Photochromic molecules provide an intriguing and relatively untapped alternative to traditional materials utilized in organic memory devices. We have recently reported on a new prototype of a nonvolatile light-emitting organic memory (LE-OMEM) that integrates a layer of crosslinkable dithienylethene photochromes (XDTE) into a solution-processed, multilayer OLED. The XDTE molecules undergo a change in both their UV-visible absorption and energy level position due to a photo- and/or electrically-induced ring-opening/-closing reaction. Exploiting the difference in HOMO and LUMO energies of both isomers and the subsequent change in hole-injection barrier we use this XDTE layer as an electrical switch within our OLED layer stack. Optimized devices have displayed ON/OFF ratios in both current and electroluminescence of greater than 10^4. We investigate both optical and electrical programming of the OMEM devices and show that precise control of the ratio of both isomers in the active layer enables access to a multitude of intermediate states demonstrating the potential of these devices for future multilevel memory applications. We also discuss the difference in the molecular-scale mechanisms that are responsible for the optically- and electrically-induced switching effect in these devices by in-situ monitoring of the fraction of closed molecules as a function of the external stimulus.