EDFA Applications in Test & Measurement

White Paper

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Overview

Erbium doped fiber amplifiers (EDFAs) amplify optical pulses without any O/E/O conversion. Prior to the advent of EDFAs, optical signals had to be first converted into electrical signals, then amplified by converting them back to optical signals. Optical amplification is a more attractive alternative because it is less expensive. Indeed, optical amplification is much less expensive when used in DWDM transmission systems, because one EDFA can amplify multiple optical signals simultaneously. An EDFA is shown in Figure 1.

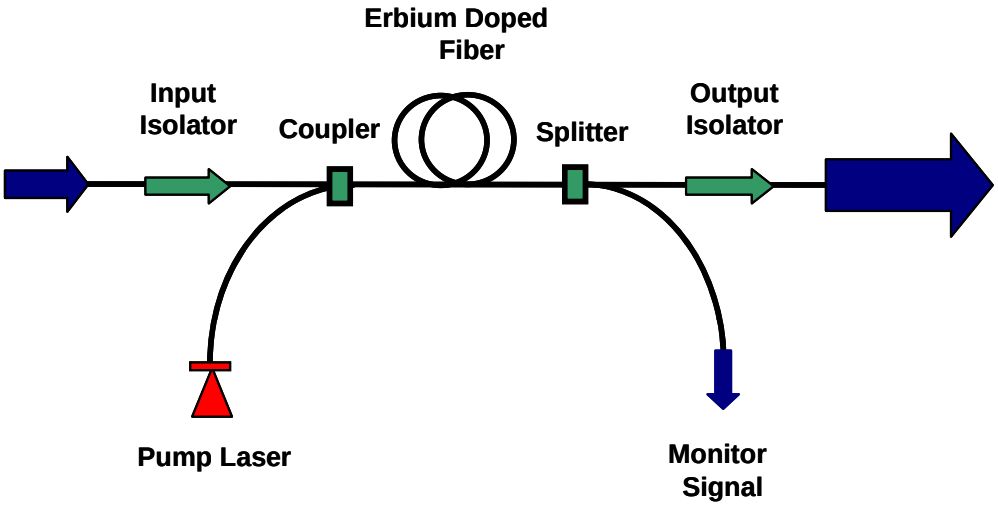

Figure 1 – Simplified Schematic of EDFA

Calmar's EDFAs are designed according to classic principles, but with two important exceptions:

- In response to customer requests for EDFAs capable of amplifying optical signals at data rates higher than 10 Gb/s, Calmar has incorporated dispersion compensating fiber into its EDFA modules. Calmar's in-depth understanding of the interplay between dispersion, signal strength, and non-linear effects, has enabled the company to design EDFAs that outperform the alternatives at high bit rates.
- Recognizing the need for polarization control, Calmar has developed a family of EDFAs designed and carefully manufactured to ensure that polarization is maintained everywhere within the amplifier.

These enhancements enable Calmar's EDFAs to amplify optical signals without penalty due to dispersion or polarization effects.

Features

- Small signal gain 25 – 35 dB
- Saturated output power 15 – 37 dBm
- Wavelength range 1530 – 1565 nm
- Input power range -25 to + 10 dBm
- Low noise figures
- Dispersion compensation 0.03 ps/nm
- Polarization extinction ratio > 22 dB
- Easy configuration and operation
- Long term stability

Applications

Although Calmar's EDFAs have been designed for a wide range of applications, they are perhaps best suited for applications using ultrafast lasers. Test applications such as high-resolution optical time domain reflectometry (OTDR), require high peak powers and picosecond pulse widths. The high peak powers necessary to overcome the inherent attenuation in fibers can be achieved by amplifying the pulsed laser output using an EDFA. Similarly, characterization of dispersion in optical fibers, another application requiring very short pulses, typically uses EDFAs to achieve the necessary high launch powers.

The increasing demand for bandwidth in telecom networks is driving the need for 40 Gb/s, and higher, bit rates. Long haul transmission of high bit rate signals requires high signal to noise ratios (SNR), and, this, in turn, requires amplification of the optical signal prior to launching into the optical fiber.

EDFAs can also used in combination with ultrafast laser sources in a wide range of material diagnostic applications, including analysis of semiconductor materials used in telecom components, and bio-medical analysis. In these applications, EDFAs are used because of their ability to provide sufficient optical power without impacting the short pulse widths and clean pulse shapes that are needed.

Technical Specifications

Table 1 provides specifications for the EDFAs in Calmar's family of low dispersion EDFAs, while table 2 provides specifications for the EDFAs in Calmar's family of polarization maintaining EDFAs. All specifications are subject to change without notice.

Model Number	AMP-LD-15	AMP-LD-17	AMP-LD-20	AMP-LD-23
Output Power (dBm)	15	17	20	23
Small Signal Gain (dB)	25	30	35	35
Input Power Range (dBm)	- 25 to +10	- 25 to +10	- 25 to +10	- 25 to +10
Wavelength (nm)	1530 - 1565	1530 - 1565	1530 - 1565	1530 - 1560
Noise Figure (dB)	< 4.5	< 5.0	< 6.0	< 6.0
Chromatic Dispersion (ps/nm)	0.03	0.03	0.03	0.03
Operating Voltage (V)	85 - 264 AC	85 - 264 AC	85 - 264 AC	85 - 264 AC
Dimensions (cm)	37(w) x 16(d) x 25(h)	37(w) x 16(d) x 25(h)	37(w) x 16(d) x 25(h)	37(w) x 16(d) x 25(h)

Table 1 – Specifications for Low Dispersion EDFAs

Model Number	AMP-PM-18	AMP-PM-22	AMP-PM-30	AMP-PM-37
Output Power (dBm)	18	22	30	37
Input Power Range (dBm)	- 25 to +10	- 25 to +10	0 ~ 3	0 ~ 3
Wavelength (nm)	1530 - 1565	1530 - 1565	1540 - 1567	1540 - 1570
Noise Figure (dB)	< 5.5	< 6.0	< 6.0	< 6.0
Polarization Extinction (dB)	> 17	> 17	> 17	> 17
Operating Voltage (V)	85 - 264 AC	85 - 264 AC	85 - 264 AC	85 - 264 AC
Dimensions (cm)	33(w) x 25(d) x 12(h)	33(w) x 25(d) x 12(h)	33(w) x 25(d) x 12(h)	33(w) x 25(d) x 12(h)

Table 2 – Specifications for Polarization Maintaining EDFAs

Performance

The following test results give an indication of the performance of Calmar's Specialty EDFAs. Figure 2 shows a plot of gain versus input power. Figure 3 shows a plot of output power versus input power. Both sets of test results are for Calmar's AMP-LD-15 amplifier.

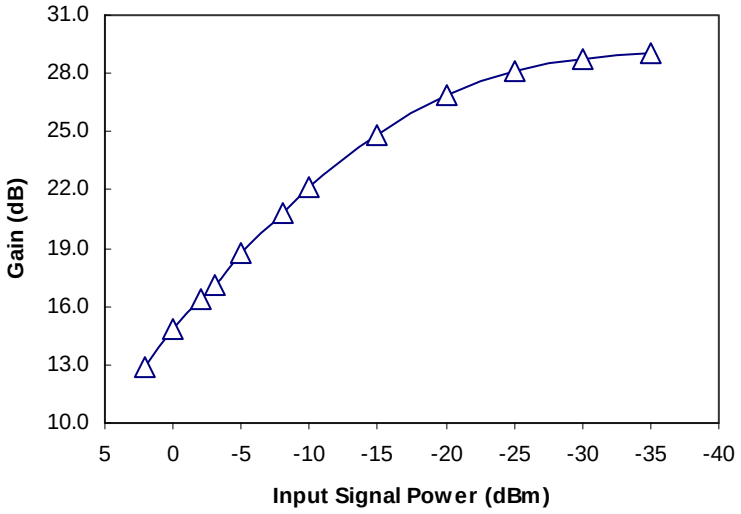

Figure 2 – Gain vs. Input Power (AMP-LD-15)

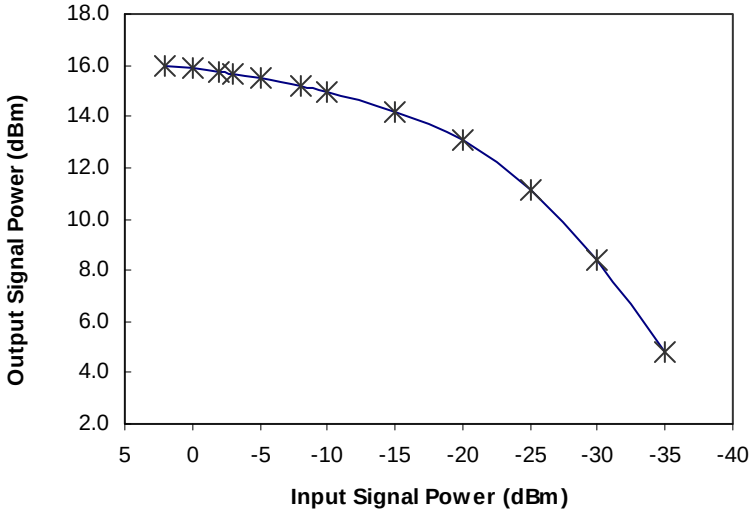

Figure 3 – Output Power vs. Input Power (AMP-LD-15)

For more information on our Picosecond Fiber Laser series, Femtosecond Fiber Laser series, or any other Calmar products, please contact us.

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