

# CPI :: Technology

## Technology

CPI has an extensive portfolio of over 4,500 products that includes a wide range of microwave and power grid VEDs, in addition to products such as:

- Satellite communications amplifier subsystems
- Radar and electronic warfare subsystems
- Solid state integrated microwave assemblies
- Medical X-ray generators and control systems
- Modulators and transmitters
- Various electronic power supply and control equipment and devices

Additionally, CPI has developed complementary, more highly integrated, subsystems that contain additional integrated components for medical imaging and for satellite communications applications.

Generally, CPI's products are used to:

- Generate or amplify (multiply) various forms of electromagnetic energy (these products are generally referred to as VEDs, vacuum electron devices, or simply as devices)
- Direct, measure and control electromagnetic energy
- Provide the voltages and currents to power and control devices that generate electromagnetic energy
- Provide some combination of the above functions

VEDs were initially developed for defense applications but have since been applied to many commercial markets. CPI uses tailored variations of this key technology to address the different frequency and power requirements in each of CPI's target markets. Generally CPI's VED products derive from, or are enhancements to, the original VED technology on which the company was founded. All of CPI's other products were natural offshoots of the original VED technology and were developed in response to the opportunities and requirements in the market for more fully integrated products. The type of device selected for a specific application is based on the operating parameters required by the system.

CPI sells several categories of VEDs, including:

- **Klystrons and gyrotrons:** Klystrons are typically high-power VEDs that operate over a narrow range of frequencies, with power output ranges from hundreds of watts to megawatts and frequencies from 500 kilohertz to over 30 gigahertz. CPI produces and manufactures klystrons for a variety of radar, communications, medical, industrial and scientific applications. Gyrotron oscillators and amplifiers operate at very high-power and very high frequencies. Power output of one megawatt has been achieved at frequencies greater than 100 gigahertz. These devices are used in areas such as fusion research, electronic warfare and high-resolution radar.
- **Helix traveling wave tubes:** Helix traveling wave tubes are VEDs that operate over a wide range of frequencies at moderate output power levels (tens of watts to thousands of watts). These devices are ideal for terrestrial and satellite communications and electronic warfare applications.
- **Coupled cavity traveling wave tubes:** Coupled cavity traveling wave tubes are VEDs that combine some of the power generating capability of a klystron with some of the increased bandwidth (wider frequency range) properties of a helix traveling wave tube. These amplifiers are medium bandwidth, high-power devices, since power output levels can be as high as one megawatt. These devices are used primarily for high-power and multi-function radars, including front line radar systems.
- **Magnetrons:** Magnetron oscillators are VEDs capable of generating high-power output at relatively low cost. Magnetrons generate power levels as high as 20 megawatts and cover frequencies up to the 40 gigahertz range. CPI design and manufacture magnetrons for radar, electronic warfare and missile programs within the defense market. Shipboard platforms include search and air traffic control radar on most aircraft carriers, cruisers and destroyers of NATO-country naval fleets. Ground-based installations include various military and civil search

and air traffic control radar systems. CPI is also a supplier of magnetrons for use in commercial weather radar. Potential new uses for magnetrons include high-power microwave systems for disruption of enemy electronic equipment and the disabling or destruction of road-side bombs and other IEDs.

- Cross-field amplifiers: Cross-field amplifiers are VEDs used for high-power radar applications because they have power output capability as high as 10 megawatts. CPI's cross-field amplifiers are primarily used to support the Aegis radar system used by the U.S. Navy and selected foreign naval vessels. CPI supply units for both new ships and replacements.
- Power grid devices: Power grid devices are lower frequency VEDs that are used to generate, amplify and control electromagnetic energy. These devices are used in commercial and defense communications systems and radio and television broadcasting. CPI also supplies power grid devices for the shortwave broadcast market. CPI's products are also widely used in equipment that serves industrial markets such as textile drying, pipe welding and semiconductor wafer fabrication.

In addition to VEDs, CPI also sells:

- Microwave transmitter subsystems: CPI's microwave transmitter subsystems are integrated assemblies generally built around CPI's VED products. These subsystems incorporate specialized high-voltage power supplies to power the VED, plus cooling and control systems that are uniquely designed to work in conjunction with CPI's devices to maximize life, performance and reliability. Microwave transmitter subsystems are used in a variety of defense and commercial applications. CPI's transmitter subsystems are available at frequencies ranging from one gigahertz all the way up to frequencies of 100 gigahertz and beyond.
- Satellite communications amplifiers: Satellite communications amplifiers provide integrated power amplification for the transmission of voice, broadcast, data, Internet and other communications signals from ground stations to satellites in all frequency bands. CPI provides a broad line of complete, integrated satellite communications amplifiers that consist of a vacuum electron device or solid-state microwave amplifier, a power supply to power the device, radio frequency conditioning circuitry, cooling equipment, electronics to control the amplifier and enable it to interface with the satellite ground station, and a cabinet. These amplifiers are often combined in sub-system configurations with other components to meet specific customer requirements. CPI offers amplifiers for both defense and commercial applications. CPI's products include amplifiers based on traveling wave tubes, klystrons, solid state devices and millimeter wave devices.
- Receiver protectors and control components: Receiver protectors are used in the defense market in radar systems to protect sensitive receivers from extraneous high-power signals, thereby preventing damage to the receiver. CPI's business has been designing and manufacturing receiver protector products for over 50 years. CPI believes it is the world's largest manufacturer of receiver protectors and the only manufacturer offering the full range of available technologies. CPI also manufactures a wide range of other components used to control the RF energy in the customer's system. CPI's receiver protectors and control components are integrated into prominent fielded military programs. As radar systems have evolved to improve performance and reduce size and weight, CPI has invested in solid state technology to develop the microwave control components to allow it to offer more fully integrated products, referred to as multifunction assemblies, as required by modern radar systems.
- Medical X-ray imaging systems: CPI designs and manufactures X-ray generators for medical imaging applications. These consist of power supplies, cooling, control and display subsystems that drive the X-ray equipment used by healthcare providers for medical imaging. The energy in an X-ray imaging system is generated by an X-ray tube, which is another version of a VED operating in a different region of the electromagnetic spectrum. These generators use the high-voltage and control systems expertise originally developed by CPI while designing power systems to drive the company's other VEDs. CPI has introduced a new line of X-ray generators intended to address the low tier, high volume part of the market. CPI also provides the electronics and software subsystems that control and tie together much of the other ancillary equipment in a typical X-ray imaging system.