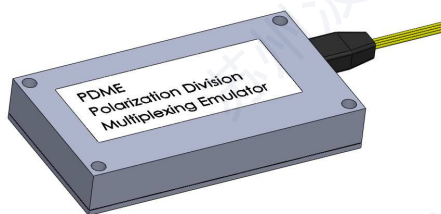


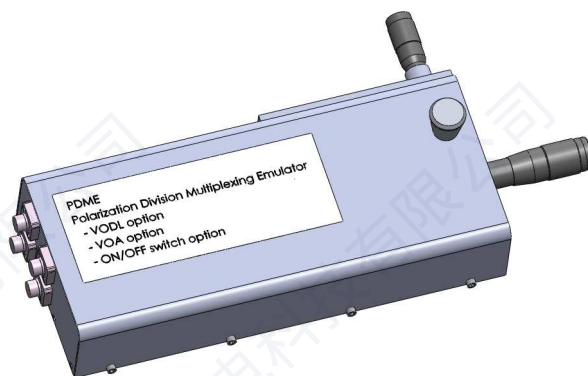
1 – Description

The Polarization Division Multiplexing Emulator (PDME) is a device that enables to control the delay between both polarizations. The PDME can be used to emulate Polarization Division Multiplexing (PDM) signal by launching a polarized signal with a given modulation format. At the output of the device the modulation format will be emulated on both polarizations. For example, if QPSK is launched at the input, PDM-QPSK will be emulated at the output. The PDME can also be used to emulate Polarization Mode Dispersion (PMD).

Several options are available on the PDME, such as ON/OFF switch, Variable Optical Attenuator, Variable Optical Delay Line or long free space delay.

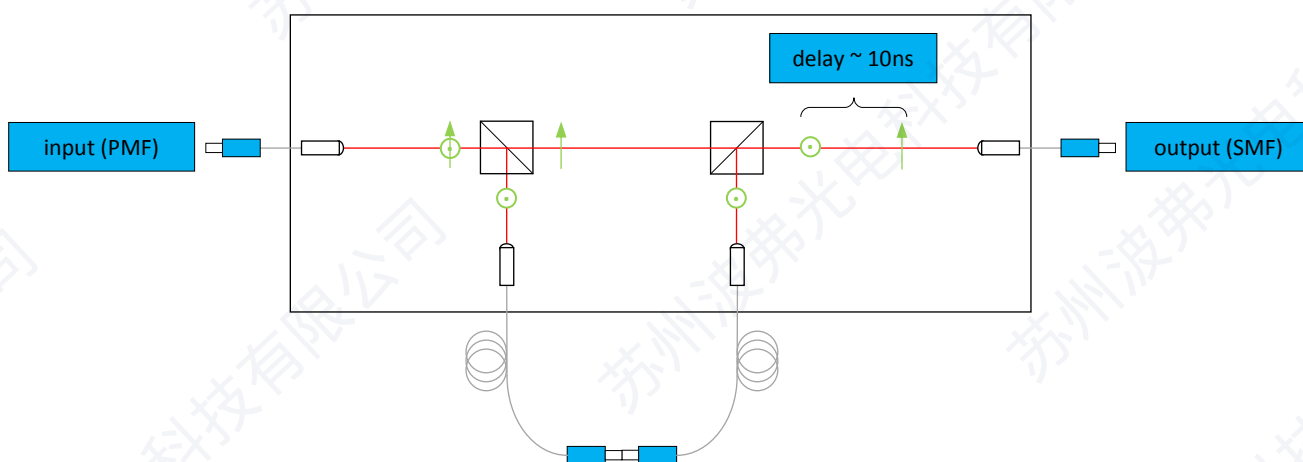


PDME (standard device)



PDME with VOA, VODL and SWITCH options

2 – Block diagram



Block diagram: PDME

The incoming polarized signal is split in two parts with equal optical power. One of them is delayed of about 10ns then both parts are recombined such as their polarizations are orthogonal.

Several options are available on the product (see following chapters) to make the use of the PDME easier.

3 – Absolute maximum ratings

| Parameter | Symbol | Min | Typ. | Max | Unit | Remarks/Conditions |
|-----------------------------|--------|-----|------|-----|------|--------------------|
| Maximal optical input power | OpIn | | | 300 | mW | |
| Storage temperature range | STR | -10 | | 40 | °C | |
| Humidity | RH | 5 | | 85 | % | Non condensing |
| Fiber bend radius | | 20 | | | mm | |

4 – Operating conditions

| Parameter | Symbol | Min | Typ. | Max | Unit | Remarks/Conditions |
|-----------------------------|--------|------|------|------|------|--------------------|
| Operating wavelength | OWR | 1520 | | 1625 | nm | |
| Operating temperature range | OTR | 10 | | 35 | °C | |

5 – Specifications

| Parameter | Symbol | Min | Typ. | Max | Unit | Remarks/Conditions |
|--|-------------|-----|------------------------------|---------------|------|--------------------|
| Insertion Losses ¹ | IL | | PM fiber delay option | 2.0 | 3.0 | dB |
| | | | long free space delay option | | 4.0 | |
| IL variation between both arms ¹ | Δ IL | | 0.4 | 1.0 | dB | |
| Optical Delay | | | in PM fiber | 10 | ns | |
| | | | in free space ² | | | |
| Optical Return Loss | ORL | 35 | | | dB | |
| Variable Optical Delay range ³ | | 330 | | | ps | |
| IL variation over delay range ³ | | | 0.3 | 1.0 | dB | |
| Variable Optical Attenuation accuracy ⁴ | | | | 0.1 | dB | |
| Packaging size | | | standard | 100 x 55 x 16 | | mm ³ |
| | | | VODL option ⁵ | 216 x 92 x 40 | | |
| Fiber Pigtail Type | | | SM (output) | SMF-28 | | |
| | | | PM (input and delayed arm) | PANDA PM | | |

¹ measured over OTR and OWR

² for long free space delay option

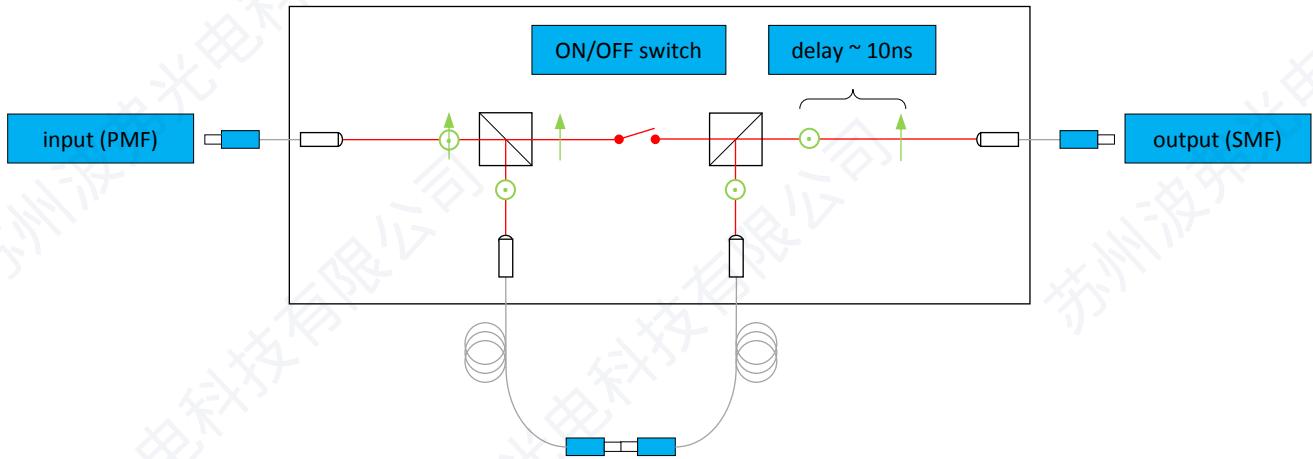
³ for VODL option

⁴ for VOA option

⁵ excluding micrometer head or piloted actuator

6 – ON/OFF switch option

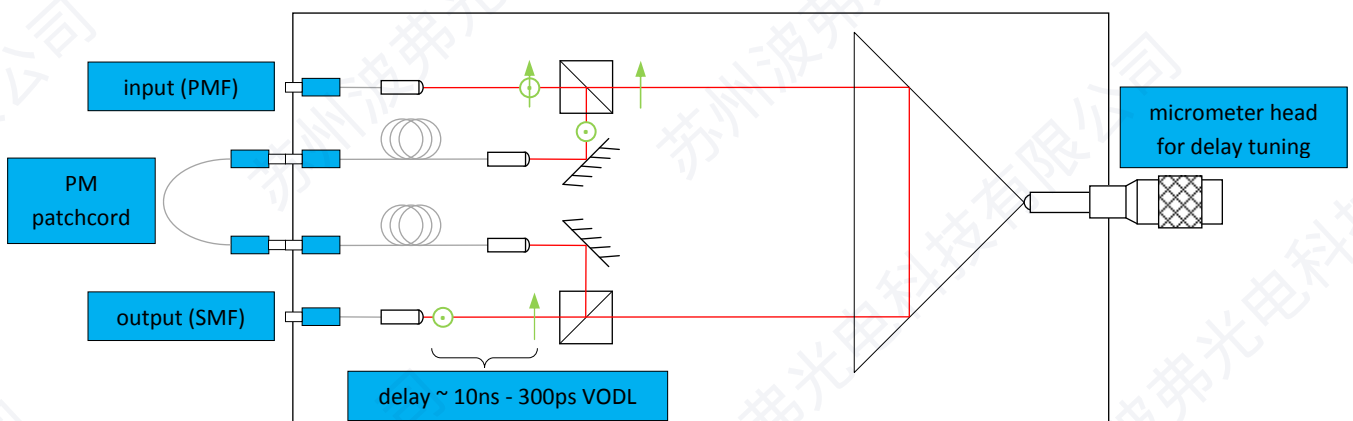
The ON/OFF switch option enables to shut one arm of the PDME and thus the output signal modulation format is the same as the input one.



PDME: ON/OFF switch option

7 – Variable Optical Delay Line (VODL) option

The VODL option enables to tune the delay over a 330ps range. Within this range the IL variations of the tuned arm will remain below 1dB.



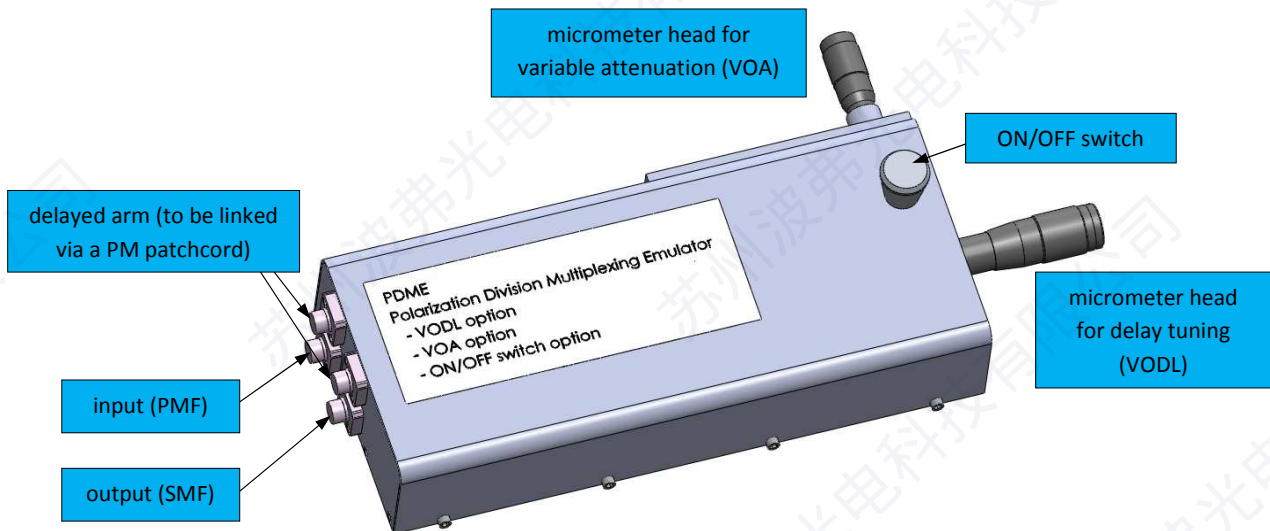
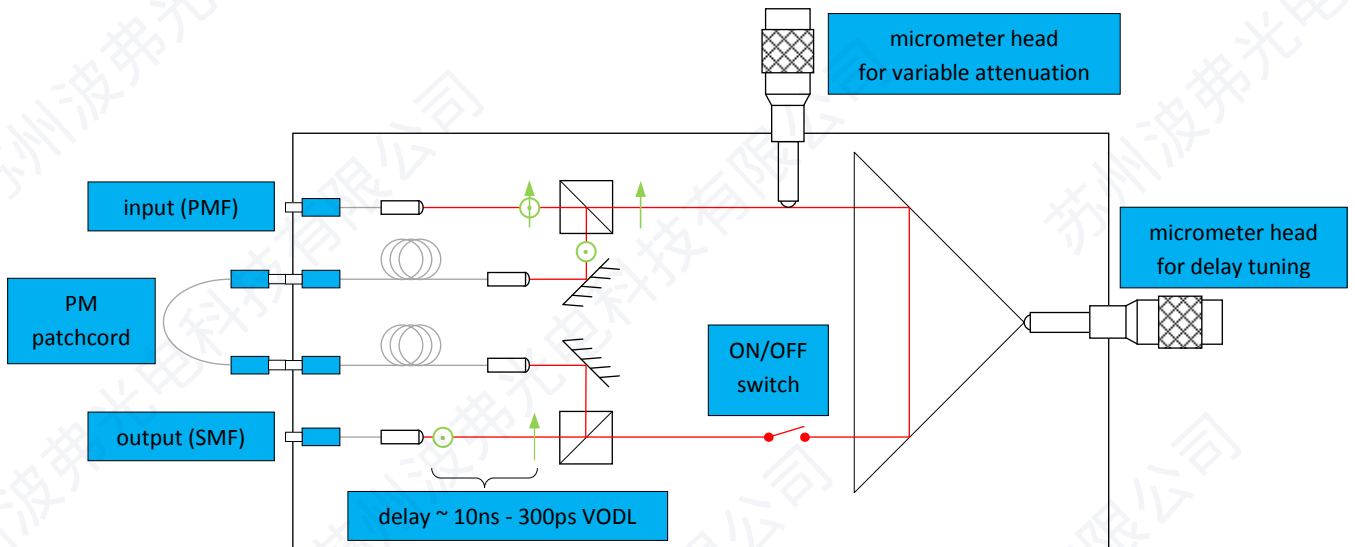
PDME: VODL option

The delayed arm required a PM patchcord. The PDME is provided with a 20cm patchcord. The user can replace it by a longer one if larger delay is needed.

The delay tuning can be piloted using a motorized actuator driven by a controller. The controller is compatible with the NEWPORT NSTRUCT Instrument Manager platform, simple and intuitive to use and conveniently accessible via USB.

8 – Variable Optical Attenuator (VOA) option

To have the best emulation one main point is to have the same power in both arms before they are recombined. Even if the difference is always low it may slightly vary depending on the wavelength used. The VODL option has also a small effect (see previous chapter). With the VOA option, one can easily adjust the power difference between both arms with 0.1dB accuracy and then get a perfect emulation.



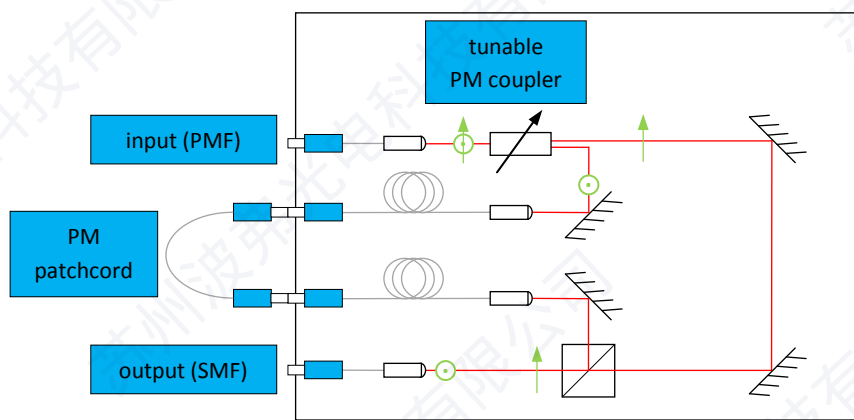
PDME: VODL + VOA + ON/OFF switch option

10 – Long Free Space Delay option

For some reasons it may be useful to have the delay between both polarizations made in free space instead of fiber. With the long free space delay option, a delay up to 20ns can be realized without any optical fiber. The additional IL induced by this set up will be below 1.0dB.

11 – Tunable Coupling option

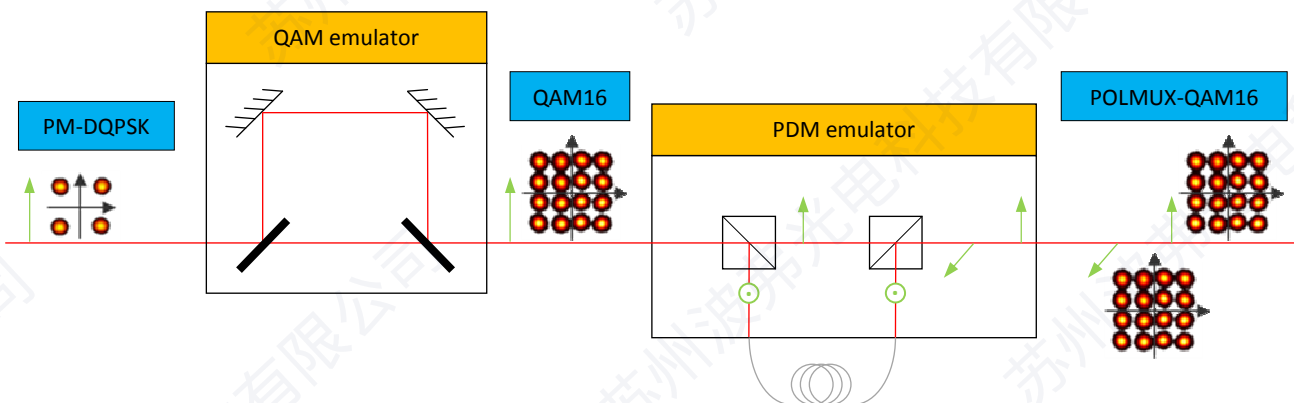
The Tunable coupling option enables to adjust the splitting ratio of the PDME from 100/0 to 0/100. This can be very useful if a precise 50/50 ratio is needed as it enables to easily adjust the power difference between both arms with 0.1dB accuracy, just like the Variable Attenuator option but without adding losses.



PDME: tunable coupling option

12 – Application note

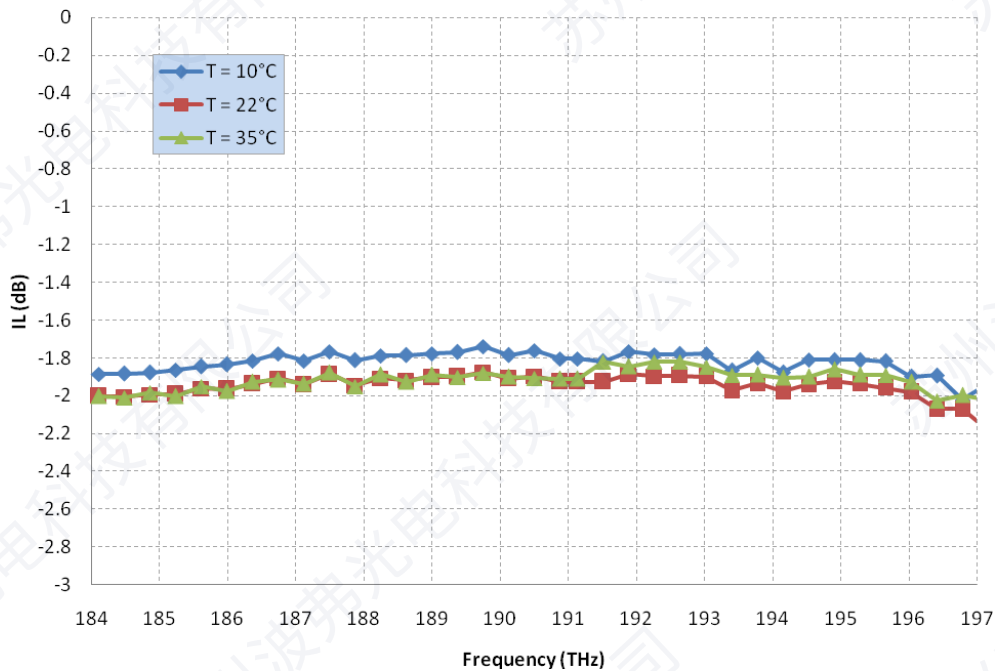
The PDME can be used to emulate a POLMUX-QAM16 signal from a QAM16 signal.



Emulation of a POLMUX-QAM16 signal from a PM-DQPSK signal

13 – Typical measurements

Here are the IL versus frequency measured at 10°C, 22°C and 35°C of a PDME with VODL option:



IL vs frequency for PDME with VODL option

14 – Fiber type and connectors

The PDME has a PM input fiber and a SMF output fiber. The fibers of the delayed arm are PM.

The devices can be proposed with any kind of connectors (FP/UPC, FC/APC, SC/PC, SC/APC, LC/PC, E2000/PC, E2000/APC).

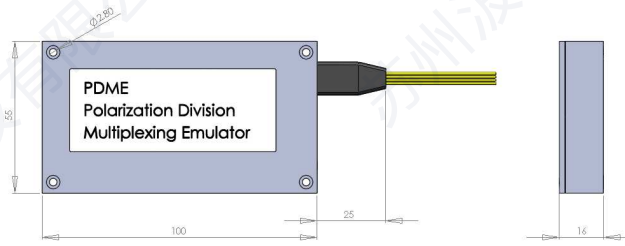
15 – Wavelength range

The PDME can be proposed at different wavelength range, from the visible to the IR. The device will be operational on a wavelength range of a tens of nanometers centered on the wavelength required by customer.

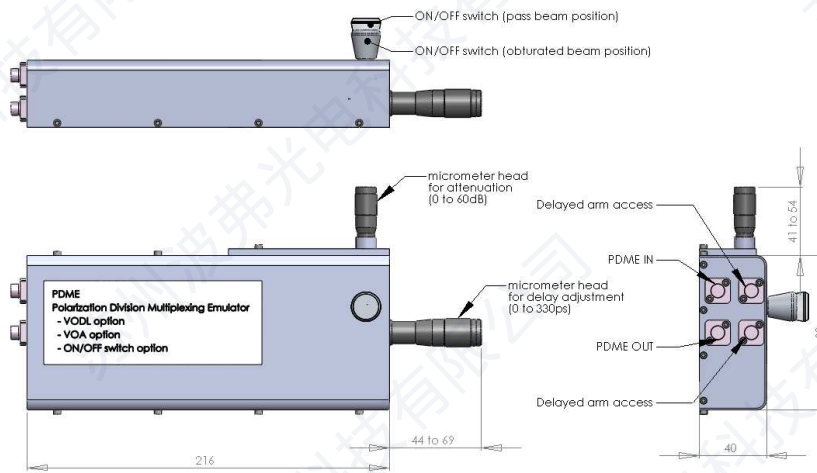
16 – Custom product

Thanks to our free-space technology we can easily customize most of our product and so it is for the PDME. Customer can feel free to ask for any customization they need. We will examine the request and do our best to have a positive answer.

17 – Package layout



PDME packaging



PDME: VODL + VOA + ON/OFF switch option

18 – Revision

| date | version | Object |
|----------------|-----------|----------|
| March 21, 2013 | PDME V1.0 | Creation |