

## Power Conversion Modules

A total of ten Semikron Semistack RE half-bridge power conversion modules were procured under ONR DURIP Grant N00014-13-1-0829. The IGBT-based power modules can be used as independent 3-phase half-bridge converters (e.g. stand-alone rectifier or inverter) but a pair of modules can easily be assembled into a full 4-quadrant bi-directional power converter. The water-cooled modules are designed for flexible integration and are rated at 1.6 MVA at 1,250 V<sub>dc</sub> and 1,400 A. Figure 1 is a picture of the Semikron half-bridge module connecting the power system testbed's dc bus to the PFN charging power supply.



**Figure 1. Semikron Semistack RE half-bridge module connecting the dc bus to the PFN charging power supply.**

Control flexibility is a critical feature of the new power converters and the onboard controllers enable configuration of the modules for multiple functions. The NI-based control platform integrates a real-time processor, a user-configurable FPGA, and a full set of power electronics control and communication I/O. Simulation models developed will run on the FPGA board with clock speeds up to 40 MHz, enabling real-time emulation of power system components (e.g. energy storage or alternative power generation). Real time digital simulation and the Semikron power modules will be used to perform hardware-in-the-loop (HIL) testing in one of its several variants, e.g. control- or power-hardware-in-the-loop (CHIL or PHIL) at MW power levels, expanding considerably the range of experiments possible on the UT microgrid.