Blind source separation has recently been investigated for blindly identifying variation patterns in multivariate manufacturing data, to aid in tracking down and eliminating root causes of manufacturing variation. Many different criteria can be used in blind separation algorithms, the performance and applicability of which depend on conditions that are generally not known a priori. We present a method for automatically combining the different criteria so as to directly minimize the mean square estimation error. The resulting algorithm is more effective and more robust than counterparts that use other means of combining the criteria.