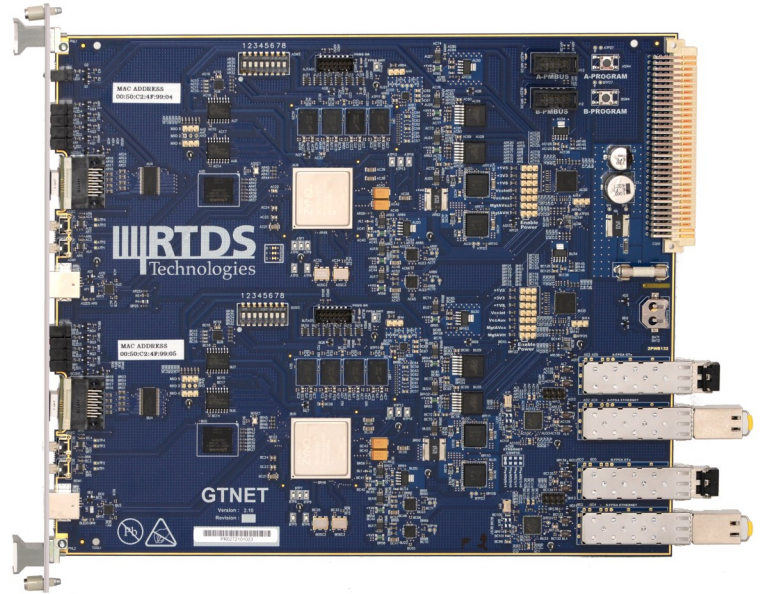


GTNETx2

The second generation Giga-Transceiver Network Communication Card, or GTNETx2, provides a real time communication link to and from the simulator via Ethernet. Different firmware versions are used with the GTNETx2 depending on the application. The different firmware versions available are described below.

Unlike other I/O cards that are rail-mounted, GTNETx2 is backplane-mounted (i.e. resides within the standard RTDS rack). It is powered from the backplane, but communicates with the rack through the GT optical port which is connected to a PB5 card.

Each GTNETx2 card has two modules. Each module has one Ethernet port, which may be equipped for one of three connection options: 100/1000 Copper, 100BASE-FX, or 1000BASE-SX.



Firmware Licensing

Each of the 2 GTNETx2 modules can have 1 active network protocol at any given time, which means each GTNETx2 card can operate a total of 2 network protocols simultaneously. This is a significant enhancement over the previous GTNET card, which could operate a maximum of 1 protocol at any given time.

When a firmware is purchased, the license is specific to a module on the GTNETx2 card. The user can install as many of the presently available network protocols on the GTNETx2 card modules as they desire. Of all the installed protocols on a given GTNETx2 card module, the user can select 1 to be active at any given time.

Included with the purchase of each GTNETx2 card are 2 network protocols – the new Socket ("GTNET-SKT") protocol, which is detailed below, and one additional user-selected protocol.

GTNET-SKT

The new Socket protocol, which is included with every GTNETx2 card, is used to interface with external software and physical equipment over a Local or Wide Area Network connection using Transmission Control Protocol (TCP) or User Datagram Protocol (UDP) sockets.

The communication is bidirectional and asynchronous. GTNET-SKT is capable of sending up to 300 data points per packet, with each point defined over 4 bytes. The data transmitted can be of either integer or floating-point (IEEE 754) type.

GTNET-GSE

The GTNET-GSE firmware option supports up to 4 TX/RX modules, which can be arranged to simulate 1-4 IEDs (i.e. 1 IED with 4 modules, 4 IEDs with 1 module each, etc.). Each module is capable of sending and receiving up to 64 points (or 32 points with associated quality bitmap). For each GSE firmware installed, 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.

GTNET-PMU

The PMU firmware option for the GTNETx2 provides P class or M class synchrophasor output data streams according to the IEEE Std C37.118.1aTM-2014. Two PMU streaming options are available for GTNET-PMU. Using the first option, a single GTNET-PMU can represent and provide output for up to eight (8) PMUs with symmetrical component information related to 3-phase sets of voltage and current using UDP or TCP connections. The reporting rate of each PMU can be set individually between 1 and 60 frames per second. Reporting rates as high as 240 frames per second are supported, but require the number of PMUs represented by one firmware to be a maximum eight. Note M class reporting rates are limited to 10 frame per second. Using the second option, a single GTNET-PMU can represent and provide output for up to twenty four (24) PMUs containing only positive sequence data. Frame rates up to the system frequency (50/60 Hz) are supported.

The GTNET-PMU component output is synchronized to an external 1PPS, IRIG-B or IEEE 1588 signal via the GTSYNC card.

GTNET-SV

The SV firmware option provides IEC 61850-9-2 sampled value messaging for power system voltages and currents. In order to timestamp the sampled values, a one pulse per second (1PPS) signal can be input to the GTNETx2 via a BNC coax connection or fibre optical port. Alternatively, the GTNETx2 can provide the master 1PPS signal to the IED(s) being tested.

One installed SV firmware, without using the GTSYNC card can provide sampled values for a maximum of eight signals (e.g. 4 x V and 4 x I) simultaneously. The sampled values are sent out from the GTNETx2 at a rate of 80 samples per cycle.

The new GTNET_SV9_v5 component is able to transmit up to two data streams for up to 4 current and 4 voltage channels at a rate of 80 samples per cycle, or one stream at 256 samples per cycle. The new component can also be configured to receive sampled data from one Merging Unit (4 x V and 4 x I) at either 80 or 256 samples per cycle. There must be a GTSYNC card present to synchronize the simulation timestep to an external time source to make use of the GTNET_SV9_v5 component.

In non-9.2LE mode, based on IEC 61869-9 and the Chinese National Standard for SV merging units, one GTNET-SV can publish 1 data stream for up to 24 voltages or currents at a rate of 80 samples per cycle, with < 10 μ s jitter between samples.

GTNET-DNP, -104

The DNP firmware option allows the GTNET to act as a DNP slave using the DNP 3.0 protocol. The 104 firmware option allows the GTNET to act as a 104 slave using the IEC 60870-5-104 protocol. DNP and 104 are SCADA protocols commonly used in substations.

For each DNP or 104 protocol operating, the GTNETx2 can communicate with one DNP or 104 master and accommodate the following maximum communication capacity:

- 1024 binary simulation status points (i.e. breaker positions) at scan rate of 1000 Hz
- 512 binary simulation control points (i.e. breaker commands) at scan rate of 1000 Hz
- 500 analogue status points (i.e. output from simulator) at scan rate of 10 Hz
- 100 analogue control (i.e. input to simulator) at scan rate of 10 Hz

The GTNETx2 card is part of our hardware exchange program. Customers on our maintenance program can exchange their GTNET card to receive a GTNETx2 at a reduced price. Learn more at www.rtds.com.

GTNET-PLAYBACK

The Playback firmware option is used to read large data files stored on a PC hard drive and allow them to be played back in an RTDS simulation. Sampling frequencies as high as 20 kHz can be maintained in a true real time simulation. Two components can be used with this firmware option, namely **rtds_risc_ctl_GTNETCOMTRADE** and **rtds_risc_ctl_GTNETPLAYBACK**.

The **rtds_risc_ctl_GTNETCOMTRADE** component allows COMTRADE files with up to 8 channels to be played back on the RTDS Simulator. Because the COMTRADE data file is stored remotely on a PC, file sizes of several GB can be handled easily. The component also allows for independent pre and post fault looping.

The primary application of the **rtds_risc_ctl_GTNETPLAYBACK** component has been to inject currents recorded at an actual installation (e.g. arc furnace or rolling mill) in a real time simulation. It is very difficult to accurately simulate the behavior of such installations so the recorded waveforms are often the best representation of the on site dynamics. By injecting the recorded current into the plant simulation, the performance of compensation equipment (e.g. SVC or STATCOM) can be accurately evaluated for the expected operating conditions. Simulation/playback times in excess of 30 minutes allow even the flicker (PST) reduction factor to be observed.