

Development of an On-board Built-in V2X System Utilizing the MG Neutral Point

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The use of battery electric vehicles (BEVs) as distributed energy resources is attracting increasing attention. However, widespread deployment of V2X systems is hindered by the cost of dedicated power conversion equipment. To address this issue, an on-board built-in V2X system utilizing the motor generator (MG) neutral point and the existing traction inverter is proposed. As shown in Fig.1, the system enables bidirectional power transfer with only a small number of additional components, providing a compact and low-cost V2X solution.

During discharge operation, the inverter generates same-phase voltages on each motor winding. Motor torque is canceled within the motor, allowing AC power extraction through the neutral point without motor rotation. PWM harmonics are filtered by additional passive components to produce sinusoidal AC power. During charging operation, power flows through the reverse path and the inverter controls battery charging in a manner similar to regenerative braking.

A prototype consisting of a 47 kW traction motor with a neutral-point output and a traction inverter was evaluated. Figures 2 and 3 show discharge test results. At a DC input voltage of 392.3 V, the system delivered 201.8 Vrms AC output at 3 kW and 50 Hz with a voltage THD of 2.0%, demonstrating sufficient power quality for a single-phase 200 V AC source. Similarly, during the charging test, stable 3 kW charging operation was achieved at an AC input voltage of 197.9 Vrms. The measured AC current was 14.95 Arms, the DC voltage reached 400.8 V, and the current THD was 5.7%.

The proposed built-in V2X system successfully demonstrated both charging and discharging operation using existing traction system components. The experimental results confirmed stable operation and acceptable power quality. Because only minimal additional hardware is required, the proposed architecture can significantly reduce the cost and complexity of conventional V2X systems and promote practical utilization of BEVs as distributed energy infrastructure.

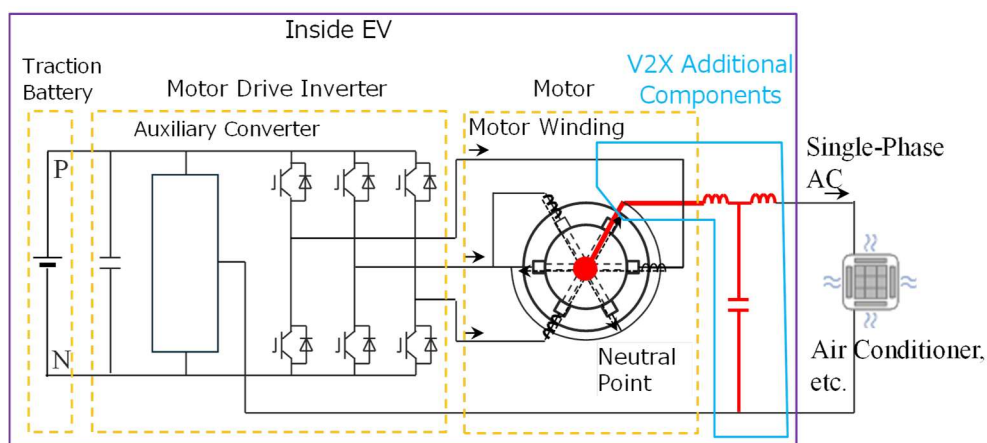


Fig.1 Proposed V2X System Configuration

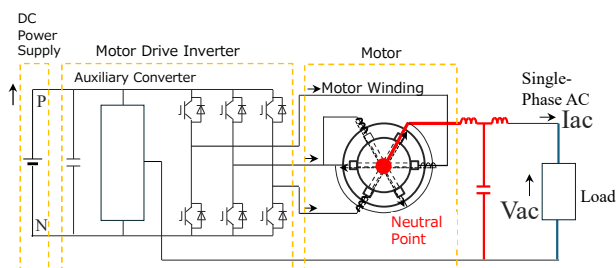


Fig.2 Discharge Evaluation Circuit

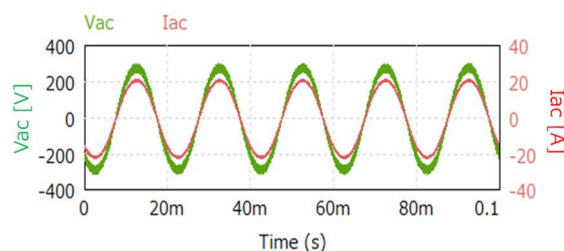


Fig.3 Discharge Evaluation Results