

## TESTING WITH IEC 61850

The RTDS® Simulator is a real time power system simulator widely used for closed-loop testing of physical protection and control equipment. For over 15 years now, conventional protection equipment has been tested by driving power amplifiers (voltage and/or current) from the simulator's analogue output channels and by reading back the status of contacts for trip, reclose and other miscellaneous elements. Since the simulator operates in true real time, the protection equipment and the response of the simulated network are just as they would be in the real system. For example if a fault simulated in the network results in a trip being issued by the protection, a breaker in the simulated network will be opened and the subsequent voltages and currents affected correspondingly. The closed-loop response of the real time simulator also allows multiple relays to be connected simultaneously so their interaction can be evaluated.

To address the testing of IEC 61850 compliant protection equipment, RTDS Technologies has developed the GTNET card. Depending on the active protocol, the GTNET card can provide IEC 61850 GOOSE messaging or IEC 61850-9-2 sampled values for voltage and current.

### GTNET - Giga Transceiver Network communication card



The GTNET card occupies a single slot of an RTDS Simulator rack and draws power from the backplane. The card transmits and receives signals from a PB5 processor through one of the GT ports on the rear of the processor card. Other GT-I/O cards can be connected in daisy chain to the GTNET and serviced through the same PB5 GT port.

The Ethernet connection to the GTNET is provided by a 100Base-TX RJ45 port, or optionally by a 100Base-FX port with ST connectors located on the rear of the unit.

The GTNET is equipped a BNC coax that can accept or provide a 1PPS timing signal for IEC 61850-9-2 synchronization. It also has two ST optical connectors, one for receiving and one for transmitting a 1PPS signal optically.

## GTNET – GSE for IEC 61850 GOOSE Messaging



The GTNET-GSE firmware option for the GTNET card can be used to model 1-4 individual IEDs (Intelligent Electronic Devices). Each model is capable of sending and receiving up to 64 points (or 32 points with associated quality bitmap). For each GTNET card, GOOSE messages can be received from a total of 16 unique external IEDs. The GTNET GOOSE configuration is done via an SCD file. RSCAD contains a built in SCD editor which helps the user to easily and conveniently configure the publication and subscription of GOOSE messages.

IEC GOOSE fields such as the Test mode, Needs Commissioning and individual Quality bitmaps can be dynamically changed and monitored for both transmit and receive messages during a simulation to allow many scenarios to be thoroughly tested and verified. The GOOSE messaging provided by the GTNET card is KEMA certified.

## GTNET – SV for IEC 61850-9-2 Sampled Value Messaging

The SV firmware option provides IEC 61850-9-2 sampled value messaging for power system voltages and currents. The GTSYNC card is used to synchronize the SV timestamps with an external 1PPS (one pulse-per-second), IEEE 1588, or IRIG-B signal from a synchronized time source (ie. GPS clock). A 1PPS signal can also be generated directly from the GTSYNC card.

Two data streams with up to 4 current and 4 voltage channels each can be transmitted at a rate of 80 samples/cycle. Alternatively, one data stream can be transmitted at 256 samples/cycle. It is also possible to receive SV data from one Merging Unit (4 currents and 4 voltages) at either 80 or 256 samples/cycle.



## Interoperability

The GTNET-GSE and GTNET-SV options have been successfully tested with products from a number of different vendors. RTDS Technologies has also demonstrated closed-loop testing that included IEC 61850 GOOSE messaging and sampled values with multiple vendor products interoperating. RTDS Technologies has also participated in IEC 61850 Inter-Operation events along with major protective relay manufacturers where the RTDS Simulator and GTNET card were an integral part of the testing.