

## Used in water-based refrigeration unit

The refrigeration unit eChiller from Efficient Energy integrates Sieb & Meyer's SD2S drive amplifiers with Classical CAN and CANopen support. The chiller uses pure water as refrigerant and operates in a capacity range of 35 kW.



Refrigeration units are essential in server rooms and computing centers amongst others, without them the sensitive IT systems would overheat (Photo: Efficient Energy)

Important components of the eChiller are the frequency converters by Sieb & Meyer. They ensure operation of the turbo compressor in the rather unusual operating environment of a water vapor vacuum.

The eChiller technology is based on the following principles: direct evaporation, compression, condensation, and expansion of water or water vapor in a closed-loop cycle. The requirement-related process takes place in a vacuum at low pressures between 10 mbar and 120 mbar, in a temperature range of -5 °C to +50 °C. Essential components of the refrigeration units are turbo compressors with compressor wheels with a diameter of 15 cm. They operate at up to 90 000 rotations per minute and increase the pressure and temperature level of the water vapor. The turbo compressors are driven by synchronous motors which are powered by frequency converters.



The frequency converters of the SD2S series (left) are used in the eChiller refrigeration units (Photo: Sieb & Meyer)

Efficient Energy uses Classical CAN-based frequency converters of the series SD2S by Sieb & Meyer. "They even were installed in the first prototype from 2007," remembered Florian Mayer, Manager of Software and Electronics Development at Efficient Energy. Today the production model of the eChiller operates with a turbo compressor developed by Efficient Energy, however, the frequency converters remain the same. In order to enable implementation based on communication and device profiles, the CiA 301 and CiA 402 CANopen protocol respectively device profile were implemented.

"The used control method ensures an exceptionally low rotor heating. Additionally, the devices could always be adjusted to the changing requirements very well thanks to the flexibly configurable software," he added. The parameterization of SD2S can be adjusted to, for example, the relatively stable loads of the refrigeration units.



The eChiller operates in a capacity range of 35 kW using water as a refrigerant (Photo: Sieb & Meyer)

The SD2S's software enables the operation of dynamic servo motors and high-speed motors in asynchronous and synchronous technologies. Depending on the application, the converters can operate without a sensor, for example, in case of spindles in machine tools.

The converters can also be directly controlled by an external control device. The connection with the higher-ranking control can be established via various options – beside others a Classical CAN interface is available. The integrated control specifies the speed of the frequency converters during operation of the eChiller. This enables the turbo compressor to transport a sufficient volume of water vapor and thus achieve the required performance. Speaking of water vapor: "The turbine of the eChiller is operated in a water vapor vacuum which is an extreme operating environment. Hence, the unit's components have to withstand these extreme conditions," explained Ralph Sawallisch.

Currently both companies collaborate to optimize the frequency converter: A water cooling shall enable to operate the eChiller with the next smaller SD2S devices. For this purpose Sieb & Meyer adjusts the design of the serial device. If this adjustment proves to be effective, a follow-up project is possible: Efficient Energy would like to implement the frequency converter in the unit in the long run. This means that costs would be reduced, as the device would no longer be installed in a separate switch cabinet. "The requirement for this would be a modified design of the SD2S with a new board layout," explains Florian Mayer.

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