Weed Instrument Company
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2DXX Optical Modules with Diagnostic Analog Output

The diagnostic analog output is used to indicate the strength of an incoming light signal to the receiver (RX) input on the optical module. The sensitivity threshold of the optical receiver is used to set the 4mA point, and the 20mA point is set at the guaranteed minimum launch power level of the optical transmit port with the power level jumper set in the High (H) position. Because the launch power of an individual optical transmit devices varies, the 20mA point is set based on the minimum launch power guaranteed to be present at the transmit optical port. Therefore in many cases a low loss connection will indicate a greater than 20mA diagnostic output (maximum reading is 28mA). This just means that the unit will function normally even with a greater fiber link loss than our specification defines as a maximum loss budget or Optical Dynamic Range. Over time, things may happen to degrade a fiber optic link, such as, dust or debris in the connector area, chemical reaction to the glass or connectors and changes to the bends in the fiber cable. Monitoring the diagnostic output of the 2DXX series of optical interface modules will show the degradation of the fiber over time. The fiber link should operate properly until it reaches the 4mA sensitivity point. By comparing the analog reading of the diagnostic output to the charts below, the remaining fiber loss budget can be determined. A reading of 20mA or greater indicates the maximum amount of guaranteed loss budget is available in the fiber link. A reading of 4mA or less indicates the maximum amount of loss allowed in the fiber link has been reached or exceeded.

The output will only indicate the signal strength if there is network data being transmitted over the fiber. If data transmissions over the fiber cease (as with no input or a broken fiber), the output level will drop to 4mA or below. The diagnostic output does not change with the amount of data being transmitted but instead indicates the amplitude of the optical data signal, which corresponds to the received power level. The power level can be correlated to the amount of attenuation (losses) in the fiber.

The optical power transfer at the connector terminations of a fiber varies from connector to connector for reasons too numerous to mention here. This means that at every connector location on a fiber link, the optical power that is transferred from launch port to fiber, fiber to receive port or fiber to fiber in a patch-panel or connector splice will vary as well. This loss may be insignificantly small, such as 0.1dB, or greater than 2dB per connector junction. In most cases the loss will be less than 1dB, but a conservative estimate of 1dB per connector junction is a good practice when estimating the losses on a fiber run.

Fiber cable varies as well in its loss per unit length. Normally specified in dB per kilometer, each manufacturer and fiber type will usually have a conservative loss specification that is based on a straight or largely coiled length of fiber. The losses that can be attributed to the glass fiber itself are the number of bends in the fiber run and outside degrading influences such as heat, cold, and chemical action over time.

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When estimating the loss on a particular fiber run, multiply the length by the fiber's loss per unit length and add 1dB for each fiber connector in the run. This will supply a conservative dB loss number that is typical for the fiber run. Actual results may vary. The only way to measure the actual loss in a fiber run is to have it measured using calibrated equipment. A reading from an Optical Time Domain Reflectometer (OTDR) is a very accurate way to measure the loss. However, it is important to understand that the single-pulse signal being sent by the OTDR is different than the multi-pulse data signal being sent by equipment such as a fiber modem. Therefore the losses determined from an OTDR may vary slightly from the actual operational losses.

From the mA reading, a determination of the fiber link's remaining loss budget can be obtained from the graphs below. A verification of the output reading can be accomplished by approximating the losses expected in the fiber link in question. Keep in mind that the values given here are conservative and assume proper fiber installation and connector terminations.

Optical Module	Fiber Size [μm]	Mode	λ [nm]	Maximum Guaranteed Loss Budget (Optical Dynamic Range) [dB]
2D06	200/230	Multi	850	21
2D07	62.5/125	Multi	850	12
2D09	62.5/125	Multi	1300	12
2D36	9/125	Single	1300	10
2D46	9/125	Single	1300	16

Fiber Optic Cable Type	Typical Attenuation [dB/km]
Large Core (200/230 μm)	8 @ 850 nm
Multi-Mode (62.5/125 μm)	1.5 @ 1300 nm 3.5 @ 850 nm
Single Mode (9/125 μm)	0.5 @ 1300 nm

Connector/Splice Method	Attenuation [dB]
Crimp & Cleave (200/125 μm)	2.0
Epoxy/Polish (62.5/125 μm)	1.0
Epoxy/Polish (9/125 μm)	0.5

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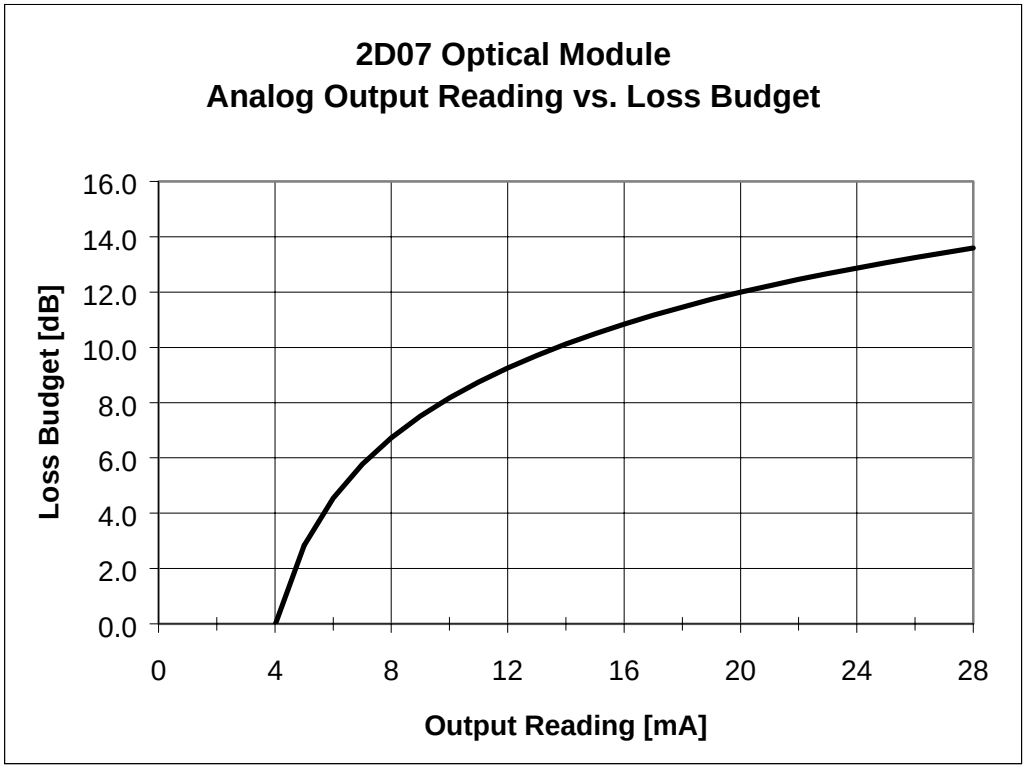
Example:

Consider the example of a point-to-point network configuration using the 2D07, 850 nm optical modules over 1.5 km (4,920 ft) of multi-mode, 62.5/125 μm fiber optic cable with two ST type connectors used as a splice halfway between end points. The analog output reading is 6 mA.

To find the loss budget remaining, use the 2D07 table below. At 6 mA, the loss budget remaining is approximately 4.5 dB. To verify the reading, approximate the total losses expected in the system. The attenuation (losses) expected from the cable length is 3.5 dB/km x 1.5 km = 5.25 dB. The attenuation (losses) due to the connectors is 1 dB/connector x 2 = 2 dB. The total loss expected in the system is 5.25 dB + 2 dB = 7.25 dB. To determine the amount of loss budget remaining, subtract the total loss in the system (7.25 dB) from the optical dynamic range of the 2D07 module (12 dB), which equals 4.75 dB loss budget remaining. Therefore, the 6 mA reading is an accurate approximation. The actual losses in a particular fiber cable run will vary based on a number of previously mentioned factors and all loss numbers supplied here are approximations.



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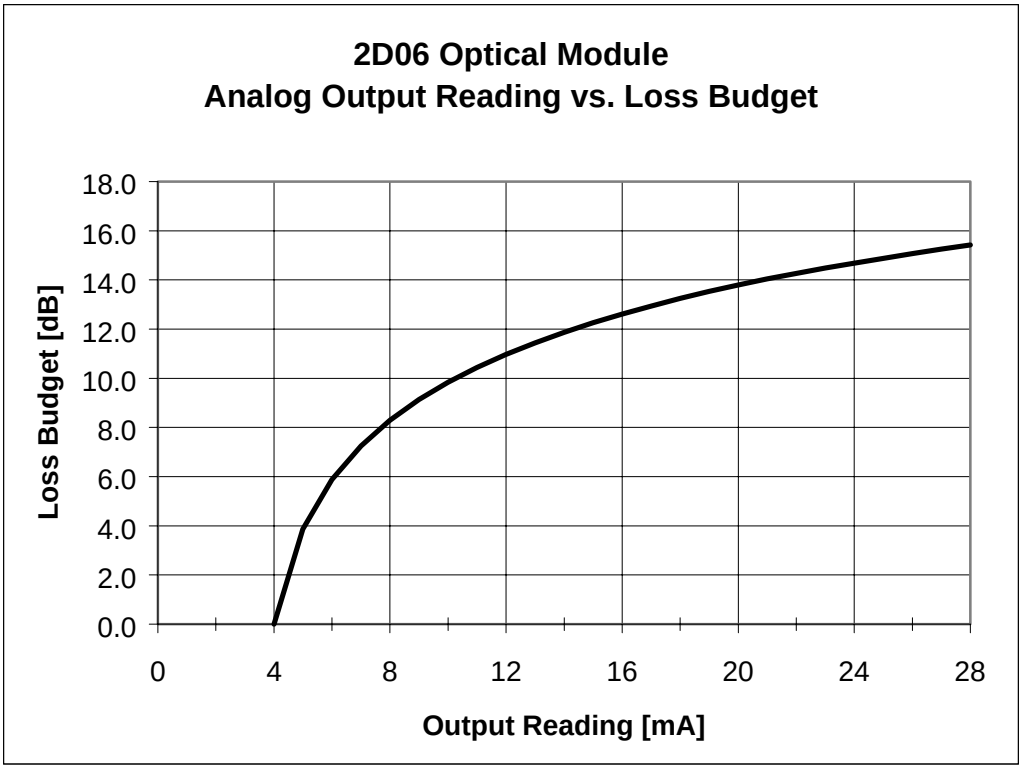
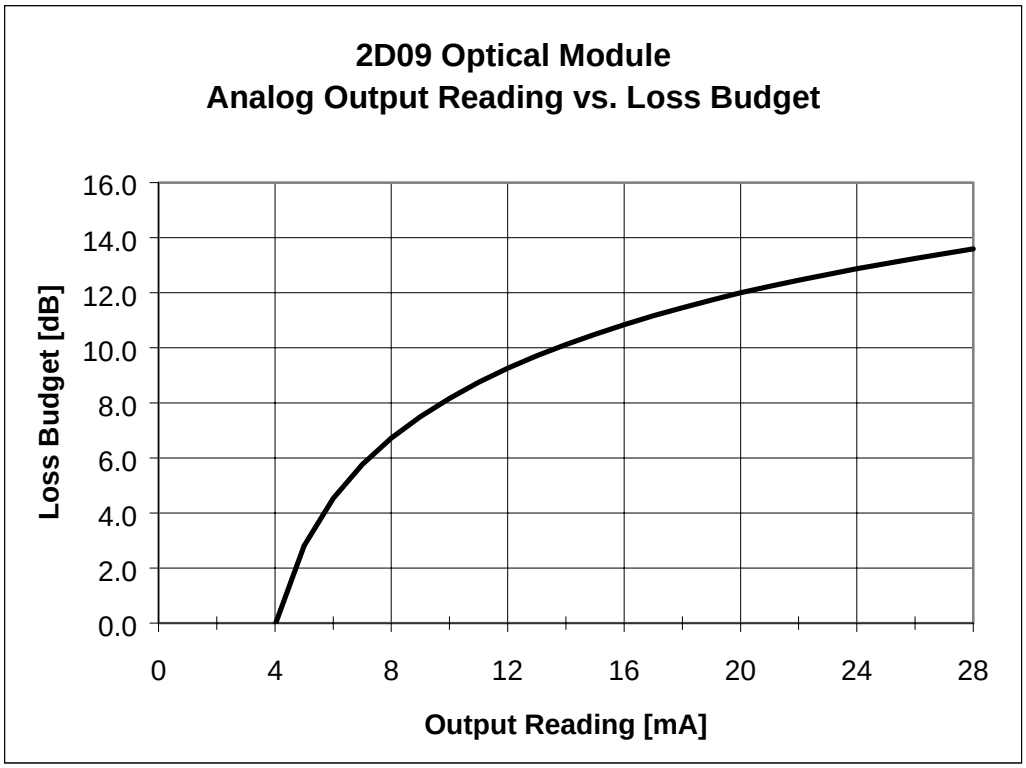


Note: At 20mA, the 2D06 module has 13.802 dB optical loss budget remaining. The chart and output only reflects a portion of its full optical dynamic range of 21 dB.



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