Functional Principle of Optical Power Meter

Overview

An increasingly common special-purpose OPM, commonly called a "PON Power Meter" is designed to hook into a live PON (Passive Optical Network) circuit, and simultaneously test the optical power in different directions and wavelengths. This unit is essentially a triple power meter, with a collection of wavelength filters and optical couplers. Proper calibration is complicated by the varying duty cycle of the measured optical signals.

Key Takeaways

An optical power meter measures the power of an optical signal by converting light into an electrical signal using a calibrated sensor, typically a photodiode or thermal detector, and displaying the corresponding power value.Core Components

An optical power meter (OPM) generally consists of three main components: a sensor, a measuring amplifier, and a display unit. The sensor is selected based on the wavelength and power range of the optical signal being measured. Common sensor types include silicon (Si), germanium (Ge), and indium gallium arsenide (InGaAs) photodiodes, as well as thermopiles or pyroelectric detectors for higher power or broadband measurements . The display shows the measured optical power, often in watts or decibel-milliwatts (dBm), along with the set wavelength for calibration purposes .

Measurement Principle

The working principle depends on the type of sensor:

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• Photodiode-based meters: The photodiode absorbs incoming photons and generates a proportional electric current. This current is then amplified and converted into a voltage signal, which is processed to calculate the optical power. Photodiode meters are highly sensitive and suitable for low-power measurements, including microwatt levels, and are often wavelength-specific .

• Thermal (thermopile) meters: These meters convert optical power into heat in an absorber coated with a black material. The resulting temperature rise is measured, typically using a thermopile, and is proportional to the optical power. Thermal meters are robust, wavelength-independent over a broad range, and suitable for higher power measurements, from milliwatts to kilowatts .
Calibration and Wavelength Considerations

Optical power meters are calibrated using traceable standards to ensure accurate readings. Since photodiode sensitivity varies with wavelength, the meter must be set to the correct test wavelength to avoid measurement errors. Thermal meters are less sensitive to wavelength variations but may require cooling for high-power measurements .

Practical Use

In fiber optic systems, an OPM is often used with a stable light source to measure absolute optical power or optical loss in a fiber link. The light source launches light into one end of the fiber, and the OPM measures the received power at the other end. This setup allows technicians to determine signal attenuation and ensure proper network performance . In summary, an optical power meter works by converting light energy into an electrical or thermal signal, amplifying it, and displaying the corresponding optical power, with sensor type and wavelength calibration being critical for accurate measurements .

Article Content

Optical power meter

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