GL720-CAN bus
IMU Dynamic Attitude Gauge
Product manual

V2.3-20250623

Technical Highlights

❖ Real-time output of horizontal attitude angle;

❖ Three-axis angular rate signal output;

❖ Axial acceleration measurement in the forward direction;

❖ Configurable CAN2.0 A/CAN2.0 B output support;

❖ Compact structure and lightweight;

❖ High long-term working stability and long service life.

Production Application

The GL720D is a high-dynamic-precision attitude measurement instrument developed by RUICOM Technology based on a MEMS inertial measurement platform. This device dynamically calculates attitude from the angular rate output by the gyroscope, providing real-time output of the carrier's horizontal azimuth, angular rate, and body acceleration along the forward axis. The product incorporates RUICOM Technology's inertial navigation algorithm and utilizes a Kalman filter model to compensate for system errors in real-time, preventing divergence and effectively suppressing short-term gyroscope drift.

This product is specifically designed for automated agricultural machinery, precision agriculture operations, AGV, and forklift automatic navigation, significantly improving operational efficiency and serving as a core component for next-generation automated precision agriculture and industrial control.

Application Scope

❖ AGV Transport Vehicles

❖ 3D Virtual Reality

❖ Industrial Automation Control

❖ Vehicle Navigation Systems

❖ Platform Stability Control

❖ Robotics Technology

Performance Parameters

<table>
<tr><th colspan="2">GL720</th><th>Parameters</th></tr>
<tr><td colspan="2">Azimuth measurement axial direction</td><td>Z-axis azimuth angle (±180)°</td></tr>
<tr><td colspan="2">Acquisition bandwidth</td><td>>100Hz</td></tr>
<tr><td colspan="2">Nonlinearity</td><td>0.1% of FS</td></tr>
<tr><td rowspan="6">Accelerometer</td><td>Acceleration range</td><td>±4g</td></tr>
<tr><td>Acceleration resolution</td><td>0.001g</td></tr>
<tr><td>Acceleration accuracy</td><td>5mg</td></tr>
<tr><td>Bias instability (Allan)</td><td>0.05mg</td></tr>
<tr><td>Velocity random walk coefficient (Allan)</td><td>0.015m/s/sqrt(h)</td></tr>
<tr><td>Bias stability (10s mean)</td><td>0.15mg</td></tr>
<tr><td rowspan="3">Gyroscope</td><td>Gyro angular velocity range</td><td>±250°/s</td></tr>
<tr><td>Angle random walk coefficient (Allan)</td><td>0.30°/sqrt(h)</td></tr>
<tr><td>Zero bias stability (10s smooth)</td><td>10°/h</td></tr>
<tr><td colspan="2" rowspan="2">Start-up time</td><td>AGV Application: 5~6s</td></tr>
<tr><td>AGM Application: 1.5s</td></tr>
<tr><td colspan="2">Power supply voltage</td><td>9~36VDC / 5VDC (optional)</td></tr>
<tr><td colspan="2">Operating current</td><td>30mA(12V)</td></tr>
<tr><td colspan="2">Operating temperature</td><td>-40 ~ +80℃</td></tr>
<tr><td colspan="2">Storage temperature</td><td>-40 ~ +85℃</td></tr>
<tr><td colspan="2">Vibration</td><td>5g~10g</td></tr>
<tr><td colspan="2">Shock</td><td>200g pk，2ms，½sine</td></tr>
<tr><td colspan="2">Service life</td><td>10 years</td></tr>
<tr><td colspan="2">Output rate</td><td>5Hz~200Hz adjustable</td></tr>
<tr><td colspan="2">Output signal</td><td>CAN2.0A or CAN2.0B</td></tr>
<tr><td colspan="2">Insulation resistance</td><td>≥100 megohms</td></tr>
<tr><td colspan="2">Shock resistance</td><td>100g@11ms, triaxial (half-sine wave)</td></tr>
<tr><td colspan="2">Vibration resistance</td><td>10grms / 10~1000Hz</td></tr>
<tr><td colspan="2">Waterproof rating</td><td>IP67</td></tr>
<tr><td colspan="2">Weight</td><td>≤117g</td></tr>
<tr><td colspan="3">Note: The AGV application startup time is 5 seconds of inactivity.</td></tr>
</table>

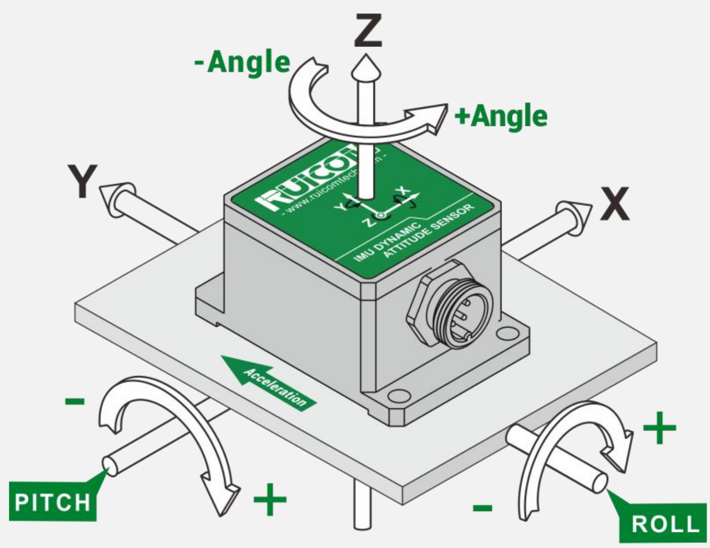
Ordering and Selecting

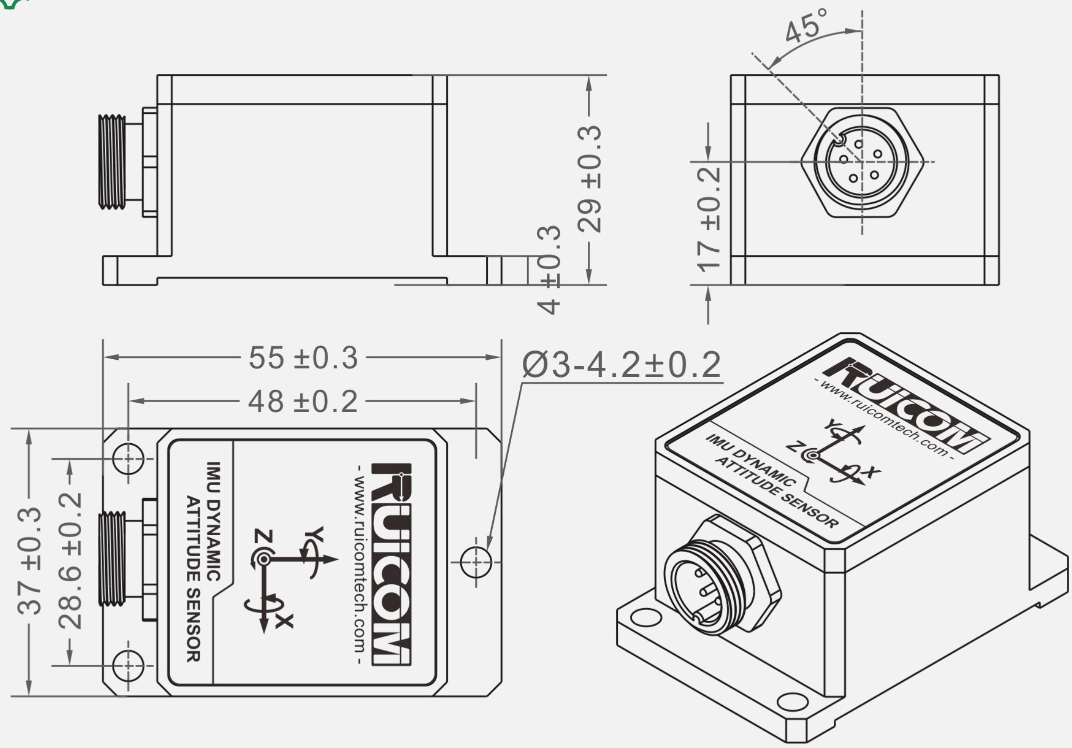
Model	Power supply		Signal output		Communication Protocol		Application type
GL720	L: 5VDC		C2: CAN2.0A		1: Euler angle frame		AGV: AGV Application
	W: 9~36VDC		C3: CAN2.0B		3: Acceleration frame		AGM: Agricultural Machinery Applications
					4: Euler angle frame + Acceleration frame		FL: Forklift and Vehicle Applications
		-		-	5: Gyro data frame	-	EL: Graders
					6: Euler angle frame + Gyro data frame		GA: General Applications
					7: Standard data frame		
					8: Acceleration frame + Gyro data frame		
					9: Euler angle frame + Acceleration frame + Gyro data frame		
E.G:GL720**L**-**C2**-**1**-**AGV**:5VDC power supply / CAN2.0A output / Euler angle frame output / AGV application.							

PIN Definition

PIN/Thread Color	Definition	Description
PIN1/Brown	5V/9~36V	VCC
PIN2/White	CAN_L	Signal Output
PIN3/Blue	CAN_H	Signal Output
PIN4/Black	GND	GND
PIN5/Gray	NC	NC

Installation measurement diagram





Product Dimensions

Housing Dimensions: L55.5×W37×H29mm
Recommended screws: 3 M4 screws

Installation Precautions

1. The angle gauge should be installed at the center of the object being measured to minimize the impact of linear acceleration on measurement accuracy, as shown in the diagram below;

The product is installed in the central position inside the AGV vehicle.

2. During installation, ensure the angle meter's mounting surface is parallel to the target surface and minimize the impact of dynamic forces and acceleration on the angle meter. Incorrect installation will lead to measurement errors; pay particular attention to the following:
3. The angle meter's mounting surface must be tightly, flat, and stable against the target surface. Uneven mounting surfaces can easily cause angular errors in the angle meter's measurement.
4. The angle meter's axis and the axis being measured must be parallel; avoid any angle between the two axes as much as possible.
5. Do not shake the product violently during use. Avoid severe vibrations and keep it away from vibration sources (if unavoidable, install a vibration damping device) to prevent affecting the product's measurement accuracy.
6. During use, avoid rapid acceleration, sudden stops, sharp turns, and other movements

with angular velocities exceeding 300°/s to prevent affecting the product's measurement accuracy.

Communication protocol

The CAN 2.0 protocol supports 2.0A (11-bit ID) or 2.0B (29-bit ID); the default is CAN 2.0A.
1) Modify the node number (node range: 0x01-0x7F), the default node number is 0x05.
Request message format

CAN-ID	1st byte	2nd byte	3rd byte	4th byte	5th byte	6th byte	7th byte	8th byte
0x600+0x05	0x40	0x10	0x10	0x00	Node_ID	0x00	0x00	0x00

Response message format

CAN-ID	1st byte	2nd byte	3rd byte	4th byte	5th byte	6th byte	7th byte	8th byte
0x580+0x05	0x40	0x10	0x10	0x00	Node_ID	0x00	0x00	0x00

Note: If the controller sends CAN-ID=0x600+0x05, and the data sent is: 40 10 10 00 10 00 00 00
The sensor returns CAN-ID=0x580+0x05, and the data returned is: 40 10 10 00 10 00 00 00.
After power-on, the received frame ID is 0x590 (0x580+0x10), indicating that the frame ID was successfully modified.
2) Set the CAN baud rate (default baud rate is: 125Kbps)
Request message format

CAN-ID	1st byte	2nd byte	3rd byte	4th byte	5th byte	6th byte	7th byte	8th byte
0x600+0x05	0x40	0x20	0x10	0x00	Baud	0x00	0x00	0x00

Response message format

CAN-ID	1st byte	2nd byte	3rd byte	4th byte	5th byte	6th byte	7th byte	8th byte
0x580+0x05	0x40	0x20	0x10	0x00	Baud	0x00	0x00	0x00

Note: The fifth byte (Baud) is 0x00, 0x01, 0x02, 0x03, or 0x04. 0x00 represents a baud rate of 1 Mbps, 0x01 represents 500 Kbps, 0x02 represents 250 Kbps, 0x03 represents 125 Kbps, and 0x04 represents 100 Kbps. The default baud rate is 125 Kbps. After sending this command and receiving the returned data, the sensor needs to be powered on again for the baud rate modification to succeed.
3) Set the automatic output cycle time (factory default output cycle is 10ms)
Request message format

CAN-ID	1st byte	2nd byte	3rd byte	4th byte	5th byte	6th byte	7th byte	8th byte
0x600+0x05	0x22	0x00	0x22	0x00	T_L	T_H	0x00	0x00

Response message format

CAN-ID	1st byte	2nd byte	3rd byte	4th byte	5th byte	6th byte	7th byte	8th byte
0x580+0x05	0x22	0x00	0x22	0x00	T_L	T_H	0x00	0x00

Response message format
The fifth and sixth bytes represent the time, with the fifth byte being the low byte and the sixth byte the high byte, ranging from 10ms to 1000ms；

For example: 50ms TIME_L=0x32， TIME_H=0x00，

100ms TIME_L=0x64， TIME_H=0x00，

1000ms TIME_L=0xE8， TIME_H=0x03，
The settable range is 10ms to 1000ms, with a factory default of 10ms (100Hz).

4) Azimuth Zeroing

Request Message Format

CAN-ID	1st byte	2nd byte	3rd byte	4th byte	5th byte	6th byte	7th byte	8th byte
0x600+0x05	0x40	0x10	0x10	0x00	0x10	0x10	0x10	0x10

Response message format

CAN-ID	1st byte	2nd byte	3rd byte	4th byte	5th byte	6th byte	7th byte	8th byte
0x580+0x05	0x40	0x10	0x10	0x00	0x10	0x10	0x10	0x10

Reset the current azimuth angle to zero

5) Set the output frame type (factory default: angle frame + acceleration frame + gyro angular rate frame)

The output data frames include: angle frame, acceleration frame, gyro angular rate frame, and standard frame. Enabling the corresponding frame output will cause the sensor to output these frames periodically according to the set cycle. For example, if the output cycle is 100ms, and angle frame + acceleration frame + gyro angular rate frame are enabled, then angle frame + acceleration frame + gyro angular rate frame will be continuously output every 100ms (there will be a very short time interval between angle frame, acceleration frame, and gyro angular rate frame).

Request message format:

CAN-ID	1st byte	2nd byte	3rd byte	4th byte	5th byte	6th byte	7th byte	8th byte
0x600+0x05	0x40	0x30	0x10	0x00	MASK	0x00	0x00	0x00

Request message format:

CAN-ID	1st byte	2nd byte	3rd byte	4th byte	5th byte	6th byte	7th byte	8th byte
0x580+0x05	0x40	0x30	0x10	0x00	MASK	0x00	0x00	0x00

The lower 4 bits of the fifth byte, Mask, are valid. Mask (binary: 0B0000dcba).

a: Represents angle frames (roll, pitch, azimuth), 1: output on, 0: output off.

b: Represents acceleration frames (three-axis acceleration), 1: output on, 0: output off.

c: Represents gyro angular velocity frames (three-axis angular velocity), 1: output on, 0: output off.

d: Represents standard frames (Z-axis angular rate, forward acceleration, azimuth), 1: output on, 0: output off.

The host sends: 40 30 10 00 07 00 00 00, which will enable angle, acceleration, and gyro angular velocity frame outputs and disable standard frame output.

The host sends: 40 30 10 00 05 00 00 00, which will enable angle and gyro angular velocity frame outputs and disable acceleration and standard frame outputs.

6) Data Parsing

①There are four types of data frames: angle frames, acceleration frames, gyroscope data frames, and standard frames.

CAN-ID	1st byte	2nd byte	3rd byte	4th byte	5th byte	6th byte	7th byte	8th byte
0x580+Node_ID	Data0	Data1	Data2	Data3	Data4	Data5	Data6	flag

Data0-Data6: Represents data, the type of which is angle, acceleration, or gyroscope data frame, determined by the corresponding flag bit.

flag (ddddccaa): Unsigned single byte, 8 bits, representing the data frame type and measurement method:

aa: Indicates the data type of the frame

- 00: Indicates an angle frame (roll ±180°, pitch ±90°, azimuth ±180°);
- 01: Indicates acceleration (±32.765g);
- 10: Indicates gyroscope (±327.65°/s);

11: Indicates a standard frame (Z-axis angular rate + Y-axis forward acceleration + Z-axis azimuth);
cc: Reserved.
dddd: Reserved.
The following is a breakdown of different data type frames for horizontal measurement methods:

A: Angle data frame

CAN-ID	1st byte	2nd byte	3rd byte	4th byte	5th byte	6th byte	7th byte	8th byte
0x580+Node_ID	XL	XH	YL	YH	ZL	ZH	Temp	0x00

The CAN-ID is followed by eight bytes of data. The first two bytes, XL and XH, represent the X-axis (ROLL) roll angle. The third and fourth bytes, YL and YH, represent the Y-axis (PITCH) tilt angle. The fifth and sixth bytes, ZL and ZH, represent the Z-axis (YAW) azimuth angle. The angle value is an int16_t, with the low byte first and the high byte last. Dividing by 100 yields the floating-point angle. The seventh byte is the temperature value, a signed single-byte integer.
Angle conversion example: 26 15 DA EA 28 23 19 00
Flag = 0 x 00 indicates the data is in degrees.
The X-axis roll angle data is represented by a 16-bit signed binary number, with the high 8 bits being XH and the low 8 bits being XL.
Convert this 16-bit signed binary number to a decimal number, then divide by 100 to obtain the angle.
For example: XL = 0x26, XH = 0x15, the angle is 54.14°.
XH XL
0x15 0x26
0x1526(5414)
The final result is 5414/100=54.14°
YH YL
0xEA 0xDA
0xEADA(-5414)
The final result is -5414/100=-54.14°
ZH ZL
0x23 0x28
0x2328(9000)
The final result is 9000/100=90.00°
Temp
0x19(25) = 25℃。

B: Acceleration data frames

CAN-ID	1st byte	2nd byte	3rd byte	4th byte	5th byte	6th byte	7th byte	8th byte
0x580+Node_ID	XL	XH	YL	YH	ZL	ZH	0x00	0x01

The CAN-ID is followed by eight bytes of data. The first two bytes, XL and XH, represent the X-axis acceleration magnitude. The third and fourth bytes, YL and YH, represent the Y-axis acceleration magnitude. The fifth and sixth bytes, ZL and ZH, represent the Z-axis acceleration magnitude. The acceleration magnitude is represented as an int16_t, with the low byte first and the high byte last. Dividing by 1000 yields the floating-point acceleration value. The seventh byte is reserved.
Example of acceleration conversion:
26 15 DA EA 28 23 00 01
Flag = 0x01 indicates that the data is acceleration.
The X-axis acceleration data is represented by a 16-bit signed binary number, with the high 8 bits being XH and the low 8 bits being XL.
Convert this 16-bit signed binary number to a decimal number, then divide by 1000 to obtain the acceleration.
For example, XL = 0x26, XH = 0x15, the acceleration is 5.414g.
XH XL

0x15 0x26
0x1526(5414)
The final result is 5414/1000=5.414g
YH YL
0xEA 0xDA
0xEADA(-5414)
The final result is -5414/1000=-5.414g
ZH ZL
0x23 0x28
0x2328(9000)
The final result is 9000/1000=9.000g

C: Gyroscope data frames

CAN-ID	1st byte	2nd byte	3rd byte	4th byte	5th byte	6th byte	7th byte	8th byte
0x580+Node_ID	XL	XH	YL	YH	ZL	ZH	0x00	0x02

The CAN-ID is followed by eight bytes of data. The first two bytes, XL and XH, represent the X-axis gyroscope size. The third and fourth bytes, YL and YH, represent the Y-axis gyroscope size. The fifth and sixth bytes, ZL and ZH, represent the Z-axis gyroscope size. The gyroscope size is represented as an int16_t, with the low byte first and the high byte last. Dividing by 100 yields the floating-point number of the gyroscope. The seventh byte is reserved.
Example of gyroscope data conversion:
26 15 DA EA 28 23 00 02
Flag = 0x02 indicates the data is for the gyroscope.
The X-axis gyroscope data size is represented by a 16-bit signed binary number, with the high 8 bits being XH and the low 8 bits being XL.
Convert this 16-bit signed binary number to a decimal number, then divide by 100 to obtain the gyroscope size.
For example, if XL = 0x26 and XH = 0x15, the gyroscope's speed is 54.14°/s.
XH XL
0x15 0x26
0x1526(5414)
The final result is 5414/100=54.14°/S
YH YL
0xEA 0xDA
0xEADA(-5414)
The final result is -5414/100=-54.14°/S
ZH ZL
0x23 0x28
0x2328(9000)
The final result is 9000/100=90.00°/S

D: Standard data frame

CAN-ID	1st byte	2nd byte	3rd byte	4th byte	5th byte	6th byte	7th byte	8th byte
0x580+Node_ID	ZrateL	ZrateH	YaccL	YaccH	ZangL	ZangH	0x00	0x03

The CAN-ID is followed by eight bytes of data. The first two bytes, ZrateL and ZrateH, represent the Z-axis gyro angular rate. The third and fourth bytes, YaccL and YaccH, represent the Y-axis body acceleration. The fifth and sixth bytes, ZangL and ZangH, represent the Z-axis azimuth. All data items are int16_t, with the low byte first and the high byte last. Dividing Zrate and Zang by 100 gives the Z-axis gyro angular rate and Z-axis azimuth. Dividing Yacc by 1000 gives the Y-axis body acceleration. The seventh byte is reserved (0x00), and the eighth byte is 0x03.
Example of standard frame conversion:
26 15 DA EA 28 23 00 03
Flag = 0x03 indicates the data is a gyro angular rate frame.
ZrateL = 0x26, ZrateH = 0x15, the gyro angular rate is 54.14°/s.
ZrateH ZrateL

0x15 0x26
0x1526(5414)
The final result is 5414/100=54.14°/S
YaccH YaccL
0xEA 0xDA
0xEADA(-5414)
The final result is -5414/1000=-5.414g
ZangH ZangL
0x23 0x28
0x2328(9000)
The final result is 9000/100=90.00°

② Periodic Output of Data Frames: Four types of data frames can be output in any combination. AGV generally select standard data frame output, while attitude control systems can select angle frame output, or angle frame, acceleration frame, and gyro angular rate output.

A. Single-frame angle output (outputs one angle frame periodically, default output method), message format as follows:

CAN-ID	1st byte	2nd byte	3rd byte	4th byte	5th byte	6th byte	7th byte	8th byte
0x580+Node_ID	XL	XH	YL	YH	ZL	ZH	Temp	0x00

B. Dual-frame angle table output (dual frames, outputted periodically), message format as follows:

CAN-ID	1st byte	2nd byte	3rd byte	4th byte	5th byte	6th byte	7th byte	8th byte
0x580+Node_ID	XL	XH	YL	YH	ZL	ZH	Temp	0x00

CAN-ID	1st byte	2nd byte	3rd byte	4th byte	5th byte	6th byte	7th byte	8th byte
0x580+Node_ID	XL	XH	YL	YH	ZL	ZH	0x00	0x01

C. Three-frame angle gyroscope output (three frames, continuously outputting three frames in a periodic manner), message format as follows:

CAN-ID	1st byte	2nd byte	3rd byte	4th byte	5th byte	6th byte	7th byte	8th byte
0x580+Node_ID	XL	XH	YL	YH	ZL	ZH	Temp	0x00

CAN-ID	1st byte	2nd byte	3rd byte	4th byte	5th byte	6th byte	7th byte	8th byte
0x580+Node_ID	XL	XH	YL	YH	ZL	ZH	0x00	0x01

CAN-ID	1st byte	2nd byte	3rd byte	4th byte	5th byte	6th byte	7th byte	8th byte
0x580+Node_ID	XL	XH	YL	YH	ZL	ZH	0x00	0x02