HAIN SUBSEA
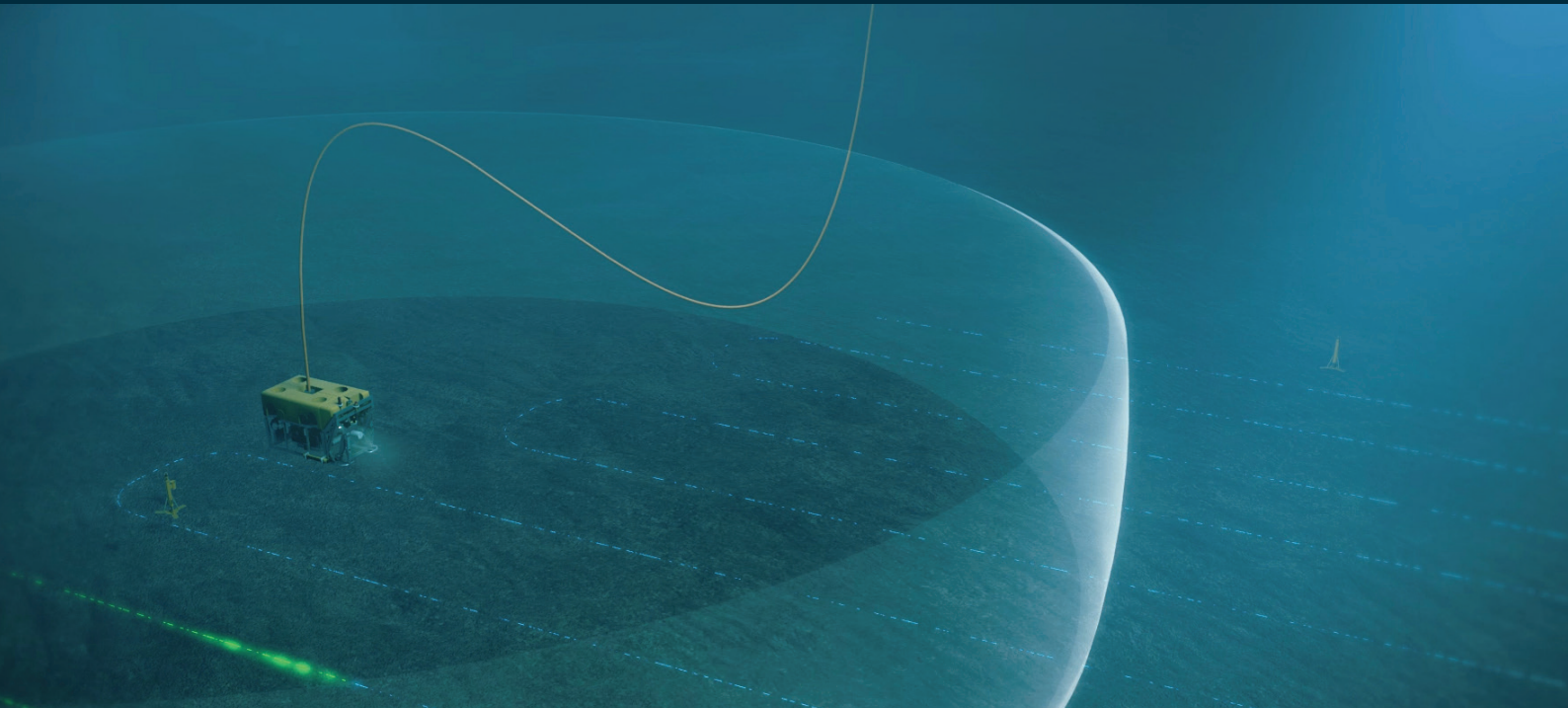

HYDROACOUSTIC INERTIAL NAVIGATION

HAIN Subsea is the combination of acoustic positioning and inertial navigation providing precise and accurate position and orientation of underwater vehicles.

HAIN Subsea is an inertial navigation system used on underwater vehicles. It will improve the acoustic positioning in water depths from surface down to 7000 meters.

Benefits:
- **precise, smooth and accurate positioning,**
- **precise and accurate depth,**
- **precise and accurate orientation (heading, roll and pitch),**
- **precise and accurate velocity estimate in 3D,**
- **any desired update rate,**
- **estimation and compensation of sensory errors,**
- **much better QC and QA,**
- **easily used with NavLab post-processing for even better accuracy, precision and integrity.**

The core of HAIN is the inertial sensors: gyroscopes and accelerometers, producing 3D angular rates and accelerations respectively. These are mathematically integrated into orientation, velocity and position. HAIN combines this with the positioning input from acoustic positioning (SSBL, USBL, LBL or other) in the best possible way to produce the best possible result. Combining these two is crucial as it produces results far better than each of them can produce on their own. This gives a result better than the sum of its parts.

Errors are always present in all sensors. Some errors are rapidly changing and some slowly changing. HAIN will estimate both rapidly changing and slowly changing errors

separately, and compensate for their effects. This is a key part of HAIN as it gives results unaffected by most errors.

Kongsberg Maritime have used our years of experience and development to be able to do this effectively for all the different sensors used by HAIN. Some errors are not possible to estimate real-time. HAIN therefore always logs all received measurements and calculated values so that they are easily used with the NavLab post-processing tool.

HAIN Subsea consist of a unit on the underwater vehicle and computer topside running APOS or APOS Survey connected by Ethernet. The APOS computer allows for easy interfacing with topside systems such as the survey and acoustics, and for monitoring and control. It is possible to add inputs from external sensors to improve the precision, accuracy and integrity.
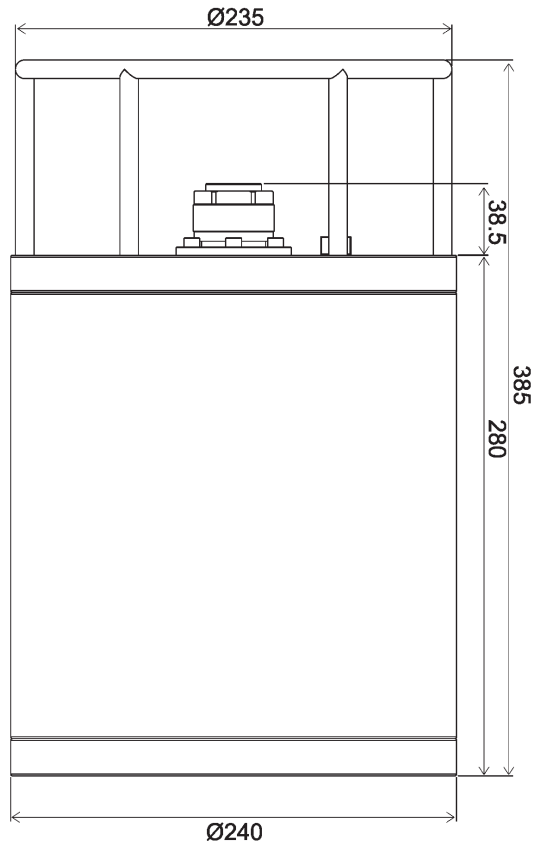
HAIN Subsea comes in 3 options:
- **SUI 1 - Most accurate - Serial IO* only available topside**
- **7K - Highly accurate - Serial IO* available subsea (topside at request)**
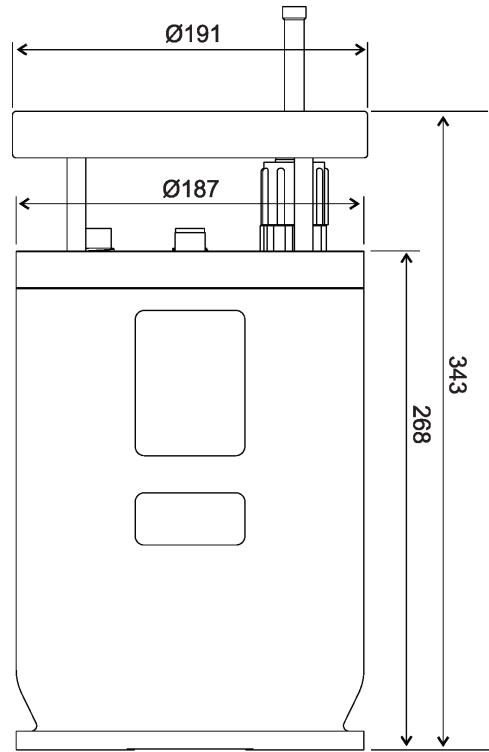- **Custom - HAIN can use your 3rd party inertial systems. Contact us for details.**

*Serial IO is typically DVL and pressure sensor inputs, and high rate orientation output.

OUTLINE DIMENSIONS

SIU 1

HAIN Subsea 7K

TECHNICAL SPECIFICATIONS

General specification	SIU 1	7K
Depth rating:	4000 m	7000 m
Material:	Titanium	Titanium
Weight in air:	30 kg	20 kg
Weight in water:	17 kg	12.5 kg
Input power:	16 - 72 VDC	24 VDC
Main connector:	Gisma 19 pin	Subconn 16 pin
Additional connector:	None	3 x Subconn 8 pin
Internal storage (hours of data):	None	~20 hours
Connection to topside:	Ethernet 10 Mbit	Ethernet 10 Mbit
Time sync	NTP topside	NTP subsea

Accuracy specification	SIU 1	7K
Position* (improvement factor):	3	3
Depth (m) - typical:	0.04	0.05
Roll/pitch (°):	0.008	0.008
Heading (° sec lat):	0.025	0.08

*Position standard deviation of HAIN compared to acoustic positioning. Example position standard deviation of acoustics at 1.5 m and of HAIN at 0.5 m gives an improvement factor of 3. The improvement factor will vary depending on acoustic performance, geometry, vehicle trajectory, external sensors etc. It may be almost as low as 1 and as high as several times the typical value.

Specifications subject to change without any further notice.