Technology Focus

Kikusui Enhances Efficiency of Power-Regenerating Units

Electronic loads serve primarily in tests of the characteristics of power supply units, and as loads for battery discharge. With conventional electronic load units, the built-in control semiconductor fully consumes the electricity from the power supply unit or battery as heat. Amid growing concerns about energy conservation in recent years, this consumption of electricity has become a questionable issue. In response, Kikusui Electronics Corp. has developed the PLZ6000R power-regenerative electronic load unit, which dramatically cuts its internal power consumption and allows significant energy savings by converting the electricity it receives into reusable electric power. It then regenerates the electricity into AC power lines.

Operating Principle

In an ordinary electronic load unit (Fig. 1), a control circuit and a control semiconductor govern the load current Iin. The control semiconductor within the unit consumes the electricity that the test artifact supplies to the electronic load unit Pin = Vx × Iin, and converts that electricity into heat.

In Kikusui's PLZ6000R power-regenerative electronic load unit (Fig. 2), the control circuit and switching elements (Q1 and Q2) control the load current Iin. A boost converter switches the electricity from the test artifact, increasing it to DC 370V, while a switching transformer isolates this electricity from the AC line. The three-phase inverter next transforms DC into AC, and then regenerates the electricity into the AC lines.

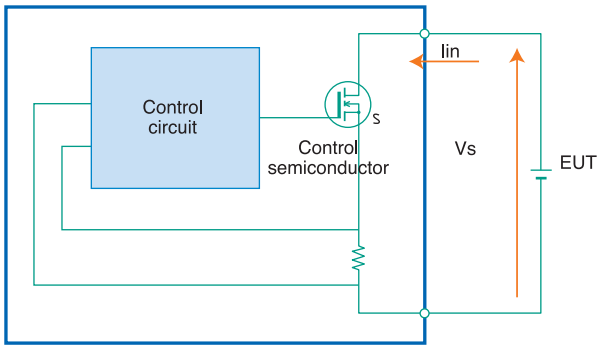

Fig. 1: Conventional electronic load unit

Substantial Savings

A discharge test for a 48V, 125A battery provides an example of how the PLZ6000R avoids wasting the electric power (Fig. 3) by returning the power to the AC line, instead of converting it to heat. In this way, Kikusui's power-regenerative electronic load unit significantly decreases power consumption.

Kikusui's PLZ6000R attains a regeneration efficiency of 85 percent, and can reach 90 percent at maximum. In the example with the 48V, 125A battery, the regeneration efficiency stands at about 88 percent. Therefore, 88 percent of the input electricity regenerates into the AC line, making the power available for use by other devices. Accordingly, the electrical

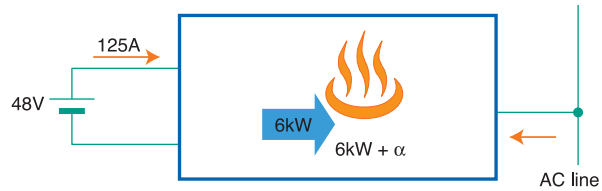

Fig. 3: Conventional electronic load unit

PLZ6000R power-regenerative electronic load unit by Kikusui Electronics Corp.

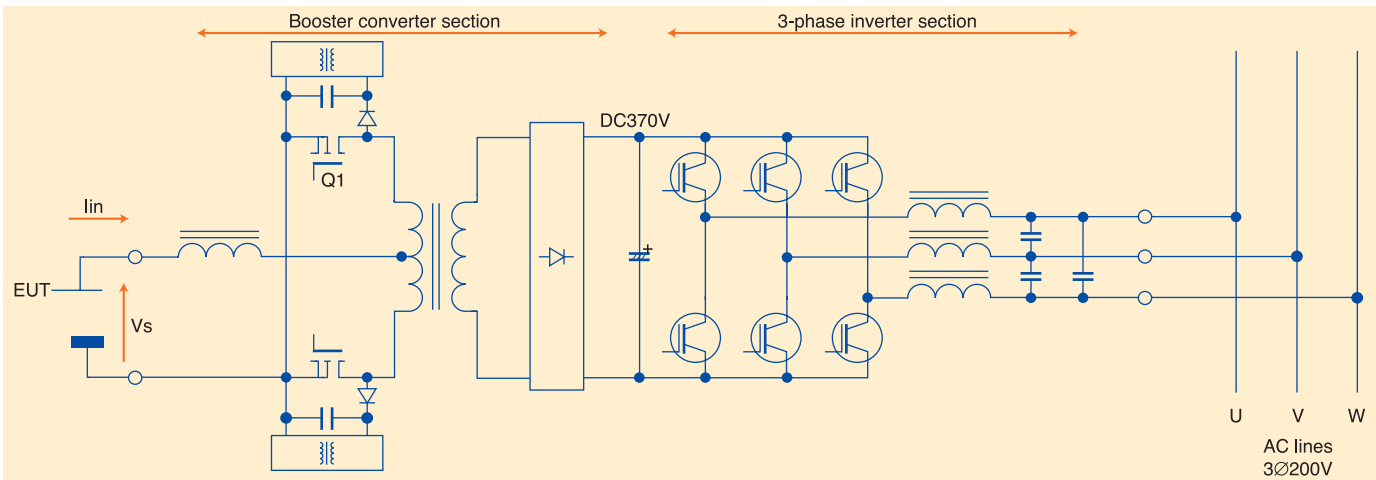

Fig. 2: The PLZ6000R

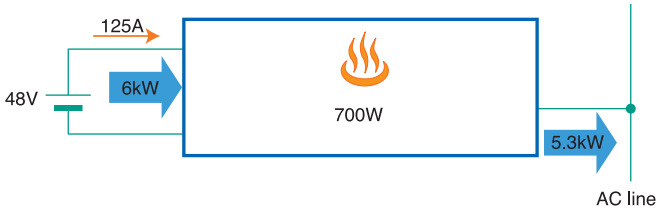

Fig. 4: Kikusui's electric power-regenerative electronic load unit

consumption of the load unit is roughly 700W, enabling a 5.3kW reduction in power consumption, compared to conventional electronic load units (Fig. 4).

Battery Tests

Another way to use the PLZ6000R is to incorporate it into a multiple-channel discharge system for lithium-ion batteries (Fig. 5). Kikusui uses the example of a system with 256 channels and a discharge capacity of up to 4A per channel.

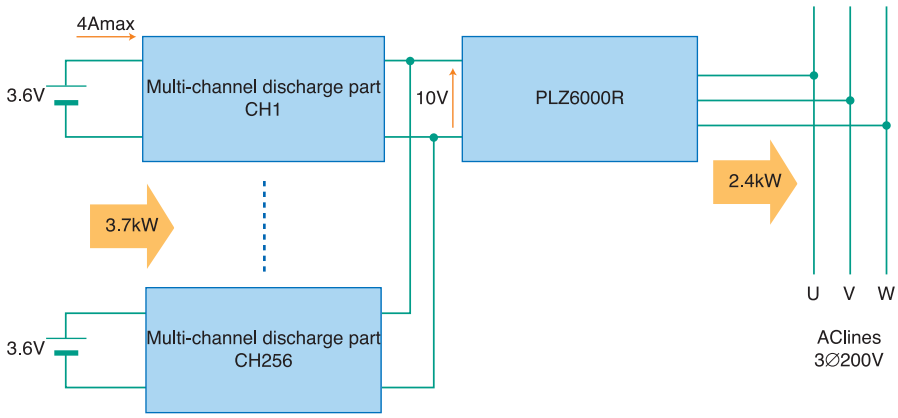

Fig. 5: The PLZ6000R in a multiple-channel discharge system

The multiple-channel discharge sections control the input current constantly on a channel-by-channel basis. Simultaneously, they raise the input voltage to a level that will allow the PLZ6000R to operate. This level generally is 3V for a 30V range. The multiple-channel discharge section provides constant-current output.

While the 256 channels of the discharge section connect in parallel, the PLZ6000R employs a serial connection. Operating in the constant voltage (CV) mode, the PLZ6000R serves as a shunt regulator. In Kikusui's example, the input voltage from the load stands at 10V. The PLZ6000R regenerates the electricity from the multiple-channel discharge section into the AC lines.

By using this configuration, the system can regenerate the electrical discharge from the batteries into the AC line. This enables a 65 percent reduction in the system's power consumption to about 1.3kW. For comparison, a conventional system consumes about 3.7kW. ❑