A chirped-pulse Fourier transform microwave spectrometer has been used to measure the microwave spectrum of CF$_3$I···PH$_3$ between 6.5 and 18.5 GHz. The complex was stabilised by supersonic expansion of a gas sample containing small percentages of CF$_3$I and PH$_3$ in a balance of 6 bar of argon. The observed spectrum is consistent with a $C_{3v}$ prolate symmetric top structure which displays evidence for internal rotation of the PH$_3$ subunit about the principal axis. Over two hundred hyperfine transitions across eleven $J''' \rightarrow J'$ transitions have been assigned to the internal rotor $A$-state allowing the rotational ($B_0$) and centrifugal distortion ($D_J$ and $D_{JK}$) constants as well as the nuclear electric quadrupole coupling constant of iodine ($\chi_{aa}(I)$) to be assigned for this state. For the $E$-state, the additional distortion terms $D_{Jm}$ and $D_{JKm}$ have been determined. The length of the halogen bond between the iodine and phosphorus atoms and the force constant of this bond have also been determined.