CE RoHS

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RoSH certification:18300RC2410801

V2.2

IMU GYRO - FARM MACHINERY VERSION

TL725D

Technical manual

○ CE certification: registration No. AT18250EC001296
○ RoHS certification: registration No.18300RC20410801
○ Revision date: 2025-6-23
Note: Product functions, parameters, appearance, etc. will be adjusted as technology upgrades. Please contact our sales to confirm when purchasing.

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● PRODUCT DESCRIPTION

TL725D is a gyroscope IMU specialized in navigation for agricultural vehicle automatic driving. With built-in industrial-grade three-axis gyroscope and three-axis accelerometer, TL725D can still output smooth attitude data under the high vibration working condition. Developed based on the MEMS inertial measurement platform and dynamic attitude algorithm of the angular rat e of the gyroscope, it outputs dynamic inclination angle, horizontal azimuth angle, three-axis a ngular rate, three-axis acceleration and forward axial body acceleration data in real time. it als o can feedback counting output in real time by the Z-axis single-axis integral output, allowing t he vehicle's front wheels turned accurately. The TL725D is specially applied for automatic agr icultural machinery aiming to precise and efficient operation. It is an indispensable component of a new generation agricultural machinery.

● FEATURE

★ Horizontal azimuth and attitude angle output
★ Real-time angular rate output
★ Long life and strong stability
★ Forward axis acceleration
★ Compact and lightweight design
★ All solid state
★ DC9~36V power supply
★ Light weight

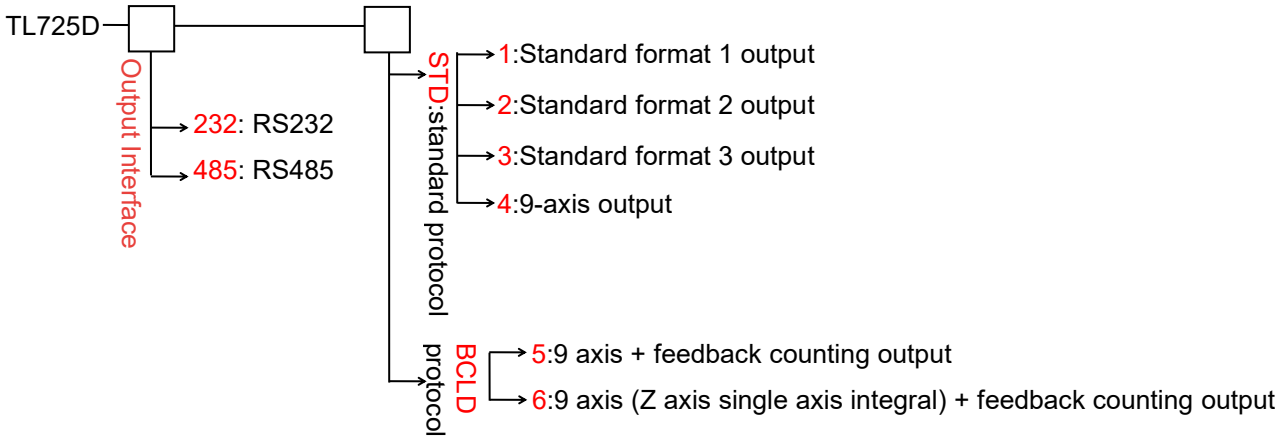
●APPLICATION

★ Automated agricultural machinery
★ Precision agriculture
★ Combination Harvesters
★ Farming machine

• SPECIFICATIONS

TL725D		PARAMETERS
Three-axis attitude		Azimuth ±180°, Roll angle±180°, Pitch angle±90
Bandwidth		>100Hz
Nonlinear		0.1% of FS
Three-axis gyroscope	Gyro Range	250°/s
	Angle random walk coefficient (allan)	0.25°/sqrt(h)
	Bias stability mg (10s smooth)	8.5°/h
Three-axis acceleration	Range	±4g
	Resolution	0.001g
	Accuracy	1mg
	Bias instability°/h (allan)	0.05mg
	Speed random walk coefficient (allan)	0.015m/s/sqrt(h)
	Bias stability°/h(10s average)	0.15mg
Startup time		500ms
Input voltage		+9~36V
Current		35mA(12V)
Working temp.		-40 ~ +80℃
Storage temp.		-40 ~ +85℃
Vibration		5g~10g
Shock		200g pk, 2ms, ½sine
Working life		10 Year
Output frequency		1Hz~200Hz Settable
Output signal		RS232 / RS485 / (Optional)
MTBF		≥98000 Hours/times
Insulation resistance		≥100MΩ
Shockproof		100g@11ms/3 Axial Direction (Half Sinusoid)
Anti-vibration		10grms/10 ~ 1000Hz
Protection grade		IP67
Cable		Standard 1 m 4 pin shield wire
Weight		≤160g (including 1 meter cable)

• ORDERING INFORMATION

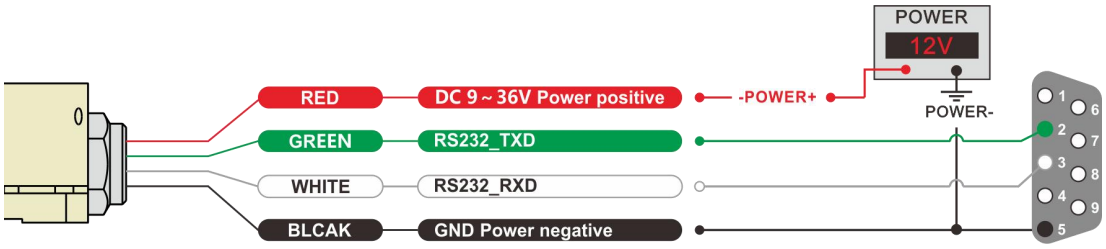


E.g 1: TL725D-232-STD1: RS232 output, STD: standard protocol standard format 1 output.
E.g 2: TL725D-232-BCLD5: RS232 output, BCLD protocol 9 axes + feedback counting output.
Note: Two protocols are optional, STD:standard protocol can choose 1~4 output, BCLD protocol can choose 5~6 output.

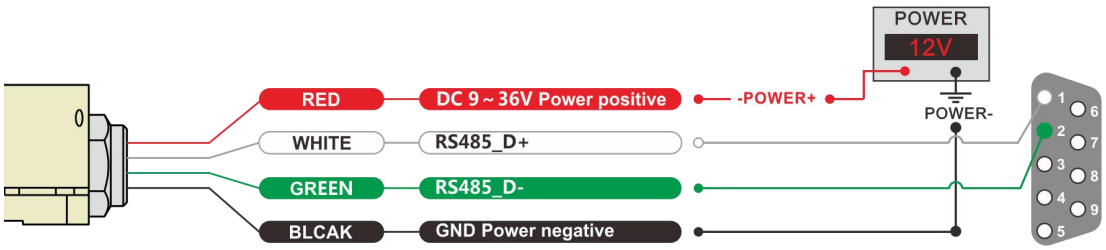
• ELECTRICAL CONNECTION

LINE COLOR INFORMATIO	BLACK	WHITE	GREEN	RED
	GND Negative power	RS232(RXD) RS485(D+)	RS232(TXD) RS485(D-)	DC 9 ~ 36V Power Positive

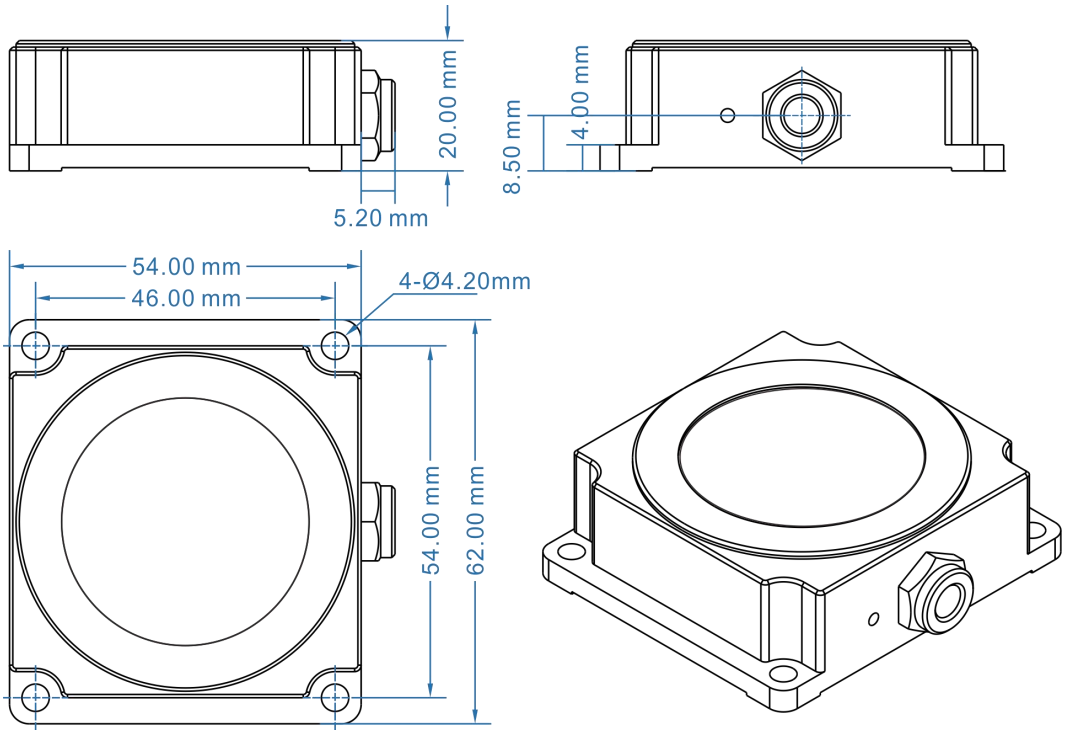
RS232 CABLE WIRE INFORMATION ▼



RS485CABLE WIRE INFORMATION ▼



• PRODUCT DIMENSION



Shell size: L62×W54×H20mm
Installation size: L54×W46×H4mm
Mounting screws: 4 M4 screws

• PRODUCTION INSTALLATION NOTES

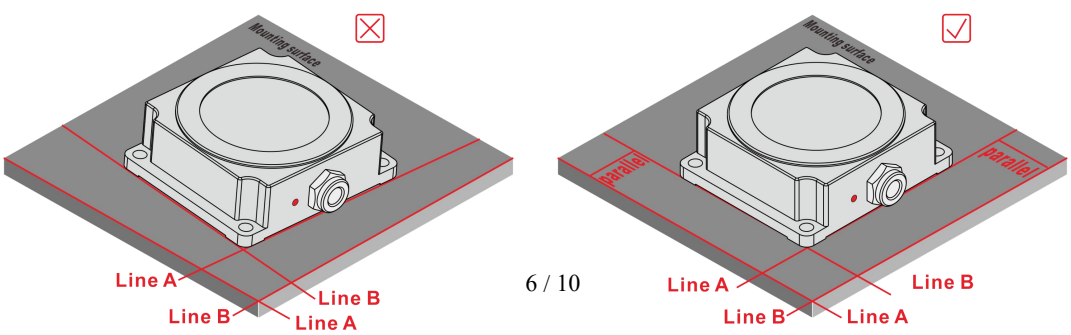
1.The installation surface of the angle instrument should be kept parallel to the measured target surface and the influence of dynamic and acceleration on the angle instrument should be reduced. Incorrect installation can cause measurement error, Pay particular attention to 1 "face" and 2 "lines ":

1)The mounting surface and the measured surface must be fixed tightly, flat and stable. If the mounting surface is uneven, it is easy to cause the angle error of the IMU gyro measurement.

2)The angle axis must be parallel to the measured axis, and the two axes can not produce an angle.

2.Do not shake the product violently during use, avoid violent vibration during use, and stay away from the source of vibration (if unavoidable, please install a shock absorber), so as not to affect the product measurement accuracy;

3.During use, try to avoid movements with angular velocity greater than 300°/s, such as rapid acceleration, sudden stop, and sharp turning, so as not to affect the product measurement accuracy.



● COMMUNICATION PROTOCOL

1. **Standard Data Frame Format**: (BCD code, 8 data bits, 1 stop bit, no parity, default baud rate 115200)

Identifier (1byte)	Date Length (1byte)	Address code (1byte)	Command Word (1byte)	Date domain	Check sum (1byte)
68h					

Identifier: fixed at 68 H;
Data length:From data length to check sum(including check sum)length;
Address code:Accumulating module address, Default :00;
Date domain will be changed according to the content and length of command word;
Check sum: Data length/Address code/Command word and data domain sum,No carry.

2. COMMAND word analysis

Desc.	Meaning/Example	Description
0X04	**Read angle command** E.g: ***68 04 00 04 08***	Data domain(0byte) No Data domain command
0X84	Sensor automatic output angle	See the detailed output format table for details Note: The data output format is set by the manufacturer according to customer requirements.
0X0C	**Set Sensor Output Mode** Automatic output: The sensor automatically outputs the angle after power on, the output frequency is 25HZ(Default settings). (This function can power off memory) Eg: ***68 05 00 0C 03 14*** ***set to 25 HZ output***	Data domain 00 0Hz Q & A output mode 01 5Hz Automatic Output Mode 02 15Hz Automatic Output Mode 03 25Hz Automatic Output Mode 04 35Hz Automatic Output Mode 05 50Hz Automatic Output Mode 06 100Hz Automatic Output Mode 07 200Hz Automatic Output Mode
0X8C	Sensor answer reply command Eg: **68 05 00 8C 00 91**	Data domain(1byte) Data domain in the number means the sensor response results 00 : Success FF : Failure
0X0B	**Set communication rate** **Eg: *68 05 00 0B 03 13*** The command setting is effective after power off then restart (power off with save function)	Data domain(1byte)baud rate: 02 means 9600 03 means19200 04 means 38400 05means 115200((factory default) 06means 256000
0X8B	Sensor answer reply command Eg: **68 05 00 8B 90**	Data domain(1byte) Data domain in the number means the sensor response results 00 : Success FF : Failure
0X28	***Azimuth angle clear command*** When the azimuth angle has errors after long-term work, you can send this command. After the transmission is successful, the azimuth angle will output "0° Eg : ***68 04 00 28 2c***	Data domain(0byte) No data domain command
0X28	Sensor answer reply command Eg : **68 05 00 28 00 2D**	Data domain(1byte) Data domain in the number means the sensor response results 00 : Success FF : Failure
0x0F	Modify sensor address Eg: 68 05 00 0F 05 19 Change the sensor address from 0x00 to	Data domain(1byte) Address(00-FE), FF Universal address.

	0x05	In the example, the modified address is: 05
0x8F	Sensor response command 68 05 00 8F 00 14	Data domain(1byte) Data domain in the number means the sensor response results 00 : Success FF : Failure

3. Detailed output format table

STD Standard Protocol

1:Standard format 1 output

SOF	0x68 (1 byte)				
Length	0x0D (1 byte)				
Address	0x00 (1 byte)				
Payload Contents	See below:				
Byte Offset	Number Format	name	content	bytes	
0	INT8U	command	0x84	1	Means data
1	INT8U	Gyro_Z	Z axis angular rate	3	10 05 23: 3 characters means-5.23°/S 00 05 23: 3 characters means+5.23°/S
4	INT8U	ACC _Y	Forward body acceleration	3	00 10 00: 3 characters means+1.000g 10 10 00: 3 characters means-1.000g
7	INT8U	YAW	Azimuth	3	11 60 00: 3 characters means-160.00° 01 60 00: 3 characters means+160.00°
10	INT8U	Checksum	Checksum	1	

2:Standard format 2 output

SOF	0x68 (1 byte)				
Length	0x0D (1 byte)				
Address	0x00 (1 byte)				
Payload Contents	See below:				
Byte Offset	Number Format	name	content	bytes	
0	INT8U	command	0x84	1	Means data
1	INT8U	ACC_X	Left and right body acceleration	3	00 00 50: 3 characters means+0.050g(right) 10 00 50: 3 characters means -0.050g(Left)
4	INT8U	ACC_Y	Forward body acceleration	3	00 10 00: 3 characters means+1.000g(forward) 10 10 00: 3 characters means-1.000g (behind)
7	INT8U	YAW	Azimuth	3	11 60 00: 3 characters means-160.00°(Clockwise) 01 60 00: 3 characters means+160.00°(Reverse time)
10	INT8U	Checksum	Checksum	1	

3:Standard format 3 output

SOF	0x68 (1 byte)				
Length	0x10 (1 byte)				
Address	0x00 (1 byte)				
Payload Contents	See below:				
Byte Offset	Number Format	name	content	bytes	
0	INT8U	command	0x84	1	Means data
1	INT8U	Gyro_Z	Z axis angular rate	3	10 05 23: 3 characters means-5.23°/S 00 05 23: 3 characters means+5.23°/S
4	INT8U	ACC_ X	Left and right body acceleration	3	00 00 50: 3 characters means +0.050g(right) 10 00 50: 3 characters means -0.050g(Left)
7	INT8U	ACC_ Y	Forward body acceleration	3	00 10 00:3 characters means +1.000g (forward) 10 10 00: 3 characters means -1.000g (behind)
10	INT8U	YAW	Azimuth	3	11 60 00: 3 characters means-160.00°(Clockwise) 01 60 00: 3 characters means+160.00°(Reverse time)
13	INT8U	Check sum	Checksum	1	

4:9-axis output: attitude angle + 3-axis acceleration + 3-axis gyro rotation speed;

SOF	0x68 (1 byte)				
Length	0x1F (1 byte)				
Address	0x00 (1 byte)				
Payload Contents	See below				
Byte Offset	Number Format	name	content	bytes	
0	INT8U	command	0x84	1	Means data
1	INT8U	ROLL	Roll angle	3	01 60 00: 3 characters means +160.00°
4	INT8U	PITCH	Pitch angle	3	10 50 23: 3 characters means -50.23°
7	INT8U	YAW	heading angle	3	11 60 00: 3 characters means -160.00°
10	INT8U	ACC X	X axis acceleration	3	00 23 04: 3 characters means Acceleration +2.304g
13	INT8U	ACC Y	Y axis acceleration	3	10 23 04: 3 characters means Acceleration -2.304g
16	INT8U	ACC Z	Z axis acceleration	3	10 23 04: 3 characters means Acceleration -2.304g
19	INT8U	Gyro_ X	X axis gyro	3	10 50 23: 3 characters means -50.23°/S
22	INT8U	Gyro_ Y	Y axis gyro	3	01 80 00: 3 characters means +180.00°/S
25	INT8U	Gyro_ Z	Z axis gyro	3	00 50 23: 3 characters means +50.23°/S
28	INT8U	Check sum	Checksum	1	

● BCLD PROTOCOL

5:9-axis + feedback angle count output: attitude angle + 3-axis acceleration + 3-axis gyro speed + feedback angle count.

SOF	0x68 (1 byte)
Length	0x21 (1 byte)
Address	0x00 (1 byte)
Payload Contents	See below

Byte Offset	Number Format	name	content	bytes	
0	INT8U	command	0x84	1	Means data
1	INT8U	ROLL	Roll angle	3	10 50 23: 3 characters means -50.23°
4	INT8U	PITCH	Pitch angle	3	01 60 00: 3 characters means +160.00°
7	INT8U	YAW*	Heading angle *	3	11 60 00: 3 characters means -160.00°
10	INT8U	ACC X	X axis acceleration	3	00 23 04: 3 characters means Acceleration +2.304g
13	INT8U	ACC Y	Y axis acceleration	3	10 23 04: 3 characters means Acceleration -2.304g
16	INT8U	ACC Z	Z axis acceleration	3	10 23 04: 3 characters means Acceleration -2.304g
19	INT8U	Gyro_ X	X axis gyro	3	10 50 23: 3 characters means -50.23°/S
22	INT8U	Gyro_ Y	Y axis gyro	3	01 80 00: 3 characters means +180.00°/S
25	INT8U	Gyro_ Z	Z axis gyro	3	00 50 23: 3 characters means +50.23°/S
28	INT8U	Fb_Count	feedback angle count	1	0-199: Count from 0 to 200(200=0)
29	INT8U	CR_Count	Calibration count	1	0-255
30	INT8U	Check sum	Checksum	1	

*The heading angle can be the 6-axis KLM heading angle, or the Z-axis single-axis integrated heading angle .

6:feedback angle format

SOF	0x68 (1 byte)
Length	0x07 (1 byte)
Address	0x00 (1 byte)
Payload Contents	See below

Byte Offset	Number Format	name	content	bytes	
0	INT8U	command	0x08	1	Means data
1	INT8U	Head Feedback	Heading angle feedback	3	10 05 23: 3 characters means-5.23° 00 05 23: 3 characters means+5.23°
4	INT8U	Check sum	Checksum	1	

For example: 68 07 00 08 10 05 23 47 feedback angle is -5.23 °, and the transmission frequency of feedback angle is ≤ 50Hz.

Note: The heading angle feedback is usually obtained by the client using the vehicle's GNSS system data, as well as parameters such as the vehicle's wheelbase, to deduce the steering angle of the front wheels under the Ackermann model. The steering angle is then judged for reliability based on the vehicle speed and guidance signals and fed back to the TL725D (gyroscope). If feedback is received, it is fed back to the gyroscope in this feedback angle format (such as the RXD signal terminal of RS232).