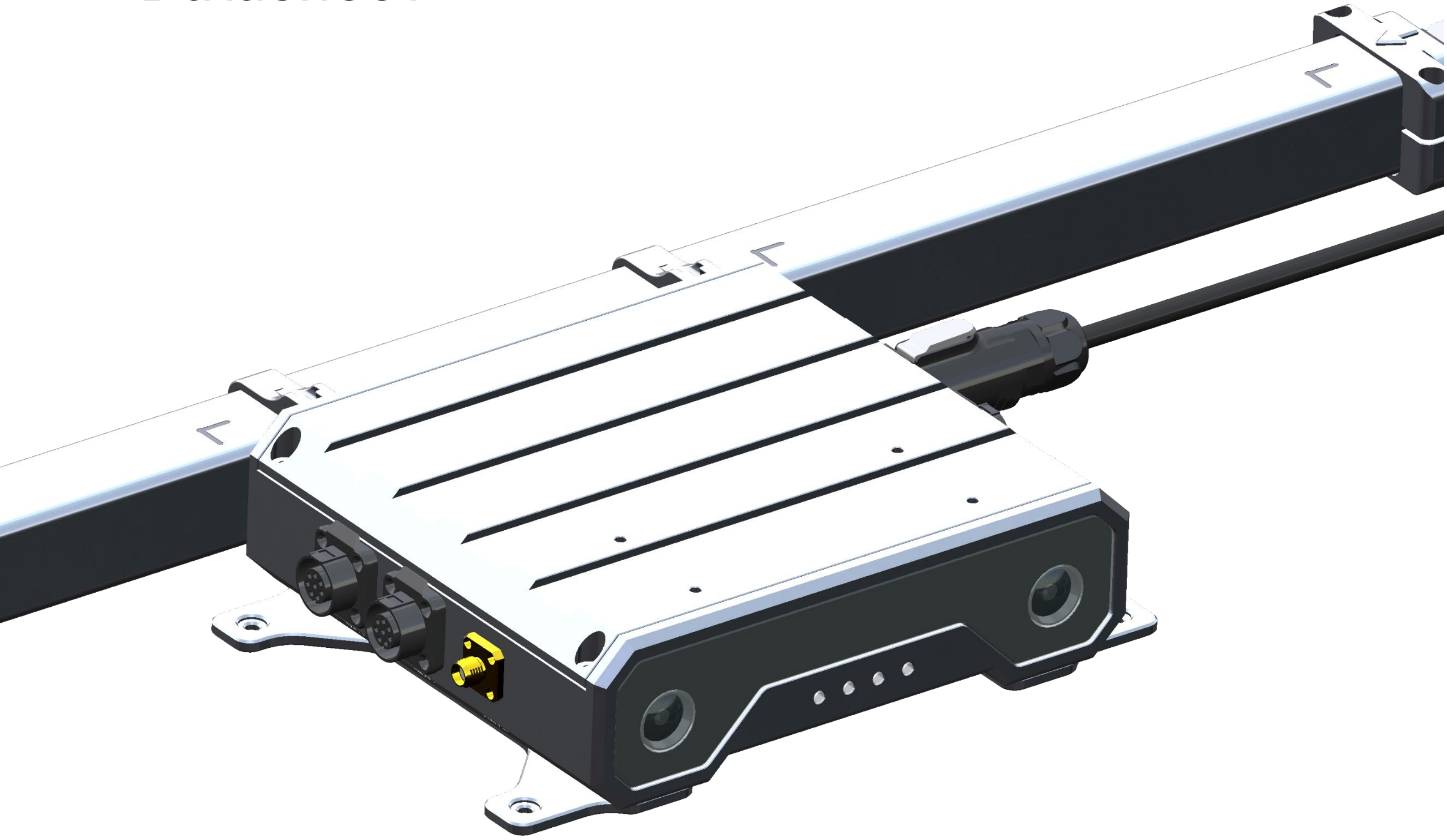
MagLoc

Absolute Positioning System

Datasheet



Reliable localization for autonomous robots in GPS-denied environments.

Product Summary

MagLoc is an innovative localization solution designed for mobile systems operating in challenging environments. It offers a compelling alternative to SLAM-based approaches, delivering robust, accurate, and cost-effective positioning where GPS and conventional signals are unavailable or unreliable.

Unlike infrastructure-dependent solutions, MagLoc operates without the need for additional positioning installations. It integrates advanced multi-sensor calibration and fusion technologies to ensure consistent accuracy and reliable performance across diverse environments and all-weather conditions.

The MagLoc positioning system consists of a powerful **MagLoc Core Unit** and a high-precision **MagLoc Sensing Bar**. The system is scalable, supporting up to 10 sensing bars per deployment. Each sensing bar incorporates multiple magnetometers and 6-axis IMUs to capture rich environmental and motion data. The Core Unit, powered by proprietary MagLoc algorithms, processes and fuses these data streams to output real-time position, velocity, and orientation.

With advanced sensor fusion, MagLoc achieves positioning accuracy of up to **5 cm**, even in geometrically degraded or GPS-denied environments. The system supports output rates of up to **100 Hz**. Featuring a compact Core Unit form factor (175 × 130 × 45 mm), MagLoc is well-suited for a wide range of applications, from indoor AGVs to mid- and large-scale ground robotic platforms.

Key Features:

- Infrastructure-free absolute localization
- Up to 5 cm positioning accuracy
- Robust operation in GPS-denied environments
- Multi-sensor fusion architecture
- Scalable sensing bar deployment
- Up to 100 Hz localization output
- Support for optional LiDAR and stereo cameras

Document Information

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Contents

1 Product Overview

1.1 Introduction

MagLoc is a **high-performance absolute positioning system** designed for autonomous mobile robots operating in challenging indoor and outdoor environments.

By combining distributed magnetic sensing, inertial sensing, LiDAR, and advanced multi-sensor fusion algorithms, MagLoc delivers **reliable real-time centimeter-level localization** without requiring external positioning infrastructure.

The system is optimized for industrial robots, AGVs, autonomous forklifts, and large-scale robotic platforms operating in GPS-denied or geometrically degraded environments.

1.2 Key Features

- **Infrastructure-Free**: No reflector/beacon/QR-code required
- **High Accuracy**: Up to 5 cm positioning accuracy
- **High Reliability**: Robust against lighting and texture changing
- **Modular Architecture**: Flexible and scalable sensing bar deployment
- **Multi-sensor fusion architecture**: Support optional LiDAR and stereo cameras
- **Real-Time Output**: Up to 100 Hz localization output

1.3 Typical Applications

- **AGV/AMR**
- **Warehouse Robotics**
- **Industrial Mobile Platforms**
- **Delivery Robots**
- **Smart Agriculture**

2 System Architecture

2.1 Architecture Diagram

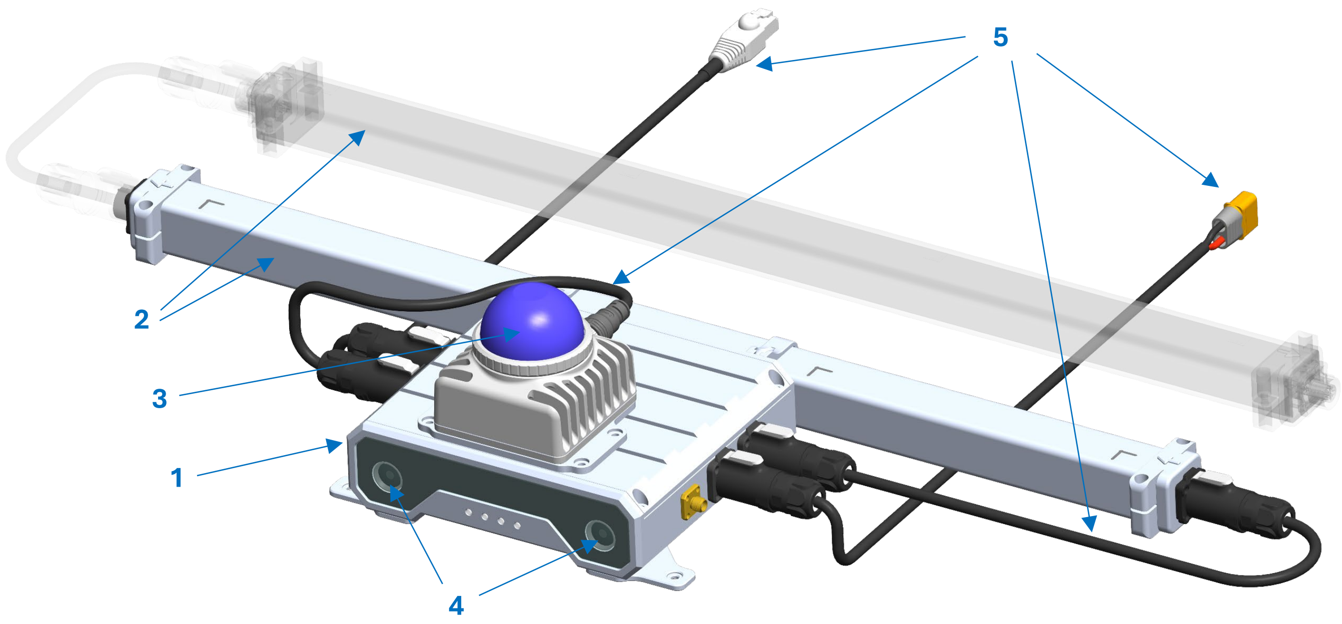

Figure 1 MagLoc System Architecture

2.2 System Components

Num	Component	Description
1	MagLoc Core Unit	Central processing module, on-board computing
2	MagLoc Sensing Bar	Distributed and scalable magnetic sensing module
3	LiDAR (Optional)	Optional sensor for higher precision profomance
4	Stereo Camera (Optional)	Optional sensor for higher precision profomance
5	Cable Set	LP12 cable set (Mag cable, LiDAR cable, Ethernet cable, Power cable)

3 Hardware Overview

3.1 MagLoc Core Unit

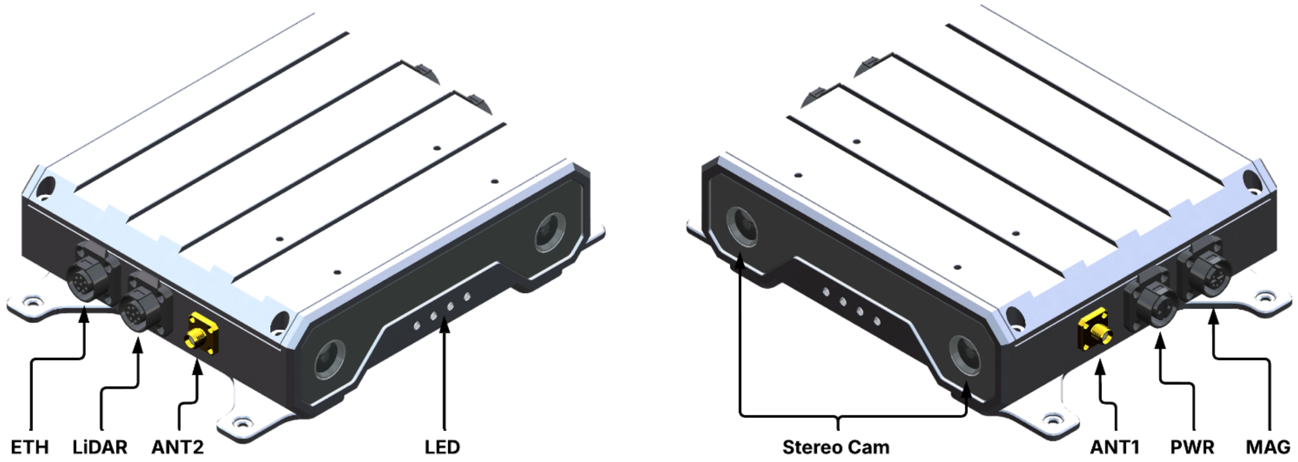

Figure 2 MagLoc Core Unit ports

Number	Label	Description
1	ETH	1000Mbps Ethernet port to connect to user's PC for data output
2	LiDAR (Optional)	M12 connector to an optional embedded Livox MID360
3	MAG	M12 connector to MagLoc Sensing Bar
4	PWR	M12 connector to DC power input
5	ANT1 (Reserved)	Reserved antenna
6	ANT2 (Reserved)	Reserved antenna
7	LED	Status indication LEDs
8	Stereo Cam (Optional)	Optional embedded stereo cameras

3.2 MagLoc Sensing Bar

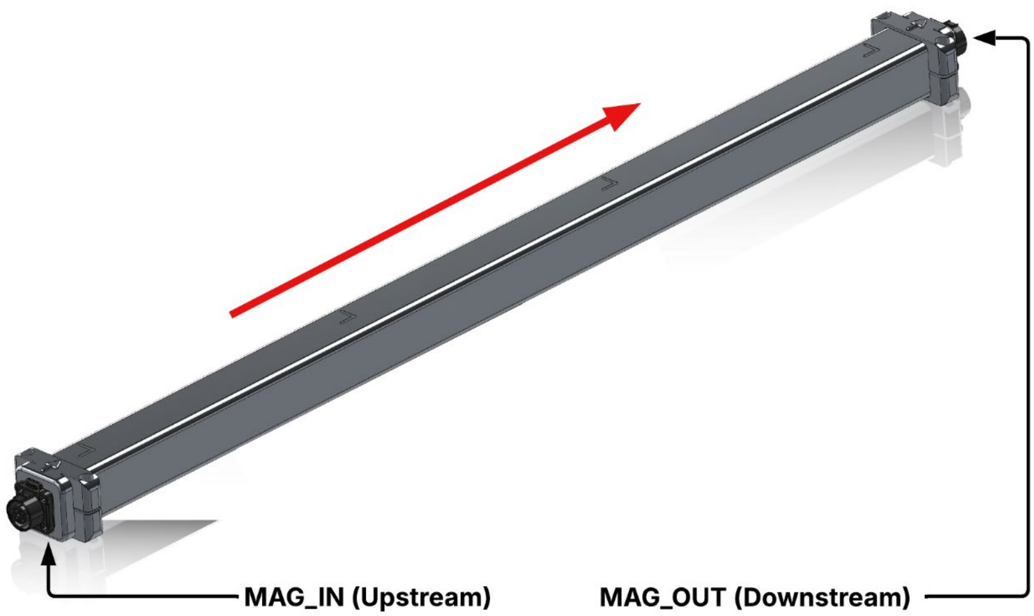

Figure 3 MagLoc Sensing Bar ports

Number	Label	Description
1	MAG_IN (Upstream)	Interface for connection toward the MagLoc Core Unit (upstream direction in the daisy chain).
2	MAG_OUT (Downstream)	Interface for connection toward subsequent MagLoc Sensing Bars (downstream direction in the daisy chain).

***Note:** The “Arrow Marks” carved on the ends of the sensing bar indicate the “Upstream” and “Downstream” of the connection. The “Arrow Mark” points from the “Upstream” to the “Downstream”.

3.3 Assembling Core Unit and Sensing Bar

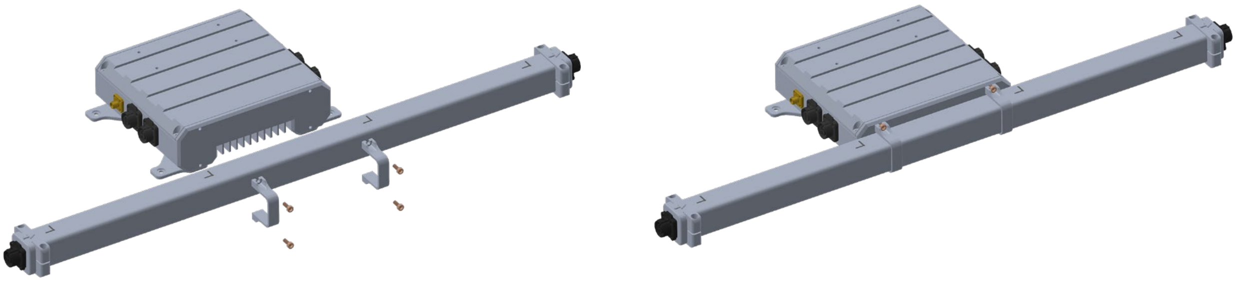

Figure 4 Assembling Core Unit and Sensing Bar

The MagLoc Core Unit and MagLoc Sensing Bar are secured using two Bar Brackets and four M3 screws.
The MagLoc Sensing Bar should be aligned with the centerline of the MagLoc Core Unit.

3.4 Assembling Core Unit and LiDAR

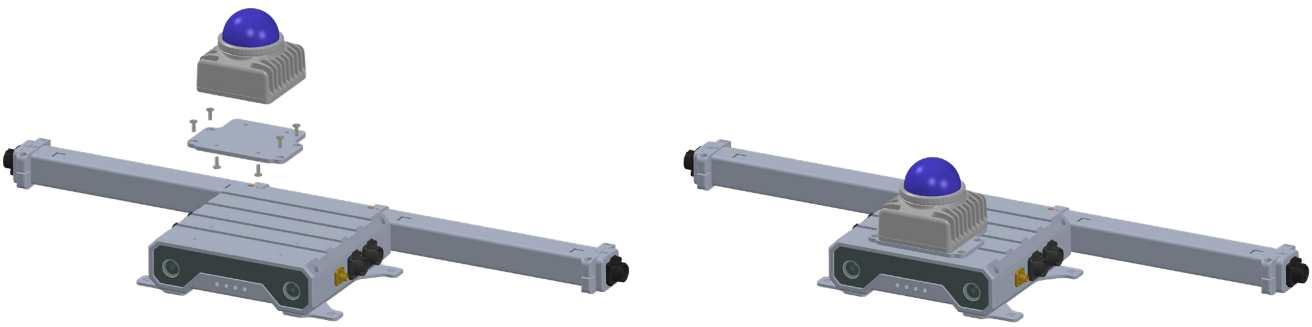

Figure 5 Assembling Core Unit and LiDAR

MagLoc supports the integration of an external LiDAR mounted above the sensor suite.
A Livox MID360 can be attached to the LiDAR mounting plate using four M3 screws. The mounting plate can then be secured to the MagLoc Core Unit using an additional four M3 screws.

4 Electrical Interfafces

4.1 Interface Summary

The MagLoc Core Unit features four LP12 series waterproof connectors and two SMA connectors.

Label	Connector Type	Description
PWR	LP12 (2-pin)	DC power input.
MAG	LP12 (4-pin)	Interface for connection toward the MagLoc Sensing Bar.
ETH	LP12 (8-pin)	Ethernet port for data transmission to the user PC.
EXT	LP12 (8-pin)	(Optional) Extension port for connecting an external Lidar.
ANT1	SMA	(Reserved) 2.4G Wi-Fi antenna port.
ANT2	SMA	(Reserved) GPS antenna port.

The MagLoc Sensing Bar features two LP12 series waterproof connectors.

Label	Connector Type	Description
MAG_IN (Upstream)	LP12 (4-pin)	Interface for connection toward the MagLoc Core Unit (upstream direction in the daisy chain).
MAG_OUT (Downstream)	LP12 (4-pin)	Interface for connection toward subsequent MagLoc Sensing Bars (downstream direction in the daisy chain).

4.2 Connector Pinout - PWR

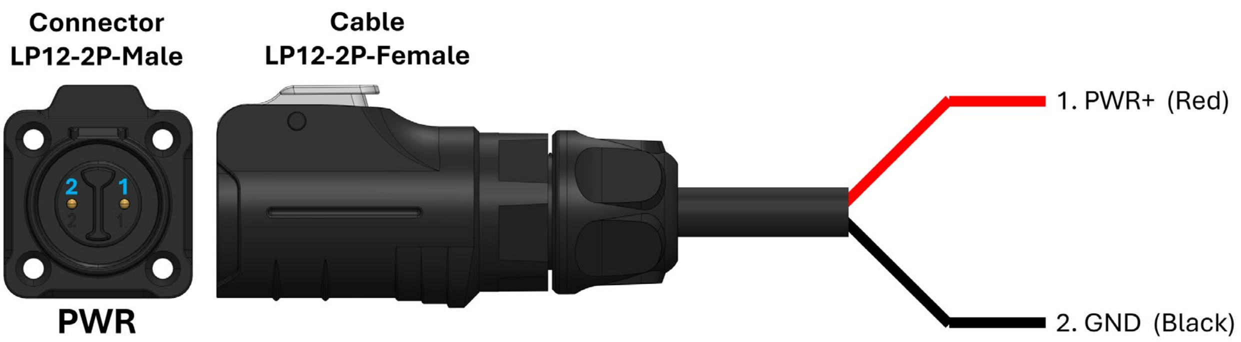

Figure 6 Connector Pinout - PWR

Pins	Signal	Color	Description	Function
1	PWR+	Red	DC 14V-60V	Power Cable
2	GND	Black	Ground	

4.3 Connector Pinout - MAG

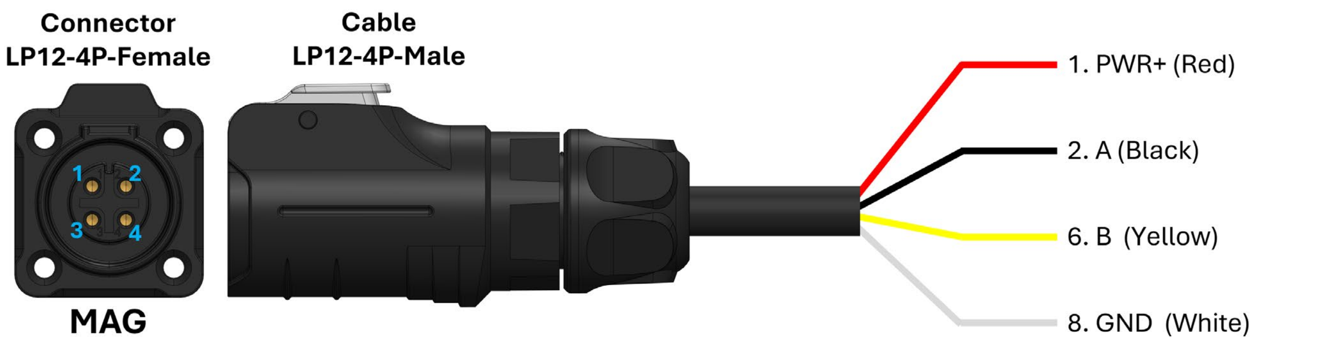

Figure 7 Connector Pinout – MAG

Pins	Signal	Color	Description	Function
1	PWR+	Red	Power Supply to Sensing BAR	Power Cable
4	GND	Black	Ground	
2	A	Yellow	Bus Signal A	Data Cable
3	B	White	Bus Signal B	

4.4 Connector Pinout - ETH

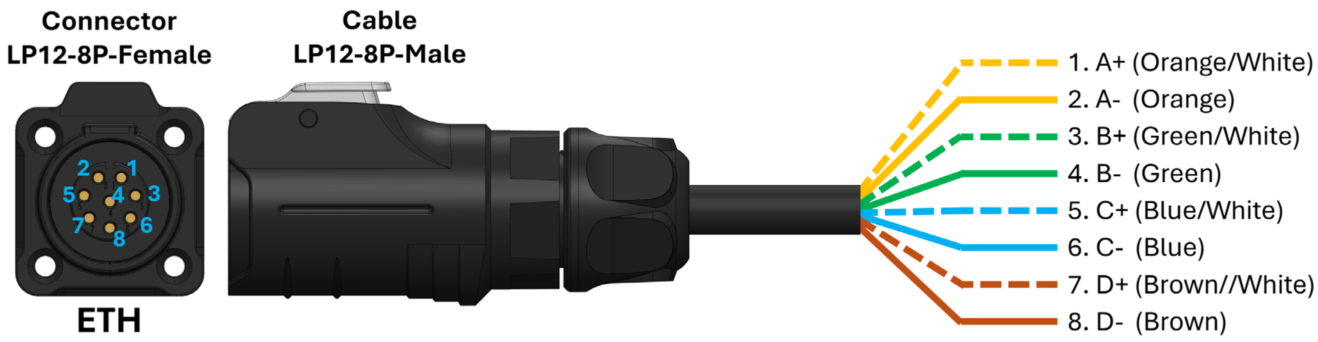

Figure 8 Connector Pinout – ETH

Pins	Signal	Color	Description	Function
1	A+	Orange/White	Ethernet - A+	1000BASE-T Ethernet Cable
2	A-	Orange	Ethernet - A-	
3	B+	Green/White	Ethernet - B+	
4	B-	Green	Ethernet - B-	
5	C+	Blue/White	Ethernet - C+	
6	C-	Blue	Ethernet - C-	
7	D+	Brown/White	Ethernet - D+	
8	D-	Brown	Ethernet - D-	

4.5 Connector Pinout - EXT

Figure 9 Connector Pinout – EXT

Pins	Signal	Color	Description	Function
1	PWR+	Brown	Power Supply to External Lidar	Power Cable
2	GND	Blue	Ground	
3	NC	White	Not Connected	NA
4	TX+	Green	Ethernet-TX+	100BASE-TX Ethernet Cable
5	ETX-	Pink	Ethernet- TX-	
6	RX+	Yellow	Ethernet-RX+	
7	RX-	Black	Ethernet- RX-	
8	NC	Grey	Not Connected	NA

5 Mechanical Specifications

5.1 MagLoc Core Unit Coordinate

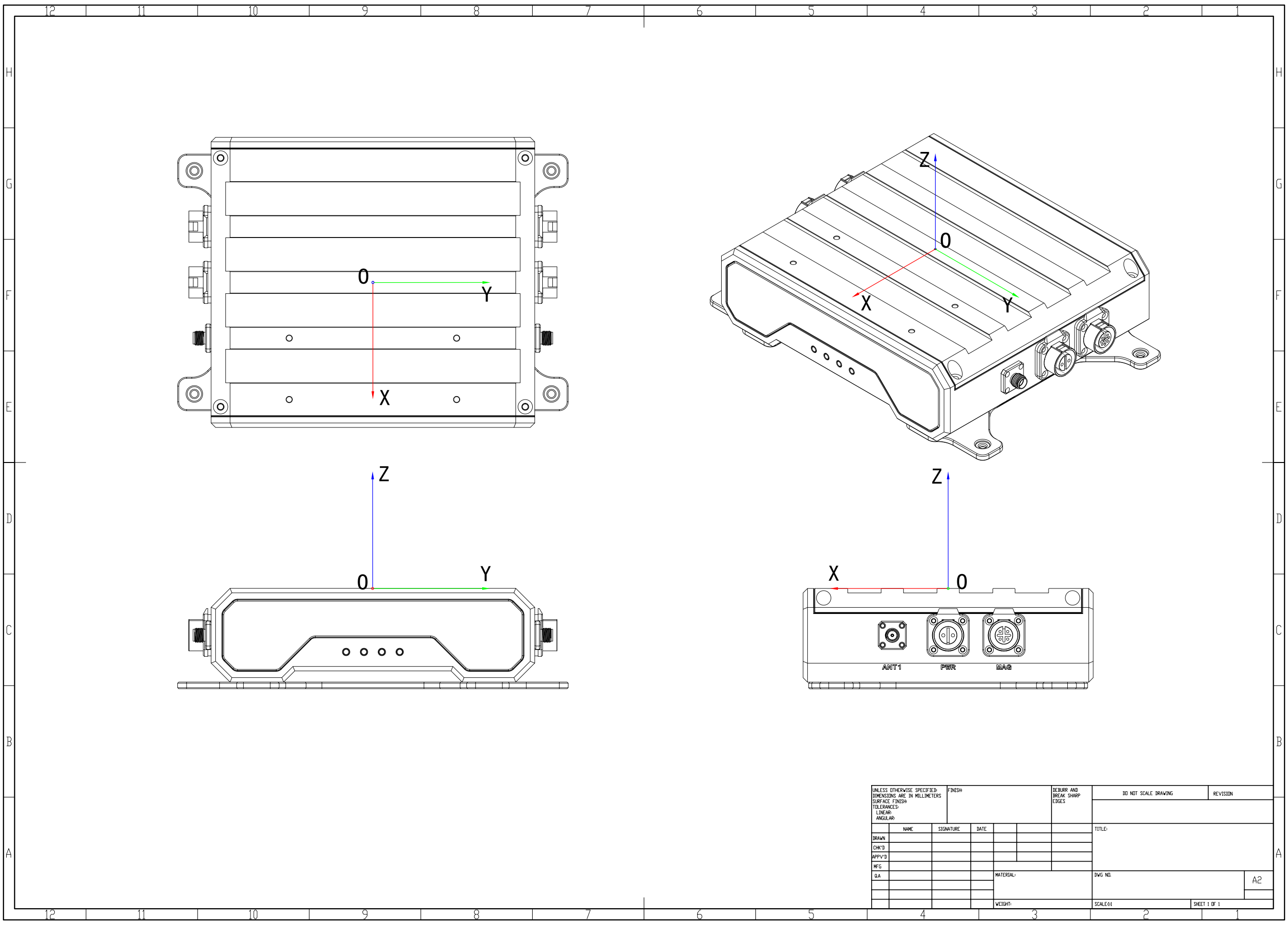

Figure 10 MagLoc Core Unit Coordinate

The origin of the MagLoc Core Unit coordinate system is defined at the center of the top surface of the unit. O-XYZ is a right-handed coordinate system, where the x-axis points forward, the y-axis points to the right, and the z-axis points upward.

5.2 MagLoc Core Unit Dimensions

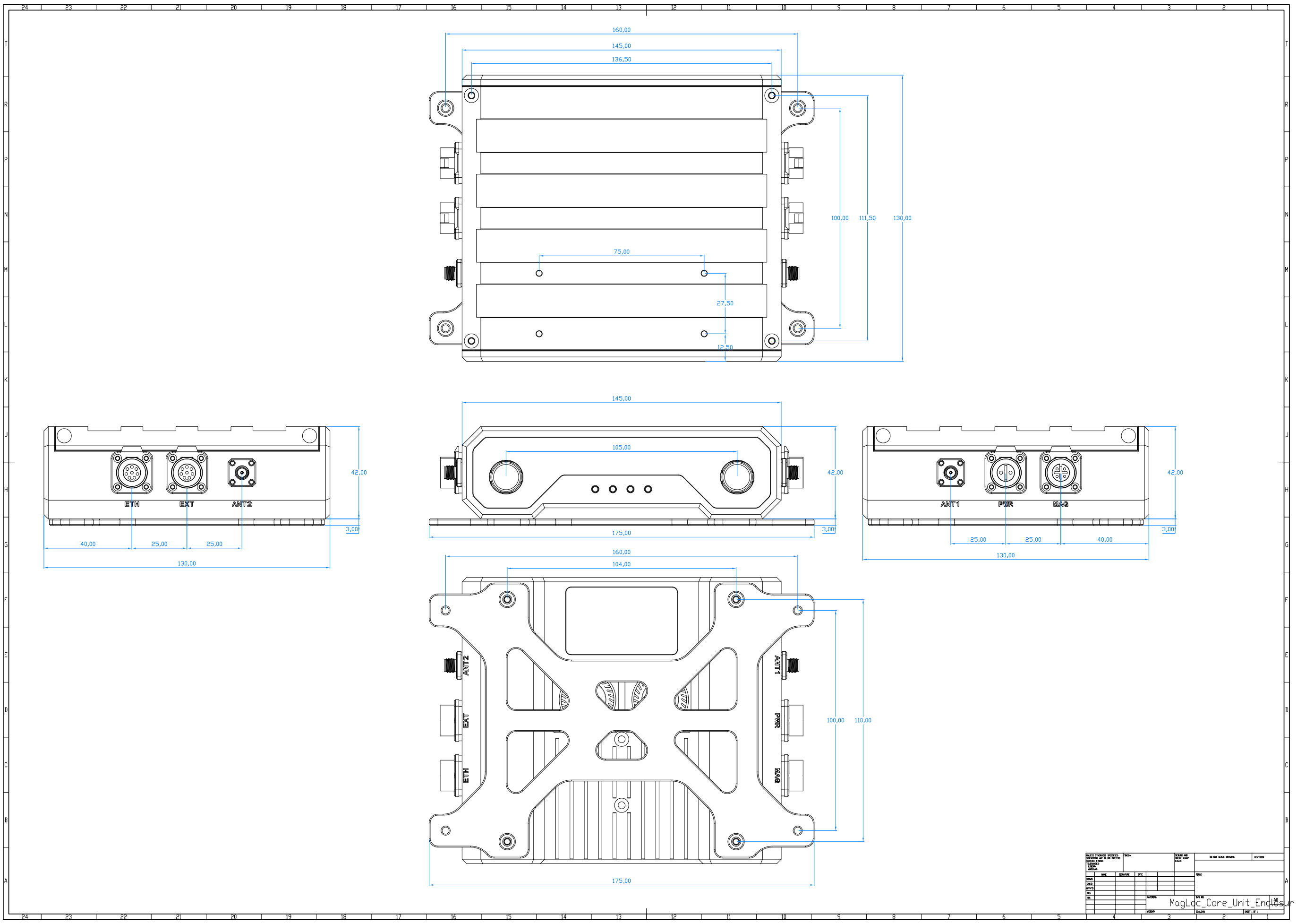

Figure 11 MagLoc Core Unit Dimensions

5.3 MagLoc Sensing Bar Coordinate

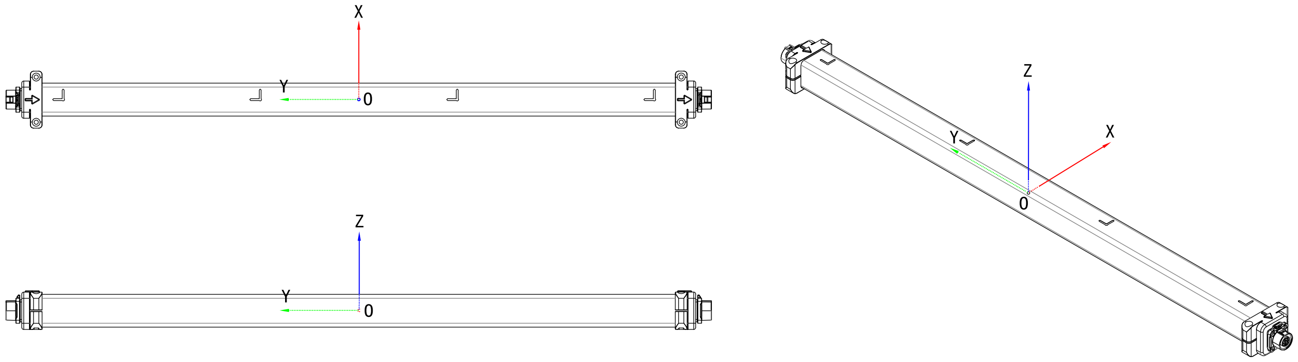

Figure 12 MagLoc Sensing Bar Coordinate

The origin of the MagLoc Sensing Bar coordinate system is defined at the geometric center of the unit.
O-XYZ is a right-handed coordinate system. The y-axis points from the downstream end toward the upstream end, opposite to the direction indicated by the arrow markings on the bar ends.

5.4 MagLoc Sensing Bar Dimensions

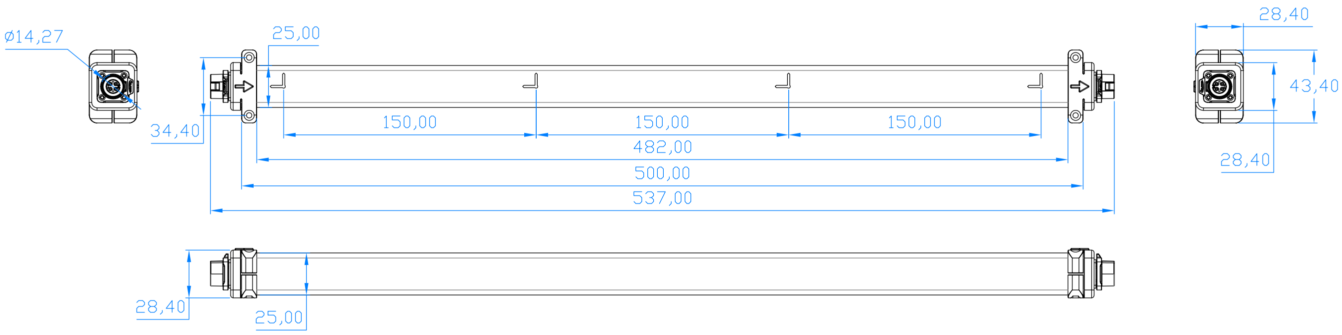

Figure 13 MagLoc Sensing Bar Dimensions

5.5 Weight

Components	Weight
MagLoc Core Unit	~950g
MagLoc Sensing Bar	~300g
Core Unit + Bar	~1250g
Core Unit + Bar + LiDAR	~1650g

6 Specifications

Item	Specification
Positioning Accuracy	Up to 10-15cm
Positioning Accuracy with Assistive Sensors	Up to 5cm
Magnetic Field Sampling Frequency	200Hz
Localization Output Frequency	Up to 100Hz
Maximum Daisy-Chain Length	20 Sensing Bars per Core Unit
Data Interface	100/1000BASE-T Ethernet, support up to 2.5GbE
Power Supply	14 ~ 60V DC
Power Consumption (Typical)	~30W
Power Consumption (Peak)	~35W
Operating Temperature	-20°C to 50°C
Storage Temperature	-20°C to 70°C
Core Unit Dimensions	175mm(L) x 130mm (W) x 45mm(H)
Sensing Bar Dimensions	537mm(L) x 25mm (W) x 25mm(H)
Total Weight	950g (1250g with magnetic sensor)