An Introduction to CO2 Lasers and the RF Amplifier Needed to Excite a CO2 Laser System

The laser tube is a very sophisticated device. It is composed of a plasma tube filled with a special mixture of CO2 and other gases, and RF (radio frequency) electronics. The function of the entire assembly is to turn electrical energy into concentrated light energy.

When the laser system is powered ON, the RF electronics produce a high frequency AC signal across the electrodes located inside the plasma tube. This causes spontaneous photon emissions from the gas mixture that produces an invisible, infrared (IR) light beam at a frequency of 10.6 microns which is at the far end of the IR spectrum – making the beam invisible to the naked eye. The width of the laser beam as it exits the tube, called the “Beam Diameter”, is about 4 mm. An optical lens focuses the beam into a very small spot, the diameter of which is dependent on the Focal Length of the lens. The Focal Length is the distance from the center of the lens to the point where it focuses the beam into the smallest spot possible. Using a standard 2 inch focal length lens, results in a spot size of approximately 5 mils (.005 inches). The Focal Range of the lens, where the beam is considered to be “in focus”, is equivalent to 5% above and below the focus point. Shorter lenses produce a precise beam but at the expense of a very narrow focal range. The longer lenses have a much wider range of focus at the expense of a precise beam

Lasers are rated by output power in watts. Simply put, the higher the wattage, the more powerful the beam. Typical CO2 lasers produce between 5 and 100 Watts of laser light power. In this case “Watt” signifies the amount of heat energy that the laser light is producing over a period of time, measured by a laser power meter.

RF Amplifier for CO2 Laser Excitation:

Various kilowatt systems can be developed through multiple combining sections within the RF power amplifier, including the use of multiple High Power Amplifier (HPA) packages, and the input splitter and output combiner circuitry used. The high-power amplifier shown in our block diagram (in the Technical Resources tab) uses multiple push-pull transistor packages to increase the output power beyond 1.2 kW. It also employs a Wilkinson splitter to properly divide the input between the 2 HPA packages and a Wilkinson combiner to properly combine the high output power from the 2 HPA stages.

Usage of CO2 Lasers Includes:

Medical
- Laser Surgery (laser scalpel)
- Skin Resurfacing (laser facelifts)
- Cauterizing
- Dermabrasion (the controlled abrasion, or “wearing away” of the upper layers of the skin)

Industrial
- Precision Cutting
- Engraving
- Welding
- Drilling
- Heat treatment (hardening and annealing; metallurgy)
- Surface Treatment

Military
- Range Finding

Contact your local sales representative or learn more about Richardson RFPD online at www.richardsonrfpd.com.