

AIMS Navigation VRU



FEATURES

- MEMS sensors
- 6 DOF
- High performance
- Extended calculation performance
- CAN 2.0B interface
- 2 x RS-232/422/485 interface
- Rugged EMC enclosure
- Vibration damper available

The AIMS Navigation VRU from KebNi Inertial Sensing is a high performance six degrees of freedom (6 DOF) Inertial Measurement Unit (IMU) and Vertical Reference Unit (VRU). It can be used in for example control and navigation systems for vehicles and boats.

The VRU delivers fully temperature compensated accelerometer and gyro data and in addition estimated roll and pitch angle. The real-time estimator is optimised for marine applications such as stabilised platforms and control systems.

The onboard floating-point unit enables implementation of customer specific software upon request.

TYPICAL APPLICATIONS

- Platform stabilisation
- Vehicle and boat control system
- Autonomous and remote operated vehicle systems
- Evaluation system for movement analysis of boats, cars and motorcycles
- Track/road/driver analysis
- Inertial navigation system (INS)
- Adjustment of chassis systems
- Racing boats



Technical data

Technical Data

Housing:	Aluminum, sealed IP67
Physical Dimensions:	86 x 83 x 37 mm (L x W x H, excl. connector)
Connector A, Power and I/O:	M12, 17-pos. female (Phoenix P/N 1419739)
Power Supply:	12/24 VDC typical (8 - 30 VDC), internal filtering complies with ISO 7637-2
Output Interface:	CAN 2.0B and 2 x RS-232/485/422
Operating Temperature Range:	-20°C to +70°C <i>(Note 1)</i>
Storage Temperature Range:	-40°C to +85°C
Weight:	400 gram
Update Rate:	200 samples/second <i>(Note 1)</i>
Vibration Resistance:	6 g _{rms} (5 - 200 Hz), 3 g _{rms} (200 - 500 Hz) for all directions
Shock Resistance:	150 g, half-sine 0.5 ms
VRU Performance	
Roll / Pitch, Static:	0.1° RMS
Roll / Pitch, Dynamic:	0.2° RMS

Acceleration Performance

Range:	± 2 g (Note 1)
Bias Error:	0.6 mg, 1σ (Note 2)
In-run Bias Stability	8 μ g (Note 4)
Scale Factor Error @ 1 g:	0.25 mg, 1σ (Note 2)
Non-linearity:	0.8 % of FS (Note 3)
Noise:	0.04 mg/ $\sqrt{\text{Hz}}$ (Note 3)
Bandwidth:	15 Hz (Note 1)
Misalignment:	1 mrad (Note 3)

Angular Rate Performance

Range:	± 120 °/s (Note 1)
Bias Error:	0.06 °/s, 1σ (Note 2)
In-run Bias Stability	5 °/h (Note 4)
Scale Factor Error:	0.06 %, 1σ (Note 2)
Non-linearity:	0.25 % of FS (Note 3)
Noise:	0.08 °/s/ $\sqrt{\text{Hz}}$ (Note 3)
Bandwidth:	15 Hz (Note 1)
Misalignment:	1 mrad (Note 3)

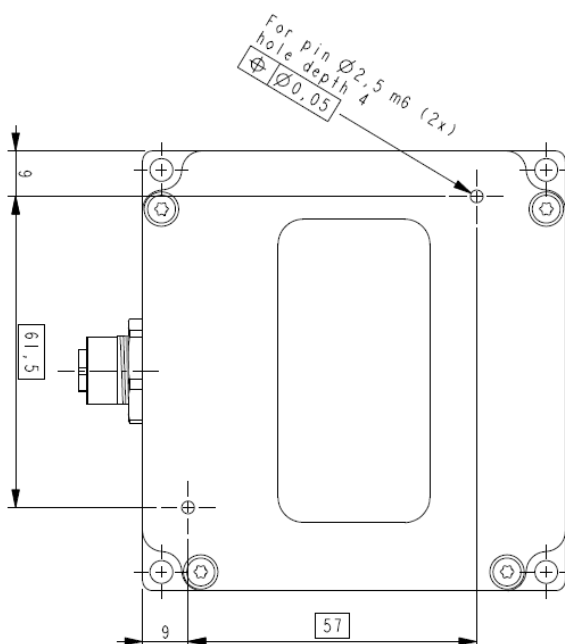
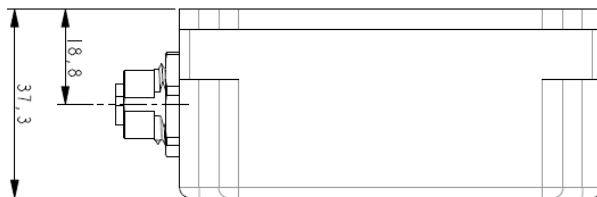
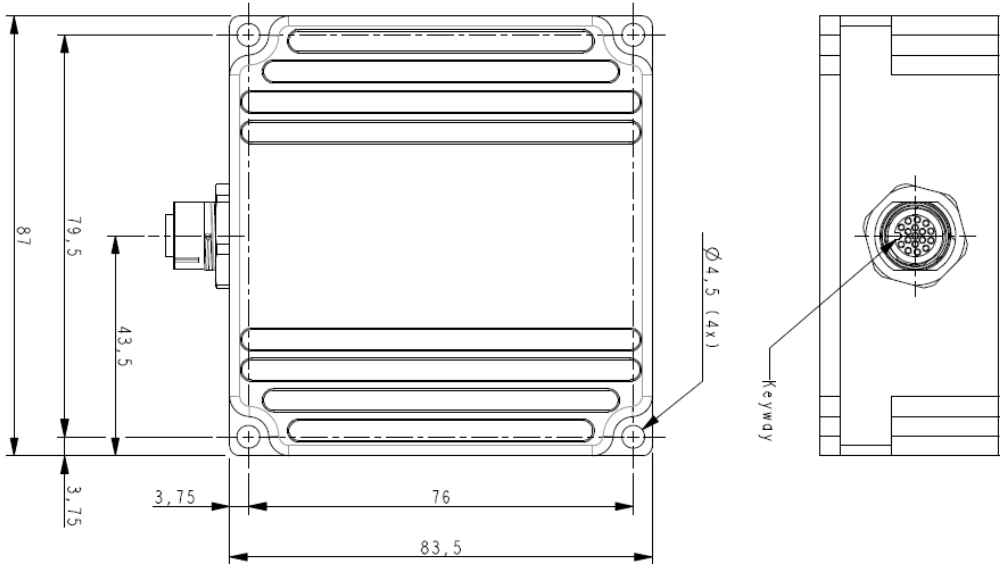
Note 1: Other configurations are available upon request

Note 2: Max value over full temperature range

Note 3: Max value at +25°C

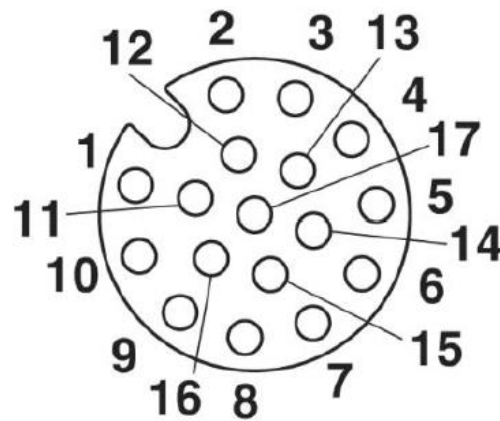
Note 4: Allan Variance method, constant temperature, typical value

MECHANICAL DRAWING



PIN ASSIGNMENT

Pin no.	Signal
1	PWR
2	BOOT
3	GND
4	B RS232RX/RS422RX+
5	B RS422TX+
6	B RS422RX-
7	CANH
8	B RS232TX/RS422TX-
9	RESET
10	CANL
11	A RS232RX/RS422RX+
12	A RS422RX-
13	A RS422TX+
14	A RS232TX/RS422TX-
15	RS232/RS422 Select A*
16	RS232/RS422 Select B*
17	RSGND



17-pos. M12 connector, female

* Set to high for RS232, floating or grounded for RS422/RS485
Only serial port "A" is used as standard

COORDINATE SYSTEM



CAN 2.0B INTERFACE

The CAN interface has a baud rate of 1 Mbit with an 11 bit identifier and a data update rate of 200 samples/second.

Every sample is delivered on the CAN-bus with three CAN-IDs; one for accelerometers, one for gyros and one for estimated angles. The byte format is little-Endian (Intel format) with a sampling point of 60%. There are 5 time quanta before sampling point and 4 time quanta after SP. The synchronization jump width is 2 time quanta.

Accelerometers		Gyroscopes		Angles	
Output	Value (LSB)	Output	Value (LSB)	Output	Value (LSB)
32767	-64 μg	32767	-4096 μ°/s	32767	-2 m°
32768	0 g	32768	0 $^\circ/\text{s}$	32768	0 $^\circ$
32769	+64 μg	32769	+4096 μ°/s	32769	2 m°

CAN-ID 1, Identifier: 0x508 (11 bit)

Byte 0-1	Byte 2-3	Byte 4-5
Acc X (16 bit)	Acc Y (16 bit)	Acc Z (16 bit)

CAN-ID 2, Identifier: 0x510 (11 bit)

Byte 0-1	Byte 2-3	Byte 4-5
Gyro X (16 bit)	Gyro Y (16 bit)	Gyro Z (16 bit)

CAN-ID 3, Identifier: 0x512 (11 bit)

Byte 0-1	Byte 2-3	Byte 4-5
Roll angle (16 bit)	Pitch angle (16 bit)	Counter (16 bit)

Other interface formats (baud rate, ID etc.) are available upon request.

RS-232/422/485 INTERFACE: Sensor data

The serial interface is a 115.2 kbps link with an update rate of 200 samples/second. The settings for the communication is 1 start bit, 8 data bits, no parity and 1 stop bit.

Accelerometers		Gyroscopes	
Output	Value (LSB)	Output	Value (LSB)
32767	-64 μg	32767	-4096 μ°/s
32768	0 g	32768	0 $^\circ/\text{s}$
32769	+64 μg	32769	+4096 μ°/s

Byte No.	Description	Data
0	STARTFLAG	0x7F
1	STARTFLAG	0x7F
2	Length	0x11 (17 ₁₀)
3	OP-code	0x8A
4	GyroX	BIT 15 to 8
5	GyroX	BIT 7 to 0
6	AccX	BIT 15 to 8
7	AccX	BIT 7 to 0
8	GyroY	BIT 15 to 8
9	GyroY	BIT 7 to 0
10	AccY	BIT 15 to 8
11	AccY	BIT 7 to 0
12	GyroZ	BIT 15 to 8
13	GyroZ	BIT 7 to 0
14	AccZ	BIT 15 to 8
15	AccZ	BIT 7 to 0
16	Checksum, XOR	BIT 7 to 0

Other interface formats (baud rate, byte order etc.) are available upon request.

RS-232/422/485 INTERFACE: Angle information

The serial interface is a 115.2 kbps link with an update rate of 200 samples/second. The settings for the communication is 1 start bit, 8 data bits, no parity and 1 stop bit.

Angles	
Output	Value (LSB)
32767	-2 m°
32768	0 °
32769	+2 m°

Byte No.	Description	Data
0	STARTFLAG	0x7F
1	STARTFLAG	0x7F
2	Length	0xB (11 ₁₀)
3	OP-code	0x89
4	Roll	BIT 15 to 8
5	Roll	BIT 7 to 0
6	Pitch	BIT 15 to 8
7	Pitch	BIT 7 to 0
8	Counter	BIT 15 to 8
9	Counter	BIT 7 to 0
10	Checksum, XOR	BIT 7 to 0