The aluminum complexes were prepared in a metal cluster source and identified with a time-of-flight mass spectrometer. The electronic spectra of the complexes were measured with single-photon ZEKE-PFI (zero electron energy pulsed field ionization) technique. The ZEKE spectrum of AlNH$_3$ shows vibronic transitions from two spin-orbit levels of the neutral ground electronic state, which allows the measurements of the following spectroscopic constants: ionization potential (39746 cm$^{-1}$), spin-orbit splitting (58 cm$^{-1}$), Al-NH$_3$ symmetric stretching frequencies ($\omega_\alpha^\pm = 339$ cm$^{-1}$, $\omega_\beta^\pm = 3.1$ cm$^{-1}$, and $\nu_3 = 227$ cm$^{-1}$), and Al-N symmetric bending frequency ($\nu_4^\pm = 557$ cm$^{-1}$). The ZEKE spectrum of AlNH$_2$(CH$_3$) displays at least four progressions, from which two vibrational modes (365 and 160 cm$^{-1}$) may be identified.