Abstract—A new technique has been developed to explore the characteristics and dynamics of the electrodynamic balance (EDB). It is demonstrated that by trapping a pair of microparticles, the electric field of and EDB can be characterized and particle stability can be investigated. The electric field in the neighborhood of the null-point was examined by comparing the oscillatory motion of the two-particle system with a theoretical analysis. In addition, the relevant balance constants were evaluated by five methods: (i) determination of the stabilization strength constant, C_1. using measurements on two-particle arrays, (ii) determination of the levitation strength constant, C_0, using measurements on single particles of known mass and charge. (iii) computation of C_1 and C_0 by solving the three-dimensional Laplace equation for the non-axisymmetric electrode system, (iv) computation of C_0 using a ring charge simulation technique, and (v) determination of the ratio C_1/C_0 by measurements of the marginal stability limit. The results of the different methods are compared and shown to be consistent. © 1997 Elsevier Science Ltd. All rights reserved