

Inertial Measurement Unit (IMU)

ASC IMU 7.X.Y



- ▶ 6-axis MEMS mini-IMU
- ▶ Acceleration & Angular Rotation analog output
- ▶ 12-pin connector with detachable cable
- ▶ Aluminium housing
- ▶ Made in Germany

Features

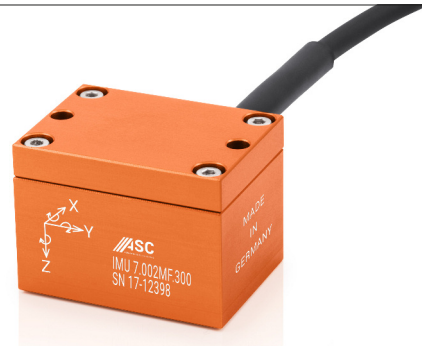
- ▶ Acceleration rate: $\pm 2g$ to $\pm 50g$
- ▶ Rotation rate: $\pm 75^\circ/s$ to $\pm 900^\circ/s$
- ▶ DC response
- ▶ Excellent Bias and Scale factor stability
- ▶ Protection class IP65
- ▶ Low power consumption
- ▶ Compact design and lightweight (26 gram)

Options

- ▶ Acceleration and rotation rate range selection
- ▶ Customised cable length and connector
- ▶ Stainless steel housing

Applications

- ▶ Indoor Navigation and Pointing
- ▶ Precision Agriculture
- ▶ Camera/Antenna/Platform Stabilisation
- ▶ Industrial and Robotics
- ▶ Biomechanics (Motion tracking; Gesture Sensing)
- ▶ Marine (yacht stabilisation; tests on ship models)
- ▶ Automotive in-car Navigation
- ▶ Precision GPS Vehicle and Personal Navigation Aiding (Dead Reckoning Navigation)

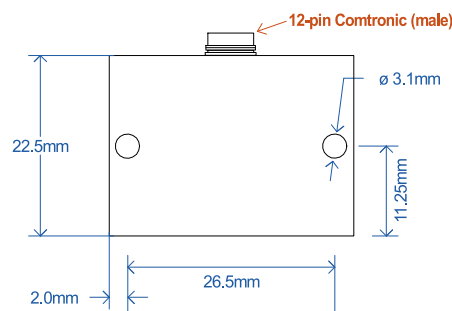
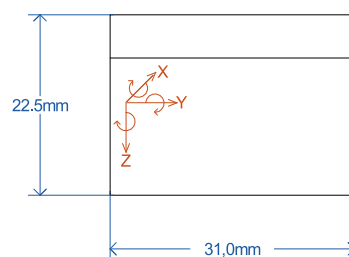


Description

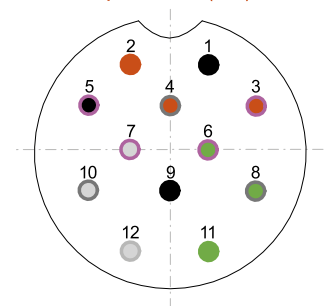
An Inertial Measurement Unit (IMUs) is a 6-axis system that measures linear and angular motion using a combination of gyroscopes and accelerometers. MEMS based IMUs incorporate an assortment of precision inertial sensors, including a 3-axis accelerometer and a 3-axis gyroscope. The IMU thus outputs raw acceleration and rotation rate signals, which could be further integrated to obtain the actual position and orientation.

ASC IMU 7.X.Y

ASC IMU 7.X.Y incorporates either the LN series (Low-Noise) accelerometers or the MF series (Medium-Frequency) accelerometers, featuring an acceleration range from $\pm 2g$ to $\pm 50g$. The IMU features MEMS vibrating ring gyros with a rate range from $\pm 75^\circ/s$ to $\pm 900^\circ/s$. ASC IMU 7.X.Y can be powered by a DC power supply (+5V to +40V) where the output voltage is independent of the supply. The miniature IMU is made of lightweight anodised aluminium housing and features the industry standard 12-pin comtronic connector and a detachable cable.



12-pin Comtronic (male)



Pin assignment:

Power Supply:

Pin 1: Power Supply - (black)
Pin 2: Power Supply + (red)

Gyroscope:

Pin 3: Signal X (red / violet)
Pin 4: Signal Y (red / grey)
Pin 5: Signal Z (black / violet)

Acceleration:

Pin 6: Signal + X (green / violet)
Pin 7: Signal - X (white / violet)
Pin 8: Signal + Y (green / grey)
Pin 9: not connected
Pin 10: Signal - Y (white / grey)
Pin 11: Signal + Z (green)
Pin 12: Signal - Z (white)

MEMS Accelerometers

ASC's capacitive accelerometers are based on MEMS sensing technology and produce an analog voltage proportional to the input acceleration. The accelerometers can measure both static (gravity) and dynamic accelerations. ASC's MEMS capacitive accelerometers can be used for very low to medium frequency vibration measurements, ranging from 0Hz to 4kHz. The sensors feature a MEMS sensor element where the seismic mass is connected between two conductive capacitor plates. When subjected to an input acceleration, the seismic mass oscillates between the two capacitor plates and there is a change in the capacitance. This change in capacitance is converted via an ASIC (Application Specific Integrated Circuit) into a low impedance analog voltage output signal.

MEMS Gyroscopes

ASC's precision navigation and pointing gyroscopes are made of robust silicon MEMS vibrating ring elements. The gyro detects the magnitude and direction of angular velocity by using the coriolis force effect. As the gyro is rotated, coriolis forces acting on the silicon ring cause radial movement at the ring perimeter, the magnitude of which is proportional to the angular velocity of rotation. The gyro thus produces an analog voltage signal, which is linearly proportional to angular rate. The balanced ring design results in excellent shock and vibration rejection.

Typical Specifications

ASC IMU 7.X.Y

DYNAMIC

| | | |
|-------------|--------------|--|
| Range | | Acceleration: $\pm 2g$ to $\pm 50g$ Rotation: $\pm 75^\circ/s$ to $\pm 900^\circ/s$ |
| Shock limit | $\pm g$ peak | 500 (operating) 2000g (unpowered) |

ELECTRICAL

| | | | |
|---------------------|------|---------------|-------------|
| Excitation voltage | V DC | MF: 5 to 40 | LN: 6 to 40 |
| Current Consumption | mA | MF: 21 | LN:30 |
| Isolation | | Case Isolated | |

ENVIRONMENTAL

| | | |
|-----------------------|------------|-------------|
| Operating Temperature | $^\circ C$ | -40 to +85 |
| Storage Temperature | $^\circ C$ | -40 to +100 |
| Sealing | | IP65 |

PHYSICAL

| | | |
|------------------------|------|---|
| Sensing elements | | MEMS Capacitive Accelerometers & MEMS Vibrating Ring Gyros |
| Case material | | Anodised Aluminium |
| Connector | | 12-pin Comtronic |
| Mounting | | M3 screws |
| Weight (without cable) | gram | 26 |
| Cable | | 12-wire PUR 30 gram/meter; AWG 30; Diameter: 4.4m |

Typical Specifications

ASC MEDIUM-FREQUENCY ACCELEROMETERS

DYNAMIC

| | | Range (\pm g) | | | | |
|------------------------------|-------|------------------|-----|------|------|------|
| | | 2 | 5 | 10 | 30 | 50 |
| Sensitivity | mV/g | 1350 | 540 | 270 | 90 | 54 |
| Frequency response: \pm 5% | Hz | 700 | 700 | 1400 | 1600 | 1800 |
| Amplitude non-linearity | % FSO | <0.5 | | | | |
| Transverse sensitivity | % | <5 | | | | |

ELECTRICAL

| | | | | | | |
|---|---------------------|-----|-----|-----|-----|-----|
| Zero acceleration output | \pm mV | 50 | | | | |
| Spectral noise | μ g/ \sqrt Hz | 20 | 40 | 70 | 200 | 340 |
| Residual / Broadband noise (\pm 5% frequency range) | μ V | 720 | 580 | 720 | 720 | 780 |

ENVIRONMENTAL

| | | | | | | |
|--|------------------|------|-----|---|---|---|
| Temperature coefficient of sensitivity (Thermal sensitivity shift) | %/ $^{\circ}$ C | 0.01 | | | | |
| Temperature coefficient of bias (Thermal zero shift) | mg/ $^{\circ}$ C | 0.2 | 0.5 | 1 | 3 | 5 |

ASC LOW NOISE ACCELEROMETERS

DYNAMIC

| | | Range (\pm g) | | | | |
|------------------------------|-------|------------------|-----|-----|-----|-----|
| | | 2 | 5 | 10 | 25 | 50 |
| Sensitivity | mV/g | 2000 | 800 | 400 | 160 | 80 |
| Frequency response: \pm 5% | Hz | 100 | 100 | 300 | 500 | 650 |
| Amplitude non-linearity | % FSO | <1 | | | | |
| Transverse sensitivity | % | 3 | | | | |

ELECTRICAL

| | | | | | | |
|---|---------------------|-----|-----|-----|-----|-----|
| Zero acceleration output | \pm mV | 150 | 150 | 80 | 80 | 80 |
| Spectral noise | μ g/ \sqrt Hz | 10 | 14 | 20 | 50 | 100 |
| Residual / Broadband noise (\pm 5% frequency range) | μ V | 200 | 120 | 140 | 180 | 200 |

ENVIRONMENTAL

| | | | | | | |
|---------------------------|------------------|-------|-----|------|---|---|
| Thermal sensitivity shift | %/ $^{\circ}$ C | 0.015 | | | | |
| Thermal zero shift | mg/ $^{\circ}$ C | 0.15 | 0.4 | 0.75 | 2 | 4 |

Typical Specifications

ASC MEMS GYROSCOPES

DYNAMIC

| | | Rate Range (\pm°/s) | | | |
|-------------------------------------|----------------------------|-------------------------------------|-----|-----|-----|
| | | 75 | 150 | 300 | 900 |
| Sensitivity ($\pm 1\%$) | mV/ $^\circ/\text{s}$ | 13.2 | 6.6 | 3.3 | 1.1 |
| Bandwidth (max.) | Hz | 150 | | | |
| Non-linearity | % | 0.05 | | | |
| g-sensitivity (linear acceleration) | $^\circ/\text{s}/\text{g}$ | 0.1 | | | |

ELECTRICAL

| | | | | | |
|---|------------------------------------|--|--|--|--|
| Bias | V | 1.65 \pm 0.006 | | | |
| Bias variation with temperature (referred to the value at +25 $^\circ\text{C}$) | $^\circ/\text{s}$ | ± 3 | | | |
| Bias Instability | $^\circ/\text{hr}$ | 9 | | | |
| Rate Noise Density | $^\circ/\text{s}/\sqrt{\text{Hz}}$ | 0.02 | | | |
| Angular Random Walk | $^\circ/\sqrt{\text{hr}}$ | 0.2 (Allan Deviation; $\tau=1\text{s}$) | | | |
| Vibration induced Noise | $^\circ/\text{s}/\text{g}^2$ | 0.08 | | | |

ENVIRONMENTAL

| | | | | | |
|--|--|-----------|--|--|--|
| Sensitivity variation over temperature % (referred to the value at +25 $^\circ\text{C}$) | | ± 1.5 | | | |
|--|--|-----------|--|--|--|

CALIBRATION

ACCELEROMETERS (LN)

| | | | | |
|--------------------|-------------------|----------------|-----------------|-----------------|
| Range | 2g and 5g | 10g | 25g and 30g | 50g |
| Sensitivity | at 160Hz and 0.5g | at 80Hz and 5g | at 80Hz and 15g | at 80Hz and 20g |
| Frequency Response | 1 to 100Hz | 10 to 300Hz | 10 to 500Hz | 10 to 650Hz |

ACCELEROMETERS (MF)

| | | | | |
|--------------------|------------------|----------------|-----------------|-----------------|
| Range | 2g and 5g | 10g | 30g | 50g |
| Sensitivity | at 16Hz and 0.5g | at 80Hz and 5g | at 80Hz and 15g | at 80Hz and 20g |
| Frequency Response | 1 to 200Hz | 10 to 1400Hz | 10 to 1600Hz | 10 to 1800Hz |

GYROSCOPES

A factory calibration certificate is provided with each axis. Sensitivity over the measurement range and non-linearity data are provided in the calibration certificate.

Note: For the IMU, a DAkkS certified (Deutsche Akkreditierungsstelle, DAkkS, to DIN EN ISO / IEC 17025) calibration can be provided upon request.

ORDERING INFORMATION

| | Accelerometer | | Gyroscope | Cable Length | Connector |
|-----------|------------------------------|---|--------------------------------|---------------------------|---|
| | Measurement Range (\pm g) | Low-noise (LN) or Medium-Frequency (MF) | Measurement Range (\pm °/s) | in meters | A: No connector |
| | XXX | LN or MF | YYY | Z | |
| ASC IMU 7 | 002 | LN | | 3 (supplied with the IMU) | Contact ASC for customised connectors such as Lemo or Sub D |
| | 005 | MF | 075 | | |
| | 010 | | 150 | | |
| | 025 | | 300 | 6 (6m cable) | |
| | 030 | | 900 | 9 (9m cable) | |
| | 050 | | | 12 (12m cable) | |

Ex: ASC IMU 7.002LN.150-3A

ASC GmbH · Advanced Sensors Calibration

Ledererstraße 10 · 85276 Pfaffenhofen · Germany · Tel. +49 (0) 8441 786 547 -0 · office@asc-sensors.de

All data, information, statements, photographs and graphic illustrations made in this data sheet are without any obligation and raise no liabilities to or form part of any sales contracts of ASC GmbH or any affiliates for components referred to herein. © ASC GmbH 2011. All rights reserved. No part of this copyrighted work may be reproduced, modified or distributed in any form or by any means, or stored in any database or retrieval system, without the prior written permission of ASC GmbH or its affiliates. Any such unauthorized use for any purpose is a violation of the relevant copyright laws. Revision Mai2017

