# Power Quality Controller with EDLC Connected in Parallel to Dispersed Power Sources

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Abstract

The number of installations of dispersed power sources is expected to increase, as they can be constructed quickly near loads. Unfortunately, the power output of dispersed power generations such as photovoltaic generation systems and wind power generators fluctuates, making AC system interconnection problematic. On the other hand, many dispersed power generations, such as fuel cell systems and photovoltaic generation systems, produce direct-current electricity, and thus require an AC-to-DC converter (inverter) to connect to an alternating-current grid system. As AC-to-DC converters generate higher harmonics, connecting them to AC grid systems can lead to degradation of system power quality.

To solve these problems, we have developed a power quality controller (PQC) with built-in electric double-layer capacitors (EDLC). There are two types for power quality compensation, that is a series connection type and a parallel connection type for loads. The former uses a series-type transformer for the insertion of compensating powers to the distribution system and the latter uses a conventional shunt transformer. We selected the parallel connection type in the PQC system for future development because its capacitor can charge regularly. The PQC is able to supply not only reactive power but active power quickly, especially minimizing output power fluctuations in dispersed power sources. Furthermore, its active filter function can be used to suppress the low-order harmonics generated by dispersed power sources.

In this paper, we explain the control method for smoothing power fluctuations and the principle and operation of the active filter function of the PQC. We also describe the results of an operation verification test we conducted using a 7-kVA prototype in a simulated transmission. The test results show that our PQC held system voltage fluctuations to under 8% even in large power changes and reduced 5th and 7th harmonics at the source by less than 30%. Finally, the power quality controller is confirmed to be useful for improving power quality of the AC grid systems introduced dispersed generations.

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