

Study on Multi-terminal DC Transmission System Applicable to Distribution Systems for a Specific Area

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Abstract

Along with the penetration of dispersed generation systems, DC-type power sources are emerging rapidly. DC loads, such as IT (Information Technology) related facilities are also increasing with the computerization of our society. Such loads must be highly reliable, especially in power sources. To obtain highly-reliable power supply systems, DC batteries are used for the back up of power supply systems in the event of AC system failures. To connect the batteries, AC/DC converters and DC/AC converters (inverters) are needed. As for the losses of the power supply systems, it is reported that they reach more than 20 % of the rated power. A direct connection between dispersed generation DC power sources and DC loads is expected to decrease losses and to save energy, because conversion processes can be simplified. So a study of a multi-terminal DC distribution system as shown in Fig. 1 has been started. It consists of a dispersed generation DC power source, a battery for energy storage and suppression of power fluctuations, DC loads and an existing AC system linkage for a power back-up in case of emergency. Each facility has a DC/DC conditioner or an AC/DC converter to connect the multi-terminal DC system. There is also a central controller to command the controllers at each facility in order to maintain power balance.

In this paper, we discuss the configurations and the specifications of a multi-terminal DC distribution system for a relatively small specific area including dispersed generation. As a key technology for realizing the system, the developing objectives of DC/DC conditioners are also discussed and the idea of the circuit is proposed. Finally, real time simulations combining a prototype model were carried out with satisfactory results.

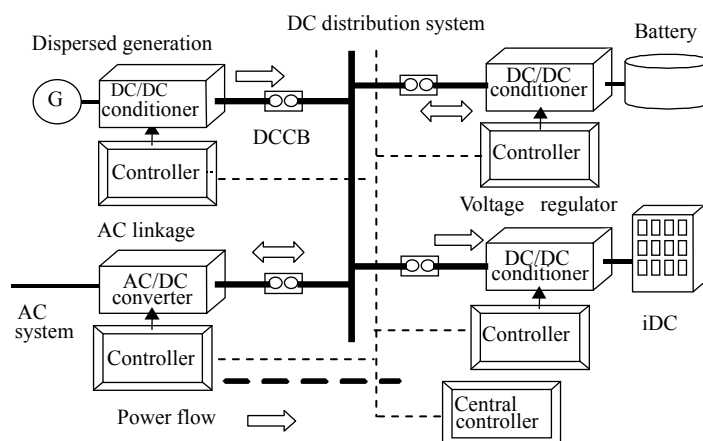


Fig.1 Multi-terminal DC distribution system