Dynamic controlled atmosphere (DCA) and low-pressure (LP) storage can be used as an alternative to store organic apples for extended periods of time. DCA uses low oxygen ($O_2$) levels and monitors the anaerobic compensation point (ACP). LP ventilates air at less than atmospheric pressure. ‘Honeycrisp’ and ‘Fuji’ apples from 4 different orchard locations were picked at commercial harvest maturity and placed into controlled atmosphere (CA) and LP storage regimes. Initial ACP was monitored using chlorophyll fluorescence (CF), respiratory quotient (RQ), and ethanol content. Final CA conditions for ‘Honeycrisp’ were: CA and CA-RQ (3kPa $O_2$/0.5 kPa $CO_2$), and CA-ILOS (Initial low oxygen stress; 0.5kPa $O_2$/0.5kPa $CO_2$-10 days, 1.0kPa $O_2$/0.7MPa $CO_2$ thereafter). Final CA conditions for ‘Fuji’ were: CA and CA-RQ (0.8kPa $O_2$/0.8 kPa $CO_2$), but CA-ILOS (Initial low oxygen stress; 0.6kPa $O_2$/0.8kPa $CO_2$-10 days, 0.8kPa $O_2$/0.8kPa $CO_2$ thereafter). Two LP storage temperatures (LP33-0.5°C/ LP37-3°C) were used in the first season, but only (LP33-0.5°C) in the second. Fruit were preconditioned in air prior to final storage. Fruit quality (fruit weight, flesh firmness, soluble solids content (SSC), titratable acidity (TA), internal ethylene concentration, and respiration rate) and physiological disorders incidence were assessed after 6 and 9 months of storage plus 4 weeks in air (3°C) plus 7 days at room temperature (20°C). The performance in storage was affected by cultivar, environment, and maturity at harvest. There was variation among seasons. The incidence of physiological disorders varied between cultivars and locations. C21 developed 19.4% of soggy breakdown and W40 developed 17.2% of internal browning in the first season. The effect of storage system on physiological disorders was depended on the effect of orchard location. The incidence of physiological disorders increased as the fruit were transferred to air and RT. LP storage reduced the incidence of physiological disorders after 9 months. LP33 developed slightly more soft scald than CA storage (2.9% and 0.4%) in the second season. LP33 maintained higher TA of ‘Fuji’ (0.28%) in the first season, and of ‘Honeycrisp’ (0.34%) in the second.