LEYSOP LTD

Manufacturers and suppliers of electro-optic components

Pulse Picking with Pockels Cells

Pulse Picking With Four Terminal Pockels Cells

One excellent approach to generating a finite duration optical gate from a much longer input step function is to use a pair of Pockels optically in series and driven from the same high voltage edge. The first Pockels cell opens to allow transmission of the beam when the leading edge of the driver pulse arrives. The electrical pulse is then passed to the second cell after an appropriate delay (i.e. a length of coaxial cable) and the second cell opens up but with the optical phase rotation in the opposite direction to that of the first cell. This produces the effect of concluding the transmission of the composite pair of cells until the voltage pulse clears the first cell. Once this happens, the transmission is returned to the high state until the voltage pulse also clears the second cell, that is after the duration of the cable delay. By appropriate choice of pulse length, this second opening of the switch can be timed to occur between pulses and so has little effect on the system performance. The advantage of this approach is that both the leading and falling edges of the gate are determined by the leading edge of the voltage step or pulse. A long recovery of the voltage does not therefore affect the fall time achievable.

There are some difficulties however associated with using two Pockels cells like so. The first is the extra alignment required for two Pockels cells instead of one. Also, the optical transmission will be reduced as there are more optical surfaces involved. This also can lead to more spurious reflections to deal with. Finally, and most significantly, the matching of the two cells has to be very close if good extinction is to be maintained. The variations in deuteration from crystal to crystal in KD*P can be sufficient to upset this balance. The solution to all these problems is a four terminal Pockels cell:

By including a second terminal on each electrode of the Pockels cell, the electrical step voltage which turns on the Pockels cell transmission may be configured to switch off the transmission after a delay determined by a length of coaxial cable connecting the two ends of the cell. The cell is connected at the opposite end to the driver to a 50W load via a suitable series capacitance. This has the benefit that under static conditions the Pockels cell sees no voltage across its terminals which helps it maintain a long lifetime. When the voltage step is applied to the first terminal, the voltage appears across the cell as the opposite end is held at Earth potential. The through connection is delayed by the coaxial cable for some moderate period of time (usually up to around 10ns) and then is fed to one of the rear terminals whereupon the overall field across the device is returned to zero. The device is then closed. The voltage step is then finally passed through via the remaining terminal to the 50W load where it is cleanly terminated to minimise reflections. For optimum performance, the voltage step source should also be 50W impedance, but this reduces the maximum effective drive voltage of the supply by a half.