

# u-blox GNSS module overview

Scalable positioning module families combine optimized cost/performance features with easy integration



## Product overview

u-blox offers a wide range of high-quality, scalable GNSS positioning modules based on the company's high-performance u-blox M8 and low-power u-blox 8 chip technologies.

u-blox GNSS modules are perfectly suited for vehicle, industrial and M2M applications, as well as mass-market consumer products with demanding size, cost and quality requirements. For telematics applications, each module provides easy integration with u-blox 2G, 3G and 4G cellular modules. This scalable module approach means u-blox GNSS modules provide exactly the right product variant to deliver the performance, ease of integration, cost and size required by today's as well as tomorrow's demanding applications.

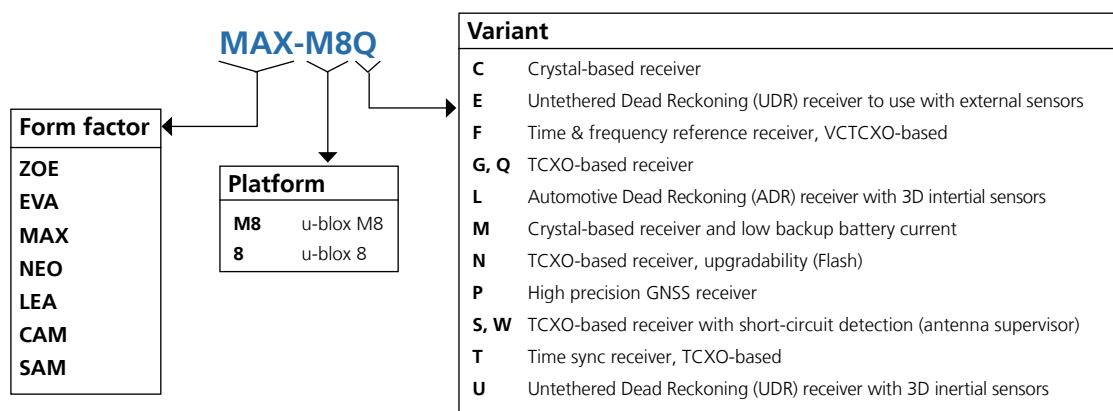
When upgrading a product for improved performance, lower cost or both, compatibility between module generations and variants is maintained. This ensures a smooth transition from older to newer designs, as well as between product variants to keep redesign costs minimal. This product philosophy enables lower R&D costs and protects the customer's investment.

## Key features and benefits

- u-blox products are available in three grades optimized for our primary market sectors: automotive, industrial (professional) and consumer (standard).
- Support of all available GNSS (GPS/QZSS, Galileo, GLONASS, BeiDou) and SBAS systems.
- Two platform offerings:
  - u-blox M8 concurrent GNSS for maximum performance
  - u-blox 8 single GNSS for power-sensitive usage
- u-blox GNSS modules require no host integration and are made to keep customer's eBOM to a minimum
- Variants to meet performance and cost requirements and for different levels of integration (e.g. with or without integrated antenna)
- Seamless operation with u-blox 2G, 3G, 4G cellular modules
- Globally available, free-of-charge Assisted-GNSS service for accelerated positioning in difficult environments
- Modules use u-blox's own AEC-Q100 qualified chips
- LCC modules are qualified according to ISO16750 standard
- Compatible with previous u-blox module generations of the same form factor

## Product selection

u-blox GNSS modules are available in different form factors and variants to provide flexibility for scaling GNSS solutions to different application requirements, such as cost, performance and level of component integration.



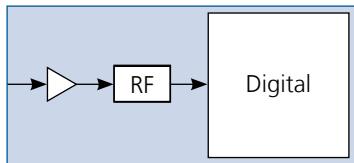
## Platform selection guide

u-blox 8 and u-blox M8 standalone GNSS modules support GPS/QZSS and GLONASS satellites plus all SBAS augmentation systems. u-blox M8 also supports BeiDou and Galileo satellites. Both platforms are optimized for keeping eBOM and system costs to an absolute minimum. u-blox RF-architecture provides good immunity performance (e.g. against cellular interference) without the need for an additional SAW filter in most applications. The selection of u-blox 8 vs. u-blox M8 modules is based on the following criteria:

### u-blox 8 single GNSS platform

Single GNSS reception is recommended for designs requiring competitive positioning and low system power. The u-blox 8 platform provides high sensitivity for positioning with fast acquisition times. Its sophisticated architecture ensures minimum power and competitive solution.

- ⇒ The economical choice for competitive performance and minimal power consumption in continuous mode

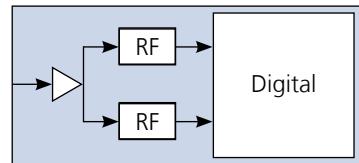


- GPS/QZSS or GLONASS
- –166 dBm Navigation sensitivity
- AssistNow Online
- AssistNow Offline (up to 35 days)
- AssistNow Autonomous (up to 6 days)
- Up to 18 Hz Navigation Rate
- Active CW jamming detection

### u-blox M8 concurrent GNSS platform

Concurrent GNSS reception is recommended for best performance with difficult antenna placement or weak/blocked signal environments. u-blox M8 modules process signals concurrently from up to three GNSS systems to increase the number of visible satellites for faster acquisition and more reliable positioning. They operate with industry leading –167 dBm navigation sensitivity.

- ⇒ The choice for maximum performance, especially in urban environments or difficult antenna placement



- GPS/QZSS, Galileo + GLONASS or BeiDou
- –167 dBm Navigation sensitivity
- AssistNow Online
- AssistNow Offline (up to 35 days)
- AssistNow Autonomous (up to 6 days)
- Up to 10 Hz Navigation Rate (18 Hz in single GNSS mode)
- Active CW jamming detection

## Form factor selector guide

Form factor		Variant											Grade		
		Crystal-based Optimized for cost sensitive applications			Crystal or TCXO-based		TCXO-based Optimized for performance					VCTCXO -based			
Module	Distinguishing features	C	M	U	L	P	E	N	G/Q	T	S/W	F	Standard	Professional	Automotive
<b>ZOE</b>	Industry's smallest multi-GNSS module; superior performance														
<b>EVA</b>	Minimal system cost; miniature form factor						UDR with external sensors								
<b>MAX</b>	Variants for performance, cost, and antenna integration requirements											short-circuit protection			
<b>NEO</b>	Versatile HW connectivity (USB, UART, SPI, I <sup>2</sup> C) for easier integration			UDR 3D inertial sensors	ADR 3D inertial sensors	High precision		Flash, additional SAW, LNA	additional SAW, LNA	additional SAW, LNA					Orange
<b>LEA</b>	For migration from existing LEA designs										additional SAW	additional SAW, short-circuit protection	additional SAW, LNA		
<b>CAM</b>	Concurrent GNSS module with integrated chip antenna in LCC package	additional SAW, LNA							additional SAW, LNA						
<b>SAM</b>	Concurrent GNSS module with integrated patch antenna in LGA package								additional SAW, LNA				Blue		

## Standard precision GNSS positioning and more

In addition to the wide selection of **standard precision GNSS** modules, the u-blox portfolio offers specialized modules.

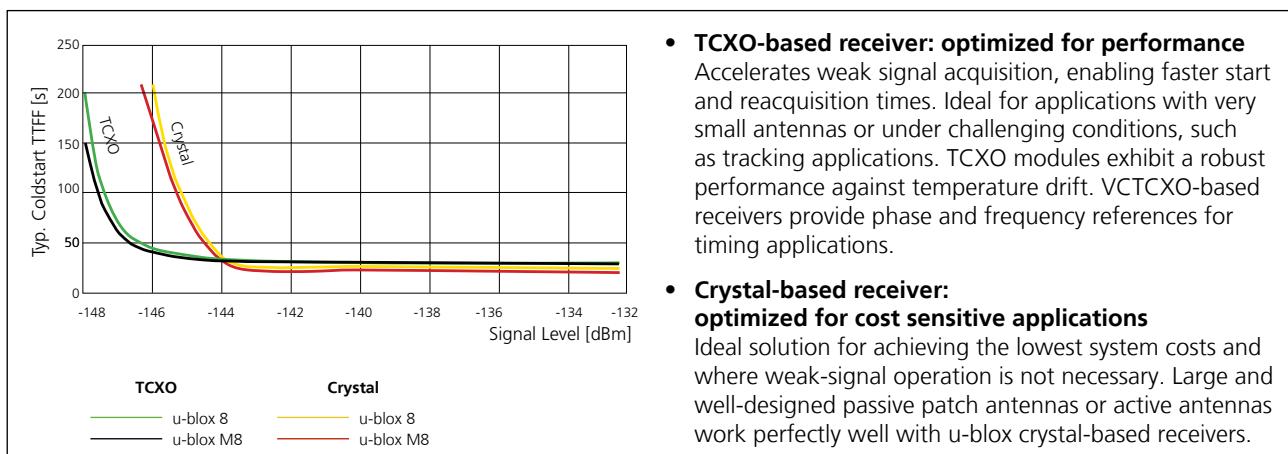
**High precision GNSS** modules provide accuracy to within at least a meter. The NEO-M8P, with centimeter-level accuracy, uses Real Time Kinematic (RTK) technology to achieve the GNSS performance needed for unmanned vehicles and other applications requiring accurate guidance.

**Dead reckoning** modules combine GNSS with measurements from sensors to deliver continuous, accurate positioning for road-vehicles in cities, tunnels and parking garages. NEO-M8L (ADR) uses speed information from the vehicle to provide the most accurate navigation performance. NEO-M8U (UDR) operates independently of any vehicle connection, perfect for after-market applications. Both modules include built-in inertial sensors and offer real-time outputs for interactive displays. The ultra-compact EVA-M8E (UDR) also operates independently of any vehicle connection, and works with external sensors.

**Timing** modules bring better phase stability in fixed locations and under poor signal conditions along with integrity measures and alarms. The multi-GNSS NEO-M8T and LEA-M8T PPS modules support a wide range of infrastructure and general purpose applications. The LEA-M8F provides a self-contained frequency and phase reference with hold-over for cost-sensitive network-edge equipment including wireless small cells.

## GNSS oscillator selector guide

u-blox GNSS modules are available in crystal and TCXO versions to meet different performance and cost requirements. Oscillators used in u-blox modules are selected and screened for stability and against frequency perturbations across the full operating temperature range,  $-40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$ , and up to  $+105^{\circ}\text{C}$  for NEO-M8Q-01A automotive grade modules. The high reliability of u-blox modules is due in part to stringent selection and qualification of critical parts such as GNSS oscillators.



- **TCXO-based receiver: optimized for performance**

Accelerates weak signal acquisition, enabling faster start and reacquisition times. Ideal for applications with very small antennas or under challenging conditions, such as tracking applications. TCXO modules exhibit a robust performance against temperature drift. VCTCXO-based receivers provide phase and frequency references for timing applications.

- **Crystal-based receiver:**

**optimized for cost sensitive applications**  
Ideal solution for achieving the lowest system costs and where weak-signal operation is not necessary. Large and well-designed passive patch antennas or active antennas work perfectly well with u-blox crystal-based receivers.

## Choosing the right module

u-blox 8 and u-blox M8 modules integrate a sophisticated RF-architecture and interference suppression for maximum performance, even in GNSS-hostile environments. The combination of this advanced RF-architecture and low noise figure allows connection of either a passive antenna or an active antenna directly to the module without compromising immunity performance.

When small size is crucial, any ZOE, MAX or EVA module is a good choice. ZOE-M8G, u-blox's smallest GNSS module, is a fully integrated, complete solution for minimal design effort. EVA modules are ideal for extremely compact and cost-sensitive applications. MAX-M8W is ideal whenever active antenna short-circuit detection and protection are required, which is typically the case with device-external active antennas. For devices with internal active antennas, all modules work well in the presence of moderate jamming (e.g. with a cellular module as long as the transmitting antenna is at least 10 cm away from the GNSS antenna).

All modules, with the exception of MAX-M8W, are suitable for passive antennas. ZOE-M8G is particularly suited for passive antennas due to the embedded SAW/LNA. For EVA-8M, EVA-M8M, EVA-M8Q with passive antennas, external SAW and LNA are recommended. Incorporating SAM and CAM into customer designs is simple and straightforward, thanks to the embedded antenna and integration of all RF components for best RF performance and robustness even in hostile jamming environments. The CAM-M8 series provides wide-band reception capability across the whole L1 band, ranging from BeiDou 1560 MHz to GLONASS 1608 MHz, which is not possible with traditional patch antenna solutions. SAM-M8Q is ideal for customers who have neither the required RF expertise nor time to design an antenna.

NEO-M8N/Q modules provide more flexibility for the antenna layout and location. They work particularly well with small passive antenna design (e.g. 15 x 15 mm), thanks to the lower noise figure and higher outband immunity, which improve reception in hostile environments. If a cellular antenna is in very close proximity to the GNSS passive antenna (e.g. on the same board), an extra SAW may be needed in some cases. For more hardware design information, consult the u-blox module's hardware integration manual.

# Why choose a u-blox GNSS module?

## Module form factor consistency

When it comes to modules, u-blox adheres to a core design philosophy: maintain form factor and compatibility to allow customers to easily upgrade their products with each new generation of u-blox positioning modules. The key benefit is simple: customers do not need to keep changing their PCB designs whenever u-blox introduces an improved version of a module product. Simply drop in the next generation module on the existing PCB and start testing!

## In-house GNSS chip technology

u-blox's in-house GNSS chip design expertise and end-to-end management of the entire IC and module manufacturing processes gives u-blox full control over features, quality and production. This enables u-blox to react quickly to customer requirements. Being independent of third party GNSS chip suppliers means u-blox offers customers exactly the right feature set, chip and module options, smooth upgrade path, excellent and highly competent support, technology know-how, and a clearly defined and transparent product roadmap extending years into the future.

## Product variants optimized for every antenna configuration

u-blox offers by far the widest range of GNSS modules in the industry, addressing all customer needs at competitive price points. These surface-mount components are complete GNSS receivers with either integrated antenna for easy integration or scalable antenna input for more flexibility of the antenna placement. The variants include modules allowing firmware upgrade, modules for time and frequency synchronization, dead reckoning modules and high precision GNSS modules. Each module results in a complete, high-performance, easy-to-integrate solution, which enables fast time to-market, easier active and passive antenna integration, and minimal eBOM and simplified logistics.

## Automotive quality and reliability

- u-blox design-centers and manufacturing sites adhere to the industry's strictest standards: ISO/TS 16949, ISO 9001, ISO 14001 and ISO/IEC 80079-34 quality standards
- Zero PPM Program for u-blox automotive grade modules
- Zero defect strategy (including testing of functions within tolerance, ongoing reliability tests, X-Ray inspection)
- Stringent product change and end-of-life notification process with advance information
- Our LCC modules have extended ISO 16750 qualification, are automotive end-of-life (ELV) compliant, and use GNSS chips qualified according to AEC-Q100
- In-house reliability lab for fast failure analysis and implementation of corrective actions
- Performance qualified across the full operating range
- Reliable firmware with low release frequency philosophy allows shipping most u-blox products as ROM-based
- Flash-based products are intended for upgrades to future features, and not for correction of bugs!

## u-blox is a reliable supplier

- Lowest component failure rates in customer production and in the field
- Very short delivery lead time due to multiple locations of well stocked products
- Flexible, responsive delivery for small, medium and high volume shipment
- Financially solid company
- Global support network with excellent and highly competent local support
- Fast and convenient availability of samples and kits – samples and pre-production quantities can be purchased directly from our online shop: [www.u-blox.com/online-shop](http://www.u-blox.com/online-shop)

## Evaluation kits: take the next step

u-blox provides comprehensive, easy-to-use evaluation tools and kits for gaining familiarity with u-blox 8 or u-blox M8 positioning products, and to evaluate functionality and visualize GNSS performance.

- **u-center:** Powerful GNSS receiver evaluation software for Windows; free-of-charge, [www.u-blox.com/product/u-center-windows](http://www.u-blox.com/product/u-center-windows)
- **Evaluation kits and application boards:** See the list at [www.u-blox.com/evaluation-kits-and-development-boards](http://www.u-blox.com/evaluation-kits-and-development-boards)

Evaluation kits and application boards can be ordered from our [online-shop](http://www.u-blox.com/online-shop) – get one today!

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For support information, visit our website at: [www.u-blox.com/support](http://www.u-blox.com/support)