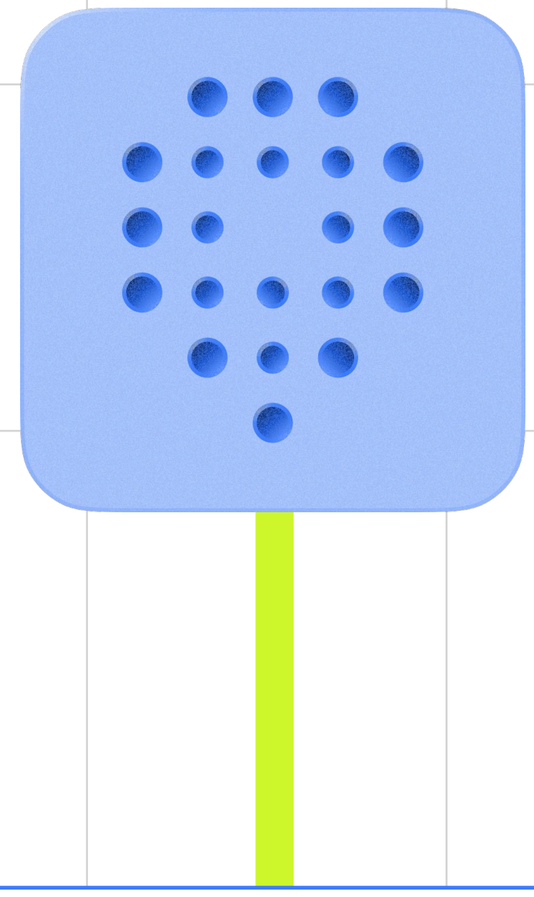
SOFTWARE-DEFINED GNSS FOR PRECISE, RESILIENT PNT ON PLATFORM COMPUTE

PpRx Precise Positioning Receiver



ABOUT

PpRx is Locus Lock's software-defined GNSS receiver for precise Positioning, Navigation, and Timing (PNT) in dynamic, degraded, and contested environments.

PpRx accepts digitized GNSS RF samples from compatible RF front ends and performs acquisition, tracking, signal processing, navigation, estimation, and threat-mitigation functions in software running on general purpose compute. By separating GNSS processing from specialized receiver hardware, PpRx can be deployed within existing compute onboard the target platform and adapted as signals, interfaces, operating requirements, and RF threats evolve.

PpRx supports single- and multi-antenna RF configurations and can be paired with compatible Locus Lock, COTS, or customer-specific RF front ends. When configured with multi-antenna RF inputs and inertial measurements, PpRx supports carrier-phase differential GNSS, heading and attitude estimation, and fused GNSS/inertial navigation.

The software-defined architecture enables additional signals, algorithms, interfaces, and threat-mitigation capabilities to be integrated through software rather than requiring a fixed-function GNSS hardware redesign.

DEPLOYMENT

PpRx is designed to deploy on the general-purpose compute and RF hardware already available within a platform architecture.

- Standard Deployment: PpRx runs on a supported Linux host with a qualified RF front end using an existing PpRx configuration, with integration support as needed.
- Custom Integration: Locus Lock can adapt PpRx to customer-specific RF hardware, host processors, operating systems, middleware, sample formats, bit-packing schemes, interfaces, and application architectures.

PpRx can be deployed as a native Linux installation, Docker container, or preinstalled on a Locus Lock-supplied host.

KEY FEATURES

- Software-Defined & Upgradeable: GNSS signal processing, navigation, and threat-mitigation capabilities can be configured and updated through software.
- Deploy on Existing Compute: PpRx's highly optimized GNSS signal processing chain enables real-time, low latency measurement and navigation solutions on resource-constrained compute. Due to its modulate, software-defined design, PpRx can be installed and run onboard general-purpose processors which already exist on the target platform.
- Flexible RF Hardware: Compatible with Locus Lock, COTS, and customer-specific RF front ends through configurable RF sample formats, bit packing, and data interfaces.
- Multi-Band, Multi-Constellation: Supports GNSS processing across multiple frequency bands and constellations, with additional signals and emerging commercial PNT constellations integrated through software.
- Multi-Antenna & Inertial Compatible: Supports multi-antenna carrier-phase processing and external inertial inputs for heading, attitude, and fused GNSS/inertial navigation.
- Resilient PNT: Anti-jam, anti-spoof, configurable signal processing, holdover, and rapid reacquisition capabilities support operation through degraded and contested GNSS conditions.

PPRX CAPABILITIES

- Real-time GNSS acquisition, tracking, and navigation processing
- Configurable RF front-end interfaces, sample formats, quantization, and bit-packing schemes
- Single- and multi-antenna RF configurations
- Real-time and post-processing operational modes
- Configurable static, dynamic, and high-dynamic navigation models
- Carrier-phase differential GNSS (CDGNSS) for multi-antenna precision heading and attitude estimation
- External IMU input for GNSS/inertial navigation
- Anti-jam capabilities, including direct-to-signal acquisition (e.g. direct-to-GPS L5, direct-to-Galileo E5a, etc.), configurable signal selection, and filtering
- Anti-spoof capabilities, including navigation-filter consistency checks
- PVT holdover and rapid GNSS reacquisition
- Custom input, output, middleware, and platform interfaces

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SUPPORTED SIGNALS

SUPPORTED GLOBAL SIGNALS

GPS	L1C/A, L1C, L2C, L5
GALILEO	E1B, E1C, E5a, E5b
BEIDOU	B1C, B2a, B2b

SUPPORTED REGIONAL SIGNALS

SBAS	L1
QZSS	L1 C/A

EMERGING COMMERCIAL LEO PNT CONSTELLATIONS

ADDITIONAL GNSS AND PNT SIGNALS THROUGH SOFTWARE INTEGRATION

RF FRONT-END COMPATIBILITY

PPRX ACCEPTS DIGITIZED GNSS RF SAMPLES FROM COMPATIBLE RF FRONT ENDS AND CAN BE CONFIGURED FOR DIFFERENT:

- SAMPLE RATES
- IF AND IQ FORMATS
- QUANTIZATION
- BIT-PACKING SCHEMES
- FREQUENCY PLANS
- CHANNEL CONFIGURATIONS
- SINGLE- AND MULTI-ANTENNA ARCHITECTURES
- CLOCK AND TIMING ARCHITECTURES
- HOST AND RF DATA INTERFACES

PPRX CAN BE INTEGRATED WITH LOCUS LOCK RF HARDWARE (SEE LEO200-D OR LEO200-S DATASHEETS), QUALIFIED COTS RF FRONT ENDS, OR CUSTOMER-SPECIFIC RF HARDWARE.

PPRX HOST COMPUTER REQUIREMENTS

BUILT FOR AVAILABLE PLATFORM COMPUTE

PPRX IS DESIGNED TO RUN ON GENERAL-PURPOSE COMPUTERS ALREADY AVAILABLE ON THE TARGET PLATFORM. LOCUS LOCK EVALUATION KITS (SEE LEO200-D OR LEO200-S DATASHEETS) ALLOCATE ADDITIONAL COMPUTE RESOURCES TO GUI VISUALIZATION, DATA COLLECTION, AND EVALUATION TOOLS; PPRX-ONLY DEPLOYMENTS OPERATE WITH SUBSTANTIALLY LESS RESOURCES.

SPECIFICATION	PPRX - ONLY	PPRX + GUI (EVALUATION KIT)
CPU	64-BIT, 1+ CORE, 1+ GHZ*	64-BIT, 4+ CORES, 1+ GHZ
RAM	100 MB*	2 GB
STORAGE	1 GB*	5 GB
USER INTERFACE	CLI / PROGRAMMATIC INTERFACES	GUI + CLI
OPERATING SYSTEM	LINUX-BASED PREFERRED	UBUNTU LTS
ARCHITECTURE	X86-64, ARM64, RISC-V	

*PPRX COMPUTE REQUIREMENTS ARE CONFIGURATION DEPENDENT AND VARY BASED ON ENABLED SIGNALS, CHANNEL COUNT, PROCESSING CONFIGURATION, AND RF DATA RATES.

SUPPORTED SENSOR INPUTS

PPRX CAN INCORPORATE EXTERNAL INERTIAL MEASUREMENTS FOR FUSED GNSS/INERTIAL NAVIGATION AND ATTITUDE ESTIMATION. SUPPORTED INTEGRATION ARCHITECTURES INCLUDE:

- EXTERNAL IMU MEASUREMENTS
- SINGLE-ANTENNA GNSS
- MULTI-ANTENNA GNSS
- GNSS + INERTIAL CONFIGURATIONS
- MULTI-ANTENNA GNSS + INERTIAL CONFIGURATIONS

SPECIFIC PERFORMANCE DEPENDS ON THE RF FRONT END, ANTENNA CONFIGURATION, CLOCK, INERTIAL SENSOR, ENABLED SIGNALS, AND OVERALL SYSTEM CONFIGURATION.

AVAILABLE OUTPUTS

NAVIGATION & GNSS DATA

GNSS OBSERVABLES

UNCORRECTED PSEUDORANGE, DOPPLER, CARRIER PHASE, AND C/N0, SIGNAL HEALTH, ATMOSPHERIC PARAMETERS, AND CODE BIASES

NAVIGATION SOLUTION

3D POSITION, 3D VELOCITY, CLOCK BIAS, CLOCK DRIFT, ANGULAR RATE, ACCELEROMETER AND GYROSCOPE BIASES

CONFIGURABLE SOLUTION & OBSERVABLES RATE	1 - 100 Hz

RAW SENSOR DATA

RAW RF	2-BIT IF SAMPLES, ~1.2 GB/min
RAW IMU & MAGNETOMETER MEASUREMENTS	~100 Hz

OUTPUT FORMATS & PROTOCOLS

GRID BINARY EXCHANGE (GBX), NMEA 0183, RINEX V2.11/V3.05, ROS2, MATLAB (.MAT), CSV (.LOG), KML, ASPN 2023

SOFTWARE DEPLOYMENT

DEPLOYMENT OPTIONS

NATIVE LINUX INSTALLATION, DOCKER CONTAINER, PREINSTALLED LOCUS LOCK HOST

INTERFACES

CLI, GUI AVAILABLE FOR EVALUATION AND DEVELOPMENT, CONFIGURABLE SOFTWARE AND MIDDLEWARE INTERFACES, CUSTOM CUSTOMER INTERFACES AVAILABLE

LICENSING

EVALUATION CHECKOUT/CHECK-IN LICENSING, TAILORED PRODUCTION LICENSING AVAILABLE

SUPPORTED SENSOR INPUTS

PPRX IS SOFTWARE DEPLOYED WITHIN A BROADER GNSS RECEIVER ARCHITECTURE. END-TO-END POSITIONING, TIMING, ACQUISITION, TRACKING, HEADING, AND INERTIAL-NAVIGATION PERFORMANCE DEPENDS ON THE RF FRONT END, ANTENNA CONFIGURATION, CLOCK, HOST CONFIGURATION, ENABLED SIGNALS, ENVIRONMENTAL CONDITIONS, AND AIDING SENSORS.

LOCUS LOCK CAN PROVIDE PERFORMANCE DATA AND CONFIGURATION GUIDANCE FOR SPECIFIC RF, COMPUTE, AND PLATFORM ARCHITECTURES.

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