm (e.g. for 1270 nm the center is 1271 nm, with a usable band of +/- 6,5 nm). Ch6 and Ch7 (1370 nm and 1390 nm) are normally not usable, due to the OH-water peak of the fibre with high attenuation at this wavelength).

### PON

Passive Optical Network. This is the fibre and splitter installation between HUB and subscriber. PON networks do not need any active devices in the field. This networks can be built also with cascaded splitters to bring the output ports of the splitting close to the subscriber.

### HUB

A HUB is a station where active transmission equipment on the providers side is installed (e.g. optical amplifiers, data transmission equipment etc.).

### PtP

This expression is often used for a Point-to-Point optical ethernet network. For CATV distribution the signal normally will be splitted to each node, but for internet traffic the second fibre (or single fibre, if WDM'ed to the CATV signal) is directly connected to the access switch port in the HUB.

### WDM pass-through

Fibre Nodes with WDM path-through can be used with 1550 nm wavelength for CATV reception and for optical data bypass. Before the PIN diode for receiving CATV, there is a Wavelength Division Filter, separating the 1550 nm from the other wavelength. The other wavelengths are by-passed to a separate optical adapter. This technology is often used for transmission of multiplexed signals for CATV @ 1500 nm) and transparent data @ 1490 nm/1310 nm (optical ethernet or GPON/EPON).



# RF-Video-Overlay and transmission

## EXTERNAL MODULATED TRANSMITTER, 1550 NM

output power 2 x 7 dBm, AC

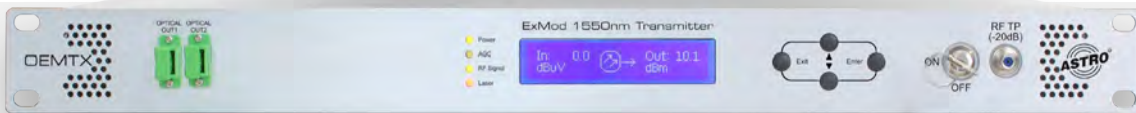
**OEMTX-1550-07 AC**

output power 2 x 8 dBm, AC

**OEMTX-1550-08 AC**

output power 2 x 10 dBm, AC

**OEMTX-1550-10 AC**



- 19', 1 RU rack mounted 1550nm optical transmitter
- for high performance long distance transmission of analogue and digital broadcast signals; CATV & HFC networks forward path transmission; RF-overlay transmission in FTTX networks; analogue and digital transmission in RFoG networks; DWDM utilized broadcast networks
- automatic gain control or manual gain control
- optical output power 2 x 7,0 dBm / 2 x 8,0 dBm or 2 x 10,0 dBm (others on request)
- advanced SBS suppression, setting in 0,5 dB steps in range 13,0 dBm ..19,0 dBm
- optical wavelength adjustable +/- 50 GHz
- external modulator
- SNMP / Web-Interface / LCD panel
- 2 redundant hot plug power supplies, AC or DC
- very low power consumption

**OEMTX-1550-07 DC**

output power 2 x 7 dBm, DC

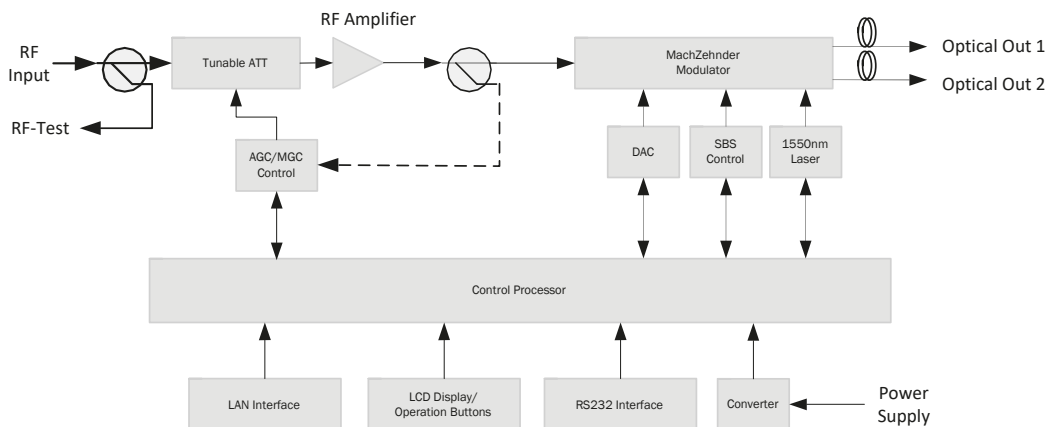
**OEMTX-1550-08 DC**

output power 2 x 8 dBm, DC

**OEMTX-1550-10 DC**

output power 2 x 10 dBm, DC

BLOCK DIAGRAM





**1550**  
nm

Type		OEMTX-1550-07 AC	OEMTX-1550-08 AC	OEMTX-1550-10 AC
Order number		212 007	212 008	212 009
EAN-Code		4026187193010	4026187193027	4026187193034
Power supply		2 hot plug AC		
Type		OEMTX-1550-07 DC	OEMTX-1550-08 DC	OEMTX-1550-10 DC
Order number		212 003	212 004	212 053
EAN-Code		4026187195915	4026187195922	4026187195939
Power supply		2 hot plug DC		
RF and optical characteristics				
Optical output power	[dBm]	2 x 7,0	2 x 8,5	2 x 10,0
Optical input wavelength	[nm]	1550nm (or according ITU grid 1545 .. 1560 nm)		
Relative intensity noise	[dB/Hz]	≤ -160		
Laser linewidth	[MHz]	0,3		
SBS suppression	[dBm]	13,0...19,0 in 0,5 dB steps		
Modulation type		external modulated		
Wavelength adjustment range	[GHz]	± 50		
Peak OMI/channel for PAL84 signal	[%]	3		
Number of optical output ports		2		
Flatness over total frequency band	[dB]	± 0,75		
Optical connector type		2 x SC/APC (other on request)		
Frequency range	[MHz]	47 - 1006		
RF input level range (AGC working range)	[dBμV]	78 - 96 (in AGC mode with modulated signal, AGC offset = 0)		
Rated input RF signal level	[dBμV]	80		
RF Input Impedance	[Ω]	75		
RF input return loss	[dB]	≥ 16		
CTB*	[dB]	≥ 65		
CSO*	[dB]	≥ 63		
C/N*	[dB]	≥ 53		
Common data				
Management		SNMP and web interface		
Chassis type		1 RU, 19" rack mounted		
Power supply	[pcs]	2 hot plug / AC or DC		
AC Power supply	[VAC]	90 - 265		
DC Power supply	[VDC]	-36 .. 72		
Power consumption	[W]	≤ 60		
Dimensions (W x H x D)	[mm]	483 x 44 x 380 (1 RU)		
Ambient temperature	[°C]	-5 .. +55 (ETSI EN 300019-3 Class 3.2)		
Relative humidity	[%]	0 -95 no condensing		

\*) measured at 65 km fibre length, one EDFA with 16dBm, optical receiver input level 0dBm with 8 pA/Sqrt Hz, 42 analogue channels (CENELEC42)



# RF-Video-Overlay and transmission

## DIRECT MODULATED TRANSMITTERS, 1550 NM

1 GHz version, AC

1218 MHz version, AC

**ODMTX-1550-10 AC**

**ODMTXe-1550-10 AC**

**NEW**



# 1,2 GHz

- 19", 1 RU rack mounted 1550nm optical transmitter
- for CATV & HFC networks forward path transmission; RF-overlay transmission in FTTX networks; PAL and QAM transmission up to 30 km and more over single mode fibres
- automatic gain control or manual gain control
- pre-distortion circuit
- version ODMTXe for 1218 MHz (DOCSIS 3.1) available
- built-in dispersion compensator, setting in 1 km steps up to 50 km
- high output power (10 dBm)
- high linear DFB laser
- SNMP / Web-Interface / LCD panel
- 2 redundant hot plug power supplies

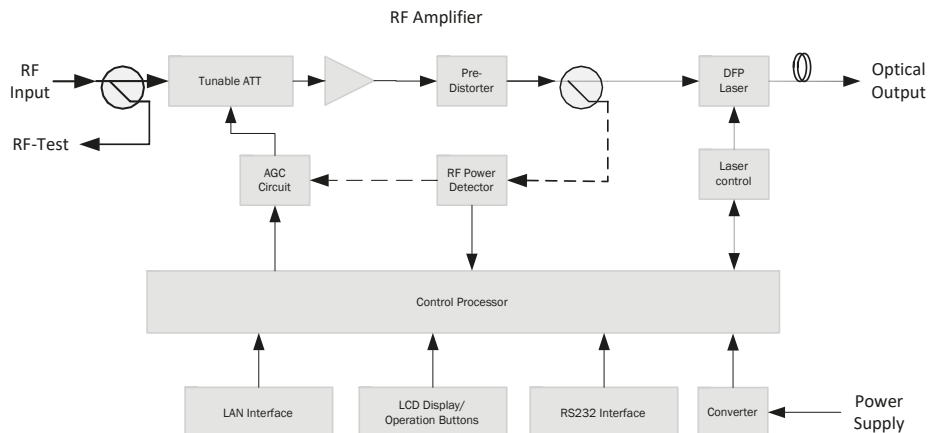
**ODMTX-1550-10 AC**

**ODMTXe-1550-10 AC**

1 GHz version, DC

1218 MHz version, DC

BLOCK DIAGRAM



**1550**  
nm

Type	ODMTXe-1550-10-AC	ODMTX-1550-10-AC
Order number	212 055	212 010
EAN-Code	4026187195953	4026187192839
Power supply	2 hot plug AC	

Type	ODMTXe-1550-10-DC	ODMTX-1550-10-DC
Order number	212 056	212 054
EAN-Code	4026187195960	4026187195946
Power supply	2 hot plug DC	

RF and optical characteristics		
Optical input wavelength	[nm]	1550 ± 20
Optical output power	[dBm]	10
Laser type		DFB high performance laser
Number of optical output ports		1
Modulation type		direct modulation
Peak OMI/channel for PAL84 signal	[%]	3
Number of optical output ports		1
Flatness	[dB]	± 0,75
Optical connector type		SC/APC (other on request)
Frequency range	[MHz]	47 - 1218
RF input level range (AGC working range)	[dBμV]	72 - 85
RF input impedance	[Ω]	75
RF input return loss	[dB]	≥ 16 (47 - 550 MHz); ≥ 14 550 - 1006 resp. 1218 MHz
CTB*	[dB]	≥ 65
CSO*	[dB]	≥ 60
C/N*	[dB]	≥ 51
AGC/MGC control range	[dB]	± 5 / ± 10

Common data		
Management		SNMP and web interface
Chassis type		1 RU, 19" rack mounted
Power supply	[pcs]	2 hot plug / AC or DC
AC Power supply	[VAC]	150 - 265
DC Power supply	[VDC]	-36 .. 72 (on request)
Power consumption	[W]	≤ 30
Dimensions (W x H x D)	[mm]	483 x 44 x 380 (1 RU)
Ambient temperature	[°C]	-5 .. +55 (ETSI EN 300019-3 Class 3.2)

\*) measured at 25 km fibre length, optical receiver input level 0 dBm, 59 PAL channels up to 550 MHz, 30 QAM channels -10dB below PAL



# RF-Video-Overlay and transmission

## DIRECT MODULATED TRANSMITTERS, 1310 NM

output power 7 dBm, AC

**ODMTX-1310-07 AC**

output power 10 dBm, AC

**ODMTX-1310-10 AC**

output power 13 dBm, AC

**ODMTX-1310-13 AC**



- 19", 1 RU rack mounted 1310nm optical transmitter
- for CATV & HFC networks forward path transmission; PAL and QAM transmission up to 30 km and more over single mode fibres
- automatic gain control or manual gain control
- output power 7 / 10 or 13 dBm (others on request)
- high linear DFB lasers
- SNMP / Web-Interface / touch screen color panel
- 2 redundant hot plug power supplies
- AC or DC power supply available
- outdoor version with die-cast housing optionally available

**ODMTX-1310-07 DC**

output power 7 dBm, DC

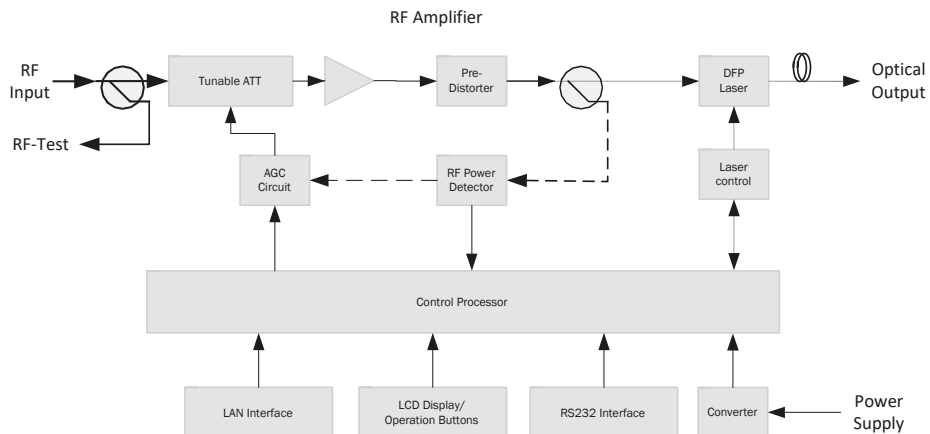
**ODMTX-1310-10 DC**

output power 10 dBm, DC

**ODMTX-1310-13 DC**

output power 13 dBm, DC

BLOCK DIAGRAM





Type		ODMTX-1310-07 AC	ODMTX-1310-10 AC	ODMTX-1310-13 AC
Order number		212 011	212 012	212 013
EAN-Code		4026187193041	4026187193065	4026187193072
Power supply		2 hot plug AC		
Type		ODMTX-1310-07 DC	ODMTX-1310-10 DC	ODMTX-1310-13 DC
Order number		212 057	212 058	212 059
EAN-Code		4026187195977	4026187195984	4026187195991
Power supply		2 hot plug DC		
RF and optical characteristics				
Optical output power	[dBm]	7,0	10,0	13,0
Optical input wavelength	[nm]	1310 ± 20		
Laser type		DFB high performance laser		
Modulation type		direct modulation		
Peak OMI/channel for PAL84 signal	[%]	3		
Number of optical output ports		1		
Flatness	[dB]	± 0,75		
Optical connector type		SC/APC (other on request)		
Frequency range	[MHz]	47 - 1006		
RF input level range (AGC working range)	[dBμV]	72 - 88		
RF input impedance	[Ω]	75		
RF input return loss	[dB]	≥ 16 (47 - 550 MHz) ≥ 14 550 - 1006 MHz		
CTB*	[dB]	≥ 65		
CSO*	[dB]	≥ 60		
C/N*	[dB]	≥ 51		
AGC/MGC control range	[dB]	± 5 / 0..10		
Common data				
Management		SNMP and web interface		
Chassis type		1 RU, 19" rack mounted		
Power supply	[pcs]	2 hot plug / AC or DC		
AC Power supply	[VAC]	150 - 265		
DC Power supply	[VDC]	-36 .. 72 (on request)		
Power consumption	[W]	≤ 30		
Dimensions (W x H x D)	[mm]	483 x 44 x 380 (1 RU)		
Ambient temperature	[°C]	-5 .. +55 (ETSI EN 300019-3 Class 3.2)		

\*) measured at 10 km fibre length, optical receiver input level -1 dBm, 59 PAL channels up to 550 MHz, 30 QAM channels -10dB below PAL

# RF-Video-Overlay and transmission

## COMPACT DIRECT MODULATED TRANSMITTERS

input wavelength 1310 nm

input wavelength 1550 nm

**ODMTX-M-1310**

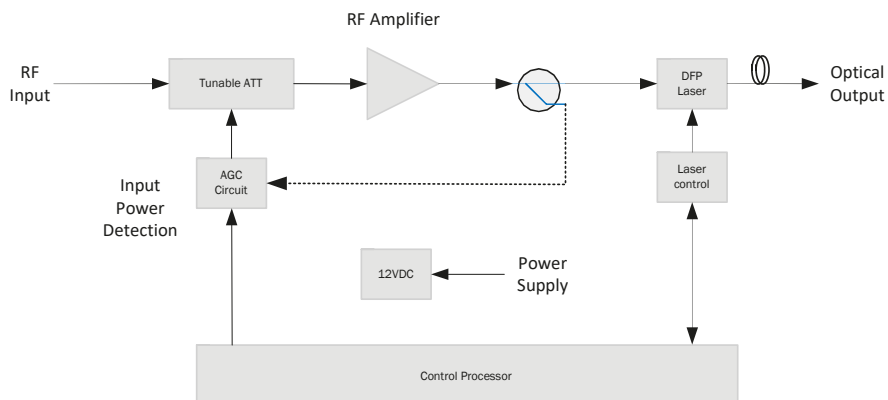
**ODMTX-M-1550**



**NEW**

- wall mount mini 1310 nm or 1550 nm optical direct modulated transmitter
- for CATV & HFC networks forward path transmission for very short distances (< 5 km); optical extension of CATV head-ends for QAM and PAL signals
- automatic gain control on Input stage
- optical output power +3 dBm
- DFB laser
- power plug 12 VDC
- SC/APC optical connector
- frequency range 47 - 1000 MHz

BLOCK DIAGRAM



**1310**  
nm

**1550**  
nm

Type		ODMTX-M-1310	ODMTX-M-1550
Order number		212 005	212 006
EAN-Code		4026187195892	4026187195908
<b>RF and optical parameters</b>			
Optical input wavelength	[nm]	1310 ± 10	1550 ± 10
Optical output power	[dBm]	+3,0 ± 0,5	
Laser type		DFB High Performance Laser	
Modulation type		Direct Modulation	
Peak OMI/channel for PAL84 signal	[%]	3	
Number of optical output ports		1	
Flatness	[dB]	± 1,2	
Optical connector type		SC/APC (andere auf Anfrage)	
Frequency range	[MHz]	47 - 1000	
RF input level range (AGC working range)	[dBμV]	65 - 75	
RF input impedance	[Ω]	75	
RF input return loss	[dB]	≥ 16 (47 - 550 MHz) ≥ 14 550 - 1000 MHz	
CTB*	[dB]	≥ 60	
CSO*	[dB]	≥ 60	
C/N*	[dB]	≥ 50	
<b>Common data</b>			
Management		SNMP and web interface	
Chassis type		mini die casting chassis for wall installation	
Power supply		12 VDC / 0,5 A, power supply unit for wall installation	
Power consumption	[W]	≤ 3	
Dimensions (W x H x D)	[mm]	128 x 32 x 95	
Ambient temperature	[°C]	-5 .. +45	

\*) Measured at 1 km fibre length, input performance of source CNR > 55 dB, optical receiver input level 0 dBm, 40 x PAL channels 110 - 862 MHz

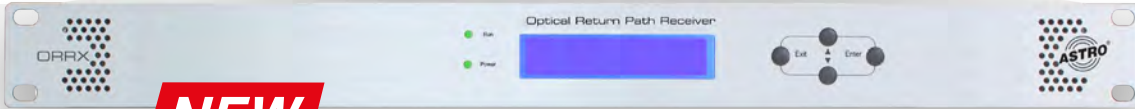


# RF-Video-Overlay and transmission

## OPTICAL RETURN PATH RECEIVERS, 4 PORTS

ORRX AC

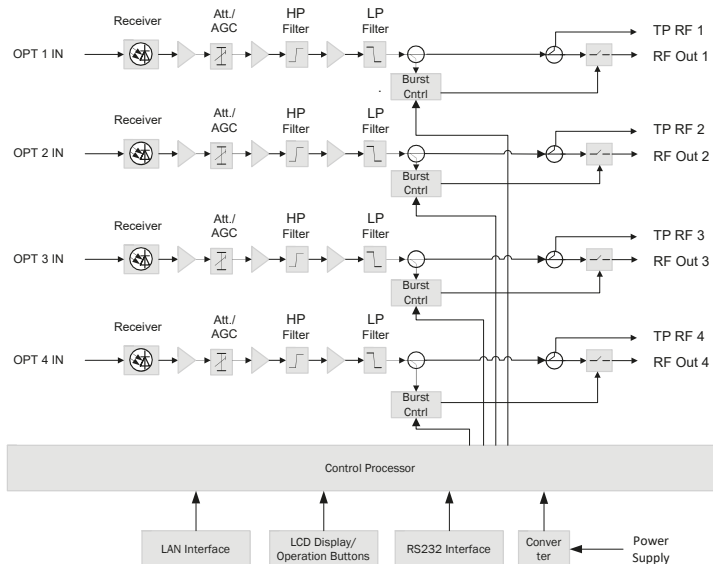
ORRX DC



**NEW**

- 19", 1 RU rack mounted 1550nm optical return channel receiver, 4 ports
- for termination of optical return path signals
- 4 independent upstream receivers
- each RF port with test port (-20 dBm)
- receiving optical power range from 0 dBm to -27 dBm
- SNMP management option
- attenuation and equalizer setting via on board display
- redundant power supply AC or DC

BLOCK DIAGRAM





Type		ORRX DC	ORRX AC
Order number		212 157	212 149
EAN-Code		4026187196707	4026187194734
Power supply		2 hot plug AC	2 hot plug DC
Optical characteristics			
Optical input wavelength	[nm]	1100...1610	
Optical AGC range	[dBm]	-10...0	
Maximum receiving optical range	[dBm]	-27...0	
Attenuation adjustment range separately for each RX for different operation modes	[dB]	0 .. 10: Normal HFC mode with AGC function 0 .. 30: Normal HFC mode with MGC function 0 .. 30: RFoG burst mode	
Optical return loss	[dB]	> 45	
Flatness	[dB]	± 1	
Return loss	[dB]	≥ 16	
Receiver noise current (Pin = 5 dB)	[pA/Sqrt Hz]	< 5	
Output Impedance	[Ω]	75	
Fibre type		Single mode fibre 9/125	
Optical connector type		SC/APC (other on request)	
RF characteristics			
Frequency range for upstream signals	[MHz]	5...200	
Typical RF output level	[dBμV]	≥ 105 (in optical range of -10...0 dBm)	
RFoG Burst mode timing and thresholds:			
RF-ON for threshold of	[dBμV]	≥ 70	
RF-OFF for threshold of	[dBμV]	≤ 62	
Signal turn on time	[μs]	0.5 ≤ t1 ≤ 1	
Signal turn off time	[μs]	0.5 ≤ t2 ≤ 1.5	
RF test port	[dB]	-20	
Common data			
Management		front panel / SNMP	
Chassis type		1 RU, 19" rack mounted	
AC Power supply	[VAC]	150 - 250	
DC Power supply	[VDC]	-36 .. 72 (on request)	
Power consumption	[W]	≤ 20	
Dimensions (W x H x D)	[mm]	483 x 44 x 365 (1 RU)	
Ambient temperature	[°C]	-5 .. +55 (ETSI EN 300019-3 Class 3.2)	
Maximum relative humidity	[%]	95 (no condensation)	

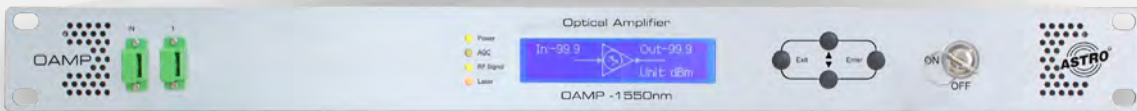


# RF-Video-Overlay and transmission

## OPTICAL AMPLIFIERS, 1550 NM

1 output

### OAMP 1..



- 19", 1 RU rack mounted amplifier
- for HFC & FTTX networks forward path transmission, optical link amplification of PAL, NTSC and QAM signals for HFC & FTTX networks
- various outputs and output powers from 1 x 13 dBm to 4 x 17 dBm (total 24 dBm) available
- pump laser 980 nm and 1480 nm
- temperature range -5 °C...+55 °C
- high reliability
- low noise figure
- outdoor version with extended temperature range available on request
- SNMP / Web interface / LCD panel
- 2 x hot plug power supplies AC or DC



### OAMP 2..

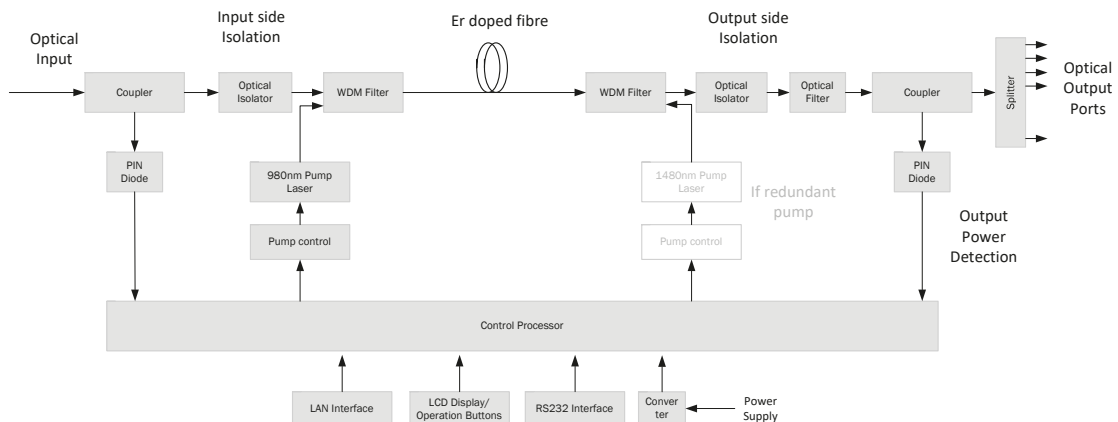
2 outputs



### OAMP 4..

4 outputs

BLOCK DIAGRAM



**1550**  
nm

Type	OAMP-113 AC	OAMP-213 AC	OAMP-413 AC	OAMP-117 AC	OAMP-217 AC	OAMP-417 AC	OAMP-120 AC	OAMP-220 AC
Order number	212 014	212 016	212 017	212 018	212 019	212 020	212 015	212 021
EAN-Code 4026187...	193089	193096	193102	193119	193126	192846	193133	193140
Power supply	2 hot plug AC							

Type	OAMP-113 DC	OAMP-213 DC	OAMP-413 DC	OAMP-117 DC	OAMP-217 DC	OAMP-417 DC	OAMP-120 DC	OAMP-220 DC
Order number	212 060	212 061	212 062	212 0 63	212 064	212 065	212 066	212 067
EAN-Code 4026187...	196004	196011	196028	196035	196042	196073	196066	196080
Power supply	2 hot plug DC							

RF and optical characteristics									
Optical output power (P <sub>tot</sub> )	[dBm]	+13.0 ± 0,5	+13.0 ± 0,5	+13.0 ± 0,5	+17.0 ± 0,5	+17.0 ± 0,5	+17.0 ± 0,5	+20.0 ± 0,5	+20.0 ± 0,5
Number of optical output ports		1	2	4	1	2	4	1	2
Optical input wavelength	[nm]	1550 ± 15							
Rated optical input power range	[dBm]	-3... +10							
Noise figure (P <sub>in</sub> =0dBm, λ=1550 nm)	[dB]	≤ 5							
Number of optical output ports		1...8							
Return loss at input	[dB]	≥ 45							
Return loss output	[dB]	≥ 45							
Optical Isolation input to output	[dB]	≥ 30							
Optical output adjustable range	[dB]	-3 ..0							
Optical connector type		SC/APC (other on request)							

Common data									
Management		SNMP and web interface							
Chassis type		1 RU, 19" rack mounted							
Power supply	[pcs]	2 hot plug / AC or DC							
AC Power supply	[VAC]	150 - 265							
DC Power supply	[VDC]	-36 .. 72 (on request)							
Power consumption	[W]	≤ 30							
Dimensions (W x H x D)	[mm]	483 x 44 x 380 (1 RU)							
Ambient temperature	[°C]	-5 .. +55 (ETSI EN 300019-3 Class 3.2)							

Other types than specified above available on request



# RF-Video-Overlay and transmission

## OPTICAL DISTRIBUTION AMPLIFIERS, 1550 NM

32 outputs

### OHPA-32..



- 19", 1 RU rack mounted distribution amplifier
- for HFC & FTTX networks forward path transmission; PON and PtP FTTX networks with RF-overlay
- various outputs and output powers from 4 x 20 dBm to 32 x 19 dBm available
- ErYb doped double-clad technology
- low noise figure
- SNMP / Web interface / LCD panel
- 2 x hot plug power supplies AC or DC
- high stability and reliability



### OHPA-16..

16 outputs

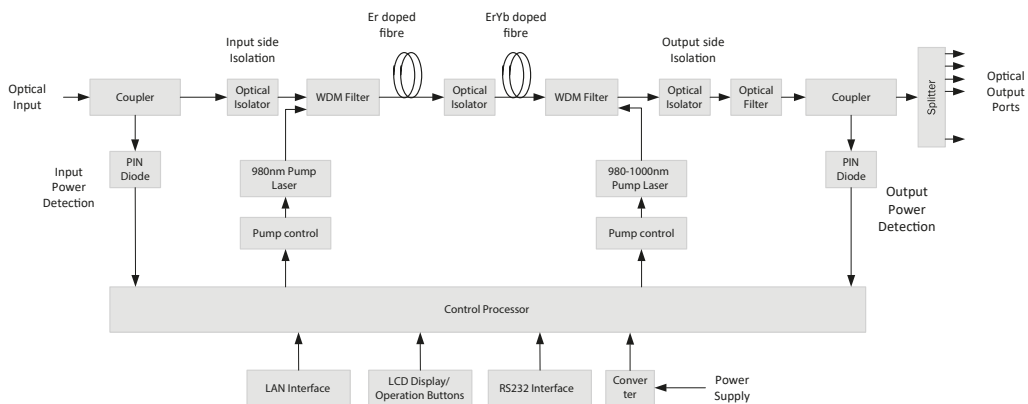
### OHPA-08..

8 outputs

### OHPA-04..

4 outputs

BLOCK DIAGRAM



**1550**  
nm

Type	OHPA-04200 AC	OHPA-08200 AC	OHPA-16170 AC	OHPA-16200 AC	OHPA-32160 AC	OHPA-32190 AC
Order number	212 023	212 024	212 025	212 026	212 027	212 028
EAN-Code 4026187...	193157	193164	193171	193188	193195	193201
Power supply	2 hot plug AC					

Type	OHPA-04200 DC	OHPA-08200 DC	OHPA-16170 DC	OHPA-16200 DC	OHPA-32160 DC	OHPA-32190 DC
Order number	212 068	212 069	212 071	212 072	212 075	212 077
EAN-Code 4026187...	196097	196103	196110	196127	196158	196172
Power supply	2 hot plug DC					

RF and optical characteristics							
Optical output power (P <sub>tot</sub> )	[dBm]	+20,0 ± 0,5	+20,0 ± 0,5	+17,0 ± 0,5	+20,0 ± 0,5	+16,0 ± 0,5	+19,0 ± 0,5
Number of optical output ports		4	8	16	16	32	32
Optical connector type		SC/APC	SC/APC	SC/APC	SC/APC	Input: SC/APC Output: LC/APC or SC/APC	Input: SC/APC Output: LC/APC or SC/APC
Optical input wavelength	[nm]	1550 ± 15					
Rated optical input power range	[dBm]	-3... +10 (details see order information)					
Output power variation	[dB]	± 0,5					
Noise figure (P <sub>in</sub> = 0 dBm, λ = 1550 nm)	[dB]	≤ 5					
Return loss at input	[dB]	≥ 45					
Return loss output	[dB]	≥ 45					
Optical output adjustable range	[dB]	-3 .. 0					
Laser switch off/on		by key lock on front for installation purposes					

Common data							
Management		SNMP and web interface					
Chassis type		1 RU, 19" rack mounted				2 RU, 19" rack mounted	
Power supply	[pcs]	2 hot plug / AC or DC					
AC Power supply	[VAC]	150 - 265					
DC Power supply	[VDC]	-36 .. 72 (on request)					
Power consumption	[W]	≤ 60					
Dimensions (W x H x D)	[mm]	483 x 44 x 380 (1 RU) 483 x 88 x 380 (2 RU)					
Ambient temperature	[°C]	-10 .. +45					
Maximum operating humidity	[%]	95% no condensing					
Storage temperature range	[°C]	-30 .. +75					
Maximum storage humidity	[%]	95% no condensing					

# RF-Video-Overlay and transmission

OPTICAL AMPLIFIERS WITH INTEGRATED INPUT SWITCH, 1550 NM

8 outputs

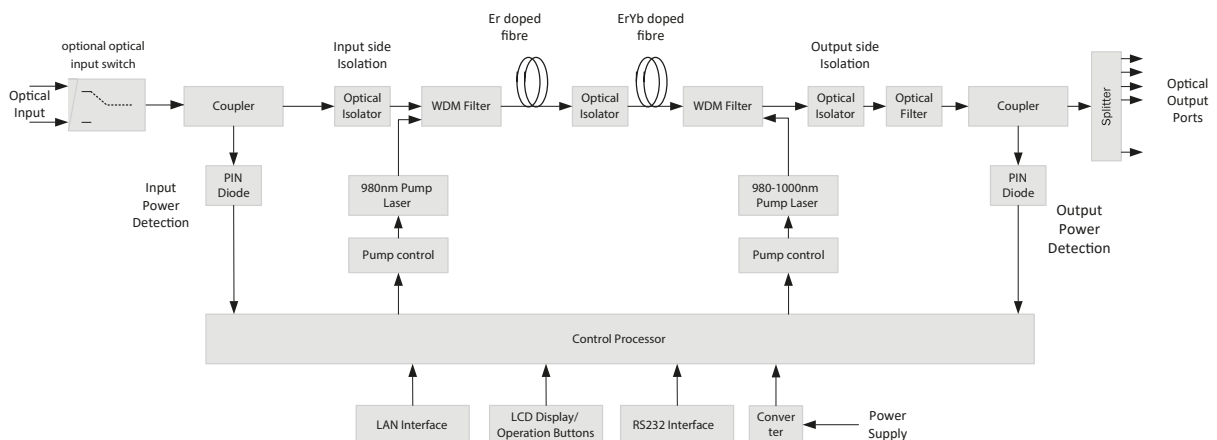
OHPA-08130-S



**NEW**

- 19", 1 RU rack mounted distribution amplifier
- for HFC & FTTH networks forward path transmission; PON and PtP FTTH networks with RF-overlay
- integrated optical input switch
- ErYb doped double-clad technology
- low noise figure
- SNMP / Web interface / LCD panel
- 2 x hot plug power supplies AC or DC
- high stability and reliability

BLOCK DIAGRAM



**1550**  
nm

Type	OHPA-08130-S AC
Order number	212 098
EAN-Code 4026187...	193157
Power supply	2 hot plug AC

Type	OHPA-08130-S DC
Order number	212 099
EAN-Code 4026187...	196530
Power supply	2 hot plug DC

RF and optical characteristics		
Optical output power (P <sub>tot</sub> )	[dBm]	+13,0 ± 0,5
Number of optical output ports		4
Optical connector type		SC/APC
Optical input wavelength	[nm]	1550 ± 15
Rated optical input power range	[dBm]	-3... +10 (details see order information)
Output power variation	[dB]	± 0,5
Noise figure (P <sub>in</sub> = 0 dBm, λ = 1550 nm)	[dB]	≤ 5
Return loss at input	[dB]	≥ 45
Return loss output	[dB]	≥ 45
Optical output adjustable range	[dB]	-3 .. 0
Laser switch off/on		by key lock on front for installation purposes

Common data		
Management		SNMP and web interface
Chassis type		1 RU, 19" rack mounted
Power supply	[pcs]	2 hot plug / AC or DC
AC Power supply	[VAC]	150 - 265
DC Power supply	[VDC]	-36 .. 72 (on request)
Power consumption	[W]	≤ 60
Dimensions (W x H x D)	[mm]	483 x 44 x 380 (1 RU)
Ambient temperature	[°C]	-10 .. +45
Maximum operating humidity	[%]	95% no condensing
Storage temperature range	[°C]	-30 .. +75
Maximum storage humidity	[%]	95% no condensing



# RF-Video-Overlay and transmission

## OPTICAL AMPLIFIERS WITH WDM, 1550 NM

32 PON, 32 COM outputs

### OHPA-32-WDM...



- 19", 1 RU rack mounted 1550 nm distribution amplifier
- for FTTH RF-overlay networks forward path transmission; RF + G(E)PON services combined on one single fiber for supplying triple play services
- including WDM for GPON/EPON
- various outputs, splits and output powers
- ErYb doped double-clad technology
- WDM filter 1310 nm / 1490 nm + 1550 nm to combine DATA and RF inside the device
- low noise figure
- SNMP / Web interface / LCD panel
- 2x hot plug power supplies AC or DC
- high stability and reliability



### OHPA-16-WDM...

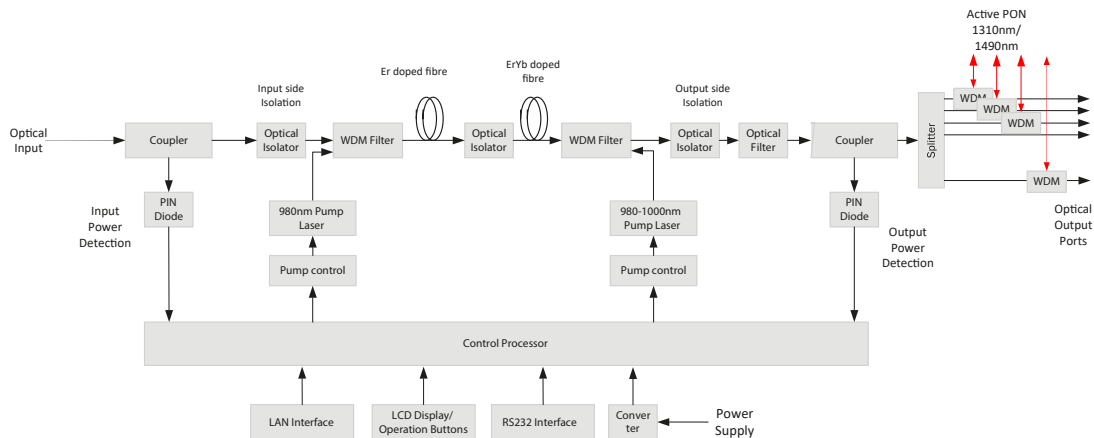
16 PON, 16 COM outputs



### OHPA-08-WDM...

8 PON, 8 COM outputs

BLOCK DIAGRAM





**1550**  
nm

Type	OHPA-08190-WDM AC	OHPA-16170-WDM AC	OHPA-16190-WDM AC	OHPA-32190-WDM AC	OHPA-32210-WDM AC	OHPA-64170-WDM AC
Order number	212 029	212 087	212 032	212 045	212 094	212 096
EAN-Code 4026187...	193218	196363	193225	196301	196325	196343
Power supply	2 hot plug AC					

Type	OHPA-08190-WDM DC	OHPA-16170-WDM DC	OHPA-16190-WDM DC	OHPA-32190-WDM DC	OHPA-32210-WDM DC	OHPA-64170-WDM DC
Order number	212 086	212 088	212 089	212 093	212 095	212 097
EAN-Code 4026187...	196257	196264	196271	196318	196332	196356
Power supply	2 hot plug DC					

RF and optical characteristics							
Optical output power (P <sub>tot</sub> )	[dBm]	+19,0 ± 0,5	+17 ± 0,5	+19,0 ± 0,5	+17 ± 0,5	+ 21 ± 0,5	+17 ± 0,7
Number of optical output ports		8 PON + 8 COM	16 PON + 16 COM	16 PON + 16 COM	32 PON + 32 COM	32 PON + 32 COM	64 PON + 64 COM
Optical connector type		Input: SC/APC (G)PON: LC/PC COM: LC/APC					
Optical input wavelength for RF	[nm]	1550 ± 15					
Rated optical input power range	[dBm]	-3... +10					
Noise figure (P <sub>in</sub> = 0 dBm, λ = 1550 nm)	[dB]	≤ 5					
Return loss at input	[dB]	≥ 45					
Return loss output	[dB]	≥ 45					
Optical output adjustable range	[dB]	-3 .. 0					
Laser switch off/on		by key lock on front for installation purposes					

Common data							
Management		SNMP and web interface					
Chassis type		1 RU, 19" rack mounted	2 RU, 19" rack mounted				
AC Power supply	[VAC]	150 - 265					
DC Power supply	[VDC]	-36 .. 72 (on request)					
Power consumption	[W]	≤ 60					
Dimensions (W x H x D)	[mm]	483 x 44 x 380 (1 RU) 483 x 88 x 380 (2 RU)					
Ambient temperature	[°C]	-10 .. +45					
Maximum operating humidity	[%]	95% no condensing					
Storage temperature range	[°C]	-30 .. +75					
Maximum storage humidity	[%]	95% no condensing					

other types on request

# RF-Video-Overlay and transmission

## OPTICAL AMPLIFIERS WITH WDM & INTEGRATED INPUT SWITCH

64 PON, 64 COM outputs

### OHPA-64...-WDM-S



- 19" 1 RU rack mounted 1550 nm distribution amplifier
- for FTTX RF-overlay networks forward path transmission; RF + G(E)PON services combined on one single fiber for supplying triple play services
- including WDM for GPON/EPON
- integrated optical input switch
- various outputs, splits and output powers
- ErYb doped double-clad technology
- WDM filter 1310 nm / 1490 nm + 1550 nm to combine DATA and RF inside the device
- low noise figure
- SNMP / Web-Interface / LCD panel
- 2x hot plug power supplies AC or DC
- high stability and reliability

**NEW**



### OHPA-32...-WDM-S

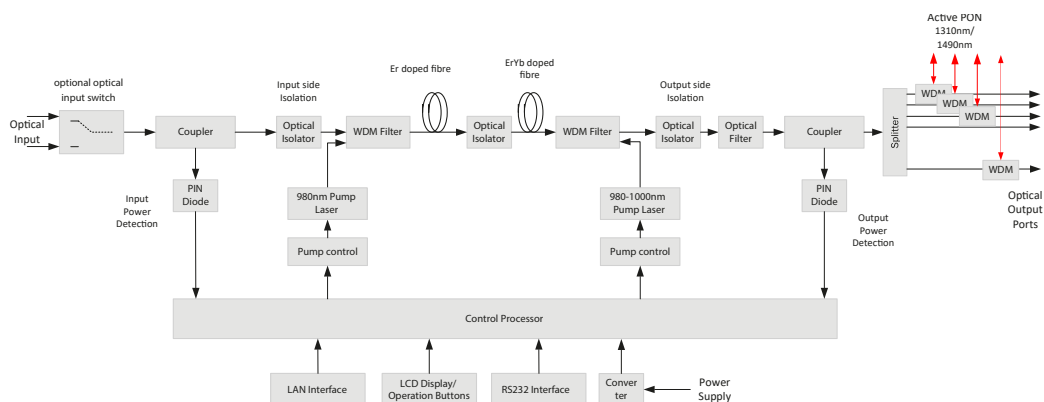
32 PON, 32 COM outputs



### OHPA-16...-WDM-S

16 PON, 16 COM outputs

BLOCK DIAGRAM



**1550**  
nm

Type	OHPA-16170-WDM-S AC	OHPA-32170-WDM-S AC	OHPA-32200-WDM-S AC	OHPA-64160-WDM-S AC	OHPA-64180-WDM-S AC	OHPA-64190-WDM-S AC
Order number	212 029	212 087	212 032	212 045	212 094	212 096
EAN-Code 4026187...	193218	196363	193225	196301	196325	196343
Power supply	2 hot plug AC					

Type	OHPA-16170-WDM-S DC	OHPA-32170-WDM-S DC	OHPA-32200-WDM-S DC	OHPA-64160-WDM-S DC	OHPA-64180-WDM-S DC	OHPA-64190-WDM-S DC
Order number	212 086	212 088	212 089	212 093	212 095	212 097
EAN-Code 4026187...	196257	196264	196271	196318	196332	196356
Power supply	2 hot plug DC					

RF and optical characteristics							
Optical output power (P <sub>tot</sub> )	[dBm]	+17,0 ± 0,5	+17 ± 0,5	+20,0 ± 0,5	+16 ± 0,5	+18 ± 0,5	+19 ± 0,5
Number of optical output ports		16 PON + 16 COM	32 PON + 32 COM	32 PON + 32 COM	64 PON + 64 COM	64 PON + 64 COM	64 PON + 64 COM
Optical connector type		Input: SC/APC (G)PON: LC/PC COM: LC/APC					
Optical input wavelength for RF	[nm]	1550 ± 15					
Rated optical input power range	[dBm]	-3... +10					
Noise figure (P <sub>in</sub> = 0 dBm, λ = 1550 nm)	[dB]	≤ 5					
Return loss at input	[dB]	≥ 45					
Return loss output	[dB]	≥ 45					
Optical output adjustable range	[dB]	-3 .. 0					
Laser switch off/on		by key lock on front for installation purposes					

Common data							
Management		SNMP and web interface					
Chassis type		1 RU, 19" rack mounted	2 RU, 19" rack mounted				
AC Power supply	[VAC]	150 - 265					
DC Power supply	[VDC]	-36 .. 72 (on request)					
Power consumption	[W]	≤ 60					
Dimensions (W x H x D)	[mm]	483 x 44 x 380 (1 RU) 483 x 88 x 380 (2 RU)					
Ambient temperature	[°C]	-10 .. +45					
Maximum operating humidity	[%]	95% no condensing					
Storage temperature range	[°C]	-30 .. +75					
Maximum storage humidity	[%]	95% no condensing					

other types on request



# RF-Video-Overlay and transmission

## OPTICAL AMPLIFIERS FOR HARSH ENVIRONMENT, 1550 NM

32 outputs

### OHPAo-32170 DC



**NEW**

- 19", 2 RU / only 24cm deep rack mounted 1550nm optical amplifier usable for outdoor cabinet installation
- for harsh environment (cabinet usage) in HFC & FTTH networks forward path transmission; RF Overlay in GPON/EPON FTTH networks; optical link amplification of PAL, NTSC and QAM signals for HFC & FTTH networks
- various types regarding number of outputs and port powers, WDM filters for GPON/EPON optional
- "hardened" pump laser technology for extended env. temperature range -30°C to +65°C optional with standard temp. range -10°C to +50°C
- low noise figure for extremely good performance
- SNMP: HMS-SCTE MIBS / Web-Interface / LCD panel
- replaceable fan unit accessible from front
- all connections accessible on front side
- optical connectors 30° angled for space saving patch cord bending
- 2 x hot plug wide band DC or AC power supplies, replaceable from front side
- optical input switch optional
- remote software download for upgrade network time protocol
- remote reset
- internal optical attenuator 0 - 3 dB

### OHPAo-16170 DC



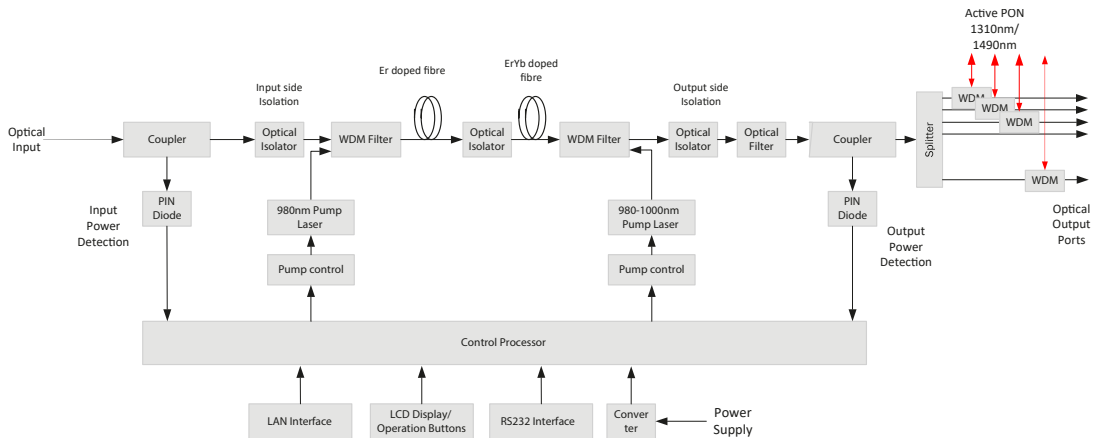
16 outputs

### OHPAo-08170 DC



8 outputs

BLOCK DIAGRAM



**1550**  
nm

Type	OHPAo-08170 DC	OHPAo-16170 DC	OHPAo-32170 DC
Order number	212 083	212 084	212 085
EAN-Code 4026187...	196226	196233	196240
Power supply	2 hot plug DC		
<b>RF and optical characteristics</b>			
Optical output power (P <sub>tot</sub> )	[dBm]	+17,0 ± 0,5	
Number of optical output ports		8	32
Optical connector type		LC-APC/LC-PC	
Optical input wavelength	[nm]	1550 ± 15	
Rated optical input power range	[dBm]	-3...+10 (details see order information)	
Recommended optical input power	[dBm]	0...+4	
Output power variation	[dB]	± 0,5	
Noise figure (P <sub>in</sub> = 0 dBm, λ = 1550 nm)	[dB]	≤ 5,3	
Return loss at input	[dB]	≥ 45	
Return loss output	[dB]	≥ 45	
Optical isolation input / output	[dB]	≥ 30	
Optical output adjustable range	[dB]	0..3	
<b>Common data</b>			
Management		SNMP and web interface	
RF test point optional	[dBμV]	78-82 (@ OMI 3.5%)	
Chassis type		2 RU, 19" rack mounted	
Power supply	[V]	-36 .. 72 DC / 100...250 AC	
Power consumption	[W]	≤ 50 (typical 42)	
Dimensions (W x H x D)	[mm]	483 x 88 x 240 (2 RU)	
Ambient temperature	[°C]	hardened laser version: -30 .. +65 (harsh outdoor environment compatible) standard laser version: -10...+50	
Maximum operating humidity	[%]	90% no condensing	
Storage temperature range	[°C]	-30 .. +75	

other types on request

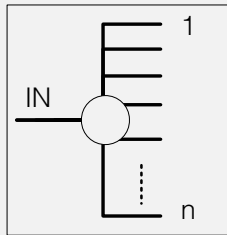


# RF-Video-Overlay and transmission

## OPTICAL PLC (PLANAR LIGHTWAVE CIRCUIT) SPLITTERS (1 INPUT)

**AOSPLC-1..**

picture shows AOSPLC-132



- for FTTX networks, CATV & HFC networks, PON network structures, optical data networks with single mode fibre
- silica optical waveguide technology
- very accurate channel to channel uniformity
- low polarization dependent loss
- wide operation wavelength (1260 .. 1650 nm)
- very high reliability and stability
- 19 inch, LGX or mini module
- any HRL connector type
- compliance to Telcordia GR-1209-CORE and Telcordia GR-1221-CORE RoHS

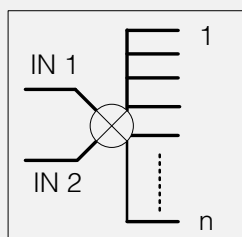
Type		AOSPLC-102	AOSPLC-104	AOSPLC-108	AOSPLC-116	AOSPLC-132	AOSPLC-164
Order number		212 710	212 711	212 712	212 713	212 714	212 715
EAN-Code 4026187...		193713	193720	193737	193744	193751	193768
<b>Optical characteristics</b>							
Splitting Ratio		1 x 2	1 x 4	1 x 8	1 x 16	1 x 32	1 x 64
Coupler/Connector type		SC/APC (other on request)					
Operating wavelength	[nm]	1260 .. 1650					
Fiber type		G657A					
Insertion loss	[dB]	3,8	7,1	10,2	13,5	16,5	20,5
Uniformity loss	[dB]	0,4	0,6	0,8	1,2	1,5	2
Polarization dependent loss	[dB]	0,2	0,2	0,2	0,25	0,3	0,35
Return loss	[dB]	55	55	55	55	55	55
Directivity	[dB]	55	55	55	55	55	55
Wavelength dependent loss	[dB]	0,3	0,3	0,3	0,3	0,5	0,5
<b>Common data</b>							
Temperature stability (-40..85 °C)	[dB]	0,4	0,4	0,4	0,5	0,5	0,5
Dimension for 19" (L x W x H) (other compact or LGX housing on request)	[mm]	483 x 150 x 45					
Ambient temperature	[°C]	0 .. 65					

# RF-Video-Overlay and transmission

## OPTICAL PLC (PLANAR LIGHTWAVE CIRCUIT) SPLITTERS (2 INPUTS)

**AOSPLC-2..**

picture shows AOSPLC-232



- for FTTX networks, CATV & HFC networks, PON network structures, optical data networks with single mode fibre
- silica optical waveguide technology
- very accurate channel to channel uniformity
- low polarization dependent loss
- wide operation wavelength (1260 .. 1650 nm)
- very high reliability and stability
- 19 inch, LGX or mini module
- any HRL connector type
- compliance to Telcordia GR-1209-CORE and Telcordia GR-1221-CORE RoHS

Type		AOSPLC-202	AOSPLC-204	AOSPLC-208	AOSPLC-216	AOSPLC-232	AOSPLC-264
Order number		212 716	212 717	212 718	212 719	212 720	212 721
EAN-Code 4026187...		193775	193782	193799	193805	193812	193829
<b>Optical characteristics</b>							
Splitting Ratio		2 x 2	2 x 4	2 x 8	2 x 16	2 x 32	2 x 64
Coupler/Connector type		SC/APC (other on request)					
Operating wavelength	[nm]	1260 .. 1650					
Fiber type		G657A					
Insertion loss	[dB]	4	7,6	11	14,4	17,5	21
Uniformity loss	[dB]	0,6	1	1,2	1,5	1,8	2,2
Polarization dependent loss	[dB]	0,2	0,2	0,2	0,3	0,4	0,4
Return loss	[dB]	55	55	55	55	55	55
Directivity	[dB]	55	55	55	55	55	55
Wavelength dependent loss	[dB]	0,3	0,4	0,5	0,5	0,5	0,5
<b>Common data</b>							
Temperature stability (-40..85 °C)	[dB]	0,4	0,4	0,4	0,5	0,5	0,5
Dimension for 19" (L x W x H) (other compact or LGX housing on request)	[mm]	483 x 150x45	483 x 150 x 45	483 x 150 x 45	483 x 150 x 45	483 x 150 x 45	483 x 150 x 45 (LC) 483 x 150 x 90 (SC)
Ambient temperature	[°C]	0 .. 65					

# RF-Video-Overlay and transmission

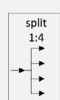
## OPTICAL SPLITTERS AND TAPS, LGX CARRIER CHASSIS

### AOSLGX...



**NEW**

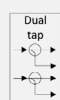
AOSLGX-104



AOSLGX-1xx



AOSLGX-2xx



- optical splitters and taps in LGX module style
- for CATV/HFC, FTTH and PON network structures
- 1 x 2 or 1 x 4 splitters and different output ratio taps
- low polarization dependent loss
- wide operating temperature range
- taps with 1 or 2 modules in a single LGX module
- chassis for 3 / 6 or 12 single slot LGX modules in compliance to Telcordia GR-1209-CORE and Telcordia GR-1221-CORE, RoHS

Type	AOSLGX-250	AOSLGX-104	AOSLGX-260	AOSLGX-270	AOSLGX-280	AOSLGX-290	
Order number	212 722	212 723	212 724	212 725	212 726	212 727	
EAN-Code 4026187...	194123	194130	194147	194154	194161	194178	
	two taps / splitters per module	one tap / splitter per module	two taps / splitters per module	two taps / splitters per module	two taps / splitters per module	two taps / splitters per module	
Splitting ratio	1 x 2 (50 : 50)	1 x 4 (4 x 25 %)	40 : 60	30 : 70	20 : 80	10 : 90	
Splitter or tap type	Fusion	PLC	Fusion	Fusion	Fusion	Fusion	
Operating wavelength	[nm]	1310 ± 40, 1550 ± 40					
Fibre type		G657A1					
Insertion loss*	[dB]	< 4,0	< 7,6	< 3,1	< 2,3	< 1,7	< 1,2
Tap loss*	[dB]	n. a.	n. a.	< 5,1	< 6,4	< 8,3	< 11,6
Polarization dependent loss	[dB]	< 0,15	< 0,25	< 0,15	< 0,15	< 0,15	< 0,15
Directivity	[dB]	55					
Connector types		SC/APC					
Operating and storage temperature	[°C]	-30...+65					
Dimensions	[mm]	Cassette for LGX Chassis 157 x 102 x 29	Cassette for LGX Chassis 157 x 102 x 29	Cassette for LGX Chassis 157 x 102 x 29	Cassette for 2U-LGX Chassis 157 x 102 x 29	Cassette for LGX Chassis 157 x 102 x 29	Cassette for LGX Chassis 157 x 102 x 29

\*) including insertion losses of high quality SC/APC connector and adapter; other types on request

### ALGXCAR...

**NEW**

- LGX carrier chassis

Type	ALGXCAR-1U	ALGXCAR-2U	ALGXCAR-3U
Order number	212 910	212 911	212 912
EAN-Code 4026187...	197117	197124	197131
Dimensions	1 U – 19 inch / depth 29 mm	2 U – 19 inch / depth 29 mm	3 U – 19 inch / depth 29 mm
LGX module capacity	3 x LGX cassettes	6 x LGX cassettes	12 x LGX cassettes

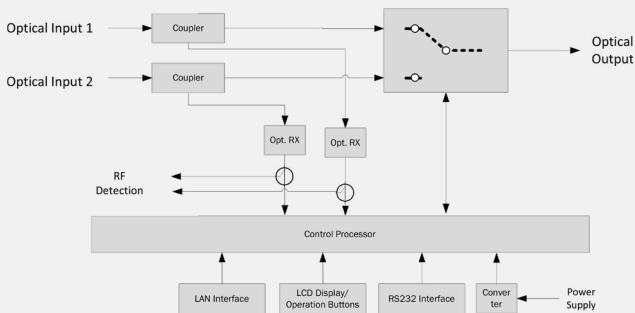
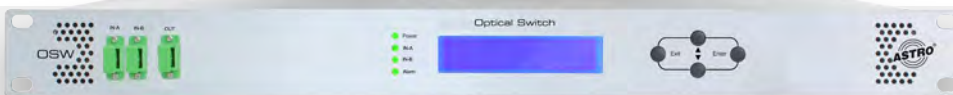


# RF-Video-Overlay and transmission

## OPTICAL SWITCH

### OSW-21 AC

### OSW-21 DC



- optical switch in 19" format for downstream link redundancy (2:1)
- for monitoring of optical link powers and additional RF modulation of every link
- priority of switching position routable to input A or B
- automatical and manual switching mode, also content based switching mode
- user setup delay for fallback from redundant to standard port (1 .. 45 seconds)
- 2 RF testpoints for each input on the rear side
- ambient temperature -5 °C...+55 °C
- SNMP / Web interface / LCD panel

Type		OSW-21 AC	OSW-21 DC
Order number		212 041	212 042
EAN-Code		4026187194192	4026187194376
<b>Optical parameters</b>			
Optical input wavelength	[nm]	1260...1600	
Optical input power	[dBm]	-15...+23	
Optical range for RF signal detection	[dBm]	+2...+23	
Configurable fallback time to main port	[s]	1...45	
Number of switching cycles (life span)		> 10 millions	
Input attenuation (IL, input A or input B to output)	[dB]	< 1	
Optical return loss	[dB]	> 45	
Isolation input A and input B	[dB]	> 80 typical	
Switching time	[ms]	≤ 8	
Optical connector type		SC/APC (others on request)	
<b>Common data</b>			
Management		SNMP and web interface	
Power supply		2 x AC	2 x DC
Supply voltage	[V]	150 - 250 (AC)	-36 - 72 (DC)
Power consumption	[W]	≤ 2	
Housing		19", 1 HU	
Dimensions (WB x H x D)	[mm]	483 x 44 x 270	
Ambient temperature	[°C]	-20 ... +55	

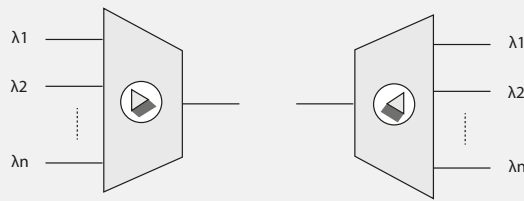


# RF-Video-Overlay and transmission

## CWDM MULTIPLEXER AND DEMULTIPLEXER

**AOCWDM-..**

picture shows AOCWDM-08Mux



- for CWDM Systems, CATV & HFC networks, PON network structures
- low insertion loss
- high isolation, low PDL
- very good channel to channel uniformity
- wide operation wavelength (1260 -1620 nm)
- wide operating temperature range
- very high reliability and stability
- 19 inch, LGX or mini module
- any HRL connector type
- compliance to Telcordia GR-1209-CORE and Telcordia GR-1221-CORE RoHS

Type	AOCWDM-02Mux AOCWDM-02DeMux	AOCWDM-04Mux AOCWDM-04DeMux	AOCWDM-08Mux AOCWDM-08DeMux	AOCWDM-16Mux AOCWDM-16DeMux
Order number	212 743 212 744	212 745 212 746	212 747 212 748	212 749 212750
EAN-Code 4026187...	193836 193843	193850 193867	193874 193881	193898 193904

Optical characteristics					
CWDM Multiplexer / De Multiplexer (Wavelength Range: 1270 nm,1290 nm ..1590 nm,1610 nm)		λ1, 2 <-> Line	1 .. 4 <-> Line	1 .. 8 <-> Line	1 .. 16 <-> Line
Center wavelength		ITU, ITU+1			
Passband	[nm]	± 6,5			
Coupler/Connector type		SC/APC (other on request)			
Operating wavelength	[nm]	1260..1620 or 1460..1620			
Fiber type		single mode fibre			
Channel space	[nm]	20			
typical insertion loss (single module)	[dB]	1	1,7	2,1	4
typical insertion loss (Mux-DeMux pair without connectors)	[dB]	≤ 2,3	≤ 3,0	≤ 3,6	≤ 6,0
Isolation adjacent channel	[dB]	30			
Isolation non adjacent channel	[dB]	50			
Ripple	[dB]	0,3	0,4	0,5	0,5
Polarization dependent loss	[dB]	0,2			
Return loss	[dB]	45			
Directivity	[dB]	50			
Ambient temperature	[°C]	0 .. 65			
Maximum optical power	[mW]	500			

Common data					
Dimension for 19" version (L x W x H) (other compact or LGX housing on request)	[mm]	483 x 150 x 45	483 x 150 x 45	483 x 150 x 45	483 x 150 x 45

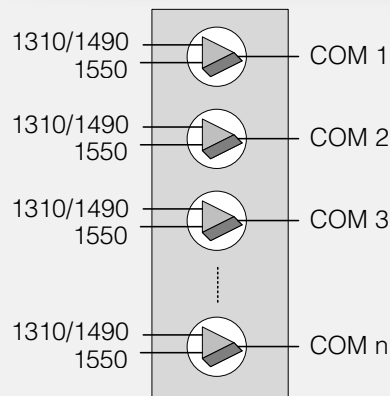
Multiplexer /DeMultiplexer with 1310 nm upgrade channel on request

# RF-Video-Overlay and transmission

## SERVICE COMBINER FOR CATV AND PON SIGNALS

**AOW-PON..**

picture shows AOW-PON04

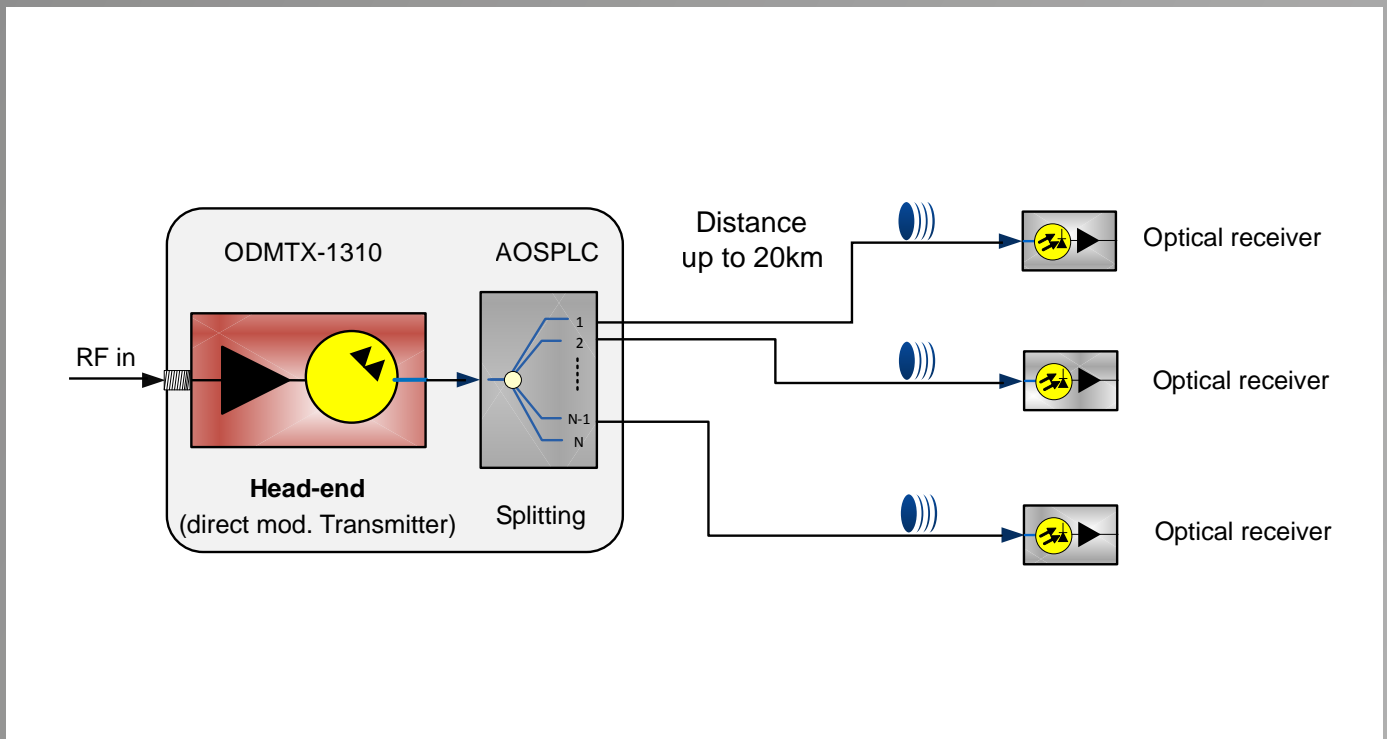


- optical service combiner for RF-overlay to be injected in PON based data networks
- for FTTX networks, G(E)PON networks with service injection of RF-Overlay; PON based data network structures with TV broadcast
- 4, 8 or 16 G(E)PON links combined with 1550 nm RF-overlay
- wide operating temperature range
- very high reliability and stability
- 19 inch rack mount
- any HRL connector type

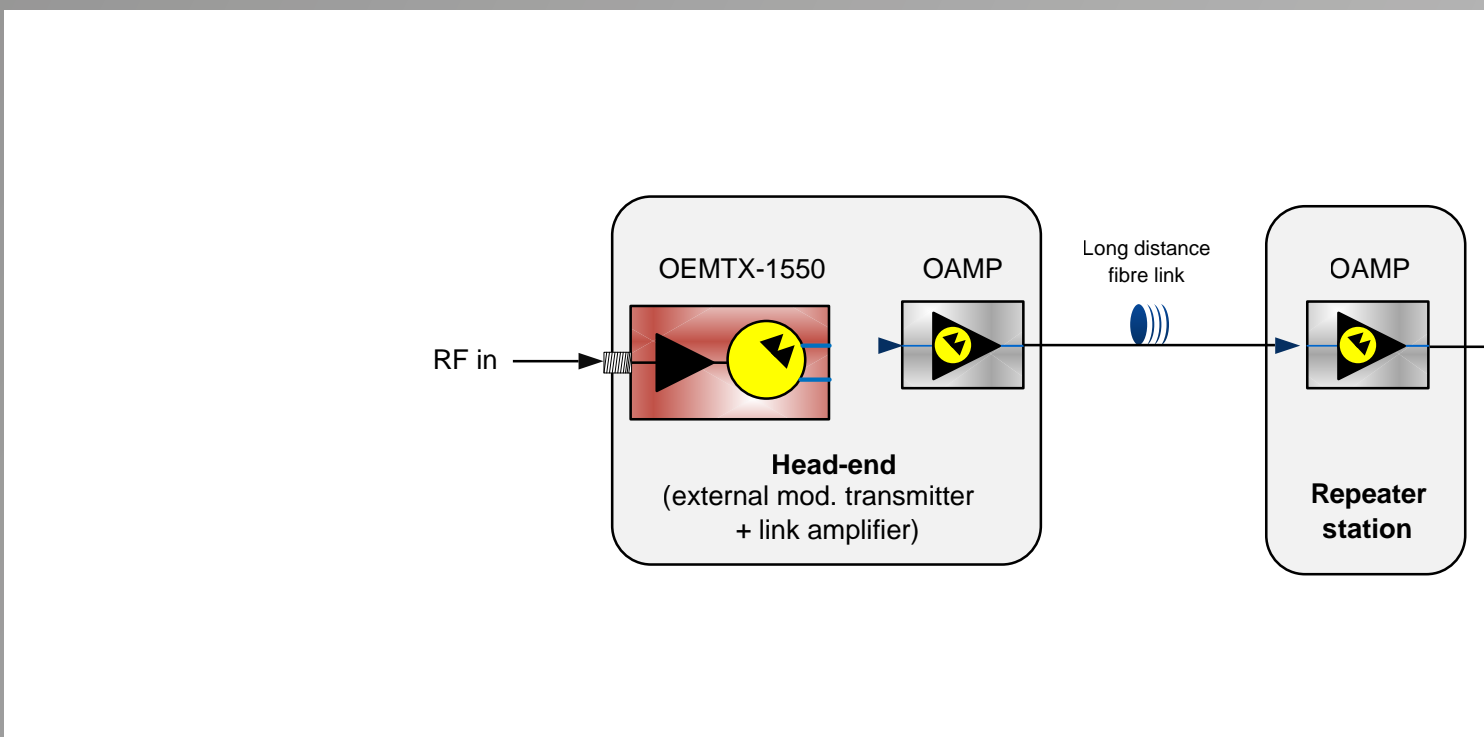
Type	AOW-PON04	AOW-PON08	AOW-PON16
Order number	212 740	212 741	212 742
EAN-Code	4026187192853	4026187193911	4026187193928
<b>Optical parameters</b>			
Number of PON ports (Input/Output 1310/1490 nm)	4	8	16
Number of CATV input ports (1550 nm)	4	8	16
Number of COM ports (1310/1490/1550 nm)	4	8	16
Coupling/connector type CATV & COM	SC/APC (others on request)		
Kupplung/Konnektortyp PON	SC/PC (others on request)		
Wavelength passband (CATV)	[nm]	1539 ..1565	
Wavelength reflectband (PON Data In/Out)	[nm]	PON US: 1270 .. 1350 / PON DS: 1480 .. 1505	
Insertion loss reflect	[dB]	≤ 0.6	
Insertion loss pass	[dB]	≤ 1.0	
Return loss	[dB]	≥ 45	
Isolation passband	[dB]	≥ 35	
Isolation reflectband	[dB]	≥ 15	
Directivity	[dB]	≥ 55	
<b>Common data</b>			
Dimensions of 19" version (L x W x H; other chassis types on request)	[mm]	483 x 150 x 45	
Ambient temperature	[°C]	-5...+65	

# RF-Video-Overlay application solutions

## Broadcasting with 1310 nm amplified optical transmission

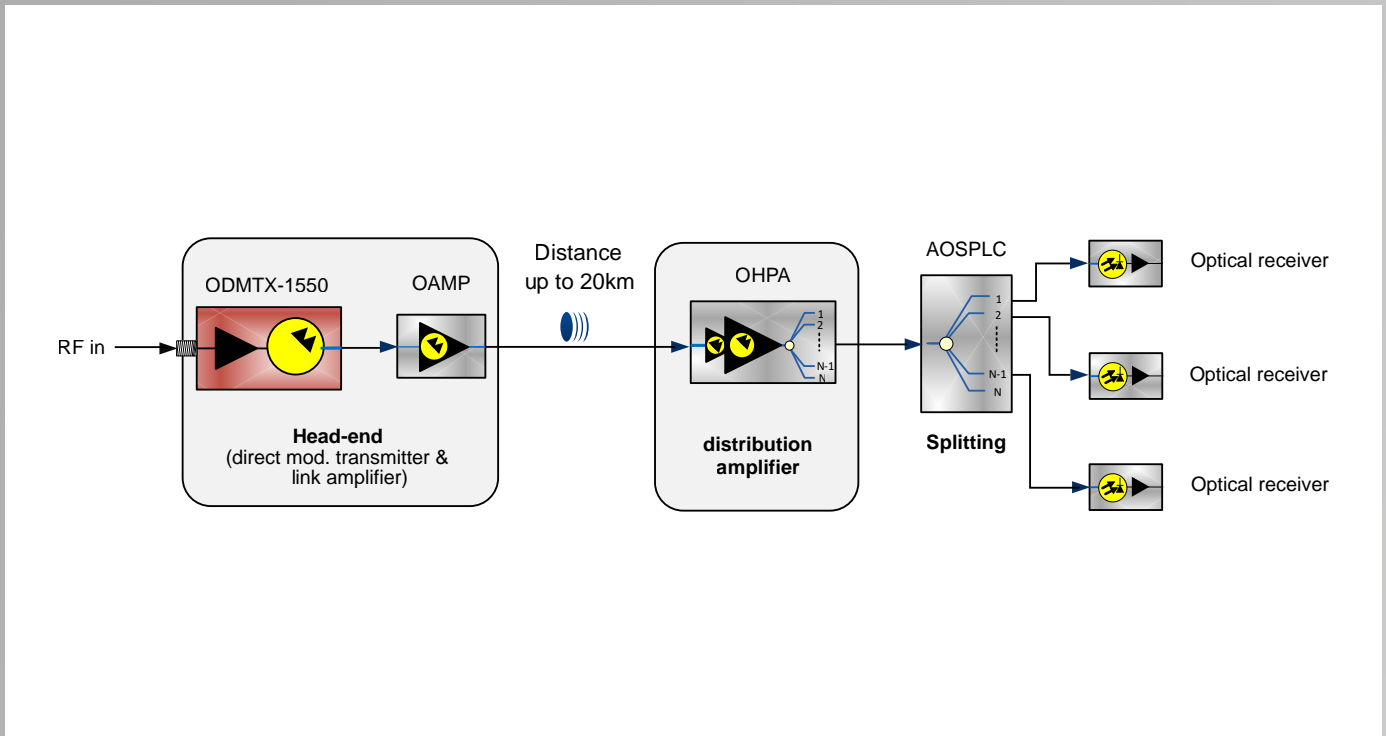


## Broadcasting with 1550 nm amplified transmission (long haul with external modulated transmitter)

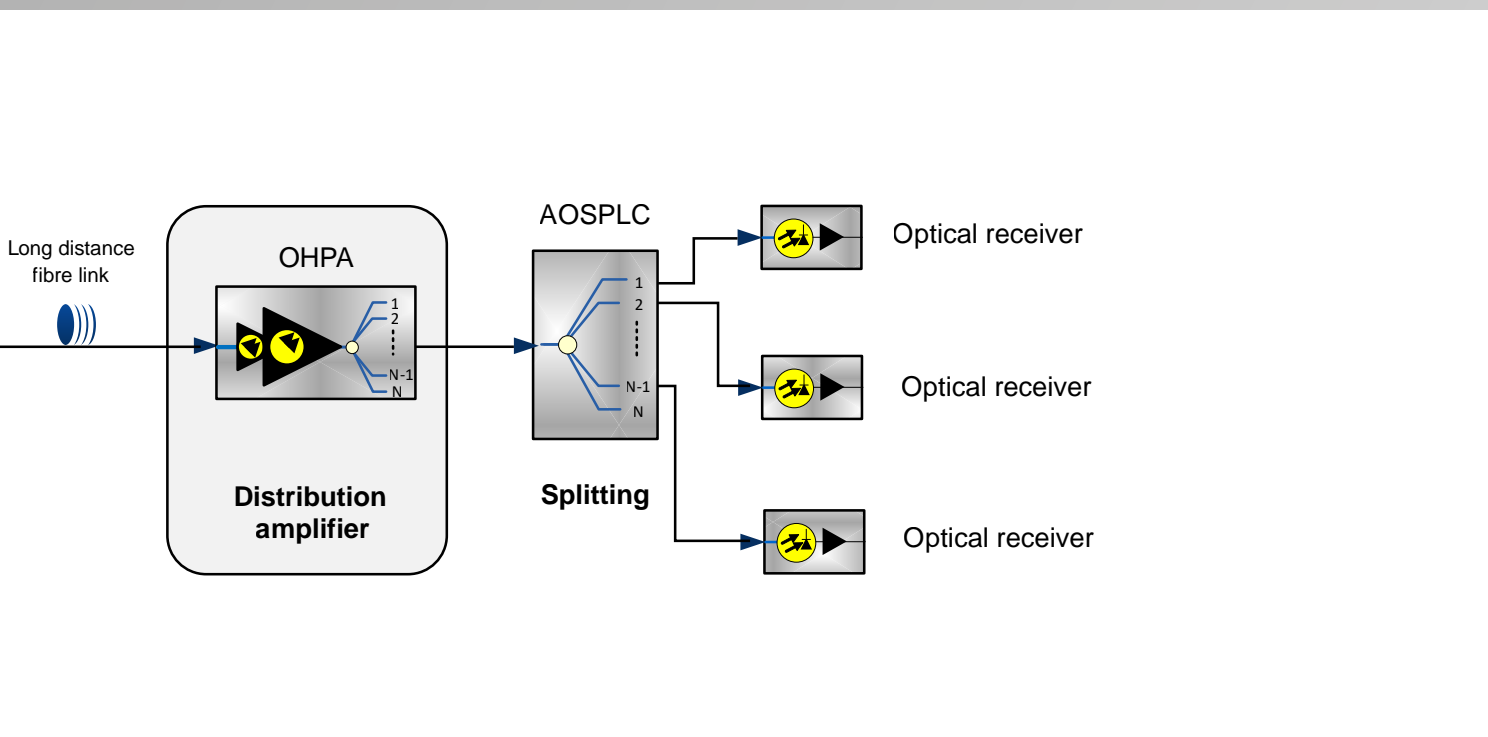


# RF-Video-Overlay application solutions

## Broadcasting with 1550 nm amplified optical transmission



mitter)



# FTTX data solutions

## GPON - a new broadband access network technology

Gigabit PON is an attractive FTTX broadband access network technology, because it meets the needs of all kinds of carriers world-wide. Gigabit PON, also known as GPON, is a method saving fibre infrastructure capacities with a WDM multiplexing technology for up- and downstream data over a single fibre, but delivering high speed IP traffic over the Passive Optical Network (PON). With GPON the fibre splitting infrastructure can be cascaded, unlike in ethernet based Point-to-Point data transmission. This enables a huge benefit in less fibre termination, since only one fibre needs to connect to the central side equipment, whereas with optical ethernet every single user needs to have a fibre termination in the central station. The GPON technology brings the optical fibre ports (splitter output ports) close to the users. Therefore, it is more easy to spread from the last splitting point to each individual end user. GPON can be seen as the optical counterpart to a coaxial distribution, where the coaxial splitters ports are close to the end users too. Ethernet technology has its electrical counterpart in a DSL like point-to-point structure, where each user needs a dedicated link to a central station.

GPON downstream data packets travel in a broadcast manner from the Optical Line Termination (OLT - located in the central side) to the Optical Network Units (ONU – located in the end user premise). Meaning each ONU connected to the same PON network receives the package, but only the targeted one take the information inside. In upstream the data packets are transmitted in a Time Division Multiple Access (TDMA) manner.

There is always a discussion about security and traffic capacity in GPON, since GPON is a shared medium between several data terminals. Similar to DOCSIS, GPON provides an encryption, so that nobody can interfere in the traffic or read the information out of the optical lines (e.g tapping the fibre etc). The OLT port bandwidth is shared between either 32 or 64 ONUs, but gives enough capacity to any of the users. For example, each of the users can have on long term 80 Mb/s in realtime (theoretically), which is enough to let the users watch an 8K UHD IP-TV movie in realtime and still have lots of capacity for other services. There will be no put-through bottleneck in the GPON access platform. It is more likely that the IP backbone is not capable to feed such bandwidth.

All the above leads to the point, that GPON is one of the dominant access technologies in the world telecommunication market. For many years this technology was only applied by big Telcos, but nowadays it is also more and more adopted for smaller networks, since installation benefits and price/performance ratio are outstanding.

TV broadcasting could be easily implemented, since the GPON structure fits very well to the standard broadcasting structure. With GPON the optical wavelength for data is well selected (downstream 1490 nm / upstream 1310 nm) so that the RF-Overlay technology can be inserted with a 3rd wavelength of 1550 nm very easy by using an external WDM filter. The frequently preferred choice is, that the broadcasting multiport amplifier provides the built-in WDM filters, so that each GPON port is connected with one fibre to the Multiport Amplifier. It is then passed to the optical network and its splitting makes the optical cabling even easier.

## Best in class devices

With its GPON products ASTRO provides “best in class” devices, with references of installations scaling from big nationwide Telcos to smaller Multi Dwelling Units (MDU).

### PON

Passive Optical Network, comprising fibers and splitters, patch cords and optical termination boxes

### OLT

OLT- Optical Line Termination is the central side equipment, providing one or multiple ports for connecting the end user equipment over the PON Network

### ONU

ONU- Optical Network Unit is the end customer premise equipment. This provides an optical link towards the OLT and one or more Data interfaces towards the home network. VoIP, POTS and Wireless can be also included, depending the type of the ONU device.

### GPON

Gigabit Passive Optical Network, comprising of OLT and ONUs, connected via a passive optical splitting network

### WDM

Wavelength Division Multiplexing, combining with an optical filter different wavelengths on one single fibre

### TDMA

Time Division Multiple Access, is a method, which grants an ONU a certain time used to transmit upstream data. During this small period no other ONU can transmit connected to the same OLT Port. This is to avoid data collision.

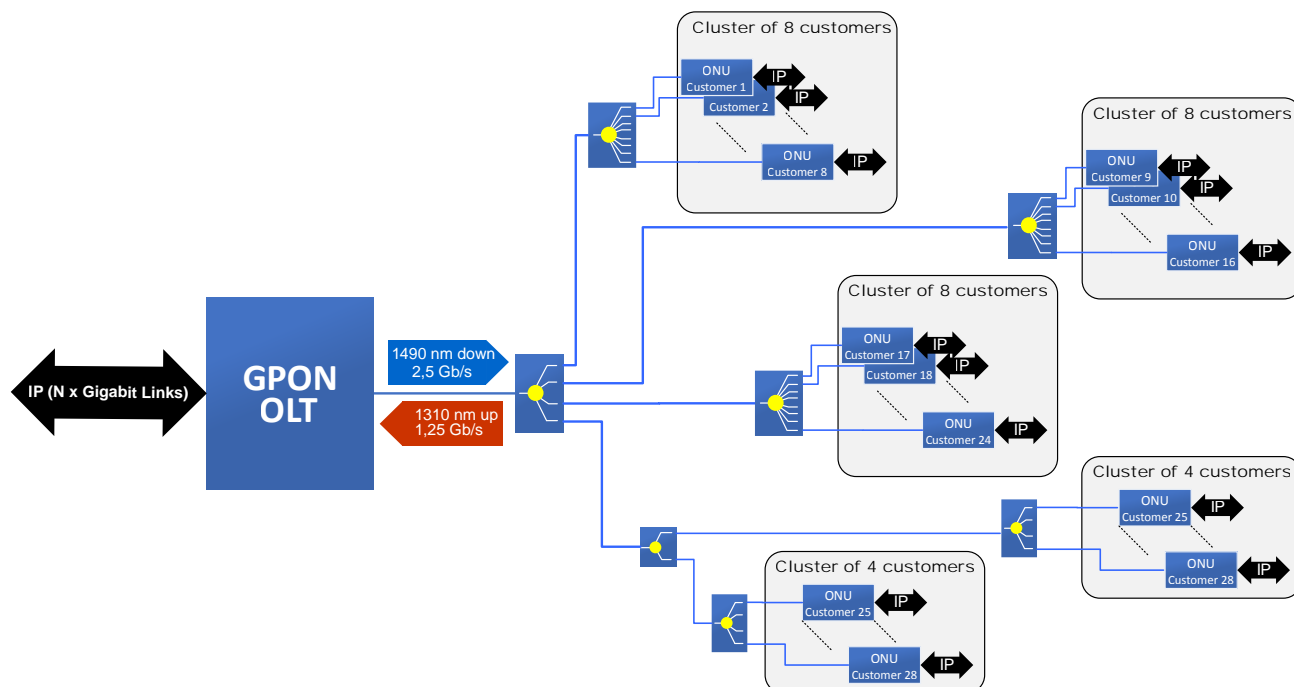
## GPON technology at a glance

### GPON supported features

Here's a short overview of the main features GPON technology has to offer:

- triple play services
- long reach up to 20 km over single mode PON structure
- splitting one GPON OLT optical link port to up to typical 32 (also 64/128) ONUs
- downlink data rate on one OLT downlink port of 2,5 Gb/s (broadcast transmission)
- uplink data rate 1,5 Gb/s from ONU to OLT (TDMA transmission)
- all traffic between OLT and ONU is encrypted using AES128
- bandwidth scheduler based on services
- ... and many other features

### GPON - how it works



ASTRO provides ONUs with integrated RF-port for RF broadcasting in parallel to the high speed IP traffic. VoIP is also an integral part of the ONUs.



# FTTX data solutions

## GPON OLT ROUTER

**OLT-V5824G**

8 ports



- 8 port optical line transmission for DATA
- for Triple Play FTTX GPON OLT Data service to ONUs
- perfect device for small to medium sized data networks for FTTX and SOHO based on GPON standard
- 96 Gbps switching capacity
- 71 Mbps forwarding rate
- 8 x 2.5 Gbps (down) / 1.25 Gbps (up)
- easy to install due to compact size
- cost-effective at thinly populated regions
- 8 x 10/100/1000 ethernet combo-type ports
- 2 x 10GE (SFP+) uplink ports
- reliable FTTx service with redundant power system for AC and DC or mixed

Rückseite:





Type		OLT-V5824G
Order number		212 804
EAN-Code		4026187193959
Specification		
Flash Memory	[MB]	40
SDRAM	[MB]	512
GPON Interface		4 x GPON (SFP, SC/PC Typ)
Uplink Port		8 x GE Combo [100/1000Base-X (SFP) or 10/100/1000Base-T (RJ45)]
MGMT Port		1 x 10/100Base-TX (RJ45)
Console Port		1 x Console (RS232)
MAC Table		16K
VLAN		4K
Switching capacity	[Gbps]	36
Put Through	[Mpps]	26,8
Ambient temperature	[°C]	0 .. 50
Maximum humidity	[%]	5 .. 90 (not condensing)
Power supply		AC Type: 100 - 240 VAC 50/60 Hz; DC Type: -48/60 VDC
Dimensions (W x H x L)	[mm]	432 x 43 x 320
Leistungsmerkmale		
MAC Adress		32K MAC Entries
VLAN		Maximum number of VLANs: 4K (1-4094) up to 4K stacked VLANs
IP Skalierbarkeit		Maximum number of L3 route entries IPv4, (IPv6): 8K(4K)
Equipment Performance		Cold Startup Time: maximum 2 minutes
Ethernet Switching		Switching / Bridging acc. to 802.1D and 802.1Q Packet Format: Ethernet-II and 802.3 Address Learning with Auto Aging Jumbo Frames up to 9k Configurable Aging Time Automatic and manual Auto-Negotiation
Link Aggregation (Uplink)		Link Aggregation (LAG) acc. to 802.3ad No. of LAG Groups: 12 No. of LAG Ports per Group: 8
Link Aggregation Control Protocol (LACP)		MAC Address bases on LACP; IP Packet based on (address based) LACP
VLAN Handling		Untagged Port Configuration: VLAN beset via port VLAN Tagging: VLAN-ID can be set via IP TOS/DSCP Tagged and Untagged Frames mixed at uplink port (outgoing) VLAN can be set via MAC Address List VLAN Duplication bases on IGMP; VLAN can be set via IP Source Address / Subnet VLAN Stripping VLAN can be set via IP Destination Address / Subnet Independent VLAN Learning (IVL); Tagged User Frames; Port Isolation
Hierarchical Functions		VLAN Stacking per Port (.1Q in .1Q); (VLAN can be set per port) Configurable Ethernet Type for VLAN VLAN Stacking (.1Q in .1Q) (Single Tagging / Stripping)
Ethernet Multicast / Broadcast		Configurable Ethernet Multicast Limit for Multicast Traffic on Uplink (with Activating- / Deactivating option) Block Unknown Multicast Flow based on configurable limit for Broadcast Traffic on Uplink (with Activating- / Deactivating option); Block Unknown Multicast Flow based on port basis
GPON Basisfunktionen		ITU-T Rec. G.984.3 AMD 2; ITU-T G.984.4 ONT Management & Control Interface (OMCI) G-PON OLT according ITU-T G.984; automatic ONT Ranging 1K of T-CONT ID; 4K of GEM Port-ID; 4K of MAC Entry Max Splitter Ratio : 128; Max Transmission Distance: 60km T-CONT Type (Type1 - Type5)
GPON extended functions		Classification/Tagging per DSCP/COS; FEC for Upstream/Downstream Key-Exchange for Encryption; ONU Auto-Discovery; ONU Authentication ONU Encryption; ONU Upgrade; Remote ONT/ONU Management
IP Functions		IPv6 H/W Ready; IPv4 Routing; IP Forwarding (Static Routing) OSPF v2; BGP v4; VRRP; OSPF ECMP (Equal Cost Multi-Path Protocol); Policy-Based Routing
IP Multicasting		IGMP v1/v2/v3 IGMP; Filtering (Filtering of Join and Leave Messages) IGMP Snooping with Single VLAN tagged; IGMP Filtering and Throttling IGMP Snooping; IGMP Proxy; IGMP v1/v2 Proxy with Single VLAN Tagged IGMP Termination; IP Multicast Routing Protocols (PIM-SM) PIM-SSM(Source Specific Multicast); RFC 1112 IGMP v1 IGMP v3; RFC 2366 IGMP v2; RFC 2362 PIM-SM IGMP Monitoring (Features as 3089); IGMP Termination
Layer 3 - Routing		RFC 2328 OSPF v2 (including MDS Authentication); RFC 1587 OSPF NSSA Option RFC 1765 OSPF Database Overflow; RFC 2370 OSPF Opaque LSA Option RFC 1771 Border Gateway Protocol 4; RFC 1965 Autonomous System Confederations for BGP RFC 1966 BGP Route Reflection; RFC 1997 BGP Communities Attribute RFC 1745 BGP/OSPF Interaction; RFC 2385 TCP MDS Authentifizierung for BGP v4
Management - SNMP & MIBs & others		RFC 1155 Structure of MGMT Information (SMI v1) RFC 1901 - 1907 SNMP Version 2c, SMIv2 and Revised MIB-II; RFC 1493 Bridge-MIB (D-Bridge) RFC 1354 IP v4 Forwarding Table MIB; RFC 1757 RMON 4 Groups: Stats, History, Alarms and Events RFC 2922 Physical Topology MIB; Siemens Enterprise MIB (SLE) RFC 2934 PIM MIB; RFC 1157 SNMP v1/v2c; RFC 854 Telnet RFC-1212, RFC-1213, RFC-1215 MIB-II & TRAPs; RFC 2030 Simple Network Time Protocol v4 (SNTP)
Security		RFC 1492 TACACS+; Radius Client; RFC 2138 RADIUS Authentication RFC 2267 Network Ingress Filtering



# FTTX data solutions

## GPON ONU ROUTER

ONU-H660RW



- optical network termination for DATA & Video service
- for Triple Play FTTX service termination of CATV and data service over one fibre connection; residential and SOHO customers
- GPON Data Service & RF overlay optical receiver in one box – all services over one single fibre connection
- CATV Port, 2 x FXS POTS, 4 high speed data interfaces (10/100/1000), WLAN
- very high data rate: downstream 2,5 Gbps, upstream 1,25 Gbps
- full triple play service: VoiP, data & video
- wire speed L2 switch
- L3 routing gateway with port forwarding
- NAPT and NAT address translation
- PPPoE client

rear view



Type		ONU-H660RW
Order number		212 805
EAN-Code		4026187193966
Physical Interface		
Optical Interface		SC/APC
GPON Interface data rate	[Gbps]	Upstream 1,25 Gbps / Downstream 2.5
GPON Link Budget	[dB]	28 for GPON wavelength 1310 nm / 1490 nm (GPON B+ Standard)
Optical input sensitivity @ 1550nm for CATV	[dBm]	AGC range -7...0 @ 1550 nm
Customer Data Ports		4 x RJ 45 - 10/100/1000Base-T
Voice Ports		2 x RJ11 – 2 x FXS for Phone Service
RF Interface		F-female, 47 ..1000 Hz, RF Level typ. 74dBμV/Channel (@ optical input within AGC range -8..0 dBm and PAL84)
System Specification		
System		128 MB Flash Memory; 128 MB SDRAM GPON Interface Capacity: Up 1.25 Gbps / Down 2,5 Gbps
GPON ONT		ITU-T G.984.x compliant, Forward Error Correction (FEC) Multiple T-CONTs/GEM Ports per Device Flexible Mapping between GEM Port and T-CONT Priority Queues and Scheduling at Upstream Activation with automatically detected serial number and password; Dying Gasp
L2 Switch		Untagged Port Configuration; IEEE802.1D und IEEE802.1Q Bridging Standard Ethernet Bridging; Spanning Tree Protokoll MAC Address Learning with Auto Aging (up to 4K MAC Adresses)
Multicast		IGMP Snooping
Quality of Service		HW-based internal IEEE 802.1p (CoS); Strict Priority (SP) 802.1Q (VLAN tag) QoS Mapping, ToS/CoS; 8 Queues per Port
Management		ITU_T 984.4 compliant OMCI Interface; IEEE802.3x Flow Control LED Indication for service; Web-based Management ONT Service Provisioning (on OLT Seite)
VLAN		VLAN Port Filtering; Destination Address Port Filtering
Wireless LAN		IEEE802.11b/g/n compliant; Multiple SSIDs; up to 32 devices simultaneously accessible 64/128bit Wireless Encryption Protocol (WEP); Bandwidth: 2.4GHz Two Transmit and Two Receive Path (2T2R); 2x2 MIMO Max. data rate : 54Mbps in 802.11g; Supports MCS0 /7 /8 /15 Modulation- a. Codingrate Supports 20 MHz and 40 MHz Channels; Security: WEP, WPA-PSK (TKIP) & WPA2-PSK (AES); Wi-Fi positioning system (WPS)
VOIP Features		SIP (RFC3261/3262/3264); 5-REN per POTS; RTP, RTCP (RFC3550/3551) DTMF Dialing / Pulse Dialing; Multiple Codecs: G.711, G.723.1, G729 T.38 FAX Modus; Echo Cancellation
Residential Gateway Unit Features (L3 Routing Modus)		PPPoE Client: Multiple Clients per RG ONT, Automatic Initialisation of Session, automatic keep alive; DHCP Server / Client DNS Relay Server (DNS Relay, DNS Transparent); NAT und NAPT; NAT Session up to 16K Port Forwarding; Integrated Stateful Packet Inspection Firewall with AC
Common data		
Dimensions	[mm]	190 x 66 x 150 (B x H x L, Antennas folded)
Operation conditions		Operating temperature -5 - 50 °C Storing temperature -30 - 60°C Maximum humidity 20 - 90% (not condensing)
Power supply (AC/DC adapter)		Input: 100 - 240 VAC, 50/60 Hz Output: 12 VDC / 1,5A



# FTTX data solutions

## FTTX POINT TO POINT ETHERNET CPE SWITCH

### CPE-HES3106



- optical network termination for DATA & video service for Point to Point based networks
- for SOHO & residential termination with Point to Point ethernet optical networks combined with RF-Overlay; FTTX CPE with network management for automatic service deployment
- fully managed switch
- customer ports: CATV port, 5 x GBE high speed data interfaces (10/100/1000)
- uplink GBE dual rate 100/1000 Base-X with SFP or SFF (fixed)
- IGMP snooping, Q-in-Q VLAN
- automatic DHCP configuration based on providers settings in configuration file
- SNMP power down trap
- dual rate WAN interface with autosensing function
- RF port for broadcast TV
- optional cable tray for fiber termination

### FBT-HES



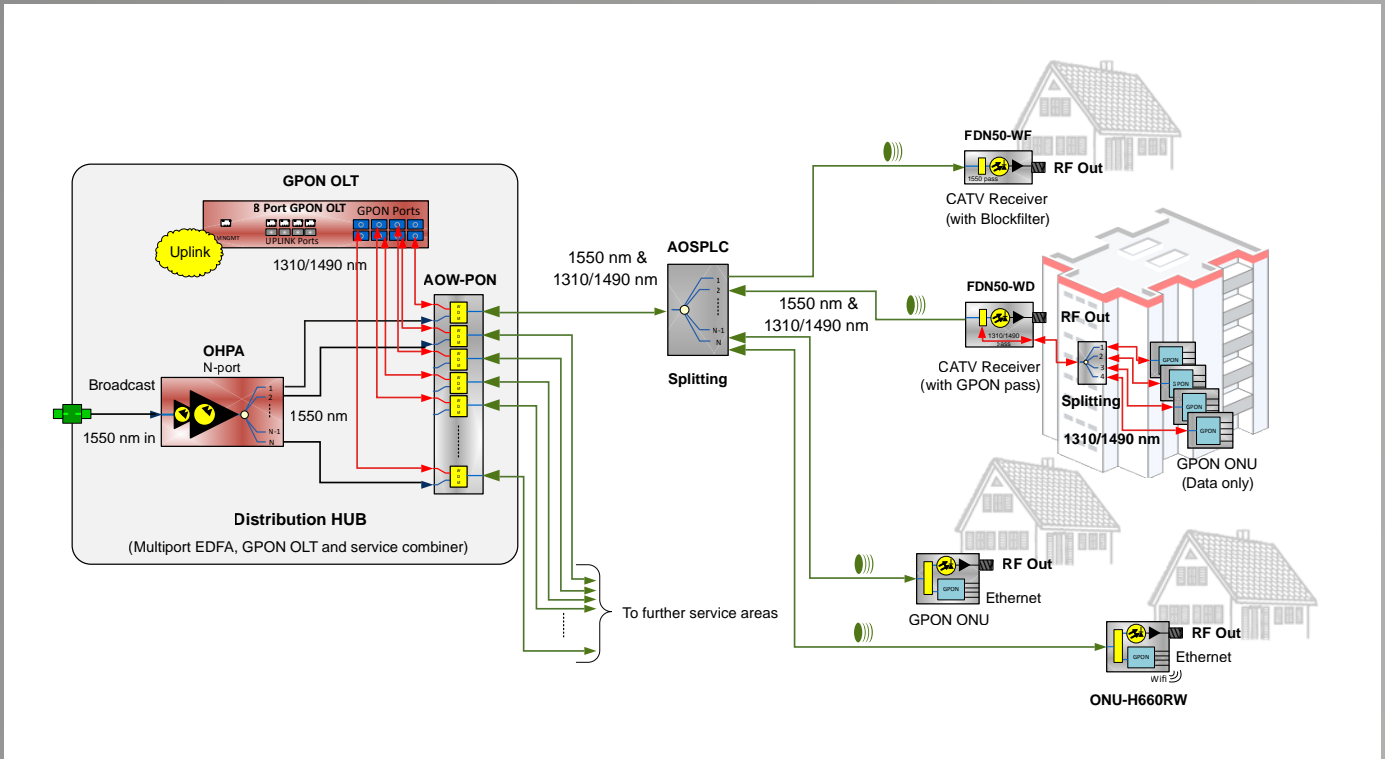
Order number: 212 416  
EAN-Code: 4026187193539

- fibre tray for CPE-HES3106

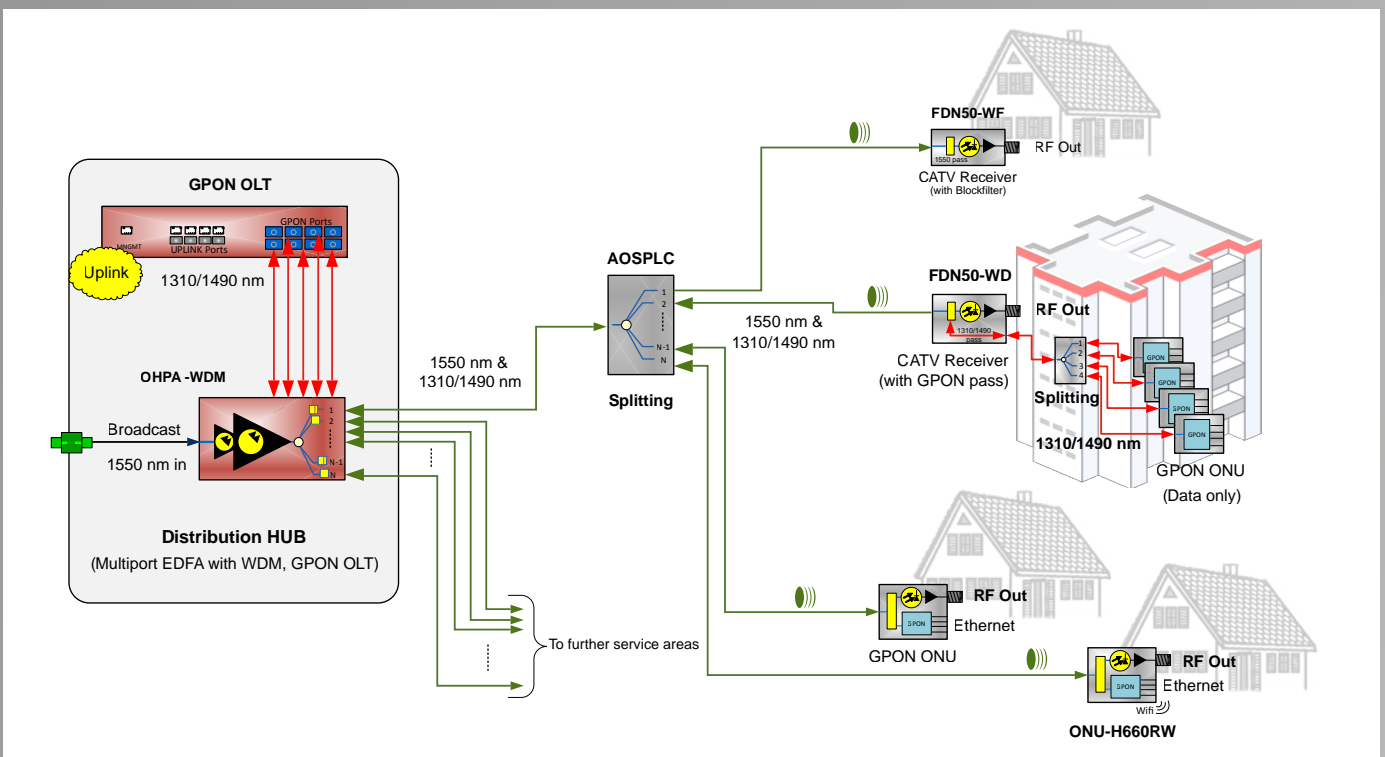
Type		CPE-HES3106
Order number		212 802
EAN-Code		4026187193935
Physical Interface		
Optical data uplink interface		SFP slot for BIDI or SFF Single Mode BIDI TX: 1310nm / RX: 1550nm / 10 km / SC/APC
Optical uplink dat rate		100/1000 Base-X dual rate / autosensing
LAN Ethernet ports		5 x 10/100/1000Base-T / RJ45
CATV Optical input port coupling		SC/APC
CATV optical wavelength	[nm]	1260 -1610
CATV optical input level (AGC range)	[dB]	AGC range -6.0 .. 0.0 @ 1550nm
CATV RF frequency range	[MHz]	45 .. 1000
CATV RF level (OMI=3.5%, opt. in=-6.0dBm)	[dBμV]	88
System Specification		
Hardware		Store and Forward Switching Mechanism; Auto Crossover via MDI/MDI-X in TP port Auto Negotiation in TP port; Half/Full Duplex Mode Operation Jumbo Frame: 9K bytes; MAC Address Table: 2K Non-Blocking Switching Fabric: 12Gbps; VLAN ID: 4K
Forward Rate		10M: 14,880/14,880pps 100M: 148,800/148,800pps 1000M:1,488,000/1,488,000pps
LEDs		Power, LAN, F/O, Status
Netzwerk Management		IPv4/IPv6 dual stack; Stateless Address AutoConfiguration (SLAAC) Web Management; Telnet CLI; SNMP Management / SNMP v1/v2c DHCP Client / DHCP Auto Provision / DHCPv6; Power Down Trap FTP/TFTP Firmware Upgrade; Loop Detection; Network Time Protocol (NTP)
Switch Features		Port Based VLAN; Q-in-Q Double Tag; IEEE802.1q Tag Based VLAN Support 128 VLAN Groups; QoS Based on P-bit, VLAN & DSCP Bandwidth Control; IGMP Snooping v1/v2
Common datat		
Dimensions	[mm]	180 x 130 x 30 (W x L x H); with Fibre Tray: 180 x 180 x 42
Weight	[kg]	0,68
Ambient temperature	[C°]	Operation: 0 - 50; Storing temperature: -20 - 60 Humidity: 5% ~ 90%, not condensing
Power supply (AC/DC adapter)		AC Input: 100 VAC ~ 240 VAC Frequency range: 50~60 Hz DC Output: 12V / 1,5A Power consumption AC site: 11,45 W (Max.) / DC Site: 6,78 W (Max.)

# FTTX data application solutions

## GPON network with RF-Overlay (external service combiner)

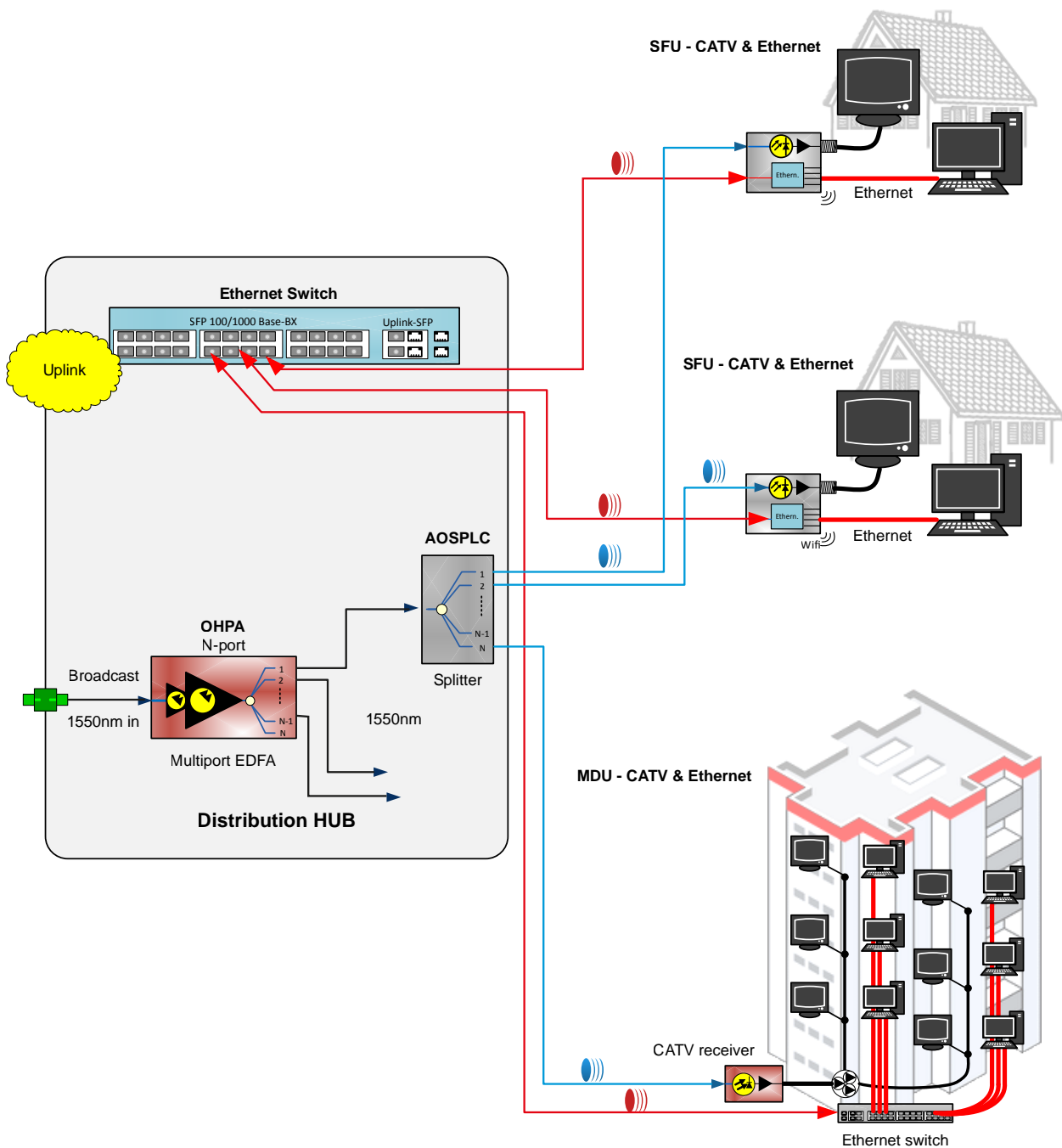


## GPON network with RF-Overlay (internal service combiner)



# FTTX data application solutions

## PtP ethernet with RF-Overlay



# FTTX RF-Receivers and Fibre Nodes

## FTTX - a renaissance for Fibre Nodes

With a fibre node the network provider uses one of several options for providing cable telecommunications services to multiple end customers. A fiber node establishes a broadcast and broadband connection through a common network box, installed at the curb or at the building. One of the main benefits of fibre node is the ability to deliver broadcasting TV and Data Services via more efficient fibre optic feeding lines. The remaining area from the node to an individual destination, often called „last mile“ service, can be achieved traditionally with coaxial cables. This is what cable operators are doing since the last two decades already: delivery of broadcast TV in combination with DOCSIS cable modem broadband IP services. The fibre node is the hybrid device, connected on one side to the optical fibre network, on the other side connected to the copper coaxial network.

Since nowadays FTTX/FTTB fibre networks are more and more upcoming, the fibre node receives renaissance in this kind of broadband data architectures, like PtP-Ethernet or GPON/EPON networks. For these systems, the data will be delivered as pure IP via the optical fibres, multiplexing broadcasting TV either on the same fibre with a different optical wavelength or alternatively on a separate fibre (e.g. PtP-Ethernet). In such FTTX installations, the fibre nodes are feeding individual residential homes or apartments. In FTTB installations, the fibre nodes are connected to the existing coaxial network in a building and deliver the broadcast analogue and digital TV (DVB-C, etc.) to the end customers, in parallel to the FTTX/FTTB pure IP data transmission technologies.

## A complete range of devices

The fibre node product portfolio of ASTRO will allow the network supplier to build any kind of network architectures and provide a reliable service to its customers. All products fit well either in “DOCSIS” or “FTTX RF-Overlay Networks”. The range of available devices includes small compact fibre nodes for receiving broadcast TV for FTTX networks, medium sized fibre nodes for FTTB applications, as well as fibre nodes for traditional cable operators with a return path transmitter for DOCSIS for FTTB/FTTC networks.

Some cable operators demand a full forward and return path redundancy. With the ASTRO node OFN400 not only forward and return path is redundant, but also the power supply - which is often the main reason for service outage - will be redundant and therefore securing a reliable service. The nodes are equipped with return path transmitters used for DOCSIS, with return path lasers available in 1310 nm wavelength, but also in the CWDM wavelength grid.

ASTROs FTTX optical compact receivers (OFN 45 and OFN50 series) can be used with all kind of FTTX data architectures, such as pure TV broadcasting networks, GPON/EPON point-to-multipoint optical architectures (providing digital data services but also RF-Overlay service), as well as Ethernet, GPON/EPON FTTX or FTTB networks combined with RF-Overlay, where RF needs to be separated from DATA at customer premise.

### Link Performance

Link performance refers to performance for a pre-defined optical or electrical link with a reference system load. The link performance on TV broadcasting is measured with performance values usually for analogue TV transmission between head-end and the output on the tested device for a pre-defined link. Resulting in CNR (Carrier Noise Ratio), CSO (Composite Second Order beats), CTB (Composite Triple Order beats) values. Link Performance depends very much on the device quality, the applied channel load and the link length to the device. Standard channel allocations used for measuring are for example for Europe Cenelec 42, for Asia PAL84 or the American NTSC 77. For Digital TV different performance values are interesting, such as BER (Bit Error Rate) and MER (Modulation Error Rate).

### EDS (Electronical Device Setup)

A configuration with LED and push buttons. Automatic Gain Control Range (AGC), gain/attenuation/equalizer settings and others, could be setup easily with a local push button panel.

### AGC

Automatic Gain Control guarantees a constant RF output power within a pre-defined optical input range. If the optical level at the input is within this AGC range, the RF output is kept stable.

### FTTX / FTTB / FTTC

Refers to different network structures, such as Fibre to the Home, Fibre to the Building or Fibre to the Curb.

### SNMP Monitoring

SNMP (Simple Network Management Protocol) is a standard method to monitor devices in the communication technology. Each element (such as a fibre node) provides a Managed Information Base (MIB) which holds the description of alarming and configuration parameters. The manager could access the element using SNMP Protocol and gets the requested information out of the element. Therefore, the MIB must be well known to the manager prior receiving information or setting configuration parameters.



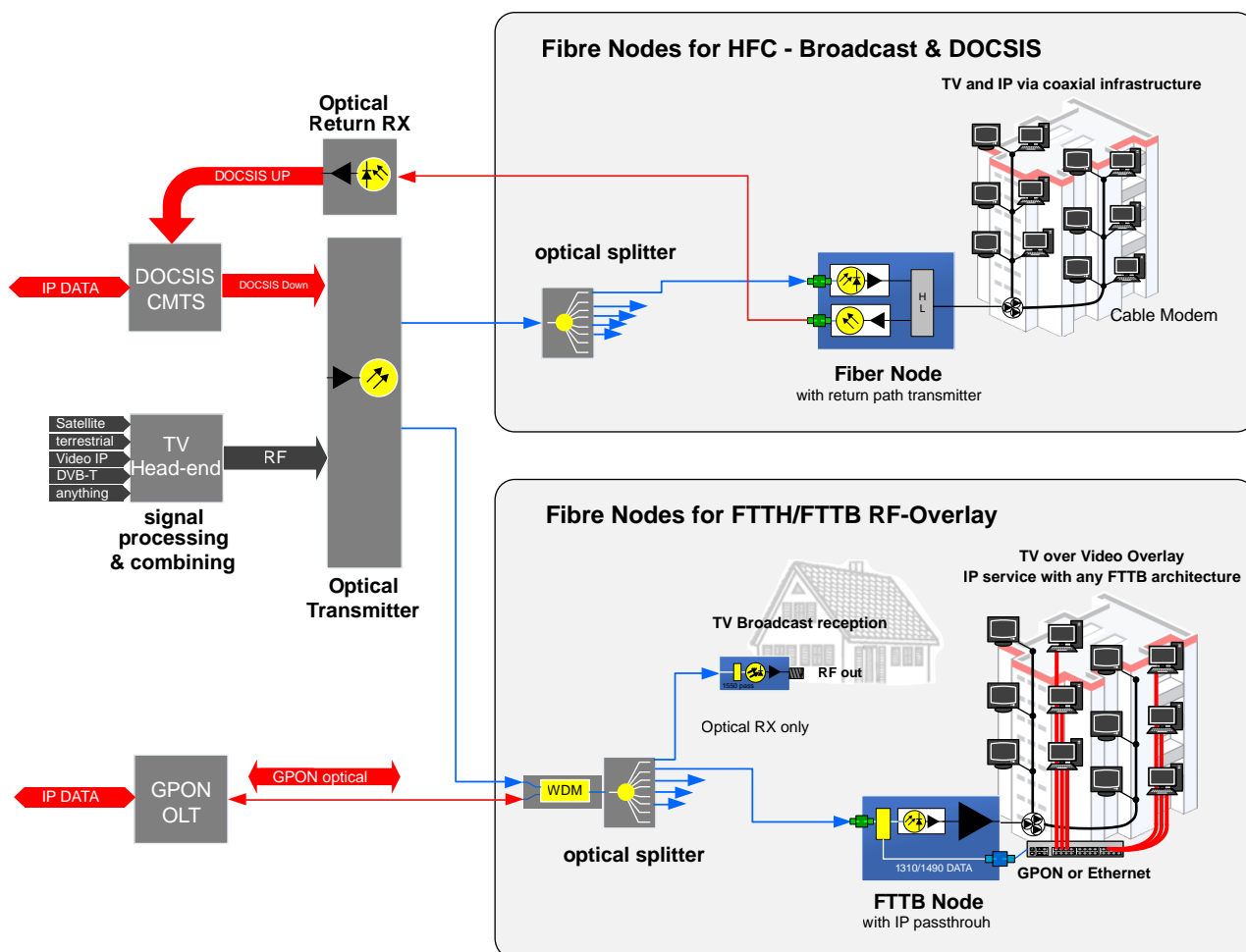
## Fibre node technology at a glance

### Feature overview

Here's a brief overview of the main features ASTRO Fibre Nodes can offer:

- all fibre nodes provide EDS (Electronical Device Setup)
- FTTX receivers with flexible output adjustment, Fiber nodes with AGC
- Fibre nodes available for any kind of required installation purposes for FTTX, FTTB or FTTC (small, medium and large)
- suitable for unidirectional and bidirectional services
- return channel transmitter options for CWDM applications in a fibre saving infrastructure
- power supply options for remote feed or mains
- RF test points

### Fibre Nodes - how they work





# FTTX RF-Receivers and Fibre Nodes

## FFTH/FTTB OPTICAL MINI RECEIVERS

OFN45-BLC



**NEW**

- forward path RX for CATV
- for termination of RF-Overlay TV broadcasting for networks incorporating GPON/EPON or PtP data service; unidirectional networks for TV broadcasting
- GPON blocking filter
- extended optical input range for AGC
- -12 dBm ... +2 dBm
- housing options: compact or with fibre tray "sealed"
- block filter (pass: 1540 .. 1560 nm)
- RF frequency range 45 - 1006 MHz
- power plug supply +12 VDC
- very low power consumption

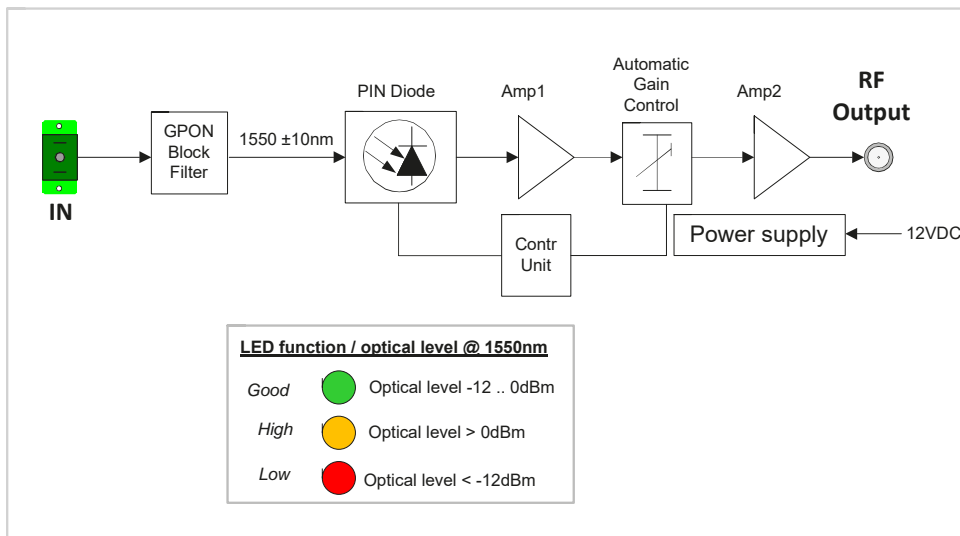


OFN45C-BSC



OFN45C-BLC

BLOCK DIAGRAM



		OFN45C-BLC	OFN45C-BSC	OFN45-BLC
Order number		212 138	212148	212 137
EAN-Code		4026187195847	4026187195878	4026187195830
Housing		compact	compact	fibre tray version with fibre management
Connector type		LC/APC	SC/APC	LC/APC
<b>Optical parameters</b>				
Optical input wavelength	[nm]		1540...1560	
Optical input power	[dBm]		-15...+2*	
Nominal optical input power (AGC range)	[dBm]		-12...+0	
Multicolor LED			green: -12 dBm...+0 dBm red: < -12 dBm yellow: > 0 dBm	
Optical return loss	[dB]		> 45	
Fibre type			Single Mode Fibre 9/125	
<b>RF parameters</b>				
Frequency range	[MHz]		45 ... 1006	
Flatness	[dB]		±0.75	
RF level (OMI 3,5 %)*	[dBμV]		76 ± 2 (@ Pin -12 dBm...0 dBm within AGC, QAM 256)	
Output return loss	[dB]		≥ 16 @ 45 MHz	
Output impedance	[Ω]		75	
<b>Common data</b>				
Power supply voltage	[VDC]		12 (with external supply unit; inner diameter 2,5 mm, outer diameter 5,5 mm)	
Power consumption	[W]		≤ 1,8	
Dimensions (L x W x H)	[mm]		136 x 136 x 40	
Ambient temperature	[°C]		-20 ... +55 (OFN45) -10...+55 (Power supply unit)	
Relative humidity	[%]		maximum 95, not condensing	

\*) = 1550 nm, Pin in the range -12.0 dBm ... 0 dBm (within AGC), QAM 256 signal level, out of AGC the RF signal changes by 2 dB for each change of 1 dB of the optical level

# FTTX RF-Receivers and Fibre Nodes

## COMPACT FTTX OPTICAL CATV RECEIVERS

### OFN50-WD

with pass through port for GPON/EPON data



- nodes for termination of RF-Overlay broadcasting for GPON/EPON or PtP networks; unidirectional networks for TV broadcasting; CATV network service extension with GPON/EPON data service (connected to the CATV receiver with pass through port the ONU)
- versions with GPON/EPON block or path through filter which enables to receive CATV @ 1550 nm on a data network
- variable attenuator 20 dB to adjust RF output level as desired
- compact housing
- very low noise current (highest picture quality on low optical input levels)

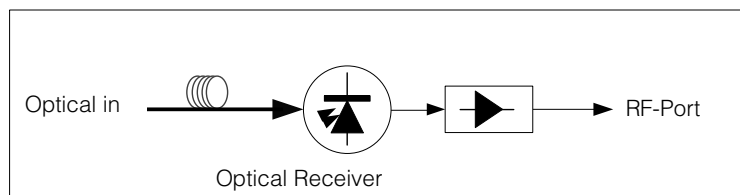


### OFN50-C

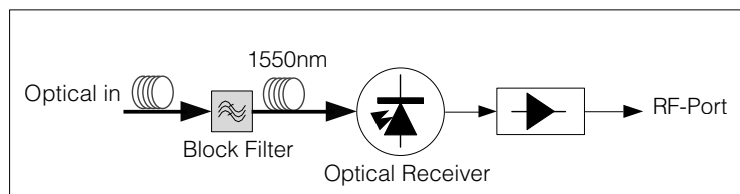
### OFN50-WF

with blocking filter for GPON/EPON data

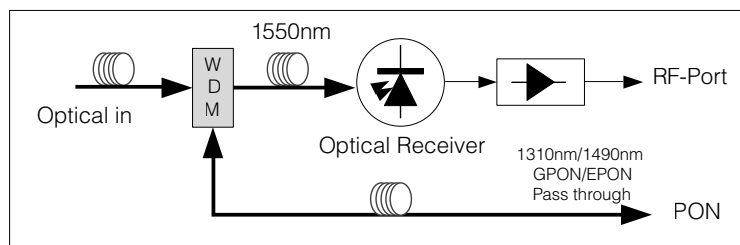
OFN50-C



OFN50-WF



OFN50-WD



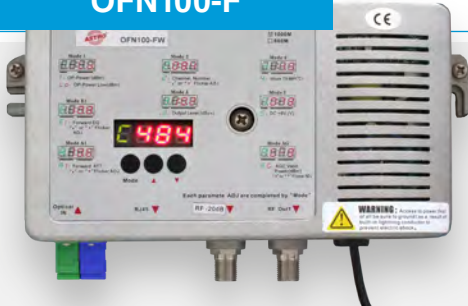
BLOCK DIAGRAM

Type		OFN50-C	OFN50-WF	OFN50-WD
Order number		212 113	212 114	212 115
EAN-Code		4026187192907	4026187192914	4026187192921
Optical node type		Optical compact receiver for CATV	Optical compact receiver with blocking filter for GPON/EPON data	Optical compact receiver with pass through port for GPON/EPON data
<b>Optical characteristics</b>				
Optical input wavelength	[nm]	1100...1600	1530...1620	CATV: 1530 .. 1620 PON: 1310/1490
Optical input power	[dBm]	-10... +2		
Optical return loss	[dB]	> 45		
Optical connector type		SC/APC	SC/APC	COM: SC/APC PON: SC/PC
Fibre type		Single mode 9/125		
<b>RF characteristics</b>				
Frequency range	[MHz]	45...1006		
Flatness	[dB]	± 0,75		
RF level (OMI 3,5 %)	[dBμV]	≥ 78 @ -6 dBm		
Output return loss	[dB]	> 14		
Output Impedance	[Ω]	75		
Manual RF adjustment	[dB]	0...20		
CSO for Cenelec 42	[dB]	> 60 @ -6 dBm		
CTB	[dB]	> 60 @ -6 dBm		
Receiver Noise Current	[pA/SQRT(Hz)]	4,5		
<b>Common data</b>				
Power plug	[VDC]	12		
Housing		compact housing		
Power consumption	[W]	≤ 3		
Dimension (L x W x H)	[mm]	109 x 80 x 26		
Ambient temperature	[°C]	-20...+55		

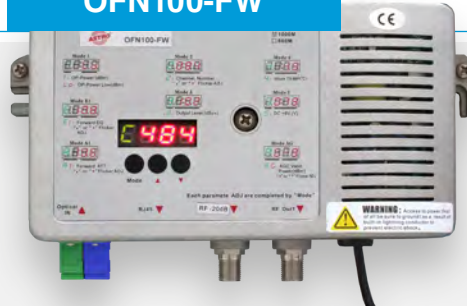
# FTTX RF-Receivers and Fibre Nodes

## COMPACT RECEIVERS FOR CATV

**OFN100-F**



**OFN100-FW**



with WDM pass through

- nodes for deep fibre CATV, HFC and FTTX networks, termination of RF-Overlay TV broadcasting for GPON/EPON or PtP networks
- frequency range 45 - 1006 MHz
- automatic adjustable gain control up to -9 dBm optical input

- high RF output level due to GaAS powered double amplifier stage
- WDM option for GPON/EPON pass through
- attenuation and equalizer setting via on board display with push buttons

**OFN100-FS**



with link redundancy

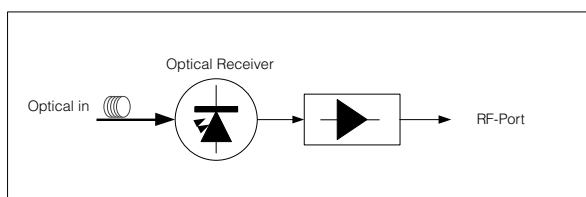
**OFN100-FR-1310**



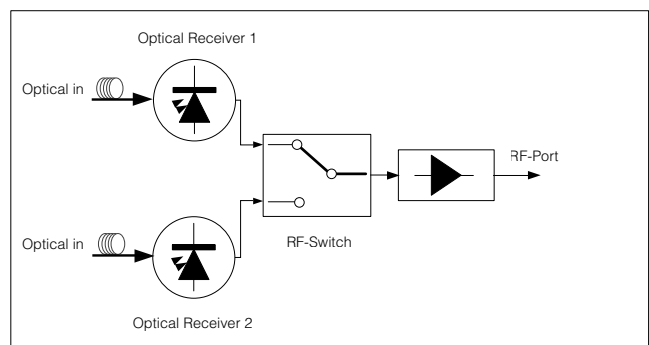
receiver & return path transmitter

BLOCK DIAGRAM

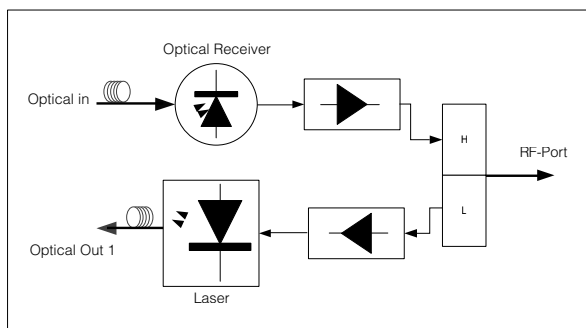
OFN100-F



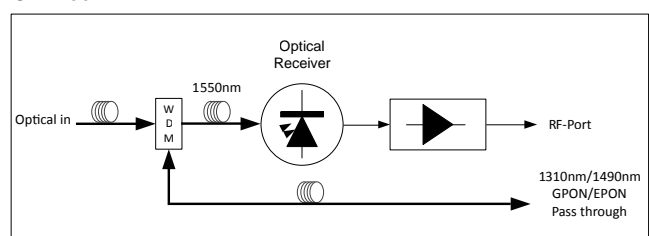
OFN100-FS



OFN100-FR



OFN100-FW





Type		OFN100-F	OFN100-FW	OFN100-FS	OFN100-FR-1310*
Order number		212 116	212 117	212 118	212 119
EAN-Code		4026187192938	4026187192945	4026187192952	4026187192969
Optical node type		Forward path only	Forward path with WDM passthrough for G(E) PON networks	Redundant forward path	Forward path with return transmitter as described below
<b>Optical characteristics</b>					
Optical input wavelength for CATV	[nm]	1100...1600	1530...1610	1100...1600	1100...1600
Optical input power	[dBm]	-9... +2			
AGC range	[dB]	adjustable -9/-8/-7...+2			
Optical return loss	[dB]	> 45			
Optical connector type		SC/APC; other on request			
Fibre type		Single mode 9/125			
<b>RF characteristics</b>					
Frequency range	[MHz]	45...1006	45...1006	85...1006	85...1006
Flatness	[dB]	± 0,75			
RF level (OMI 3,5 %)	[dBμV]	≥ 102			
Output return loss	[dB]	> 16			
Output Impedance	[Ω]	75			
Electronic control EQ range	[dB]	0...15			
Electronic control ATT range	[dB]	0...15			
RF testpoint		-20			
<b>Common data</b>					
Power supply	[VAC]	150...265			
Chassis type		diecast housing			
Power consumption	[W]	≤ 8	≤ 8	≤ 8	≤ 10
Dimension (L x W x H)	[mm]	190 x 110 x 52			
Ambient temperature	[°C]	-40...+60			
Relative humidity	[%]	maximum 95, non condensing			
<b>Link performance**</b>					
C/N	[nm]	≥ 51			
CTB	[dBm]	≥ 60			
CSO	[dB]	≥ 60			
<b>Return path (only OFN100-FR)</b>					
Optical wavelength	[nm]	-	-	-	1310 (CWDM on request)
Optical output power	[dBm]	-	-	-	0
Transmission mode		-	-	-	constant or burst mode
Optical connector type		-	-	-	SC/APC; other on request
Fibre type		-	-	-	Single mode 9/125
Frequency range	[MHz]	-	-	-	5-65
Flatness in band	[dB]	-	-	-	± 1
RF input level	[dBμV]	-	-	-	75 - 85
Impedance	[Ω]	-	-	-	75

\*) other wavelengths on request

\*\*) Cenelec42, Link length 20 km @ 1550 nm, optical in 0d Bm, AGC -9 dBm, RF output level 102 dBμV, EQ = 0

Other types than specified above available on request

# FTTX RF-Receivers and Fibre Nodes

## DIE-CAST HOUSING FIBRE NODES

**OFN200-F**

forward path only



- node for deep fibre CATV & HFC networks; termination of RF-overlay TV broadcasting for GPON/EPON or PtP networks
- frequency range 45 - 1006 MHz
- automatic adjustable gain control
- high RF output level due to GaAS power double amplifier stage
- WDM option for GPON/EPON pass through
- attenuation and equalizer setting via on board display with push buttons
- optical link redundancy with optional second RX/RF-switch

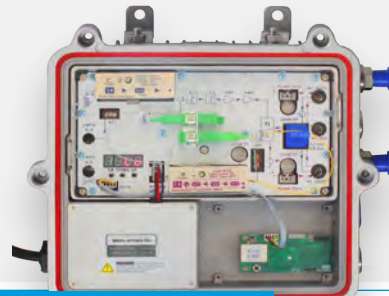
**OFN200-FS**

redundant forward path



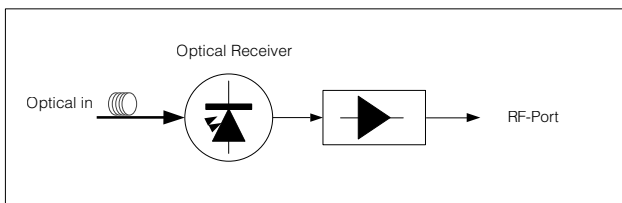
**OFN200-FR-1310**

with pluggable return path

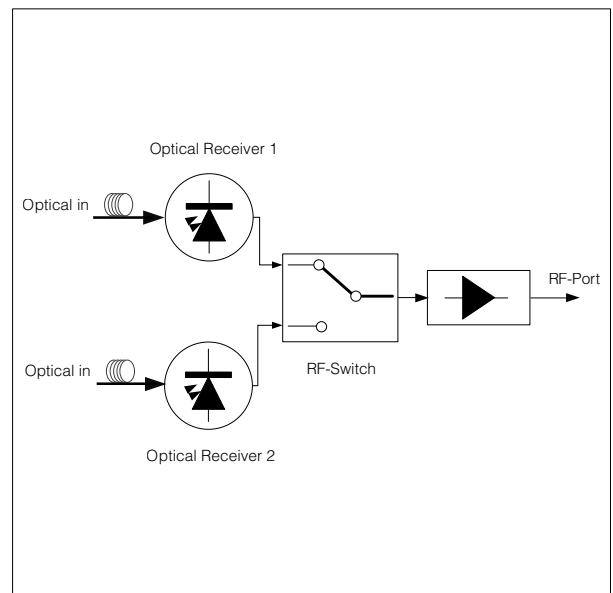


BLOCK DIAGRAM

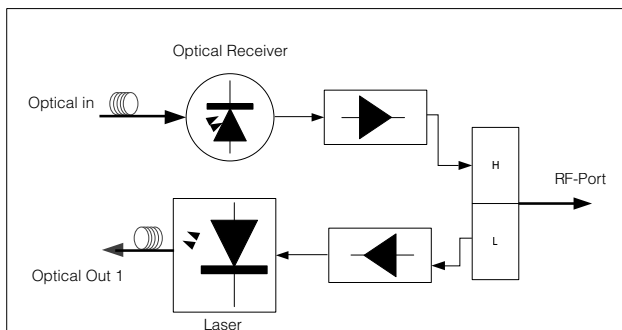
OFN200-F



OFN200-FS



OFN200-FR





Type		OFN200-F AC	OFN200-FS AC	OFN200-FR-1310 AC**
Order number		212 120	212 121	212 122
EAN-Code		4026187192976	4026187192983	4026187192990
Optical node type		Forward path only (no pluggable return module)	Redundant forward path (with RF switch, no pluggable return module)	Forward path with pluggable return module as described below
<b>Optical characteristics</b>				
Optical input wavelength	[nm]	1100...1600		
Optical input power	[dBm]	-9...+2		
AGC range	[dB]	adjustable -9/-8/-7...+2		
Optical return loss	[dB]	> 45		
Optical connector type		SC/APC; other on request		
Fibre type		Single mode 9/125		
<b>RF characteristics</b>				
Frequency range	[MHz]	45...1006	45...1006	85...1006
Flatness	[dB]	± 0,75		
RF level (OMI 3,5 %)	[dBμV]	≥ 108		
Output return loss	[dB]	> 16		
Output Impedance	[Ω]	75		
Electronic control EQ range	[dB]	0...15		
Electronic control ATT range	[dB]	0...15		
RF testpoint	[dB]	-20		
<b>Common data</b>				
Power supply	[VAC]	Mains: 150...265; Remote: 35...90		
Chassis type		diecast housing		
Power consumption	[W]	≤ 14	≤ 14	≤ 30
Dimension (L x W x H)	[mm]	220 x 205 x 65		
Ambient temperature	[°C]	-40...+60		
<b>Link performance*</b>				
C/N	[nm]	≥ 51		
CTB	[dBm]	≥ 67		
CSO	[dB]	≥ 62		
<b>Return path (only OFN200-FR)</b>				
Optical wavelength	[nm]	-	-	1310 (CWDM on request)
Optical output power	[dBm]	-	-	0
Transmission mode		-	-	constant or burst mode
Optical connector type		-	-	SC/APC; other on request
Fibre type		-	-	Single mode 9/125
Frequency range	[MHz]	-	-	5-65
Flatness in band	[dB]	-	-	± 1
RF input level	[dBμV]	-	-	72 - 85
Impedance	[Ω]	-	-	75

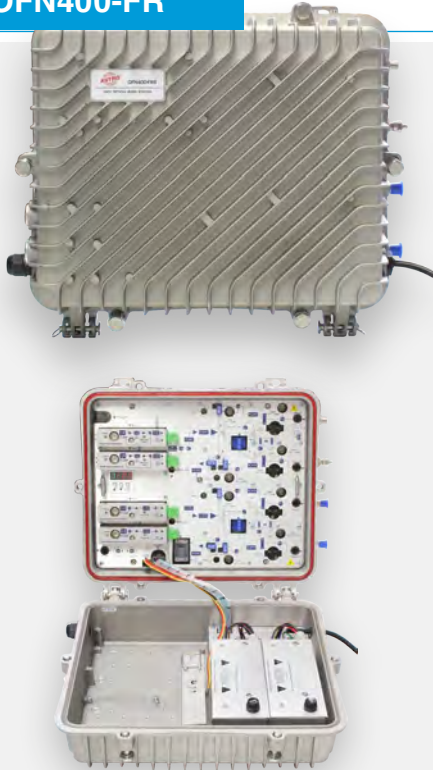
\*) Cenelec42, Link length 20 km @ 1550 nm, optical in 0dBm, AGC -9 dBm, RF output level 108 dBμV, EQ = 0

\*\*) Other types than specified above available on request

# FTTX RF-Receivers and Fibre Nodes

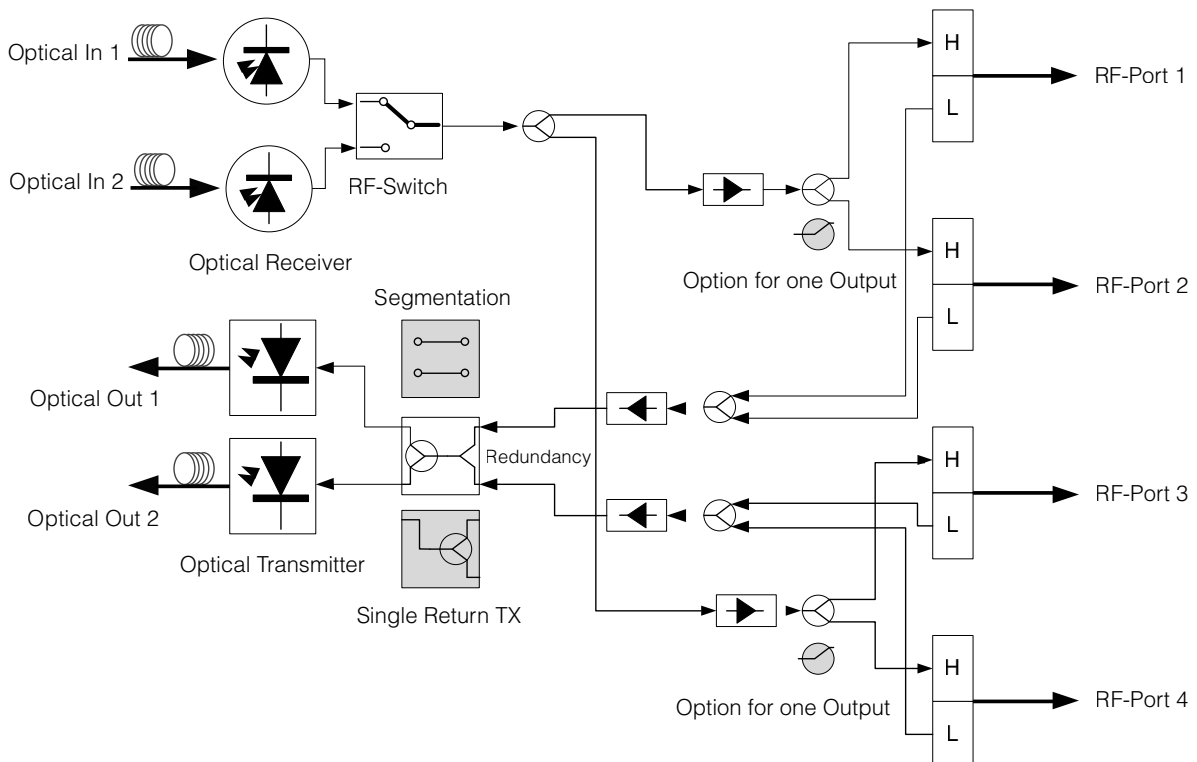
## FIBRE NODE WITH REDUNDANT FORWARD AND RETURN PATH

### OFN400-FR



- Broadcasting and DOCSIS optical Fibre node for CATV & HFC networks
- frequency range 45 - 1006 MHz
- 2 optical forward path receivers, redundant via RF switch
- 2 optical return path transmitters, segmentation or redundancy feature
- power supply **redundancy**
- automatic adjustable gain control
- high RF output level due to GaAS power double amplifier stage
- attenuation and equalizer setting via on board display with push buttons
- flexible setting for 2 or 4 RF output ports
- SNMP monitoring option
- local compact CMTS (C-CMTS) interface

BLOCK DIAGRAM

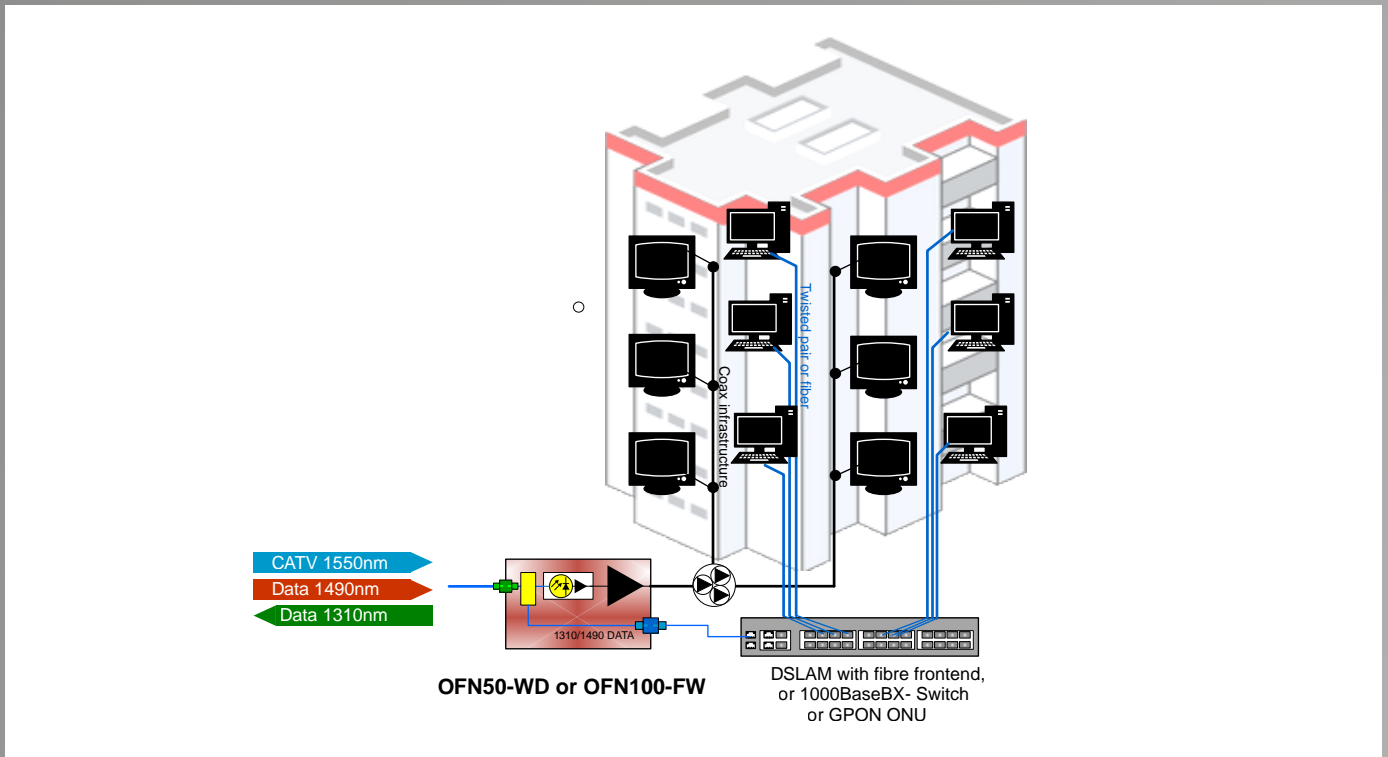


Type		OFN400-FR
Order number		212 123
EAN-Code		4026187193003
Optical node type		2 x 2 full redundant 4 port fibre node
Optical characteristics		
Optical input wavelength	[nm]	1100...1600
Optical input power	[dBm]	-8... +2
AGC range	[dB]	adjustable -9/-8/-7...+2
Optical return loss	[dB]	> 45
Optical connector type		SC/APC; other on request
Fibre type		Single mode 9/125
RF characteristics		
Frequency range	[MHz]	87...1006
Flatness	[dB]	± 0,75
RF level (OMI 3,5 %)	[dBμV]	≥ 108 (4 Ports output) ≥ 112 (2 Ports output)
Output return loss	[dB]	> 16
Output Impedance	[Ω]	75
Electronic control EQ range	[dB]	0...15
Electronic control ATT range	[dB]	0...15
RF testpoint	[dB]	-20
Common data		
Power supply	[VAC]	redundant mains: 150 .. 250 or redundant remote power: 35 .. 90
Chassis type		diecast housing
Power consumption	[W]	≤ 70
Dimension (L x W x H)	[mm]	360 x 330 x 155
Ambient temperature	[°C]	-40...+60
Link performance*		
C/N	[nm]	≥ 51
CTB	[dBm]	≥ 60
CSO	[dB]	≥ 60
Return path (2 modules for redundancy or segmentation)		
Optical wavelength	[nm]	1310 (CWDM on request)
Optical output power	[dBm]	@ 1310 nm: 0
Transmission mode		constant or burst mode
Optical connector type		SC/APC other on request
Fibre type		Single mode fiber 9/125
Frequency range	[MHz]	5 - 65
Flatness in band	[dB]	±1
RF input level	[dBμV]	72 - 85
Impedance	[Ω]	75

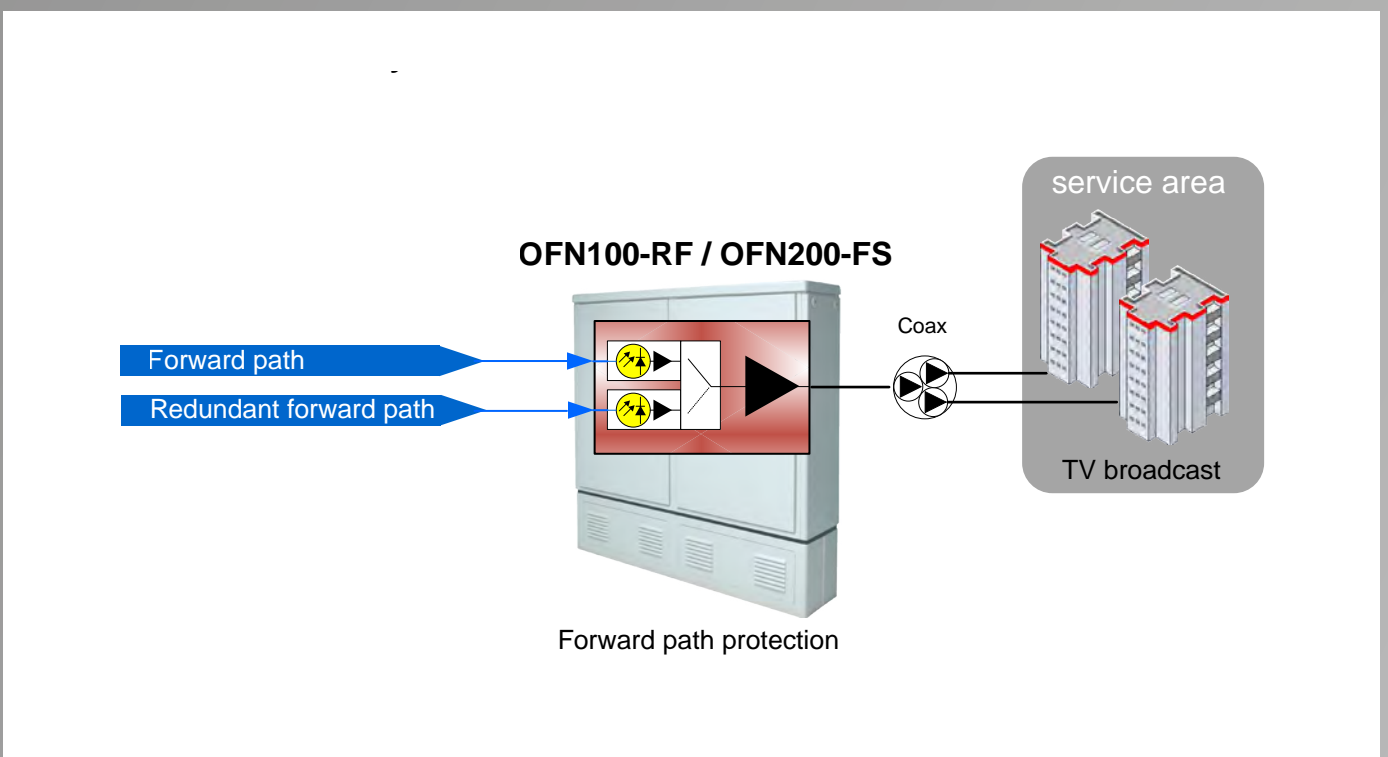
\*) Cenelec42, Link length 20 km @ 1550 nm, optical in 0dBm, AGC -9 dBm, RF output level 108 dBμV, EQ = 0

# Fibre Node application solutions

## FTTB - Broadcast TV and IP to metro building via one fibre

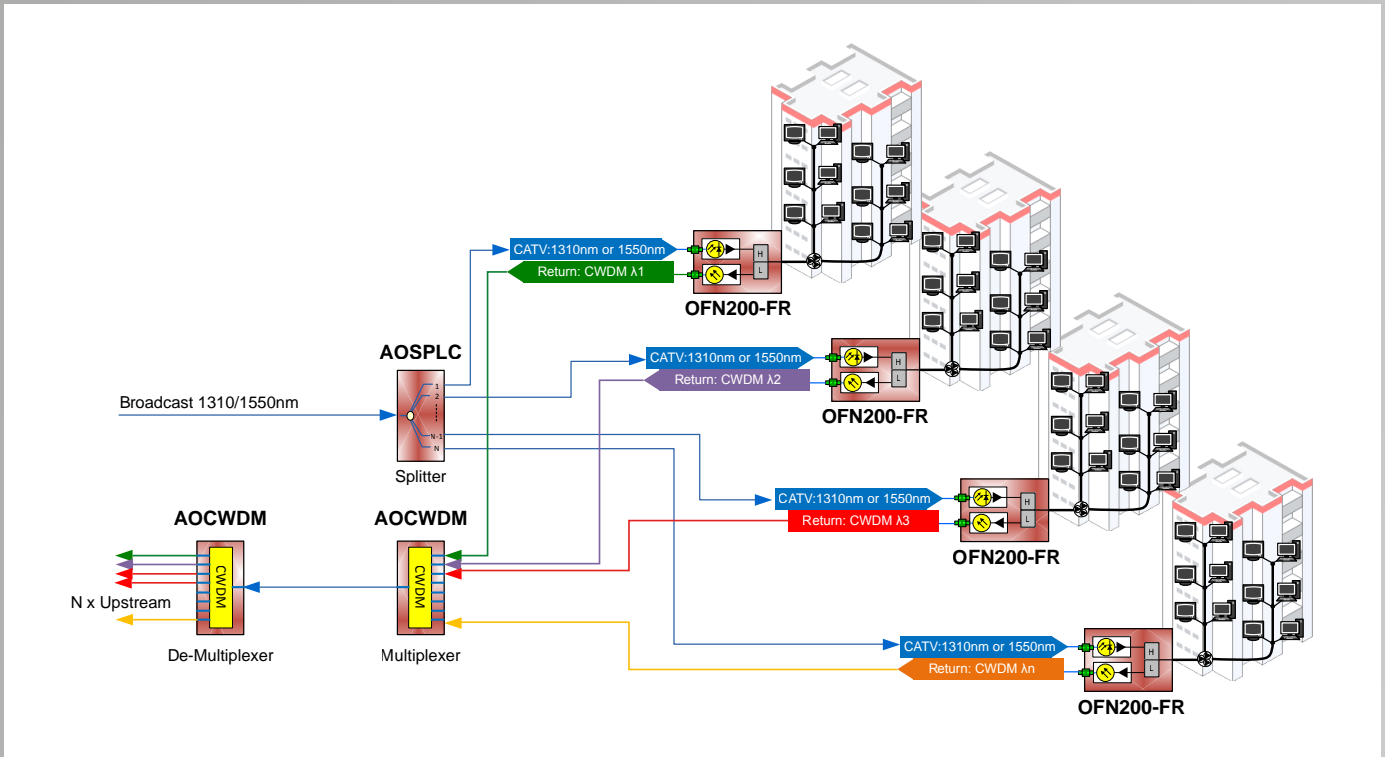


## Forward path redundancy with OFN100-FS or OFN200-FS

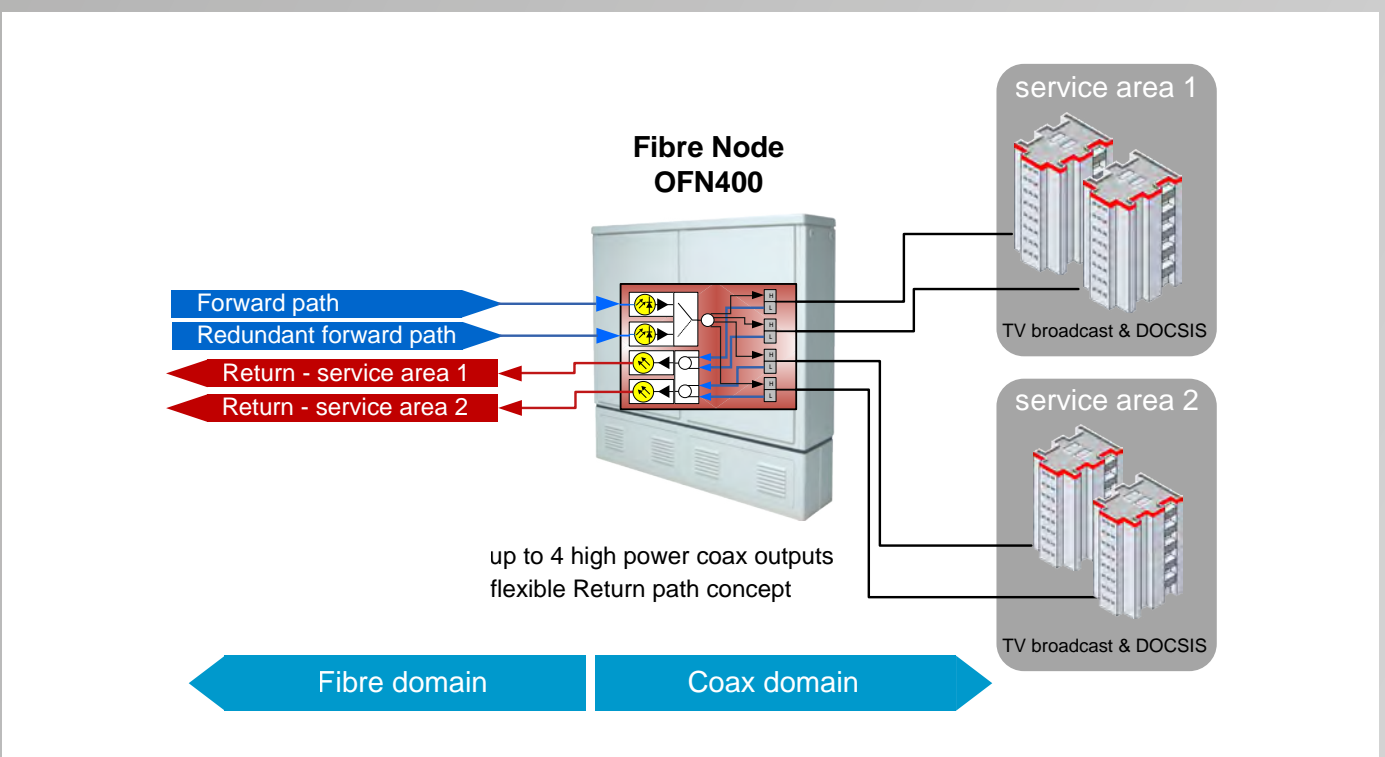


# Fibre Node application solutions

## FTTB - TV broadcast + DOCSIS (CWDM return path)



## Forward path redundancy and return return channel segmentation with OFN400





# Optical accessories

## OPTICAL CONNECTORS, ADAPTERS

FC/PC connectors

### AOFC-FCP



- field installable connectors without splicing
- pre-embedded fibre and pre polished ceramic ferrule (APC or PC) for excellent optical performance
- fibres can be connectorized on-site without splicing
- quick mounting process saves installation time
- easy handling
- long and stable durability
- low insertion loss (typical  $\leq 0,3$  dB)

Type	AOFC-FCP	
Order number	212 496	
EAN-Code 4026187...	193430	
Type	optical fast connector FC/PC	
Connector type	FC/PC	
Fiber type	single mode 9/125	
Patch cord or drop cable diameter	mm	2,0 - 3,1
Typical insertion loss after installation	dB	$\leq 0,3$
Return loss	dB	$\geq 50$

different connector types available

### AOC ...



- optical adapters

Type	AOC-SCA	AOC-SCP	AOC-FCA	AOC-FCP	AOC-LCA	AOC-LCP
Order number	212 410	212 411	212 412	212 413	212 414	212 415
EAN-Code 4026187...	195373	196844	196769	196806	196813	196820
Optical connector / coupler type	SC/APC	SC/PC	FC/APC	FC/PC	LC/APC	LC/PC
Insertion loss	[dB]	typical $\leq 0,2$				
Interchangeability	[dB]	$\leq 0,2$				
Repeatability	[dB]	$\leq 0,2$				
Mechanical durability		typical 500 connections				
Ambient temperature	[°C]	-40 .. +80				

# Optical accessories

## FTTX TOOLCASE, OPTICAL ATTENUATORS



### FTTX Toolcase

Order number: 212 417  
EAN-Code: 4026187193553

- toolcase including:
- optical power meter for wavelengths 1300 nm, 1310 nm, 1490 nm, 1550 nm, optical level up to 24 dBm
- red light source
- fibre cleaver (Japan)
- different sizes of stripping pliers

different connector types available

### AOA ...



- optical attenuators

Types with 3 dB attenuation		AOA 3 SCA	AOA 3 FCA	AOA 3 LCA
Order number		390 161	390 175	390 170
EAN-Code		4026187192280	4026187197230	4026187197186
Types with 6 dB attenuation		AOA 6 SCA	AOA 6 FCA	AOA 6 LCA
Order number		390 166	390 176	390 171
EAN-Code		4026187197148	4026187197247	4026187197193
Types with 9 dB attenuation		AOA 9 SCA	AOA 9 FCA	AOA 9 LCA
Order number		390 167	390 177	390172
EAN-Code		4026187197155	4026187197254	4026187197209
Types with 12 dB attenuation		AOA 12 SCA	AOA 12 FCA	AOA 12 LCA
Order number		390 168	390 178	390 173
EAN-Code		4026187197162	4026187197261	4026187197216
Types with 15 dB attenuation		AOA 15 SCA	AOA 15 FCA	AOA 15 LCA
Order number		390 169	390 179	390 174
EAN-Code		4026187197179	4026187197278	4026187197223
Optical connector / coupler		SC/APC	FC/APC	LC/APC
Optical attenuation	[dB]		xx: 1.. 15	
Wavelength	[nm]		1310/1550	
Accuracy depending on ATT value	[dB]		1..9 dB: ± 0,5; 10 ..15 dB: ± 1,0	
Maximum optical power	[mW/dBm]		500/27	
Ambient temperature	[°C]		-25... +75	

other types on request



# Optical accessories

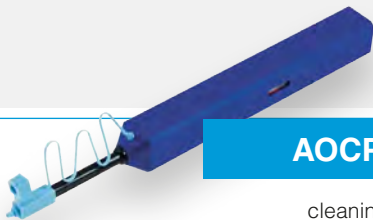
## OPTICAL CLEANING TOOLS



**AOCC**

cleaning cartridge

- optical cleaner for all kind of optical connectors or couplers
- for cleaning of optical patch cords and couplers attached on device
- AOCC: ribbon cleaner with more than 500 cleaning cycles for any optical patch cord type
- AOCP-...: smart cleaning pens with more than 800 cleaning cycles for connectors and also coupler ports attached on a device directly. Inner cleaning of couplers ports when removing cap completely. Connector / patch cord cleaning when removing only the tip of the cap.



**AOCP-250**

cleaning pen for SC, FC and SC surfaces



**AOCP-125**

cleaning pen for LC and MU surfaces

Type		AOCC	AOCP-250	AOCP-125
Order number		212 497	212 498	212 499
EAN-Code 4026187...		193447	193454	193461
Coupler/Connector type		any optical Connector SC, FC, MU, LC, ST, DIN, E2000	SC, FC and SC ferrules surfaces (also inside optical coupler ports)	LC or MU ferrules surfaces (also inside optical coupler ports)
Diameter of optical patchcords/ connectors ferrules	mm	any Patchcord	2,5	1,25
Number of cleaning cycles		> 500	> 800	> 800
Method of cleaning		non-alcohol ribbon	non-alcohol micro thread, audible click when cleaning done	non-alcohol micro thread, audible click when cleaning done



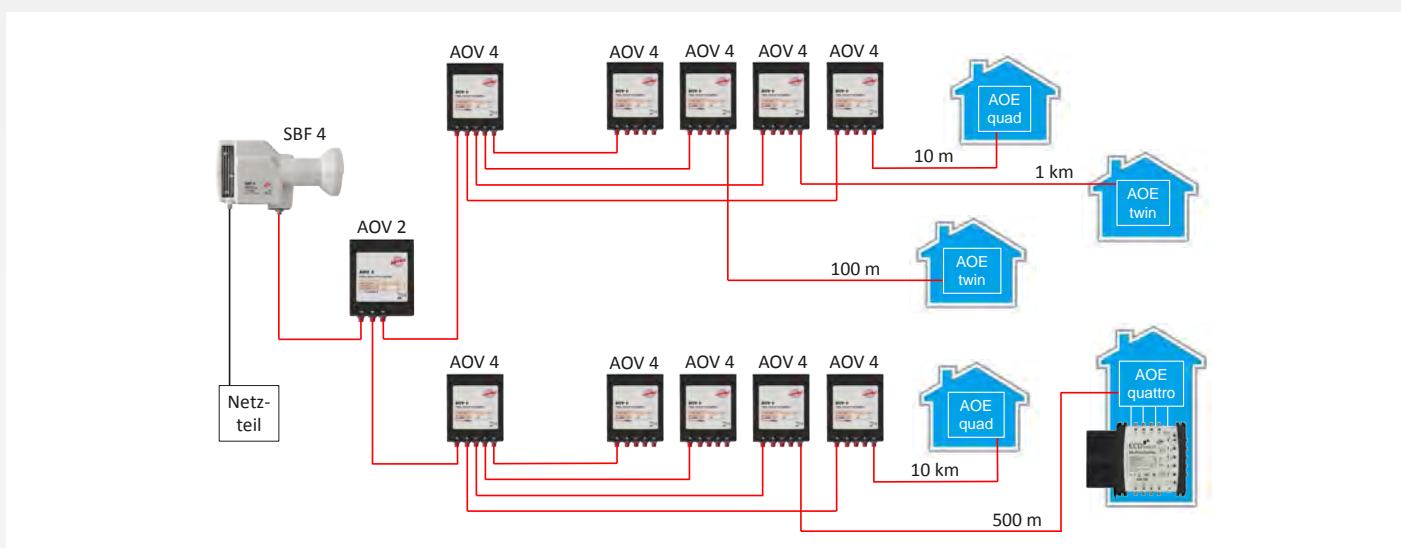
# Optical SAT-IF distribution

To increase the signal range in SAT-IF distribution facilities or to increase the number of subscribers, the use of optical components is mandatory. ASTRO offers an optical LNC, splitters and signal converters that transform the optical signal back into a standard RF signal. By utilising this technology, it is possible to supply up to 32 reception points within a radius of up to 10 km with signals - a territorial dimension that could not be achieved with coaxial SAT-IF technology.

The main advantages of optical SAT-IF distribution are:

- excellent signal quality and best reliability
- up to 30 % less mounting effort compared to conventional coax multiswitch distribution
- low error potential during installation process
- independent subscriber access

## Application example



## ASTRO components for building optical SAT-IF facilities

- optical LNC
- optical splitters
- prefabricated, ready to use optical fibre
- optical attenuators with different attenuation values
- opto/electro converters for direct connection of a SAT receiver or a multiswitch
- optical transmitters and receivers



You can find the complete ASTRO product range of optical SAT-IF in our online catalogue: menu „SAT and Terrestrial“, section „Optical components“.



# Technical appendix

## Abbreviations in digital technology

Abbr.	Term	Meaning
CA	Conditional Access	conditional access to a encrypted program programme offering (access only for authorized users)
CAM	Conditional Access Module	decoder module for decryption of programme content
CAS	Conditional Access System	access system for pay TV
CI	Common Interface	common interface of DVB receivers for a CA module
COFM	Coded Orthogonal Frequency Multiplex	frequency multiplexing procedure; special implementation of multicarrier modulation
DiSEqC	Digital Satellite Equipment Control	digital control signal technology in satellite reception devices
DVB	Digital Video Broadcasting	standardised procedure for transmission of digital content (e. g. TV, radio, multi channel sound)
DVB-C	Digital Video Broadcasting - Cable	digital cable TV
DVB-S	Digital Video Broadcasting - Satellite	digital satellite TV
DVB-T	Digital Video Broadcasting - Terrestrial	digital terrestrial TV
EPG	Electronic Program Guide	electronic program guide in set top boxes and TVs
FEC	Forward Error Correction	detection and correction of transmission errors by use of a redundancy info, attached to the signal
FTA	Free To Air	unencrypted transmitted TV offering
HDTV	High Definition Television	5 x higher resolution than conventional TV signal (SDTV) with aspect ratio 16:9
LNB	Low Noise Block Converter	reception head placed in the focus of a parabolic dish
MCPC	Multi Channel Per Carrier	merging of SCPC (see below) via multiplexing into a transponder
MPEG	Moving Pictures Expert Group	expert group engaging in standardisation of video and audio compression
NIT	Network Information Table	table including information on multiplexes and transport streams in a network (e. g. name and type of transmission system)
OSD	On-Screen-Display	additional information on the screen (e. g. programming data or adjustment menus)
PAT	Program Association Table	list of all available programmes in a transport stream (each program is assigned to a PID fin a program map table (PMT))
PCR	Program Clock Reference	enables the synchronisation of each decoder to the received TV signal (at least once every 100 ms a PCR is transmitted)
PID	Packet Identifier	each table or each elementary stream in a transport stream is identified by a 13 bit PID
PMT	Program Map Table	table with informations on programmes
PPV	Pay-Per-View	billing method for pay TV
PSIP	Program and System Information Protocol	defines virtual channels and their content as well as the electronic programme guide
QAM	Quadrature Amplitude Modulation	a modulation procedure in communications engineering, combining amplitude modulation and phase modulation
QPSK	Quadrature Phase Shift Keying	digital modulation procedure in communications engineering; with QPSK two bits per symbol can be transmitted
SCPC	Single Channel Per Carrier	satellite transponder with only one service (TV, radio) per signal carrier
SCR	Satellite Channel Router	europaean uncable standard
SDTV	Standard Definition Television	conventional TV signal with low picture resolution in PAL or NTSC
STB	Set Top Box	device for extending the usability of TVs
TDT	Time and Date Table	incorporates the universal time specification (UTC - universal time) coded as MJD (modified julian date)
TS	Transport Stream	standard format for transmission and storage of video, audio and SIPS data (see above)
USB	Universal Serial Bus	standard for connecting auxiliary devices (e. g. mouse, keyboard) to a PC



# Your partner for concepts of tomorrow

## ASTRO - System provider for IP and FTTX

As a system provider ASTRO develops and produces a complete range of reception and distribution installations for satellite, cable and IPTV. We are the perfect partner for handling the versatile challenges, multimedia communication involves. We offer individual solutions on highest technological level for the complex requirements in this future market.

Quality, flexibility and reliability are basic core values of our profound company philosophy. As a modern high-tech company with more than

70 years of experience you will take profit of a successful relation between tradition and innovation. With 140 high-qualified employees, our own research & development department and our international sales & service structure we will be a reliable partner for all upcoming questions in the IP and FTTX world – and beyond.

ASTRO is very proud to have a long and profound history in IP-technology and for being market leader in the IP-market in Germany. In addition to this, during the past years we established a complete range of FTTX components. We see a positive synergy of IP and FTTX technology in the upcoming technical situations and individual market conditions in the future. It is our understanding to go a step further and deliver the best product-mix for your projects.

 Longtime experience and security	 Leading expert in the SAT & Cable branch
 Development of products and services	 Strong regional partner
 Project planning and support from A-Z	 Market leader for head-ends in Germany
 Individual support in technology and sales	 Guarantor für more sales and rating spread
 Training and know-how transfer	 Patents, licenses, CE, security

## Quality „Made in Germany“

 **Made in Germany** ASTRO head-end components are “Made in Germany”. Each device of the U series is developed and produced in Bensberg close to Cologne. Before leaving our manufacturing area every product will be tested in an exceptional output quality control process – for the satisfaction of our customers.





Please subscribe to our newsletter!

## International Sales Directors & Headquarter

### GUS / Baltikum

Germann Geer  
04105 Leipzig  
Tel: +49 341-9276491  
Fax: +49 341-9276492  
E-mail: g.geer@astro-kom.de

### EMEA / LATAM

Motty Vigdor  
Tel: +49 2204967129  
E-mail: v.motty@astro-kom.de

### South-East Asia

Roland Würth  
Tangerang 15321  
Tel: +62 215376179  
Fax: +62 215376179  
E-mail: r.wuerth@astro-kom.de

### Optical Transmission Technology

Siegbert Munding  
Tel: +49 1702219717  
E-mail: s.munding@astro-kom.de

### Headquarter Germany

ASTRO Strobel GmbH  
Olefant 3  
51427 Bergisch Gladbach  
Tel: +49 22044050  
Fax: +49 220440510

## World-wide Partners

### Albania

ALBtelecom SH.A.  
Kashar, Tirane  
Tel: +35 542200123  
www.albtelecom.al

### Argentina

AVSystemas  
Buenos Aires  
Tel: +54 1147779090  
E-mail: avs@avsistemas.com  
www.avsistemas.com

### Austria

Normann Engineering  
4600 Wels  
Tel: +43 7242709210  
E-mail: office@normann.at  
www.normann.at

### Belarus

Mobileservice  
220037 Minsk  
Tel: +375-172848699  
E-mail: info@mobiles.by  
www.mobiles.by

### Belgium

Telenet Group BVBA  
1200 Brussels  
www.telenet.be/en

### Bosnia and Herzegovina

VERSO d.o.o.  
71000 Sarajevo  
Tel: +387 33264810  
E-mail: aisa.zembo@verso.ba

### Czech Republic

Katro Servis spol. s.r.o.  
51301 Semily  
Tel: +42 481621255  
E-mail: katro@katro.cz  
www.katro.cz

### Denmark

Teledan-Witronic A/S  
2610 Radovre  
Tel: 3672 2000  
E-mail: info@witronic.dk  
https://teledan-witronic.dk

### Domenican Republic

WIND Telecom  
Santo Domingo  
Tel: 809 200 3000  
E-mail: info@wind.com.do  
www.wind.com.do

### Egypt

Cablenet Egypt  
Cairo  
Tel: 002-24023451  
E-mail: Tvnetcable1@tedata.net.eg  
https://cablenetegypt.com

### Estonia

DSM Eesti OÜ  
13515 Tallinn  
Tel: +372 56224222  
E-mail: info@mrf.ee  
www.vectrum.eu

### Hungary

HFC Technics  
H-1044 Budapest  
Tel: +36 12731991  
E-mail: info@hfctechnics.eu  
www.hfctechnics.eu

### Italy

MR Telecom & Broadcast Services  
20121 Milano  
Tel: +39 0382925710  
E-mail: info@mrtelecom.it  
www.mrtelecom.it

### Jordan

Technology Land Trade Co. Ltd.  
11185 Amman  
Tel: 00962 777614441  
E-mail: technoland@orange.jo  
www.technoland.jo

### Latvia

Vectrum  
1021 Riga  
Tel: 00371 66117690  
E-mail: info@vectrum.eu  
www.vectrum.eu

### Lituania

Elpa IR Partneriai UAB  
LT-91203 Klaipeda  
Tel: +370 46380178  
Email: mindaugas@elpa.lt  
www.elpa.lt

### Luxembourg

Eltrona Interdiffusion S. A.  
L-1112 Luxembourg  
Tel: 499 466 888  
Email: service-clients@eltrona  
www.eltrona.lu

### Netherlands

Hemmink B.V.  
8013 PV Zwolle  
Tel: +31 384698200  
E-mail: info@hemmink.nl  
www.hemmink.nl

### Hirschmann Multimedia B.V.

1382 JS Weesp  
Tel: +31 294462555  
E-mail: info@hirschmann.nl  
https://www.hirschmann-multimedia.nl

### Norway

CableCom a.s  
3241 Sandefjord  
Tel: +47 33483348  
E-mail: regnskap@alcadon.no  
https://www.alcadon.no

### Poland

Wachowiak & Syn s.c.  
60-322 Poznan  
Tel: +48 618600339  
E-mail: info@wachowiakisyn.pl  
www.wachowiakisyn.pl

### Slovakia

Normann Engineering  
SK - 82101 Bratislava  
Tel: +421 244634740  
E-mail: rischer@normann.sk  
https://www.normann-engineering.com/sk

### Republic of Moldova

Digimax Ltd.  
MD 2032 Chishinau  
Tel: +373 69180913  
E-mail: info@digimax.md  
www.digimax.md

### Russia

Kontur M  
129344 Moscow  
Tel: +7 4952218188  
E-mail: barg@konturm.ru  
www.konturm.ru

### Serbia

SAT-TRAKT doo Backa Topola  
111 Marsala Tita  
Tel: +381 24224166  
E-mail: b.topola@sattrakt.com  
www.sattrakt.com

### AVcom d.o.o. M.Sc.

11000 Beograd  
Tel: +381 113216700703  
E-mail: office@avcom.rs  
www.avcom.rs

### Sweden

Antennlaget AB  
350 03 Växjö  
Tel: +46 470709190  
E-mail: info@antennlaget.se  
www.antennlaget.se

### Turkey

Proaktif A.S.  
34386 Okmeydani Istanbul  
Tel: +90 2122102770  
E-Mail: info@proaktif.com.tr  
http://www.proaktif.com.tr

### Ukraine

Mortelecom  
65029 Odessa  
Tel: +38 0487774447  
E-mail: mtk@mtk.com.ua  
www.mtk.com.ua

