



# INS401

## AUTOMOTIVE INERTIAL NAVIGATION SYSTEM



The ACEINNA INS401 is a state-of-the-art, high performance Inertial Navigation System with an RTK-enabled GNSS receiver, triple-redundant inertial sensors, Positioning Engine, and Ethernet interface. It is designed for use in L2+ and higher ADAS and other high-volume applications requiring precise position information. The INS401 provides cm-level accuracy, enhanced reliability, and superior performance during GNSS outages. The dead reckoning solution delivers strong performance in GNSS challenged urban environments. The INS401 is qualified for automotive applications, and is certified to ASIL-B level according to ISO26262.





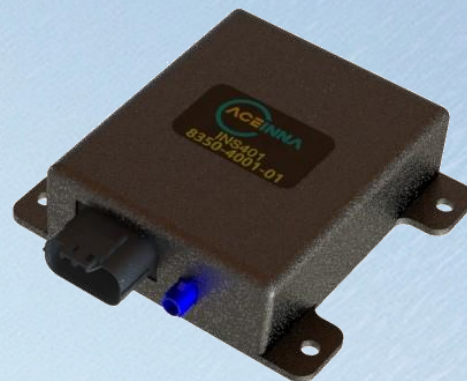
# INS401

## AUTOMOTIVE INERTIAL NAVIGATION SYSTEM

The ACEINNA INS401 supports GPS, GALILEO, GLONASS, QZSS, and BeiDou satellite systems. The on-board triple redundant IMU and fusion algorithms provide accurate position, velocity, and attitude data continuously at 100 Hz, filling in gaps between GNSS updates and enabling dead-reckoning for short duration GNSS outages. The INS401 enables OTA firmware upgrades via Ethernet.

### Applications

- Autonomous Vehicles
- ADAS Systems
- Agriculture Vehicle Auto Steer Systems
- Construction Vehicles



### Features

- 100 Hz GNSS/INS solution; position, velocity, attitude
- Supported GNSS

GPS	L1 C/A + L2C
GLONASS	G1
BeiDou	B1I+B2I
Galileo	E1 +E5b
QZSS	L1 C/A + L2C
- 80 channels tracking and RTK algorithm support for centimeter level accuracy
- Integrated and calibrated triple-redundant MEMS Inertial Measurement Unit –  $\pm 8$  g and  $\pm 200$  °/s
- Ethernet interface (for CAN see INS401-C)
- 1PPS output
- Single (INS401) and Dual (INS402) antenna versions available
- Includes functionality for saving navigation data prior to shut down for faster initialization

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### Technical Characteristics

Accuracy <sup>1</sup>	
Horizontal Position Accuracy (RMS)	
SPS	1.2 m CEP
RTK <sup>2</sup>	0.02 m
10s GNSS Outage	0.35 m
60s GNSS Outage	3.5 m
Vertical Position Accuracy (RMS)	
SPS	1.8 m CEP
RTK <sup>2</sup>	0.03 m
10s GNSS Outage	0.4 m
60s GNSS Outage	4 m
Velocity Accuracy (RMS)	
Horizontal	0.02 m/s
Vertical	0.02 m/s
Heading Accuracy (RMS) <sup>3</sup>	0.2°
Attitude Accuracy (Roll/Pitch, RMS)	0.1°
Operating Limits	
Velocity	515 m/s
Acceleration	±8 g
Angular Rate	±200 °/s
Temperature Calibration Range	-40°C to +85°C
Timing	
Time to First Fix <sup>4</sup>	
Cold Start <sup>5</sup>	< 40 s
Warm Start <sup>6</sup>	< 30 s
Hot Start <sup>7</sup>	< 10 s
Signal Re-acquisition	< 2 s
RTK Initialization Time	< 10 s
GNSS Update Rate	10 Hz
INS Output Data Rate	100 Hz
1PPS Accuracy <sup>1, 8</sup>	±50 ns
Sensitivity	
Tracking	-160 dBm
Cold Start	-140 dBm
Environment	
Operating Temperature	-40 °C to +85 °C
Non-Operating Temperature	-40 °C to +85 °C
Qualification	
Specified in QTR	Contact Factory
Electrical	
Input Voltage (VDC)	9-32 V
Power Consumption	< 5 W
Digital Interface	Ethernet

Mechanical	
Package Type	Aluminum
Protection Class	IP5K0
Dimensions	115 x 126 x 35 mm
Weight	<500 g
Mating Connector	JAЕ PN: MX23A18SF1
RF Connector	Molex FAKRA PN: 734036262

### RTK Operation

INS401 requires RTCM 3.x format RTK correction data. These corrections can be provided by ACEINNA's OpenARC network, or by 3<sup>rd</sup> party services supporting NTRIP protocol.

### Multi-Band, Multi-Constellation

INS401's GNSS chipset is based on ST Microelectronics Teseo APP chipset. The Teseo APP chipset baseband processor tracks various subsets of constellations and bands. Teseo APP is connected to the powerful on-board application processor, which runs the firmware and algorithms.

### Ordering Information

Model	Description
INS401	Inertial Navigation System Solution – ASIL B Certified, Ethernet I/O
INS401-C	Inertial Navigation System – ASIL B Certified, Ethernet + CAN I/O (Contact Factory for Availability)
INS402	Dual-Antenna Inertial Navigation System (Contact Factory for Availability)

Note 1: Typical values, subject to ionospheric / tropospheric conditions, satellite geometry, baseline length, multipath, with odometer

Note 2: Add 1ppm of baseline length.

Note 3: After dynamic motion initialization.

Note 4: Typical values.

Note 5: No previous satellite or position information.

Note 6: Using aged ephemeris and last known position.

Note 7: Using accurate ephemeris and last known position.

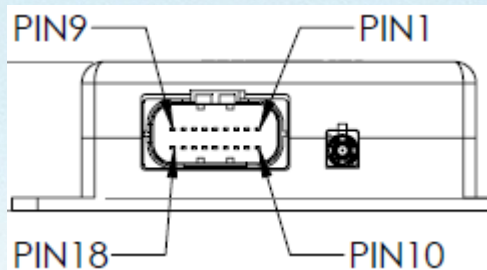
Note 8: Time accuracy does not include biases due to RF or antenna delay



### Evaluation Kit

- INS401 EVK
  - INS401 Module
  - L1/L2/L5 GNSS Antenna with cable and connector
  - Mating connector with breakouts for Ethernet, 1PPS, and Power
  - Contact Factory for Availability

Connector Pin Out



Pin #	Definition	Signal Description
1	Reserved	Reserved
2	Reserved	Reserved
3	ETH_TRX_N	Ethernet Negative
4	ETH_TRX_P	Ethernet Positive
5	Reserved	Reserved
6	Reserved	Reserved
7	Reserved	Reserved
8	Reserved	Reserved
9	VCC_IN	Power Supply Positive
10	Reserved	Reserved
11	Reserved	Reserved
12	Reserved	Reserved
13	Reserved	Reserved
14	GND	Power Supply Negative
15	GND	Power Supply Negative
16	PPS	Synchronization Signal
17	GND	Power Supply Negative
18	GND	Power Supply Negative

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