

Gaps Series (G5)

Pre-calibrated USBL positioning and communication systems

Gaps Series are Ultra Short Baseline (USBL) positioning and communication systems which combine a USBL antenna and a fiber-optic gyroscope (FOG) in the same housing. Their unique 3D acoustic array enables tracking and communication from the deep sea to extremely shallow water, even at angles above horizontal.



FEATURES

- Compact, all-in-one INS and USBL solution
- Robust acoustic telemetry
- Wide bandwidth signals
- Third-party transponder compatibility
- Compatible with major DP class 2, 3
- Subsea INS USBL aiding

BENEFITS

- Calibration free
- Truly omnidirectional
- Multiple tracking capability
- Easy interfacing with major navigation suites
- Fits vessels and USVs
- Export restriction free version available

A SCALABLE RANGE OF SYSTEMS

The Gaps series comprises three distinct models, including pre-calibrated and non-pre-calibrated variants, both free from export restrictions, and extended-range versions to fulfill diverse operational needs up to 7,000m water depth. The newest addition, Gaps M3, retains the acoustic performance of the original Gaps for both shallow and deep waters, all while maintaining a more budget-friendly approach and an ideal form factor for permanent installation.

NEW GENERATION = NEW CAPABILITIES

The fifth generation of the Gaps series incorporates the latest enhancements, featuring advanced capabilities such as improved acoustic communication for commanding and controlling multiple subsea assets, a new web MMI offering real-time 2D mapping, and increased compatibility with third-party transponders.

VERY STRONG TRACK RECORD

Exail has been supplying inertial navigation systems and acoustic positioning systems for over 15 years. The Gaps series is employed globally for various survey applications, cable laying, marine construction, and more.

GAPS SERIES SPECIFICATIONS

Positioning performance

	Gaps M3	Gaps M5	Gaps M7
Repeatability ^{(1) (2)}	0.10 %SR – CEP50	0.10 %SR – CEP50	0.06 %SR – CEP50
Pre-calibrated accuracy ^{(1) (3)}	-	0.20 %SR – CEP50	0.06 %SR – CEP50
Bearing accuracy ⁽⁴⁾	0.03°	0.03°	0.03°
Range accuracy	1 cm	1 cm	1 cm
Max position update rate	3 Hz	3 Hz	3 Hz
Number of targets	40	40	40

Acoustic performance ⁽⁵⁾

	Gaps M3	Gaps M5	Gaps M7
Operating frequency	18 – 34 kHz	18 – 34 kHz	18 – 34 kHz 12 – 34 kHz (LF option)
Range	995 m 4,000 m (XR version)	995 m 4,000 m (XR version)	4,000 m 7,000 m (LF option) ^{(6) (7)}
Coverage	>200°	>200°	>200°

Embedded INS/AHRS

	Gaps M3	Gaps M5	Gaps M7
Type	-	AHRS	INS
Heading accuracy	-	0.15° secant lat (RMS)	0.01° secant lat (RMS)
Roll/Pitch accuracy	-	0.1° (RMS)	0.01° (RMS)
Heave accuracy	-	10 cm RMS	2.5 cm or 2.5 % RMS
No aiding for 2 min / 5 min	-	-	0.06m / 0.3m (CEP50)

Acoustic communication

	Gaps Series
Frequency	18-34 kHz
Range	up to 3,000 m
Services	8-80 bytes messages, modem and file transfer
Bitrate	500 bps to 8 kbps

(1): %SR = % of slant range; CEP50 = Circular Error Probability at 50%

(2): In vertical conditions at input SNR = 20 dB, with MF transponder

(3): In vertical conditions. Including GPS error of 0.1 m. Sound velocity profile compensated. With MF transponder, transmit level = 191 dB ref μPa @ 1 m. Slant range of 1 000 m

(4): RMS value at input SNR = 20 dB, with MF transponder

(5): Positioning max range is 995 m with M3 and M5 export free version. Extended range version is subject to export licence

(6): Maximum operating range with surface noise level < 67 dBref $1\mu\text{Pa}/\sqrt{\text{Hz}}$

(7): Positioning range with LF transponder

Mechanical

	Gaps M3	Gaps M5	Gaps M7
Housing	Carbon fiber	Carbon fiber	Carbon fiber
Weight (air/water)	12 kg / TBD	14 kg / TBD	17 kg / -7 kg (positive buoyancy)
Dimensions (HxØ)	465x296	520x296	640x296
Depth rating	25 m	25 m	25 m

Envrionment

	Gaps M3	Gaps M5	Gaps M7
Temperature (operating)	-5°C to +35°C	-5°C to +35°C	-5°C to +35°C
Temperature (storage)	-40°C to +70°C	-40°C to +70°C	-40°C to +70°C
EMC	EN60945	EN60945	EN60945

Interfaces

	Gaps M3	Gaps M5	Gaps M7
Power supply	100 to 240 VAC / 50-60 Hz 24/36 VDC	100 to 240 VAC / 50-60 Hz 24/36 VDC	100 to 240 VAC / 50-60 Hz 24/36 VDC
Power consumption nominal with Gaps Box and 50m cable	14 W	24 W	30 W
Input/output ports	Ethernet 4 serial RS232/422 (with Gaps BOX)	Ethernet 4 serial RS232/422 (with Gaps BOX)	Ethernet 4 serial RS232/422 (with Gaps BOX)
Synchronisation	1 PPS + 3 IN/OUT (TTL or differential +/-5V)	1 PPS + 3 IN/OUT (TTL or differential +/-5V)	1 PPS + 3 IN/OUT (TTL or differential +/-5V)

GAPS BOX SPECIFICATIONS

Dimension	233 mm x 330 mm x 94 mm
Weight	4.1 kg
Temperature (operating)	-25°C to +55°C
Temperature (storage)	-40°C to +70°C

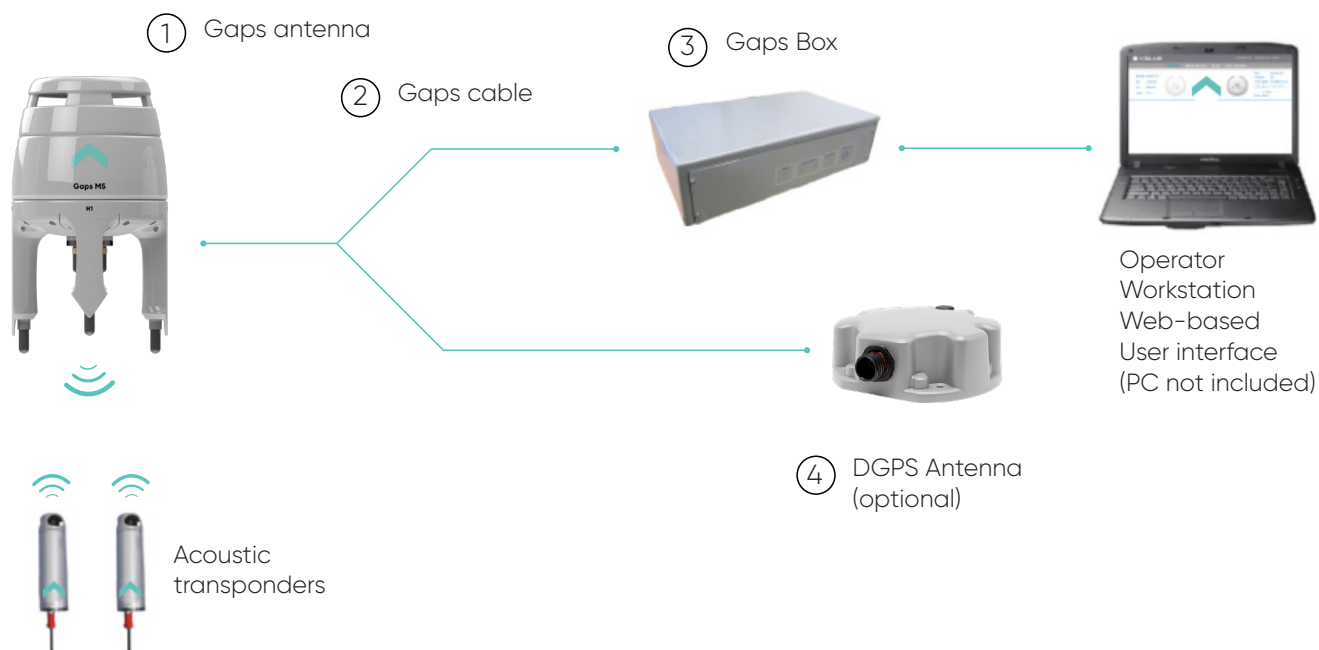
GAPS SERIES TRANSPONDERS

Gaps is compatible with all Exail MF beacons including:

Name	Description	Acoustic communication	Applications
MT9x2 series 	Internal rechargeable battery, OEM, 1000, 3000 m depth rated		ROV, Tow fish and diver positioning
MTBx2 series 	Mini transponder for AUV OEM and 300 m depth rated	●	AUV positioning
Canopus 	LBL and Sparse LBL Intelligent transponder 4000 and 6000 m depth rated	●	AUV positioning, LBL calibration, Dynamic Positioning (DP)

Third-party transponders compatibility: contact Exail

COMPONENTS



① Gaps antenna

This is the main part of the Gaps system. It combines a USBL acoustic array and INS/AHRS in the same mechanical structure.

② Gaps cable

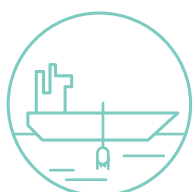
20/50/95 m long cable used to communicate with Gaps head. Extendable up to 190 m with a Repeater Box.

③ Gaps Box

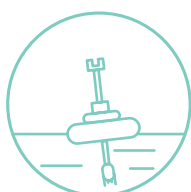
Gaps Box designed to interface between the Gaps head and external peripherals. Gaps Box can be replaced by an octopus cable for tight integration. Contact Exail for details

④ DGPS Antenna

A complete turnkey solution is available on option, including a GPS receiver.



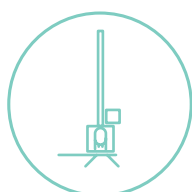
Side pole



Buoy



Moon pool



Hoisting system



Towed platform



Drone (USV)



Pipelay Vessel