Energy matrices for the g^2 electron configuration in the $jj-$coupling basis

$$
\begin{array}{ll}
J=0 & (7/2)^2 \qquad\qquad (9/2)^2 \\
(7/2)^2 & \left(\begin{array}{cc} F_0+\frac{4235}{3}F_2+\frac{13013}{9}F_4+\frac{3575}{3}F_6-5\zeta & \sqrt{5}(\frac{154}{3}F_2+\frac{2002}{9}F_4+\frac{2002}{3}F_6+972F_8) \\ \sqrt{5}(\frac{154}{3}F_2+\frac{2002}{9}F_4+\frac{2002}{3}F_6+972F_8) & F_0+\frac{4312}{3}F_2+\frac{14014}{9}F_4+\frac{4576}{3}F_6+4862F_8+4\zeta \end{array} \right)
\end{array}
$$

$$
\begin{array}{ll}
J=1 & (7/2,9/2) \\
(7/2,9/2) & \left(F_0+1309F_2+1001F_4-143F_6-19448F_8-\frac{\zeta}{2} \right)
\end{array}
$$

$$
\begin{array}{lll}
J=2 & (7/2)^2 \qquad\qquad (7/2,9/2) \qquad\qquad (9/2)^2 \\
(7/2)^2 & \left(\begin{array}{ccc} F_0+\frac{5929}{9}F_2-\frac{13013}{27}F_4-\frac{3575}{9}F_6 -5\zeta & -\sqrt{22}(\frac{638}{9}F_2+\frac{3380}{27}F_4-\frac{910}{9}F_6) & \sqrt{154}(\frac{53}{9}F_2-\frac{130}{27}F_4-\frac{559}{9}F_6 +884F_8) \\ -\sqrt{22}(\frac{638}{9}F_2+\frac{3380}{27}F_4-\frac{910}{9}F_6) & F_0+\frac{8377}{9}F_2+\frac{5707}{27}F_4+\frac{416}{9}F_6 -12376F_8-\frac{\zeta}{2} & \sqrt{7}(\frac{1064}{9}F_2+\frac{7280}{27}F_4+\frac{416}{9}F_6 -3536F_8) \\ \sqrt{154}(\frac{53}{9}F_2-\frac{130}{27}F_4-\frac{559}{9}F_6+884F_8) & \sqrt{7}(\frac{1064}{9}F_2+\frac{7280}{27}F_4+\frac{416}{9}F_6 -3536F_8) & F_0+\frac{8428}{9}F_2+\frac{637}{27}F_4-\frac{6656}{9}F_6 -884F_8+4\zeta \end{array} \right)
\end{array}
$$

$$
\begin{array}{ll}
J=3 & (7/2.9/2) \\
(7/2,9/2) & \left(F_0+334F_2-949F_4+442F_6-6188F_8-\frac{\zeta}{2} \right)
\end{array}
$$

$$
\begin{array}{lll}
J=4 & (7/2)^2 \qquad\qquad (7/2,9/2) \qquad\qquad (9/2)^2 \\
(7/2)^2 & \left(\begin{array}{ccc} F_0-\frac{4235}{9}F_2+\frac{13013}{81}F_4-\frac{3575}{9}F_6 -5\zeta & \sqrt{130}(\frac{220}{9}F_2-\frac{3796}{81}F_4+\frac{700}{9}F_6) & \sqrt{910}(-\frac{1}{9}F_2-\frac{368}{81}F_4+\frac{167}{9}F_6 68F_8) \\ \sqrt{130}(\frac{220}{9}F_2-\frac{3796}{81}F_4+\frac{700}{9}F_6) & F_0-\frac{1010}{9}F_2-\frac{29149}{81}F_4+\frac{730}{9}F_6 -2380F_8-\frac{\zeta}{2} & -\sqrt{7}(\frac{1120}{9}F_2-\frac{11620}{81}F_4+\frac{160}{9}F_6 -1360F_8) \\ \sqrt{910}(-\frac{1}{9}F_2-\frac{368}{81}F_4+\frac{167}{9}F_6 +68F_8) & -\sqrt{7}(\frac{1120}{9}F_2-\frac{11620}{81}F_4+\frac{160}{9}F_6 -1360F_8) & F_0+\frac{196}{9}F_2-\frac{51499}{81}F_4+\frac{5248}{9}F_6 -2108F_8+4\zeta \end{array} \right)
\end{array}
$$

$$
\begin{array}{ll}
J=5 & (7/2,9/2) \\
(7/2,9/2) & \left(F_0-665F_2+581F_4-1205F_6-680F_8-\frac{\zeta}{2} \right)
\end{array}
$$

$$
\begin{array}{lll}
J=6 & (7/2)^2 \qquad\qquad (7/2,9/2) \qquad\qquad (9/2)^2 \\
(7/2)^2 & \left(\begin{array}{ccc} F_0-\frac{4235}{9}F_2-\frac{13013}{27}F_4-\frac{275}{9}F_6 -5\zeta & -\sqrt{70}(-\frac{154}{9}F_2+\frac{1820}{27}F_4+\frac{170}{9}F_6) & \sqrt{10}(-\frac{182}{9}F_2+\frac{1750}{27}F_4-\frac{826}{9}F_6 +34F_8) \\ -\sqrt{70}(-\frac{154}{9}F_2+\frac{1820}{27}F_4+\frac{170}{9}F_6) & F_0-\frac{6125}{9}F_2+\frac{10927}{27}F_4-\frac{689}{9}F_6 -136F_8-\frac{\zeta}{2} & -\sqrt{7}(\frac{112}{9}F_2+\frac{280}{27}F_4-\frac{2624}{9}F_6 136F_8) \\ \sqrt{10}(-\frac{182}{9}F_2+\frac{1750}{27}F_4-\frac{826}{9}F_6 34F_8) & -\sqrt{7}(\frac{112}{9}F_2+\frac{280}{27}F_4-\frac{2624}{9}F_6 -136F_8) & F_0-\frac{6277}{9}F_2+\frac{16072}{27}F_4-\frac{5840}{9}F_6 -425F_8+4\zeta \end{array} \right)
\end{array}
$$

$$
\begin{array}{ll}
J=7 & (7/2,9/2) \\
(7/2,9/2) & \left(F_0 - 392F_2 - 784F_4 - 152F_6 - 17F_8 - \frac{\zeta}{2} \right)
\end{array}
$$

$$
\begin{array}{lcc}
J=8 & (7/2,9/2) & (9/2)^2 \\
(7/2,9/2) & F_0 + \frac{1960}{3}F_2 + \frac{784}{9}F_4 - \frac{8}{3}F_6 - F_8 - \frac{\zeta}{2} & \sqrt{2}(-\frac{784}{3}F_2 - \frac{1960}{9}F_4 - \frac{112}{3}F_6 - 4F_8) \\
(9/2)^2 & \sqrt{2}(-\frac{784}{3}F_2 - \frac{1960}{9}F_4 - \frac{112}{3}F_6 - 4F_8) & F_0 - \frac{784}{3}F_2 - \frac{6076}{9}F_4 - \frac{400}{3}F_6 - 115F_8 + 4\zeta
\end{array}
$$