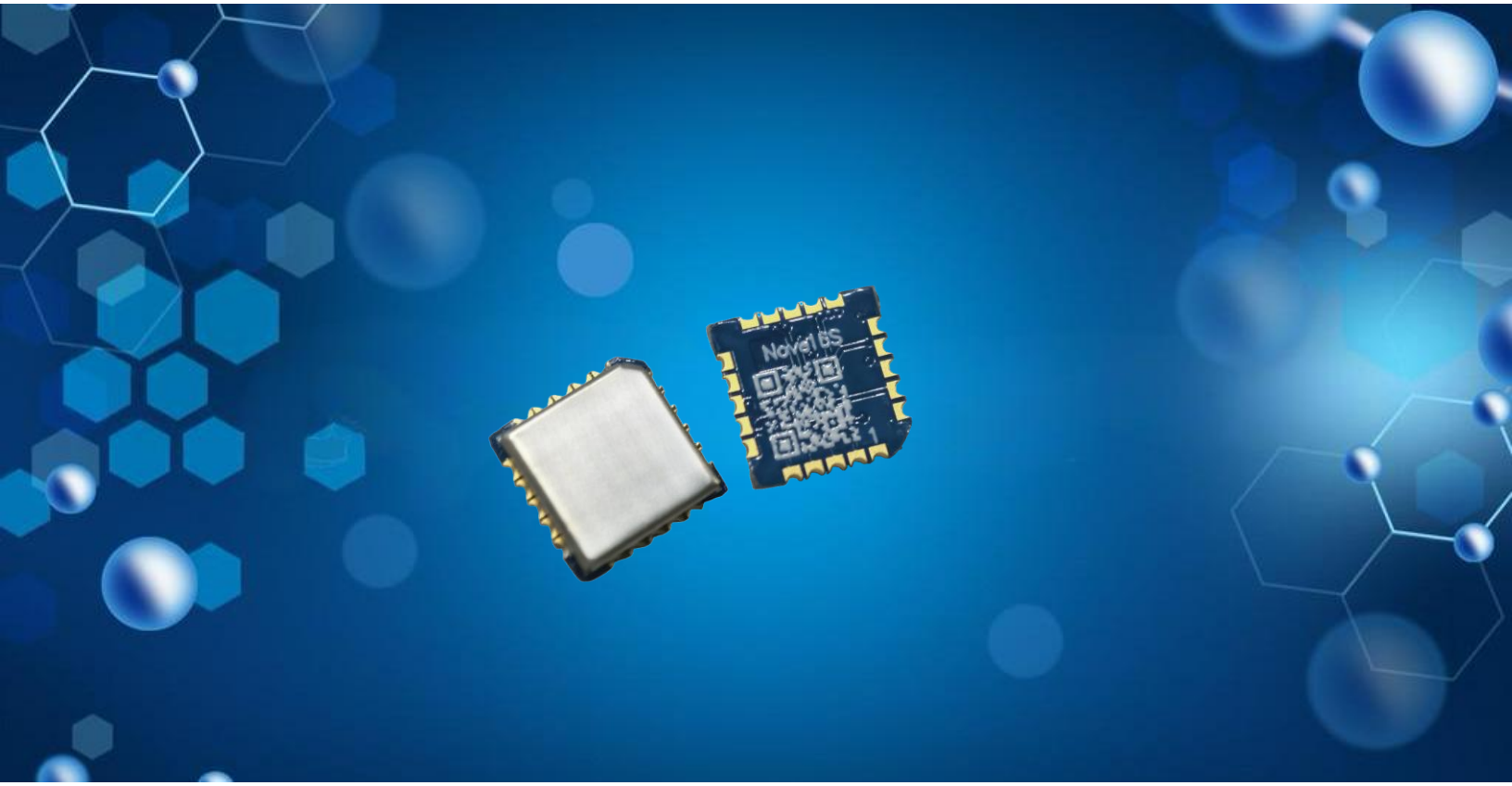
AIT



ARS-2247-P09 series

Small Size High Cost-Effective Attitude and Heading Reference System

Technical Manual

V1.0

Attitude and Heading Reference System

ARS-2247-P09

FEATURES

- Three-axis gyroscope, magnetometer, accelerometer
- IMU output up to 1000HZ
- Rapid calibration algorithm
- High precision, compact size
- Wide operating temperature range: -40° C to +85° C
- Dimensions: L10 × W10 × H2.4(mm)
- TTL, reserved for CAN/USB

APPLICATIONS

- Human Robots
- Rotary-wing Drones
- AGV
- Quadruped Robot
- Motion Capture
- Observation and Aiming Equipment
- Night Vision Devices
- Collaborative Robot

DESCRIPTION

The ARS-2247-P09 is high-precision attitude and heading reference system employs industrial-grade microcontrollers renowned for their reliability and robust interference resistance, alongside high-precision magnetic sensors and driver chips. It integrates AIT's proprietary rapid calibration algorithm and anti-interference algorithm, enabling spatial manoeuvring during magnetic field calibration while resisting transient magnetic disturbances. This product employs a three-axis accelerometer and three-axis gyroscope to compensate for tilt angles, ensuring accurate heading data even in extremely harsh environments.
Featuring IAP upgrade capability, subsequent functionalities and interfaces will be delivered via IAP updates following programme revisions. Customisable to client requirements, it facilitates the swift and straightforward integration of attitude and heading reference system functionality into diverse products.

SPECIFICATIONS

Table 1. Performance Parameters

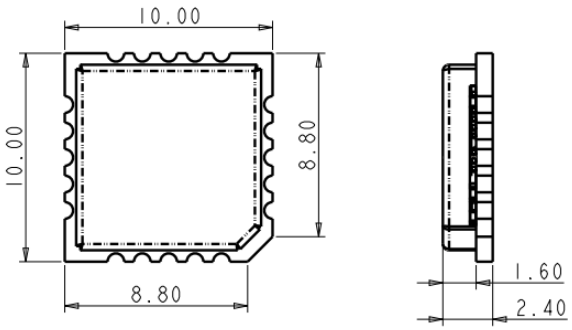
	Accelerometer	Gyroscope	Magnetometer
Range	±8g	±1000°/s	±8Gauss
Noise density	200 μg/√Hz	5mdps/√Hz	1.5mGauss/√Hz
Bandwidth	100Hz	100Hz	-
Zero bias stability (@10s)	0.15mg	12°/h	-
Zero bias stability (ALLAN)	30ug	3°/h	-

Table 2. Performance Parameters

Condition	Baud rate	9600～921600 (Default 115200)
Output frequency	Raw data mode	up to 1000Hz
	Resolution mode	up to 500Hz

DIMENSIONS

Size: Dimensions: L10 * W10 * H2.4(mm), please refer to the actual product



ELECTRICAL PARAMETERS

Table 3. Electrical Parameters

Working voltage	3.3 DC
Power current	<150mA
Maximum power consumption	<1W
Operating temperature	-40℃~+85℃
Storage temperature	-50℃~+100℃

ELECTRICAL CONNECTORS

Table 4. Pin Definition

Pin	Definition	Interface	Description	Status
1	VCC	Power Supply	Power Input	OK
2	VCC	Power Supply	Power Input	OK
3	GND	Power Supply	Power Ground	OK
4	GND	Power Supply	Power Ground	OK
5	COM1_TX	O	TTL Output	OK
6	COM1_RX	I	TTL Input	OK
7	GPIO1		PPS Input	
8	CAN_H or USB_DP/D+	I/O	CAN High or USB Data Plus/D+	OK
9	COM3_TX	O	TTL Output	OK
10	CAN_L or USB_DP/D-	I/O	CAN Low or USB Data Minus/D-	OK
11	COM3_RX	I	TTL Input	OK
12	GPIO2		PPS Output	
13	NC		Vacant	
14	COM2_TX	O	TTL Output	OK
15	NC		Vacant	
16	COM2_RX	I	TTL Input	OK

Currently, only pins marked as OK are available for use. The remaining pins will be progressively enabled in subsequent updates.

CAN and USB can be switched via software configuration. When USB is selected, only COM1_TX and COM1_RX are supported.

Important Notes

Keep away from strong magnetic field materials such as magnets, iron, and nickel to prevent irreversible damage to the product's magnetically sensitive components.
Keep clear of motors, conductors, capacitors, inductors, and other components prone to generating magnetic fields due to current flow. This prevents continuous measurement from being affected by electromagnetic field fluctuations caused by energized components, thereby safeguarding the sensor's heading accuracy.
Maintain distance from moving ferrous components such as robotic arms, flywheels, and engines. This prevents magnetic field variations induced by the motion of ferromagnetic parts from compromising the sensor's heading precision.

Calibration

Calibration is performed using the quick calibration method as follows:

1. Open the serial port and set it to HEX transmit, HEX receive, and put the sensor in answer mode;
2. Position the sensor in the direction where the pitch angle is 0°, the roll angle is 0°, and the heading angle is pointing to the direction of due north, and use this direction as the reference direction, if you do not know where the due north is, you can use any direction as the reference direction. Keeping the sensor stationary, send the start calibration command 77 05 00 E4 01 EA , the sensor returns 77 05 00 E4 01 EA to start the calibration mode. When calibration mode is initiated, it will automatically send 77 05 00 E5 XX YY where XX is the calibration count, which will iterate through the motion calibration process and converge and begin to increase when stationary. If you are stationary at this time, XX will also increase automatically over time, and the calibration results are not reliable at this time.
3. Slowly rotate the sensor once around the X axis.;
4. Slowly rotate the sensor once around the Y-axis;
5. Slowly rotate the sensor once around the Z-axis, the rotation step is completed.;
6. Place the sensor in a static position and wait for XX in the return command to be greater than or equal to 0x0A, then calibration is considered complete.
7. Send the end calibration command 77 05 00 E4 02 EB, calibration is complete!;