



CX9020 Embedded PC with measurement technology integrated as a modular I/O level

Integrated measurement technology for a power utility in western Switzerland

## EtherCAT Terminals reduce costs and ensure reliable grid management for power utility

Romande Energie SA, one of the five largest energy utilities in Switzerland, employs EL3453 power measurement terminals and other EtherCAT Terminals from Beckhoff in its substations to safeguard the availability of its grid. This is implemented with the help of a secondary data acquisition system that can compensate for partial or total failures of the primary acquisition path.

Romande Energie produces, distributes and sales electrical energy in the canton of Vaud and parts of the cantons Valais, Fribourg and Geneva. It is also in charge of the 125 kV grid as the distribution network operator. It serves more than 300,000 customers or roughly 500,000 people. The grid infrastructure comprises 45 transformer stations (high to medium voltage), 3,200 substations (medium to low voltage), 10,000 kilometers of power lines, and 720 kilometers of fiber-optic lines.

Romande Energy employs Beckhoff technology in its installations since 2017. According to the power utility, the main reason for this choice was the fact that the compact and affordable CX9020 Embedded PC provides the ideal platform for using StreamX®, a modular software gateway solution for power infrastructures. Romande Energie and Services Industriels de Genève developed StreamX® to standardize communication for the construction and operation of electrical substations. According to Romande

Energie, using its own gateway (based on StreamX® product) enabled it to simplify existing installations, cut back to a single engineering tool and standardize its applications. It was also able to do without several proprietary tools, resulting in significant cost savings. The long-term availability of Beckhoff products is also important for the implementation, says Romande Energie, because the substations have a life cycle of approximately 30 years.

### Secondary circuit for measuring power flows

Romande Energie manage its grid from a regional control center that monitors power flows around the clock. The transformer stations are controlled remotely via a proprietary communication network. Each substation continuously transmits its status and thus the status of the grid topology to the control center. To ensure the reliable distribution of power, the substations house intelligent devices for protective and control functions. If a fault occurs,



Project engineers Patrick Ducret and Gabriel Pelet of Romande Energie and Vincent Hauert from Beckhoff's Yverdon office (from left to right) in front of the high-voltage switching equipment.

these intelligent electronics devices interrupt the lines or make sure that the respective switching device operates in accordance with the command issued by the control center. They also transmit positions of circuit breakers and disconnectors along with measurements data such as voltage, current and various output values to the control center.

Since Romande Energie complies with the recommendations of the Swiss Power Companies Association regarding the availability of information and communication technology within the supply continuity framework, the transparency of the power supply grid must be ensured at all times, which required the installation of an emergency acquisition system. This secondary system, which runs on a fiber-optic loop and compensates for the partial or total failure of the main acquisition system, employs numerous EtherCAT I/Os from Beckhoff.

- EL1712-0020 (120 V DC) digital input terminals acquire the positions of the switches (power switches, disconnectors and circuit breakers), information from the alarm groups and watchdog signals.
- ES1008 (24 V DC, 3 ms) digital input terminals sample general signals such as information on the status of emergency services and the local substation administration (including status information about the 110 V DC distribution, fire alarm signals and the on-site staff).

The pluggable "ES" version of the EtherCAT Terminals has proven to be especially useful for Romande Energie in the design of protective housings and switching cabinets as well as during troubleshooting because the I/Os can be replaced without having to modify any wiring.

#### Power measurement terminals in high-voltage systems

EL3453 3-phase power measurement terminals operate in each of the utility's high-voltage modules, which are installed in line. With a measurement voltage of up to 690 V AC, the inputs are connected directly on the low voltage side

of the instrument transformers. In the high-voltage installations of Romande Energie, they supply measurements information such as current, voltage and power values as well as the direction of power flows.

In the past, corresponding measurements were only possible with transducers because the existing equipment did not support voltages and currents that came from the secondary side of the instrument transformers. The EL3453 eliminates these additional expenses. In addition, the EtherCAT power measurement terminals can withstand the kind of high currents that may occur during equipment malfunctions. The nominal current for measurement is normally 1 A, but it can rise to a maximum of 60 A for 1 second. The EL3453 saves costs not only by eliminating the need for transducers, but it also simplifies installation effort considerably. The bottom line: lower hardware costs, a standardized solution for high- and medium-voltage installations, and a single engineering tool for the entire control and data acquisition system for both the primary and the secondary channels.

#### Medium-voltage installations in the power supply grid

Medium-voltage systems (10 to 20 kV) feed into the district transformers that provide medium- and low-voltage power to the utility's end customers. Here, EtherCAT Terminals (ES1008) from Beckhoff transmit information (breakers and/or switches positions, earthfault and short-circuit detections) that the control center uses to manage the supply grid. They also provide the basis for grid status assessments as well as for managing power flows and analyzing emergencies. The ES2624 (125 V AC/30 V DC) relay output terminals are used to transmit commands for opening and/or closing switching devices (power switches and circuit breakers). Romande Energie does not employ power measurement terminals for its medium-voltage systems since its medium-voltage distribution grid requires very few measurements. Measurement devices that run under the Modbus or IEC 61850 protocol exist in a few cases, and they are fully supported by the EL6614 Ethernet switch port terminal.

#### Supporting the transformation in power supply

Fabian Assion, Product Manager I/O, Beckhoff: "The vast area of power supply is in transition and not only as a result of climate change. Rather, it is important to manage general and significant changes in electrical power distribution, and Beckhoff is committed to ensuring that this transformation is successful. In this respect, we will continue to adapt and expand our product portfolio to meet the needs of utilities and grid operators in particular. Measurement terminals with a 100 V interface are planned as a next step, for example, which are optimized for connection of voltage transformers for medium- and high-voltage installations."

More information:

[www.romande-energie.ch](http://www.romande-energie.ch)

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