



FoX Platform

3U SpaceVPX flexible avionics for LEO, MEO, GEO and cislunar applications

The high-performance FoX platform is a modular system of off-the-shelf modules, including Software/Firmware, to meet any need for your space electronics. Applications include spacecraft control, edge/payload processing, payload/robotics control, GNSS receiver, cloud computing and much more.

Key Features

- **Outstanding performance at competitive cost.** Beyond Gravity's innovative component selection and test approach based on decades of successfully building space equipment delivers "traditional space" reliability & quality at "new space" cost.
- **Guaranteed resilience and flexibility due to design dedicated to space applications**
- **Ethernet-based communication** facilitates redundancy and robustness at high data rates to ensure mission success.
- **3U SpaceVPX modular platform** allows you to scale the Fox Platform to match your mission's need.
- Designed for **10+ years** LEO, MEO and GEO

Standards Modules

- GNSS Rx Module
- Master Reference Oscillator
- Single-Board Computer
- Software Defined Radio
- Mass Memory
- Ethernet Switch
- GPU Module

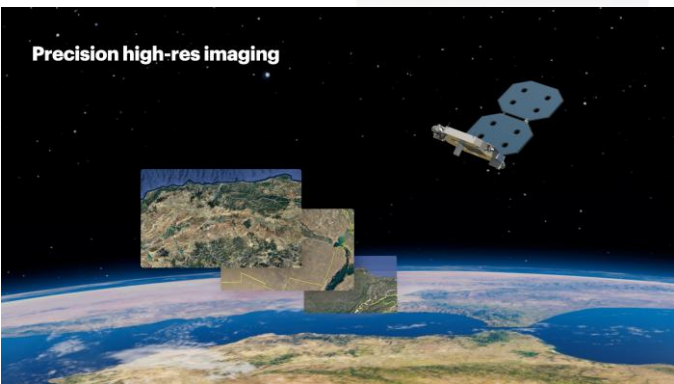
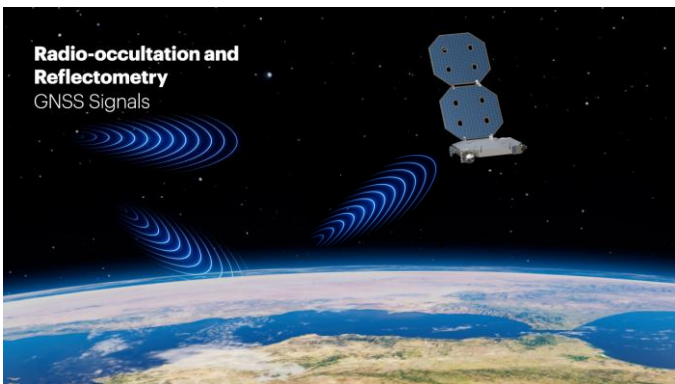
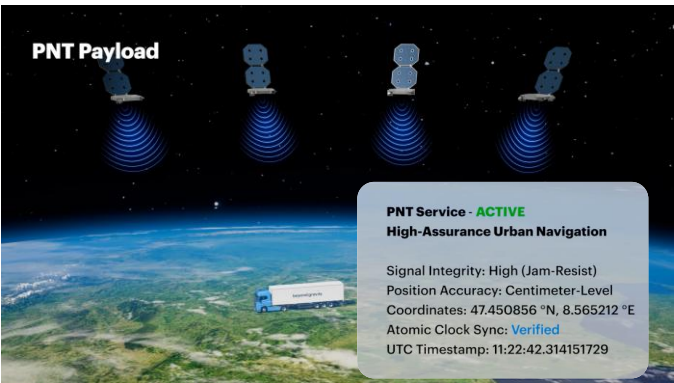
Radiation Tolerance

- All orbits suitable (additional shielding for long missions in challenging orbits)
- Latch-up free (53 MeV.cm²/mg)
- Component Total Ionising Dose (TID) > 36 kRad
- All memories with ECC
- Triple modular redundancy in FPGAs

Physical / Environment

- Operating temperature: -20°C to +60°C
- TID allows >10 years in LEO
- Random Vibration 15g RMS
- Shock 2000g @ 2000Hz

Example Applications

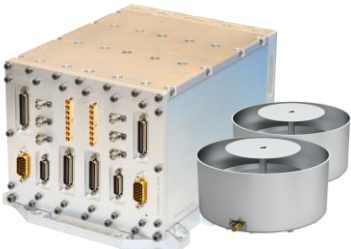


Example Configurations



FoX PNT

- **P**recise **N**avigation and **T**iming with software defined radio and single-board computer modules
- Flexible and scalable solution of FoX up to 15 slots
- Highly integrated solution



FoX NavROX

- GNSS Receiver functionality combined with master reference oscillator (MRO) module
- Autonomous clock discipline using GNSS time / atomic clock
- Exceptional short-term and long-term frequency stability of < 1 ppb



FoX NavRIX

- Dual frequency, dual antenna GNSS receiver
- LEO Precision down to 20cm/5ns
- Dual redundant in a single housing
- Resilient to jamming/spoofing



FoX Payload Processor

- Processing and control unit for payloads or robotics
- Spare slots for more processing power and/or mass memory



Units can be configured depending on the mission requirements.

All FoX Modules also available stand-alone upon request

FoX Module Details

FoX NavRIX (GNSS Receiver)

Key Features

- The NavRIX Pinpoint receivers rely on BG's proven [space heritage](#) and are [designed for space environments and long lifetimes](#), providing the highest [fault tolerance and availability](#) in the radiation environment encountered in orbit.
- [Flexible Software Defined Radio design](#) with all BG heritage building blocks unified in a single product allows adaption to the needs and requirements of different constellations or future missions even after launch.
- [Outstanding position, velocity & timing performance](#) of under 20cm 3D rms, < 1 mm/s, and < 5 ns rms applying Precise Point Positioning (PPP) technique (option)
- [Highest availability in flight](#) due to active mitigation of radiation effects in the design reducing performance outages to the bare minimum.
- The advanced dynamically filtered navigation solution implemented [guarantees resilience](#) and allows also for outstanding positional and timing performance [even during periods of GNSS outage](#).



Supported Signals	Time-to-first fix	Performance
- GPS L1 C/A - GPS L5 I/Q - GPS L2C - Galileo E1 B/C - Galileo E5a I/Q - Galileo E6	- Warm start typ. < 60s - Cold start typ. < 60s	- Position 3D rms < 0.2m (PPP) - Velocity 3D rms < 1mm/s (PPP) - Time 1 sigma < 5ns (PPP)

Data Products	Physical / environment
Navigation solution based on multi-frequency and dual-constellation (GPS/Galileo) measurements - Up to 2 independent PPS signals synchronized to GPS/Galileo Carrier & Code phase measurements for each tracked signal - Support Data: - Tracking state - GDOP - Carrier to noise (C/N0) measurement of each tracked signal - Noise measurements of each RF down conversion chain - Satellites in view status - Satellite navigation message	- Operating temperature: -20°C to +60°C - Total Ionising Dose (TID) allows >10 years in LEO - Power consumption: 5 W - Module mass: 435g
Interfaces	
2 antenna inputs - TC/TM: UART (RS-422) 2 PPS outputs (RS-422) - Primary power input 28 V unregulated (on/off command or autostart upon power application) - Up to 2 external clock inputs (opt)	

FoX Module Details

FoX MRO – Master Reference Oscillator

Key Features

- Master Reference Oscillator combined with GNSS Receiver
- Autonomous clock discipline using GNSS Timing
- Fallback to **Chip Scale Atomic Clock (CSAC)** timing during GNSS outages → 10x better accuracy during outages than without
- Exceptional short-term and long-term frequency stability of < 1 ppb



Performance

- Power consumption max. 24W
- Module mass: 480g
- Output Frequency 1MHz–500MHz
- Frequency stability: <1ppb
- Phase Noise (@10MHz):
 - 105 dBc/Hz @ 1Hz
 - 130 dBc/Hz @ 10Hz
 - 140 dBc/Hz @ 100Hz
 - 145 dBc/Hz @ 1kHz

External Interfaces

- Up to 8 CLK outputs (SMA)
- Up to 8 PPS outputs (SMA)
- 2 antenna inputs (SMA)
- 2 TC/TM: UART (RS-422)
- 2 PPS outputs (RS-422)
- 1 flexible primary power input (on/off command or autostart upon power application)

FoX Module Details

FoX Single-Board Computer (SBC)

Key Features

- High performance processor and a powerful FPGA for flexibility in terms of communication, interface and processing capability
- Quad Core ARM, > 20.000 DMIPS
- 4 GiB DDR processing memory with ECC
- 20 GiB non-volatile storage with ECC
- Extension modules available providing additional external interfaces allowing to meet every mission's need

External Interfaces

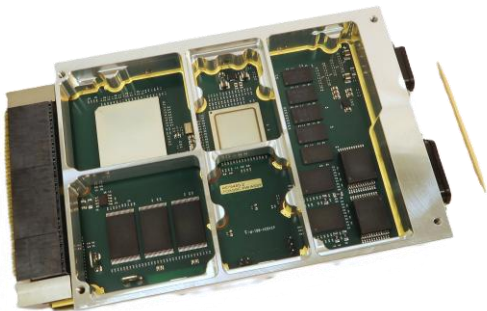
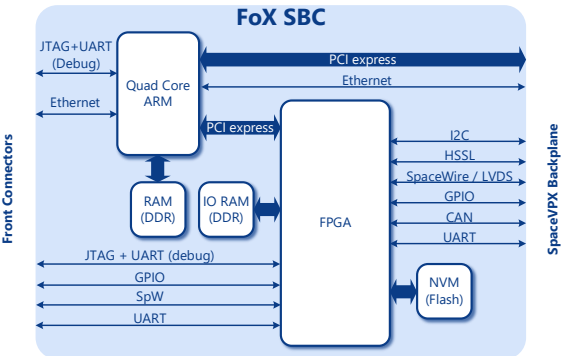
- | | |
|---------------------|-----------------------------|
| • 2 - 4x Ethernet | (1000BASE-T, 10/100BASE-TX) |
| • 2 - 4x SpaceWire | (LVDS) |
| • 2 - 4x UART | (RS422/485) |
| • 1 x MIL-STD-1553B | (optional, Nom + Red) |
| • 2 x CAN | (optional) |
| • Processor Debug | (UART + JTAG) |
| • FPGA Debug | (UART + JTAG) |
| • GPIO | (CMOS in/out) |

Backplane Interfaces

- | | |
|----------------|-------------------------------------|
| • 4x Ethernet | (1000BASE-KX) |
| • 2x PCIe | (Two 1-lane Root Complex functions) |
| • 4x HSSL | (4 general purpose lanes) |
| • 2x CAN | |
| • 2x SpaceWire | (LVDS) |
| • 2x I2C | |

Performance

- Power consumption <20W @ 1.2 GHz
- Power consumption <32W @ 1.8 GHz
- Module mass: 460g



FoX Module Details

FoX Mass Memory

Key Features

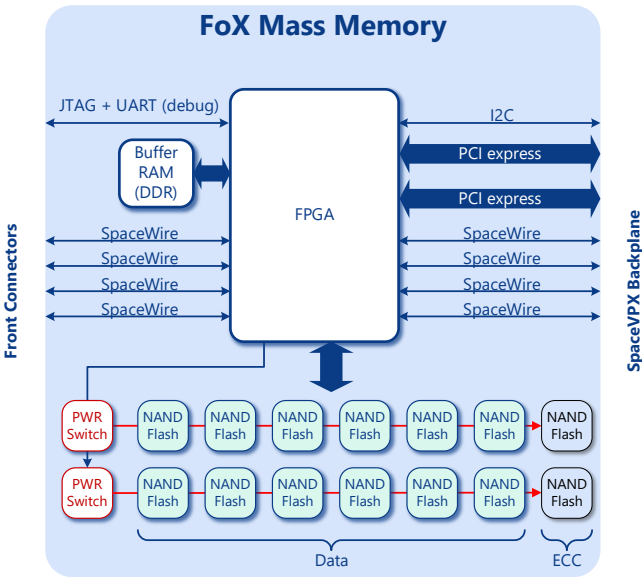
- 1 Terabit (EOL) mass storage
- Advances error correcting capabilities
- Fast access from FoX SBCs
- Prepared for future extensions
 - Direct storage from instruments, cameras etc.
 - Direct downlink to ground

External Interfaces

- 4x SpaceWire (LVDS)
- Debug (UART + JTAG)

Backplane Interfaces

- 2x PCIe EP (1-lane)
- 4x SpaceWire (LVDS)
- 2x I2C



Performance

- Power consumption max. 8.2W
- Module mass: 450g

FoX Module Details

FoX Software Defined Radio (SDR)

Key Features

- Versatile building block for FoX platform with generic and re-configurable hardware
- In-orbit reprogrammable SoC with multicore RISC-V processor
- 4 GiB DDR processing memory with ECC
- Additional 2 GiB DDR sampling memory
- 4 individual transmit paths and 4 individual receive paths with operation up to 12GHz

External Interfaces

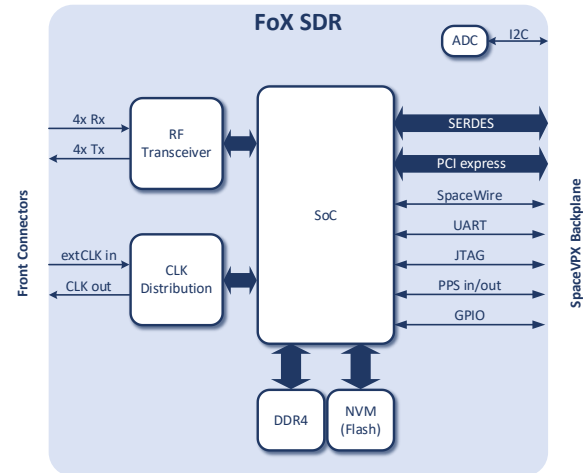
- 4x Tx paths
- 4x Rx paths
- CLK in & out

Backplane Interfaces

- 12x SERDES
- 2x PCIe
- 2x SpaceWire
- 2x UART
- 2x PPS in & out
- 1x JTAG & SPI
- 2x I2C

Performance

- Power consumption max. 38W
- Module mass: 460g



Please contact us:

All FoX Modules also available stand-alone upon request