Lasers –Solution Note

Background

A **LASER** (Light Amplification by Stimulated Emission of Radiation) is an electro-optical device that emits highly coherent light radiation. Lasers have become a multi-billion dollar industry with applications ranging from storage devices to cosmetics.

A laser consists of an energy source, a gain medium and an optical resonator. The energy source, for example a flashlamp, provides the energy to the laser system. The gain medium amplifies the light passing through it, and the optical resonator, usually two mirrors, provides the optical feedback. As light bounces back and forth through the gain medium it is amplified each time. The light that escapes the laser, for example through one of the mirrors, forms the laser beam output.

Some lasers are operated in a continuous fashion, whereas others generate *pulses*, which can be supplied in a variety of intensities. In the pulsed mode of operation, the output of a laser varies with respect to time, alternating between *on* and *off* periods. Often, pulse applications require extremely high energy input levels over a very short period of time.

Requirement

Q-switching is a technique used to perform pulse operations on lasers. Q-switching is achieved by utilizing a variable attenuator called a "Q-switch" inside the laser's optical resonator. When the attenuator is functioning, light which leaves the gain medium does not return, and lasing cannot begin.

Initially, the laser medium is optically pumped while the Q-switch is set to "low Q" in order to prevent feedback of light into the gain medium. As lasing cannot occur at that time, the energy fed into the gain medium by the pumping mechanism accumulates there.

When the stored energy reaches a maximum level ("saturation"), the Q-switch device is quickly reset to "high Q", allowing feedback of light into the gain medium and initiating the energy emission process. Because of the large amount of energy already stored in the gain medium, the intensity of light in the laser resonator builds up very quickly. This causes the energy stored in the medium to be depleted quickly as well.

The net result is a short pulse of light emanating from the laser, known as a giant pulse, which may have a very high peak intensity and a duration as short as a few nanoseconds.

Operating the laser in pulses demands accurate triggering for both the laser components (flashlamp, Q-switch) and for peripheral equipment such as measuring equipment or cameras, and requires precise synchronization and timing capabilities.

Solution

Tabor Electronics' *Wonder Wave* family of Arbitrary Waveform Generators (AWGs) offers an outstanding solution for laser pulse applications. Wonder Wave offers 4 synchronized output channels, supporting sampling rates of up to 200 MS/second. Its multi-channel solution allows you to synchronize the activity of the flashlamp, the Q-switch, and peripheral devices, as shown in the diagram in Figure 1 below.

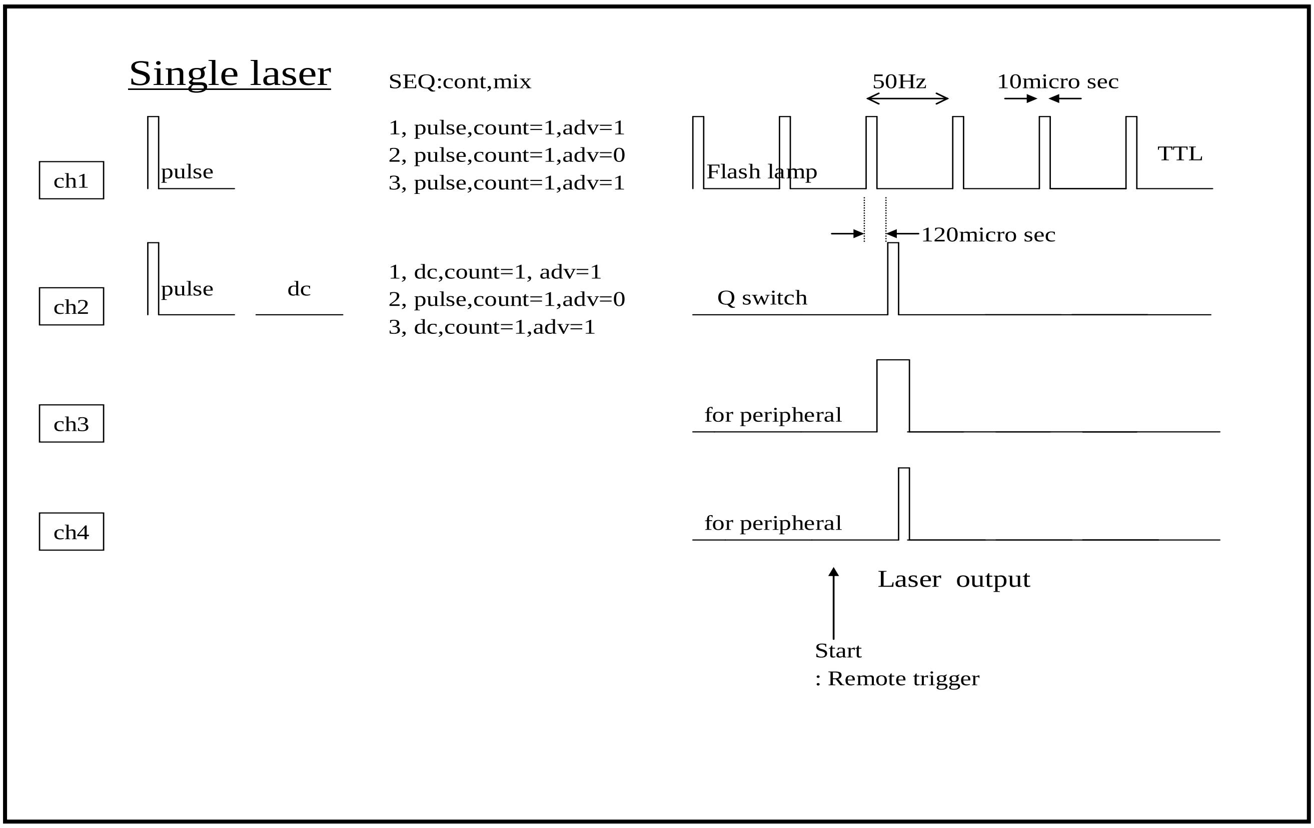

Figure 1: Wonder Wave Support for Laser Pulse Applications

Wonder Wave's powerful sequence generator provides outstanding support for highly complex applications, offering storage of 10,000 repeatable waveform segments, with up to 4 million memory points.

Wonder Wave is supplied with ArbConnection – Tabor's comprehensive software tool that controls AWG operation, and supports the creation of unique, arbitrary waveforms using its powerful *Waveform Composer.*

For More Information

To learn more about Tabor's solutions or to schedule a demo, please contact your local Tabor representative or email your request to info@tabor.co.il. More information can be found at our website at www.taborelec.com