

The flagship GNSS simulator that grows with your needs

For DESIGN, VALIDATION and PRODUCTION

The history of Constellator™ started more than 20 years ago with the first simulator for Galileo. Its singularity lies in the **Real-time tight coupling of SDR (Software Defined Radio) and state-of-the-art RF Analog front-end.**

Today, RTGS4 represents Syntony's 4th generation of simulators for GNSS and LEO PNT. It has been designed to meet the highest requirements in terms of fidelity, performance, flexibility and ease of use.

Powerful & High-Fidelity

- ▶ Realtime, Multi-constellation and Multi-frequency GPS, Galileo, GLONASS, QZSS, NavIC (IRNSS), BeiDou, SBAS, Encrypted signals.
- ▶ Powerful with 1 200+ L1C/A equivalent signals
Simulate fully representative, high-density scenarios with Constellator's full potential.
- ▶ From simple trajectories to complex extreme dynamics
Create trajectories in seconds, on earth, in the air or even in space.
- ▶ Representing real-life imperfections
Error sources simulation: orbits, clocks, and ionosphere.
- ▶ Hardware-in-the-loop with zero effective latency
Even with 6 DoF, up to 10 000 Hz input rate.

Easy to setup and use

- ▶ Quick integration & Extended Remote Control
User-friendly GUI or remote control via API.
- ▶ Smooth hardware setup, ready for multi-antenna or multi-receiver
Interfaces: 10 MHz Clock reference (IN & OUT), triggers, PPS IN & OUT.
- ▶ Extensive documentation, scenario library available & local support
User guides, ICD, Python script examples & .xls tools for data structure.

Extremely configurable for advanced simulations

- ▶ Rich multipath and terrain obscuration, with one click presets
Leverage our library of customizable models (urban, suburban, highway...).
- ▶ All standard ionospheric & tropospheric models, Advanced 3D space dedicated models
UNB, Klobuchar, Nequick, Customizable grid.
- ▶ On the fly scenario modifications & extensive simulation options
Easily test the effect of perturbations to signals in real-time.
- ▶ Leverage extensive testing reports in realtime as a source of truth data
Leverage 25+ environment variables and 20+ variables per satellite in view.
- ▶ Ready for jamming and spoofing tests
Simulate up to 20 sources of jamming or spoofing, with configurable waveforms and signals.

Built to evolve with your testing requirements

- ▶ Scalable SDR architecture allowing continuous enhancements
New signals and features remotely updatable by software licence.
- ▶ Designing a new LEO PNT signal, or a cis-lunar PNT constellation?
As demonstrated at ION GNSS+ '22 with LEO PNT, Constellator is adaptable.

SPACE & DEFENSE



AVIATION



TELECOM & 5G



AUTOMOTIVE





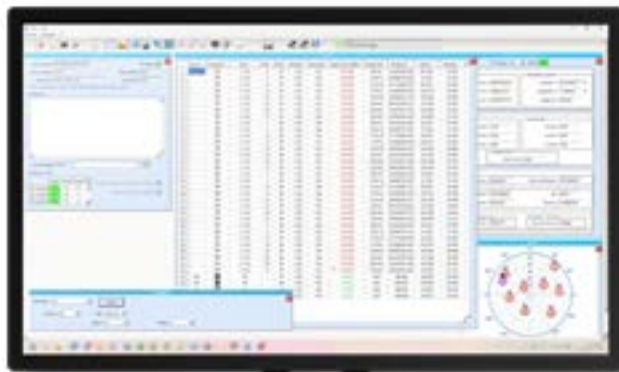
Constellator™

real-time multi-constellation & multi-frequency GNSS Simulator

A Comprehensive GNSS Simulation Solution

The Constellator family covers the full range of GNSS simulators tailored to address all use-cases. Available in three dedicated series, it can handle:

- ▶ **Constellator RF Series:** Conducted RF testing of single or multi-antenna receivers, including synchronized multiple receiver tests, from early R&D stages to Final Assembly Lines.
- ▶ **Constellator CRPA Series:** Specialized testing of CRPA receivers, with extreme phase synchronization and stability between RF outputs.
- ▶ **Constellator Anechoic Series:** Comprehensive testing in anechoic chambers for all types of GNSS devices.



SIMULATION

Constellations & Signals

| | |
|---------------|---|
| GPS | L1C/A, L1C, L2C, L5, L1P(Y), L2P(Y) |
| Galileo | E1, E5a, E5b, E6HAS |
| GLONASS | L1OF, L1OC, L2OF, L2OC, L3OC |
| OZSS | L1C/A, L1C, L2C, L5, L62 |
| NavIC (IRNSS) | L1, L5, S |
| BeiDou | B1I, B1C, B2a, B3I |
| SBAS | L1, L5 (EGNOS, WAAS, GAGAN, MSAS, SDCM, SNAS) |

| | |
|------------------|---|
| Specific signals | GPS L1P(Y) & L2P(Y), NavIC L5-RS & S-RS |
|------------------|---|

Performance

| | |
|---------------------------|--------------------------------|
| Computation power | 1 200+ (equiv. L1C/1A signals) |
| RF Channels | 3 or 6 |
| Simulation Iteration Rate | 1 000 Hz |
| HWIL Input Rate | up to 10 000 Hz |
| Relativistic Effects | ✓ |
| Pseudorange Rate | +/- 0.001 m/s |
| Pseudorange Accuracy | +/- 0.001 m |

SIMULATOR

Connectivity

| | |
|------------------------------|--|
| RF Output Connector | 3xSMA Mono-Band and 1xN Female Multi-Band or 6xSMA Mono-Band and 2xN Female Multi-Band |
| Int. 10 MHz Reference Output | BNC female |
| Ext. 10 MHz Reference Input | BNC female |
| External Trigger In/Out | BNC female, TTL Level, 5V DC, Configurable Timing & Pulse widths |
| PPS in, PPS out | BNC female, 1Hz rate, PPS-In 5 Volts, PPS-out 3.3 Volts, +/- 5 ns from RF output |
| GUI/Network Connector | RJ45 (1Gb/s) |
| Dedicated HWIL Connector | RJ45 (1 Gb/s) |
| PRN Link | RJ45 (10 Gb/s) |



HARDWARE

| | |
|---|--|
| Input Voltage Range | 100 to 240 V AC +/-10% |
| Input Frequency Range | 50 to 60 Hz |
| Power Consumption | 120 W |
| Operating Temp. Rang | 0 °C to +50 °C |
| Storage Temp. Range | -20 °C to +70 °C |
| Relative Humidity (Operating/Storage/Transit) | 10-93%, @ 40 °C, non condensing |
| Operating altitude | 5000 m |
| Shock (according to EN 60068-2-27) | Operating: 15 G 11 ms duration Non-operating: 30 G 11 ms duration |

RF FRONT END

RF Output

| | |
|--------------------|--|
| Frequency Range | From 1 100 MHz to 1 700 MHz and from 2 450 to 2 550 MHz |
| RF Bandwidth | 20 up to 200 MHz |
| RF Power (@50 Ohm) | From -55 to -120 dBm 0.1 dB resolution +/- 0.1 dB Power Accuracy |

| | |
|---------------------------|--|
| RF Signal Level (Jamming) | Up to +80 dB J/S with signal (S) reference power at -120 dBm |
|---------------------------|--|

| | |
|-------------|-------|
| Output VSWR | < 1.3 |
|-------------|-------|

| | |
|----------------|---------------|
| Supported VSWR | ∞ (permanent) |
|----------------|---------------|

RF Quality

| | |
|-----------------------|--------------------------|
| Harmonic Spurious | < -65 dBc min |
| Non-harmonic Spurious | < -55 dBc (SF dependent) |
| RMS Jitter | 104 fs |
| Group Delay Variation | < 15ns @ BW = 55 MHz |
| Group Delay Stability | < 10ps/°C @ BW = 55 MHz |
| Phase Noise | <5.10 ⁻³ |

Synthesizer - Internal 10 MHz Reference

| | |
|-----------|--|
| Signal | Sinus |
| Stability | 5.10 ⁻⁹ from +10°C to +40°C |
| Aging | 0.5 ppb/day and 50 ppb/year the first year, then 10 ppb/year |

| | |
|---------------------|-----------------------------|
| Allan Variance (1s) | 2x10 ⁻¹² |
| Noise Floor Level | < -193 dBW.Hz ⁻¹ |

Synthesizer - Internal 10 MHz Reference Output

| | |
|-----------|--------|
| Signal | Sinus |
| Impedance | 50 Ohm |
| Level | 6 dBm |

| | Standard Dynamics | Extended Dynamics |
|--------------|-------------------|-------------------|
| Altitude | No Limitation | No limitation |
| Acceleration | No limitation | No limitation |
| Velocity | < 600 m/s | No limitation |
| Jerk | No limitation | No limitation |

| | |
|---------------------------------------|--|
| Vibration (according to EN 60068-2-6) | Operating: 10-150 Hz: 1G/3 axis Non-operating: 10-150 Hz: 2G/3 axis |
| MTBF | > 50.000 hrs |



2U

430 x 88 x 510 mm
17 x 3.5 x 20 in

12 kg / 26.5 lb



4U

430 x 177 x 472 mm
17 x 7 x 18.5 in

20 kg / 44 lb

Each configuration comes with 1 Multi RF output and 3 Mono RF outputs, simulating 80, 240, 600 and 1 200+ L1C/A equivalent signals.

Up to 6 Mono RF and 2 Multi RF outputs can be added to RTGS4-14 and RTGS4-24 units (also known as RTGS4-PRO 6RF).

Base configurations

| Base configurations | | HIGH-END R&D | |
|---|--|--|---|
| PRODUCTION | | VALIDATION | |
|  |  |  |  |
| RTGS4-02 | RTGS4-12 | RTGS4-14 | RTGS4-24 |
| <ul style="list-style-type: none"> Standard 2U unit 80 signals Constellator Simulation Software 2 Constellations, 2 Bands | <ul style="list-style-type: none"> Standard 2U unit 240+ signals Constellator Simulation Software (Signals & Bands to be added individually) | <ul style="list-style-type: none"> Standard 4U unit 600+ signals Constellator Simulation Software (Signals & Bands to be added individually) | <ul style="list-style-type: none"> Standard 4U unit 1200+ signals Constellator Simulation Software (Signals & Bands to be added individually) |

Constellator's singularity lies in the **Real-time tight coupling of SDR (Software Defined Radio) and state-of-the-art RF Analog front-end**. Top-end processing performance and superior RF quality are met into a COTS solution offering maximum flexibility in simulation control.

Options

| | |
|--|---|
| Constellations | GPS, Galileo, GLONASS, QZSS, NavIC (IRNSS), BeiDou, SBAS systems |
| Frequency Bands | L1, L2, L5, L6, S |
| Specific Signals | GPS L1P, GPS L2P, NavIC L5-RS, NavIC S-RS |
| RTGS_Trajectory_Replay RTGS_Trajectory_Replay_High_Rate | Replay of user-defined trajectory, from file, up to 100 Hz / 10 000 Hz. Specific file format to configure a specific predefined user-defined trajectory. Conversion tool included. |
| RTGS_HIL RTGS_HIL_High_Rate | Live feed of user-defined trajectory and orientation, up to 100 Hz / 10 000 Hz. Allows full control of trajectory, in live, with zero-effective latency. |
| RTGS_Space | Allows altitude above 100 km. Includes interfaces to specify open loop orbital trajectories (Keplerian parameter or initial position & velocity). Trajectory propagation using 40th order gravitational model, atmospheric drag, lunar & solar gravitational perturbation, solar pressure. Space dedicated 3D extensions of all standard ionospheric models. |
| RTGS_Extended_Dynamics | Allows receiver trajectories with velocity above 600 m/s (requires Export Licence) |
| RTGS_Jamming | Up to 20 jammers with up to 10 signals each amongst: CW, Pulsed-CW, Spectrum-matching noise & Band-Limited Additional White Gaussian noise. Up to 80 dB J/S with shared RF Output. Up to 115 dB (resp. 130) with 40 dB C/N0 (resp. 25) on GNSS signal with specific RF Output. |
| RTGS_Spoofing | Up to 20 Spoofers with configurable source positions, spoofing positions, delay, RF power, list of signals, meaconing. |
| RTGS_Signal_Advanced_File RTGS_Signal_Advanced_Live | Interface to inject low level perturbations to signals (amplitude, delay, drift, phase offset), modelling advanced effects: all sorts of multipath, clock bias, drifts or noise, scintillation, radio occultation, and more. File: Effects are user-defined, and uploaded via a file in a specific format. Live: Effects can be injected in real-time by the user, during a simulation. |
| RTGS_PRN Link | Input card to inject spreading codes for encrypted signals (L1P(Y), L2P(Y), NavIC RS, or other signals on demand). |

The future of navigation is software

Since 2015, Syntony has become a leader in the GNSS industry. Syntony offers unique location solutions allying Software-Defined Radio (SDR) and state-of-the-art RF Analog front-end.

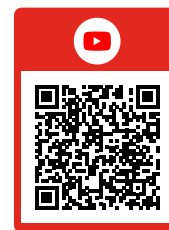
Easy to setup and use, Syntony solutions are built to evolve with the market needs, and inherit from 20 years of R&D and collaboration with high-demanding industries and administrations.

For more information

Visit our website:
syntony-gnss.com

Contact us:
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Safety Certifications
EN/IEC 61010-1:2010
ROHS, 2011/65/EU
NRTL UL 62368-1
CB IEC 62368-1

Emissions
EN 61326-1:2013
FCC Part 15 : 2016 – Verification
(Section 2.902 47 CFR)