

HDO776 C-BAND DWDM FIBRE TRANSMITTER

HDO776 is a high performance directly modulated C-band DWDM transmitter for forward path fibre optic links in CATV and FTTx networks. It has an extended frequency range to fulfil DOCSIS 3.1 requirements. HDO776 is able to carry all kind of analogue or/ and digital channel loading on the whole frequency band.

HDO776 transmitter contains an electrical dispersion compensator that is important especially when analogue channels are transmitted to longer distances. HDO776 is installed into HDX installation frame. It is available with different optical wavelengths in accordance with the ITU wavelength grid.

HDO776 has two identical inputs with individual level and slope adjustments to support broadcast and narrowcast signal distribution. The RF isolation between the inputs is high minimising the leakage of narrowcast signals to other narrowcast node segments. The power consumption is low but HDO776 still offers high performance and the widest variety of features, including the internal spectrum analyser module. An integrated WDM filter is available as an option for applications where forward path and return path is transmitted in one fibre.



Features

- DOCSIS 3.1 compatible
- Standardised input level
- Two inputs with level adjustments
- Equaliser in both inputs
- High isolation between inputs
- Automatic power control providing constant total OMI as standard feature
- ITU wavelengths
- Electrical dispersion compensator provides a good CSO performance over longer transmission distances
- Unused input can be switched off for power saving and noise reduction
- Integrated input amplifiers and laser driver amplifiers
- Low power consumption and high performance
- Optional spectrum analyser function
- Optional integrated xWDM filter to combine forward and return paths into one fibre or to combine various forward wavelengths into one fibre
- Fibre connectors can be located at the rear or at the front panel
- Small form factor family, 2 RU height
- Local and remote software control of all adjustments
- Forced cooling through the unit

Management features

- Monitoring of APC (Automatic Power Control) functionality with user configurable offset
- Optical output power monitoring
- Laser bias current monitoring
- TEC (Thermo-Electric Cooler) current monitoring
- Laser temperature monitoring
- Signal level adjustment in both inputs
- Slope adjustment in both inputs
- Input 2 switch on/off
- Channel level measurement when equipped with spectrum analyser option
- Link length setting
- LED indicators for signal and module statuses
- Internal temperature measurement and monitoring
- Intelligent fan speed control with monitoring
- Non-volatile logging of 32 latest events, including alarms, alarming values, settings changes and application starts.
- Uptime and total uptime counters
- All adjustments and alarm limits fully user configurable
- Local PC connection through backplane HDO bus with HDX021 cable
- Remote IP connection through HDC100 controller module
- SNMP monitoring and configuration through HDC100 controller module

Technical specifications

Parameter	Specification	Note
Optical parameters		
Light source	Cooled DFB with optical isolator	
Peak wavelength	1530...1560 nm (ITU ch59...21)	1)
Output power	+10 dBm	2)
Relative intensity noise	-154 dBc/Hz	3)
OMI per channel	4.0...4.5 %	4)
Link length setting 0...50 km		
Pass band of optional xWDM filter		5)
Pass channel	±0.12 nm (DWDM) or ±6.5 nm (CWDM)	
Reflect channel, DWDM	1520...1565 nm except the pass channel	
Reflect channel, CWDM	1260...1620 nm except the pass channel	
Number of optical ports	1 or 2	
RF parameters		
Frequency range	47...1218 MHz	
RF impedance	75 Ω	
Input return loss	18 dB	6)
Flatness	±0.4 dB	7)
Automatic power control (APC)	Yes	8)
Laser test point level for 4.5 % OMI	71...73 dBμV	9)
Input level	77 dBμV	10)
Level adjustment range	10 dB	
Equaliser adjustment range	0...6 dB	
Isolation between inputs	50 dB	11)

Spectrum analyser module (optional)

Measurement range	47...1218 MHz, 0.25 MHz steps	
Measurement bandwidth	0.35 MHz	12)
Dynamic range	58...92 dB μ V	13)
Measurement accuracy	± 1 dB	14)

Noise and distortion performance, CENELEC 42 chs

C/N	52.5 dB	15)
CTB	68 dB	16)
CSO	61 dB	17)

Noise and distortion performance, digital loading

MER	40 dB	18)
BER	$< -10^9$	19)

General

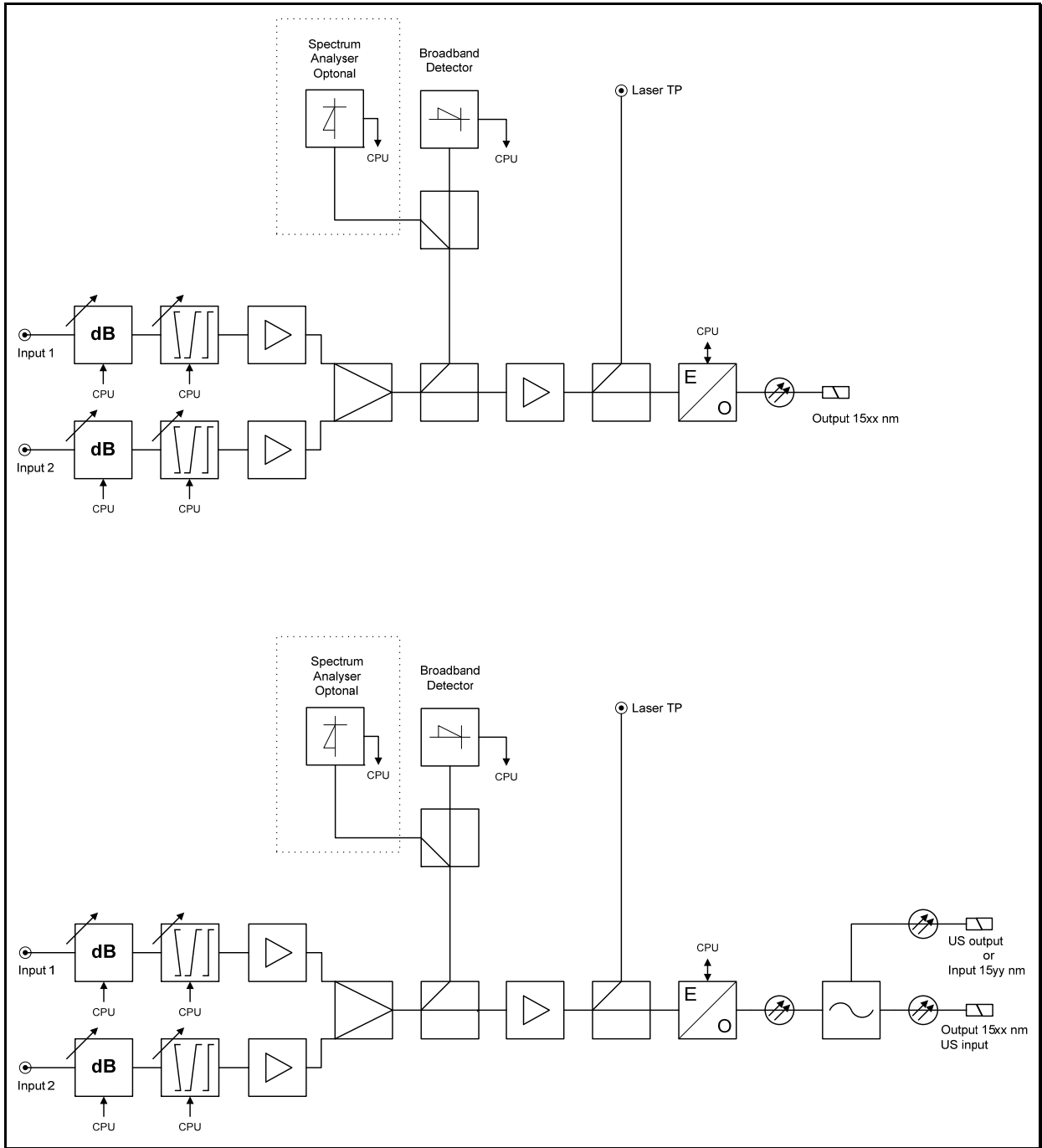
Power consumption	8 (10.5) W	20)
Supply voltages	25 V / 250 mA (310 mA)	20)
	6.3 V / 250 mA (390 mA)	20)
RF connectors	F female	21)
Optical connector	SC/APC, E-2000	22)
Cooling	Field replaceable fan	23)
Dimensions	2U x 7HP x 380 mm	h x w x d
	Occupies 1/12 of HDX installation frame	
Weight	1.5 kg	
EMC compliance	EN 50083-2	24)
Enclosure classification	IP20	
Operating temperature range	0...+45 °C	
Storage temperature range	-20...+60 °C	
Operating relative humidity	0...85 %	

Notes

- 1) ITU channels 59, 58, 57, ..., 21. Total number available 39 wavelengths. See the configuration map.
- 2) Typical value. The tolerance is from +9.5 dBm to 11.0 dBm.
- 3) Worst case value.
- 4) Recommended OMI with CENELEC 42 chs.
- 5) DWDM filter is used if the return path is based on DWDM. CWDM filter is used if the return path is based on CWDM. xWDM filter decreases the output power 0.5 dB typically.
- 6) 47...85 MHz RL >16 dB, 85...100 MHz RL >18 dB and from 100 MHz -1 dB/ octave.
- 7) Typical value. Maximum value is ± 0.75 dB.
- 8) APC is based on broadband detection in which the total laser driving power is measured and adjusted so that if the RF power is evenly divided into all channels. At least 4 % OMI/ channel is achieved. The offset can be set by a user.
- 9) Typical value is 72 dB μ V. The valid value is printed on the front panel label. TP accuracy is ± 0.5 dB.
- 10) Input level required to reach 4.5 % OMI with adjustments in 0 dB positions. 4.0 % OMI equals to 1 dB lower level.
- 11) The attenuation from one input to the other input. Above 860 MHz the isolation is more than 40 dB.
- 12) Typical -3 dB bandwidth. Typical -45 dB bandwidth is 0.5 MHz.

- 13) Level at laser (OMI) test point for modulated CW/ PAL signal. For QAM detection the dynamic range is approx. 6 dB higher. QAM detection measures a ~0.35 MHz band and the level calculation assumes the carrier to be 6.875 Msymbols/s signal. Nominal level denotes 4.5 % OMI. (0.45...45 % OMI range)
- 14) This is the typical performance over band 50...740 MHz for CW/ PAL signals. For PAL signals above 740 MHz and all QAM signals the accuracy is ± 1.7 dB.
- 15) This is a typical C/N value over 25 km fibre. The minimum value is 51.5 dB @ 4.5 % OMI. An optical receiver input power is 0 dBm. Over 50 km fibre the minimum value is 49 dB.
- 16) This is a typical CTB value over 25 km fibre. The minimum value is 65 dB @ 4.5 % OMI. Over 50 km fibre the minimum value is 64 dB and above 862 MHz 60 dB. CTB performance is tested up to 1218 MHz. With modulated channels the distortion distances are better. The modulation improvement is typically 8 dB for CTB.
- 17) This is a typical CSO value over 25 km fibre. The minimum value is 57 dB @ 4.5 % OMI. Over 50 km fibre the minimum value is 56 dB and above 862 MHz 54 dB. CSO performance is tested up to 1218 MHz. With modulated channels the distortion distances are better. The modulation improvement is typically 6 dB for CSO.
- 18) Typical value when the load is 130 x 256-QAM channels and 8 wavelengths are transmitted in 25 km fibre. Minimum value is 39 dB.
- 19) At nominal loading i.e. total OMI is max. 26 %.
- 20) Typical power consumption at 25°C without the spectrum analyser module and the 2nd input switched off. 10.5 W is valid with the spectrum analyser (6.3 V supply) and the 2nd input switched on (25 V supply).
- 21) Fixed connections are located at the rear panel. Test points are located at the front panel.
- 22) Fibre connectors can be located at the rear or at the front panel.
- 23) The fan can be replaced by the user without signal interruption.
- 24) Radiation limit is 20 dBpW.

Block diagrams, with and without WDM filter (optional)



Ordering information

HDO776 configuration map

	1-	2-	3-	4-	5-	6-
	1	1	1	1	1	1
HDO776		-		-		-

1-1 Transmitter type	
A	Full Band, ITU Ch 21...59
B	N/A

3-1 Fibre location	
F	Front panel
R	Rear panel

2-1 ITU ch and wavelength	
21	ITU Ch 21 1560.61 nm
22	ITU Ch 22 1559.79 nm
23	ITU Ch 23 1558.98 nm
24	ITU Ch 24 1558.17 nm
25	ITU Ch 25 1557.36 nm
26	ITU Ch 26 1556.55 nm
27	ITU Ch 27 1555.75 nm
28	ITU Ch 28 1554.94 nm
29	ITU Ch 29 1554.13 nm
30	ITU Ch 30 1553.33 nm
31	ITU Ch 31 1552.52 nm
32	ITU Ch 32 1551.72 nm
33	ITU Ch 33 1550.92 nm
34	ITU Ch 34 1550.12 nm
35	ITU Ch 35 1549.32 nm
36	ITU Ch 36 1548.51 nm
37	ITU Ch 37 1547.72 nm
38	ITU Ch 38 1546.92 nm
39	ITU Ch 39 1546.12 nm
40	ITU Ch 40 1545.32 nm
41	ITU Ch 41 1544.53 nm
42	ITU Ch 42 1543.73 nm
43	ITU Ch 43 1542.94 nm
44	ITU Ch 44 1542.14 nm
45	ITU Ch 45 1541.35 nm
46	ITU Ch 46 1540.56 nm
47	ITU Ch 47 1539.77 nm
48	ITU Ch 48 1538.98 nm
49	ITU Ch 49 1538.19 nm
50	ITU Ch 50 1537.40 nm
51	ITU Ch 51 1536.61 nm
52	ITU Ch 52 1535.82 nm
53	ITU Ch 53 1535.04 nm
54	ITU Ch 54 1534.25 nm
55	ITU Ch 55 1533.47 nm
56	ITU Ch 56 1532.68 nm
57	ITU Ch 57 1531.90 nm
58	ITU Ch 58 1531.12 nm
59	ITU Ch 59 1530.33 nm

4-1 Optopassive	
F21	ITU21 filter, front
R21	ITU21 filter, rear
F22	ITU22 filter, front
R22	ITU22 filter, rear
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F59	ITU59 filter, front
R59	ITU59 filter, rear
FC3	1531 nm filter, front
RC3	1531 nm filter, rear
FC5	1551 nm filter, front
RC5	1551 nm filter, rear
FXX	None
RXX	None

5-1 Fibre connector type	
A1	SC/APC, 9 deg.
B1	FC/APC
C1	E2000/APC
D1	SC/APC 8 deg.
H1	SC/APC 8 deg. with shutter
A2	2xSC/APC 9 deg.
B2	2xFC/APC
C2	2xE2000/APC
D2	2xSC/APC 8 deg.
H2	2xSC/APC 8 deg. with shutter

6-1 Signal monitoring	
B	Spectrum analyser
X	None

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