LOCOSYS Technology Inc.
20F.-13, No.79, Sec. 1, Xintai 5th Rd.,
Xizhi Dist., New Taipei City 22101, Taiwan
☏ 886-2-8698-3698
886-2-8698-3699
www.locosystech.com/

Product name	Description	Version
LS23236	High precision dead reckoning GNSS receiver	1.0

1 Introduction

LS23236 is a dual-frequency multi-constellation GNSS receiver providing RTK high precision and sensor fusion solution. It not only supports GPS, GLONASS, GALILEO, BEIDOU and QZSS, but also has inertial sensors (3-axis accelerometers and 3-axis gyros) to provide dead reckoning.

No requirement of installation orientation and automatic alignment function make it easy to use. With these features, LS23236 can reduce position errors in multipath environment and continue to work where GNSS signals are poor or not available, such as tunnels and indoor parking lots, as well as deliver seamless navigation. The fast Time-To-First-Fix, RTK convergence, superior sensitivity, low power consumption and water proof make it a better choice for car navigation.

2 Features

- Dual-frequency and multi-constellation RTK positioning solution
- Support GPS, GLONASS, GALILEO, BEIDOU and QZSS
- Capable of SBAS (WAAS, EGNOS, MSAS, GAGAN) and QZSS SLAS
- Support 135-channel GNSS
- Built-in MEMS sensor (3-axis gyroscope and 3-axis accelerometer)
- No requirement for installation orientation
- Smart jammer detection and suppression
- IPX7 waterproof

3 Application

- Car navigation

LOCOSYS Technology Inc.
20F.-13, No.79, Sec. 1, Xintai 5th Rd.,
Xizhi Dist., New Taipei City 22101, Taiwan
☏ 886-2-8698-3698
886-2-8698-3699
www.locosystech.com/

4 GNSS specification

Frequency	GPS/QZSS: L1 C/A, L5C GLONASS: L1OF GALILEO: E1, E5a BEIDOU: B1I, B2a	
Channels	Support 135 channels	
Update rate	1Hz	
Acquisition Time	Cold start	30s (typical)
	RTK convergence time	< 10s (typical, after 3D fix)
Position accuracy	Autonomous	1.5m CEP (1)
	RTK	1cm + 1ppm CEP (horizontal) (1) 1.5cm + 1ppm CEP (vertical) (1)
	DR mode	CEP ≤ 10% of distance travelled without GNSS (2)
Datum	WGS-84 (default)	
Max. altitude	< 10,000 m	
Max. velocity	< 500 m/s	
Protocol support	115200 bps, 8 data bits, no parity, 1 stop bits (default)	
	NMEA 0183 ver. 4.1	1Hz: $PLSATTIT, GLL, GGA, RMC 0.2Hz: GSA, GSV

<Note>

1. 24hr, static, open sky.
2. Test condition: after alignment, drive at 30 km/h for 60 seconds without GNSS signals.

LOCOSYS Technology Inc.
20F.-13, No.79, Sec. 1, Xintai 5th Rd.,
Xizhi Dist., New Taipei City 22101, Taiwan
☏ 886-2-8698-3698
886-2-8698-3699
www.locosystech.com/

5 Software interface

5.1 NMEA output message

Table 5.1-1 NMEA output message

NMEA record	Description
GGA	Global positioning system fixed data
GLL	Geographic position - latitude/longitude
GSA	GNSS DOP and active satellites
GSV	GNSS satellites in view
RMC	Recommended minimum specific GNSS data
VTG	Course over ground and ground speed
GST	Estimated error in position solution

- **GGA--- Global Positioning System Fixed Data**

Table 5.1-2 contains the values for the following example:

$GNGGA,091250.000,2503.71250,N,12138.74514,E,1,32,0.55,119.0,M,17.2,M,,*7E

Table5.1- 2 GGA Data Format

Name	Example	Units	Description
Message ID	$GNGGA		GGA protocol header
UTC Time	091250.000		hhmmss.sss
Latitude	2503.71250		ddmm.mmmmm
N/S indicator	N		N=north or S=south
Longitude	12138.74514		dddmm.mmmmm
E/W Indicator	E		E=east or W=west
Position Fix Indicator	1		See Table 5.1-3
Satellites Used	32		Number of satellites in use
HDOP	0.55		Horizontal Dilution of Precision (meters)
MSL Altitude	119.0	meters	Antenna Altitude above/below mean-sea-level (geoid) (in meters)
Units	M	meters	Units of antenna altitude, meters
Geoidal Separation	17.2	meters	
Units	M	meters	Units of geoidal separation, meters
Age of diff. GNSS data		second	Null fields when DGPS is not used
Diff. Ref. Station ID			Differential reference station ID, 0000-1023
Checksum	*7E		Checksum
<CR> <LF>			End of message termination

Table 5.1-3 Position Fix Indicators

Value	Description
0	No position fix
1	Autonomous GNSS fix
2	Differential GNSS fix
4	RTK fixed
5	RTK float
6	Estimated/Dead reckoning fix

● GLL--- Geographic Position – Latitude/Longitude

Table 5.1-4 contains the values for the following example:

$GNGLL,2503.71193,N,12138.74582,E,094450.000,A,A*47

Table 5.1-4 GLL Data Format

Name	**Example**	**Units**	**Description**
Message ID	$GNGLL		GLL protocol header
Latitude	2503.71193		ddmm.mmmmm
N/S indicator	N		N=north or S=south
Longitude	12138.74582		dddmm.mmmmm
E/W indicator	E		E=east or W=west
UTC Time	094450.000		hhmmss.sss
Status	A		A=data valid or V=data not valid
Mode	A		N = No position fix A = Autonomous GNSS fix D = Differential GNSS fix R = RTK fixed F = RTK float E = Estimated/Dead reckoning fix
Checksum	*47		
<CR> <LF>			End of message termination

● GSA---GNSS DOP and Active Satellites

Table 5.1-5 contains the values for the following example:

$GNGSA,A,3,11,195,194,199,08,07,01,27,16,09,23,,1.19,0.64,1.00,1*3F

$GNGSA,A,3,87,81,76,,,,,,,,,1.19,0.64,1.00,2*0F

$GNGSA,A,3,,,,,,,,,,,,,1.19,0.64,1.00,3*09

$GNGSA,A,3,34,24,12,07,11,10,08,38,25,09,13,16,1.19,0.64,1.00,4*02

Table 5.1-5 GSA Data Format

Name	**Example**	**Units**	**Description**

Message ID	$GNGSA		GSA protocol header
Mode 1	A		See Table 5.1-6
Mode 2	3		See Table 5.1-7
ID of satellite used	11		SV on Channel 1
ID of satellite used	195		SV on Channel 2
….			….
ID of satellite used			SV on Channel 12
PDOP	1.19		Position Dilution of Precision
HDOP	0.64		Horizontal Dilution of Precision
VDOP	1.00		Vertical Dilution of Precision
GNSS system ID	4		See Table 5.1-8
Checksum	*3F		
<CR> <LF>			End of message termination

Table 5.1-6 Mode 1

Value	Description
M	Manually set to operate in 2D or 3D mode
A	Automatically switching between 2D or 3D mode

Table 5.1-7 Mode 2

Value	Description
1	No position fix
2	2D fix
3	3D fix

Table 5.1-8 GNSS system ID

Value	Description
1	GPS
2	GLONASS
3	GALILEO
4	BEIDOU
6	IRNSS

● GSV---GNSS Satellites in View

Table 5.1-9 contains the values for the following example:

$GPGSV,3,1,09,8,71,268,47,27,63,18,49,11,44,191,46,4,41,237,46,1*54

$GPGSV,3,2,09,16,38,42,42,9,32,279,39,26,22,70,38,31,15,131,36,1*56

$GPGSV,3,3,09,7,15,320,40,1*6B

$GPGSV,1,1,04,8,71,268,50,27,63,18,49,9,32,279,43,26,22,70,42,8*6C

$GLGSV,2,1,05,82,63,47,47,83,56,182,36,80,47,9,42,79,33,85,45,1*71

$GLGSV,2,2,05,81,15,27,37,1*71

$GAGSV,1,1,04,08,48,300,43,03,47,025,45,13,36,309,42,05,06,061,34,7*79

$GAGSV,1,1,04,08,48,300,43,03,47,025,47,13,36,309,43,05,06,061,33,1*7B

$GBGSV,5,1,17,12,80,182,47,24,64,5,51,7,58,355,44,3,57,205,45,1*7C

$GBGSV,5,2,17,1,54,141,44,34,52,211,49,9,48,230,45,10,47,316,42,1*79

$GBGSV,5,3,17,26,44,100,47,16,39,207,43,4,38,117,41,2,37,240,41,1*77

$GBGSV,5,4,17,39,37,210,43,6,36,198,41,38,27,173,41,25,18,317,42,1*4E

$GBGSV,5,5,17,35,16,39,40,1*7F

$GBGSV,1,1,02,24,64,5,50,26,44,100,43,4*77

Table 5.1-9 GSV Data Format

Name	**Example**	**Units**	**Description**
Message ID	$GPGSV		GSV protocol header GP=GPS/QZSS, GL=GLONSS, GA=GALILEO, GB=BEIDOU, GI=IRNSS.
Total number of messages	3		Range 1 to 9
Message number	1		Range 1 to 9
Satellites in view	09		
Satellite ID	8		Channel 1
Elevation	71	degrees	Channel 1 (Range 00 to 90)
Azimuth	268	degrees	Channel 1 (Range 000 to 359)
SNR (C/No)	47	dB-Hz	Channel 1 (Range 00 to 99, null when not tracking)
….			….
Satellite ID	4		Channel 4 (Range 01 to 196)
Elevation	41	degrees	Channel 4 (Range 00 to 90)
Azimuth	237	degrees	Channel 4 (Range 000 to 359)
SNR (C/No)	46	dB-Hz	Channel 4 (Range 00 to 99, null when not tracking)
Signal ID	1		GPS/QZSS: L1 C/A=1, L5Q=8 GLONASS: L1 C/A=1 GALILEO: E1=7, E5a=1 BEIDOU: B1=1, B2a=4 IRNSS: L6=1
Checksum	*54		
<CR> <LF>			End of message termination

● RMC---Recommended Minimum Specific GNSS Data

Table 5.1-10 contains the values for the following example:

$GNRMC,070143.000,A,2503.71317,N,12138.74533,E,0.002,70.50,130220,,,A,V*01

LOCOSYS Technology Inc.
20F.-13, No.79, Sec. 1, Xintai 5th Rd.,
Xizhi Dist., New Taipei City 22101, Taiwan
☏ 886-2-8698-3698
886-2-8698-3699
www.locosystech.com/

Table 5.1-10 RMC Data Format

Name	Example	Units	Description
Message ID	$GNRMC		RMC protocol header
UTC Time	070143.000		hhmmss.sss
Status	A		A=data valid or V=data not valid
Latitude	2503.71317		ddmm.mmmmm
N/S Indicator	N		N=north or S=south
Longitude	12138.74533		dddmm.mmmmm
E/W Indicator	E		E=east or W=west
Speed over ground	0.002	knots	True
Course over ground	70.50	degrees	
Date	130220		ddmmyy
Magnetic variation		degrees	
Variation sense			E=east or W=west
Mode	A		N = No position fix A = Autonomous GNSS fix D = Differential GNSS fix R = RTK fixed F = RTK float E = Estimated/Dead reckoning fix
Navigational status indicator	V		S = Safe C = Caution U = Unsafe V = Void
Checksum	*01		
<CR> <LF>			End of message termination

● VTG---Course Over Ground and Ground Speed

Table 5.1-11 contains the values for the following example:

$GNVTG,0.00,T,,M,0.003,N,0.006,K,A*26

Table 5.1-11 VTG Data Format

Name	Example	Units	Description
Message ID	$GPVTG		VTG protocol header
Course over ground	0.00	degrees	Measured heading
Reference	T		True
Course over ground		degrees	Measured heading
Reference	M		Magnetic

Speed over ground	0.003	knots	Measured speed
Units	N		Knots
Speed over ground	0.006	km/hr	Measured speed
Units	K		Kilometer per hour
Mode	A		N = No position fix A = Autonomous GNSS fix D = Differential GNSS fix R = RTK fixed F = RTK float E = Estimated/Dead reckoning fix
Checksum	*26		
<CR> <LF>			End of message termination

- **GST---Estimated error in position solution**

Table 5.1-12 contains the values for the following example:

$GNGST,075707.000,2.9,1.8,1.5,113.3,1.6,1.8,5.9*7F

Table 5.1-12 GST Data Format

Name	**Example**	**Units**	**Description**
Message ID	$GNGST		GST protocol header
UTC Time	075707.000		hhmmss.sss
RangeRMS	2.9	meters	RMS value of the standard deviation of the ranges
stdMajor	1.8	meters	Standard deviation of semi-major axis of error ellipse
stdMinor	1.5	meters	Standard deviation of semi-minor axis of error ellipse
Orient	113.3	degrees	Orientation of semi-major axis of error ellipse
stdLat	1.6	meters	Standard deviation of latitude error
stdLong	1.8	meters	Standard deviation of longitude error
stdAlt	5.9	meters	Standard deviation of altitude error
Checksum	*7F		
<CR> <LF>			End of message termination

5.2 Proprietary output message

- **PLSATTIT**

Table 5.2-1 contains the values for the following example:

$PLSATTIT,061030.000,120723,3,2,0,155.54,0.70,-0.41,25.0619348,121.6561793,30.39,-27.99,11.84,0.06,37.00,21.66,0.0,0.0*2D

Table5.2- 1 PLSATTIT Data Format

Name	**Example**	**Units**	**Description**

Message ID	$PLSATTIT		PLSATTIT protocol header
UTC Time	061030.000		hhmmss.sss
Date	120723		ddmmyy
DR_Stage	3		DR algorithm stage, 0: unknown, 1: initializing, 2: coarse, 3: stable.
Static_Status	2		User static status, 0: unknown, 1: static, 2: dynamic
Motion_Alarm	0		User motion detection alarm, 0: unknown 1: HARSH_ACCELERATION 2: HARSH_DECELERATION 4: HARSH_TURN 8: HARSH_LANE_CHANGE 16: HORIZONTAL_COLLISION 32: ROLLOVER 64: STABILITY_WARNING 128: EULER_ANOMALY
Vehicle_Heading	155.54	degree	0 ~ 360
Vehicle_Pitch	0.70	degree	-180 ~ 180
Vehicle_Roll	-0.41	degree	-180 ~ 180
Latitude	25.0619348	degree	dd.dddddd, latitude in WGS84
Longitude	121.6561793	degree	dd.dddddd, longitude in WGS84
Ground_Speed	30.39	km/hr	Speed over ground (2D)
Velocity_North	-27.99	km/hr	Velocity in north direction
Velocity_East	11.84	km/hr	Velocity in east direction
Velocity_Down	0.06	km/hr	Velocity in down direction
Height_WGS84_Ellipsoid	37.00	meter	Altitude above WGS84 ellipsoid
Height_Mean_Sea_Level	21.66	meter	Altitude above mean sea level
Reserved1	0.0		
Reserved2	0.0		
Checksum	*2D		Checksum
<CR> <LF>			End of message termination

5.3 Proprietary command

5.3.1 ID: 001

[Description]

PAIR_ACK. Acknowledge of the input command.

[Return]

$PAIR001,Command_ID,Result*CS<CR><LF>

Command_ID: The command / packet type the acknowledge responds.

Result: The result of the command.

0: The command was successfully sent.

1: The command is processing. You must wait for the result.

2: Sending the command failed.

3: This command ID is not supported.

4: Command parameter error. Out of range / some parameters were lost / checksum error.

5: Service is busy. You can try again soon.

[Example]

Send:

$PAIR002*38\r\n

Response:

$PAIR001,002,0*39\r\n ==> Success

5.3.2 ID: 002

[Description]

Power on the GNSS system. Include DSP/RF/Clock and other GNSS sections.

[Data Field]

$PAIR002*CS<CR><LF>

[Return]

PAIR_ACK for send result.

[Example]

Send:

$PAIR002*38\r\n

Response:

$PAIR001,002,1*38\r\n ==> The power on process is running. Please wait a moment.

$PAIR001,002,0*39\r\n ==> Power on was successful.

5.3.3 ID: 003

[Description]

Power off GNSS system. Include DSP/RF/Clock and other GNSS sections. The location service is not available after this command is executed. The module can still receive configuration commands.

[Data Field]

$PAIR003*CS<CR><LF>

[Return]

PAIR_ACK for send result.

[Example]

Send:

$PAIR003*39\r\n

Response:

$PAIR001,003,1*39\r\n ==> The power off process is running. Please wait a moment.

$PAIR001,003,0*38\r\n ==> Power off was successful.

5.3.4 ID: 004

[Description]

Hot Start. Use the available data in the NVRAM.

[Data Field]

$PAIR004*CS<CR><LF>

[Return]

PAIR_ACK for send result.

[Example]

Send:

$PAIR004*3E\r\n

Response:

$PAIR001,004,0*3F\r\n ==> Success

5.3.5 ID: 005

[Description]

Warm Start. Not using Ephemeris data at the start.

[Data Field]

$PAIR005*CS<CR><LF>

[Return]

PAIR_ACK for send result.

[Example]

Send:

$PAIR005*3F\r\n

Response:

$PAIR001,005,0*3E\r\n ==> Success

5.3.6 ID: 006

[Description]

Cold Start. Not using the Position, Almanac and Ephemeris data at the start.

[Data Field]

$PAIR006*CS<CR><LF>

LOCOSYS Technology Inc.
20F.-13, No.79, Sec. 1, Xintai 5th Rd.,
Xizhi Dist., New Taipei City 22101, Taiwan
☏ 886-2-8698-3698
886-2-8698-3699
www.locosystech.com/

[Return]

PAIR_ACK for send result.

[Example]

Send:

$PAIR006*3C\r\n

Response:

$PAIR001,006,0*3D\r\n ==> Success

5.3.7 ID: 008

[Description]

Get GNSS subsystem status.

[Data Field]

$PAIR008*CS<CR><LF>

[Return]

1. PAIR_ACK for send result.
2. $PAIR008,<status>*CS<CR><LF>

status: the status of GNSS subsystem.

0: The GNSS subsystem has powered on.

1: The GNSS subsystem is powered off.

[Example]

Send:

$PAIR008*32\r\n

Response:

$PAIR001,008,0*33\r\n ==> Success

$PAIR008,1,0*33\r\n ==> GNSS subsystem has powered on.

5.3.8 ID: 400

[Description]

Set DGPS correction data source mode.

[Data Field]

$PAIR400,<Mode> *CS<CR><LF>

Mode: DGPS data source mode.

'0': No DGPS source

'1': RTCM

'2': SBAS (Include WAAS/EGNOS/GAGAN/MSAS)

'3': QZSS SLAS

[Return]

PAIR_ACK for send result.

LOCOSYS Technology Inc.
20F.-13, No.79, Sec. 1, Xintai 5th Rd.,
Xizhi Dist., New Taipei City 22101, Taiwan
☏ 886-2-8698-3698
886-2-8698-3699
www.locosystech.com/

[Example]

Send:

$PAIR400,2*20\r\n ==> Set SBAS Mode

Response:

$PAIR001,400,0*3F\r\n ==> Success

5.3.9 ID: 401

[Description]

Query the DGPS data source mode.

[Data Field]

$PAIR401*CS<CR><LF>

[Return]

1. PAIR_ACK for send result.
2. $PAIR401,<Mode>*CS<CR><LF>

Mode: DGPS data source mode.

'0': No DGPS source

'1': RTCM

'2': SBAS (Include WAAS/EGNOS/GAGAN/MSAS)

'3': QZSS SLAS

[Example]

Send:

$PAIR401*3F\r\n

Response:

$PAIR001,401,0*3E\r\n ==> Success

$PAIR401,2*21\r\n ==> SBAS Mode

5.3.10 ID: 410

[Description]

Enable searching a SBAS satellite or not.

When navigation mode is Fitness or Swimming mode, SBAS is not supported.

[Data Field]

$PAIR410,<Enabled>*CS<CR><LF>

Enabled: Enable or disable

'0' = Disable

'1' = Enable

[Return]

PAIR_ACK for send result.

[Example]

Send:

$PAIR410,1*22\r\n ==> Enable SBAS

Response:

$PAIR001,410,0*3E\r\n ==> Success

5.3.11 ID: 411

[Description]

Query the status of SBAS to whether it is enabled.

[Data Field]

$PAIR411<Enabled>*CS<CR><LF>

[Return]

1. PAIR_ACK for send result.
2. $PAIR411,<Enabled>*CS<CR><LF>

Enabled: Enable or disable

'0' = Disable

'1' = Enable

[Example]

Send:

$PAIR411*3E\r\n

Response:

$PAIR001,411,0*3F\r\n ==> Success

$PAIR411,1*23\r\n ==> Enable SBAS

5.3.12 ID: 420

[Description]

Enable the QZSS SLAS (Sub-meter Level Augmentation Service) operation.

When navigation mode is Fitness or Swimming mode, QZSS SLAS is not supported.

[Data Field]

$PAIR420,<Enabled>*CS<CR><LF>

Enabled: Enable or disable

'0' = Disable

'1' = Enable

[Return]

PAIR_ACK for send result.

[Example]

Send:

$PAIR420,1*21\r\n ==> Enable QZSS SLAS

Response:

$PAIR001,420,0*3D\r\n ==> Success

5.3.13 ID: 421

[Description]

Query the status of SLAS to check whether it is enabled.

[Data Field]

$PAIR421*CS<CR><LF>

[Return]

1. PAIR_ACK for send result.
2. $PAIR421,<Enabled>*CS<CR><LF>

Enabled: Enable or disable

'0' = Disable

'1' = Enable

[Example]

Send:

$PAIR421*3D\r\n ==> Enable QZSS SLAS

Response:

$PAIR001,421,0*3C\r\n ==> Success

$PAIR421,1*20\r\n ==> The status of QZSS SLAS is enabled

5.3.14 ID: 513

[Description]

Save the current configuration from RTC RAM to flash.

[Data Field]

$PAIR513*CS<CR><LF>

[Return]

PAIR_ACK for send result.

[Example]

Send:

$PAIR513*3D\r\n

Response:

$PAIR001,513,0*3C\r\n

[Note]

The changes of the configuration are kept in the RTC RAM that is powered from V_BCKP pin. If the power from V_BCKP pin is not kept, the changes will be lost after system reboot. The user can use this command to save the changes into the non-volatile flash memory.

5.3.15 ID: 514

[Description]

Clear the current configuration and restore the factory default settings. This function does not support run time restore when GNSS is power on. Please send $PAIR003 command to power off GNSS before using this command.

[Data Field]

$PAIR514*CS<CR><LF>

[Return]

PAIR_ACK for send result.

[Example]

Send:

$PAIR514*3A\r\n

Response:

$PAIR001,514,0*3B\r\n

5.3.16 ID: 772

[Description]

Set the Vehicle Motion Dynamic System (VMDS) configuration.

[Data Field]

$PAIR772,<VMDS_type>,<threshold1>,<threshold2>*CS<CR><LF>

VMDS_type -> (threshold1, threshold2)

1 -> threshold1: Threshold for harsh acceleration [m/s2], [Range: 1.0 ~ 5.0, default: 2.5]

2 -> threshold1: Threshold for harsh deceleration [m/s2], [Range: -2.0 ~ -6.0, default: -4.5]

4 -> threshold1: Lateral acceleration threshold for harsh turn [m/s2], [Range: 2.0 ~ 6.0, default: 4.0]

-> threshold2: Heading change threshold for harsh turn [deg], [Range: 30 ~ 80, default: 45]

8 -> threshold1: Lateral acceleration threshold for harsh lane change [m/s2], [Range: 1.5 ~ 5.0, default: 4.0]

-> threshold2: Heading change threshold for harsh lane change [deg], [Range: 15 ~ 30, default: 20]

16 -> threshold1: Acceleration threshold for horizontal collision [m/s2], [Range: 15 ~ 20, default: 20]

-> threshold2: Tilt angle threshold for horizontal collision [deg], [Range: 15 ~ 50, default: 20]

32 -> threshold1: Threshold for rollover angle [deg], [Range: 50 ~ 90, default: 70]

64 -> threshold1: Heading change threshold for instability warning [deg/s], [Range: 20 ~ 60, default: 50]

128 -> threshold1: Max angle for euler angle anomaly [deg], [Range: 50 ~ 80, default: 70]

-> threshold2: Min angle for euler angle anomaly [deg], [Range: 15 ~ 40, default: 20]

[Return]

PAIR_ACK for send result.

[Example]

Send:

$PAIR722,1,1*38\r\n

Response:

$PAIR001,722,1*38\r\n ==> Processing

$PAIR001,722,0*39\r\n ==> Success

[Note]

The threshold would be set with 2 decimal places.

5.3.17 ID: 773

[Description]

Get the VMDS configuration.

[Data Field]

$PAIR773,<VMDS_type>*CS<CR><LF>

[Return]

1. PAIR_ACK for send result.
2. $PAIR773,<VMDS_type>,<threshold1>,<threshold2>*CS<CR><LF>

VMDS_type -> (threshold1, threshold2)

1 -> threshold1: Threshold for harsh acceleration [m/s2]

2 -> threshold1: Threshold for harsh deceleration [m/s2]

4 -> threshold1: Lateral acceleration threshold for harsh turn [m/s2]
-> threshold2: Heading change threshold for harsh turn [deg]

8 -> threshold1: Lateral acceleration threshold for harsh lane change [m/s2]
-> threshold2: Heading change threshold for harsh lane change [deg]

16 -> threshold1: Acceleration threshold for horizontal collision [m/s2]
-> threshold2: Tilt angle threshold for horizontal collision [deg]

32 -> threshold1: Threshold for rollover angle [deg]

64 -> threshold1: Heading change threshold for instability warning [deg/s]

128 -> threshold1: Max angle for euler angle anomaly [deg]
-> threshold2: Min angle for euler angle anomaly [deg] [Example]

[Example]

Send:

$PAIR773,1*24\r\n

Response:

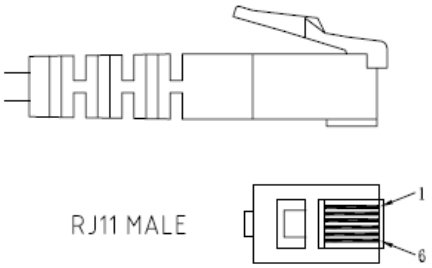
$PAIR001,773,1*39\r\n ==> Processing

$PAIR001,773,0*38\r\n ==> Success

LOCOSYS Technology Inc.
20F.-13, No.79, Sec. 1, Xintai 5th Rd.,
Xizhi Dist., New Taipei City 22101, Taiwan
☎ 886-2-8698-3698
886-2-8698-3699
www.locosystech.com/

$PAIR773,1,2.50*11\r\n

6 Pin assignment and descriptions



Pin #	Name	Type	Description
1	NC		Not connect
2	GND	P	Ground
3	RX	I	Data input (RS232 level)
4	TX	O	Data output (RS232 level)
5	VCC	I	Power input.
6	NC		Not connect

LOCOSYS Technology Inc.
20F.-13, No.79, Sec. 1, Xintai 5th Rd.,
Xizhi Dist., New Taipei City 22101, Taiwan
☎ 886-2-8698-3698
886-2-8698-3699
www.locosystech.com/

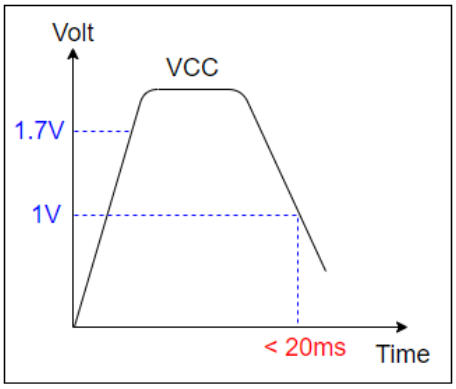
7 DC & Temperature characteristics

7.1 Power consumption

Parameter	Symbol	Min.	Typ.	Max.	Units
Input voltage (1)	VCC	4	5	5.5	V
Input current	I_{CC}		69 (2)		mA

<Note>

1. The input voltage from 0 to its working voltage must be a stable rising slope. Avoid powering the module at the same time during mechanical contact of the connector. The mechanical contact bounce may result in the following voltage waveform. This may make the receiver not work. When this happens, VCC must be re-powered to enable the receiver.



2. Measured when position fix is available.

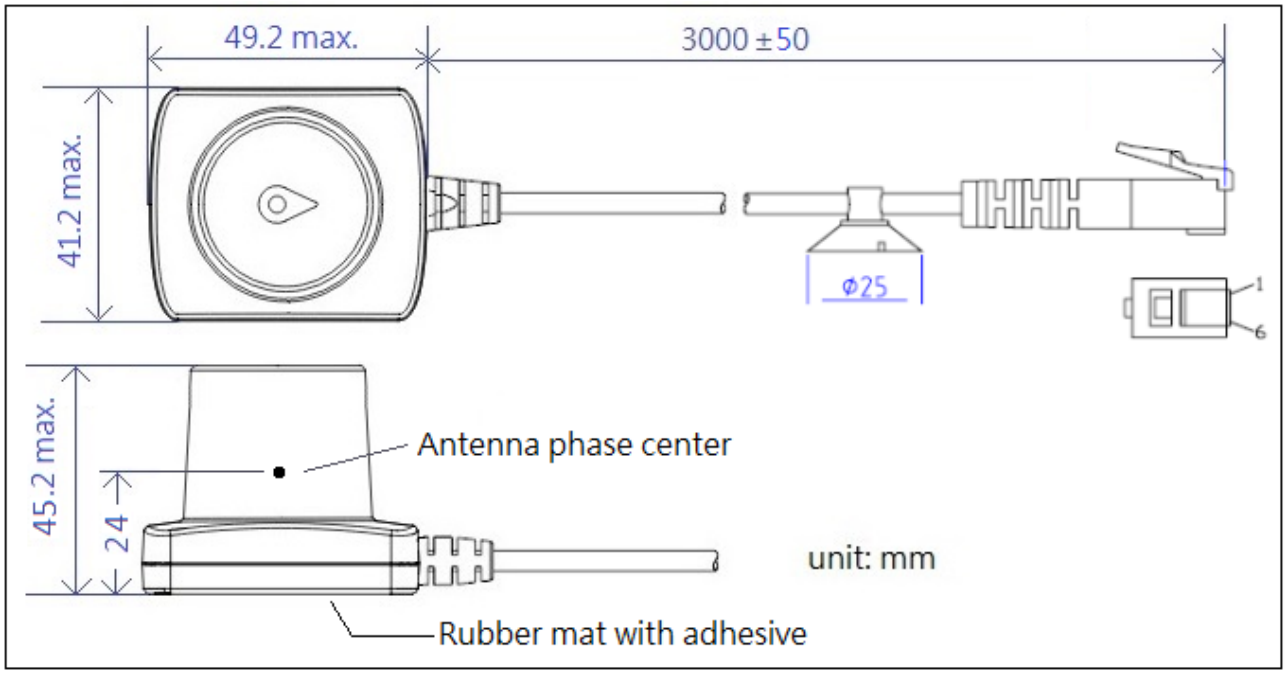
7.2 Temperature characteristics

Parameter	Symbol	Min.	Typ.	Max.	Units
Operating Temperature	T_{OPR}	-40	-	85	℃
Storage Temperature	T_{STG}	-40	25	85	℃

LOCOSYS Technology Inc.
20F.-13, No.79, Sec. 1, Xintai 5th Rd.,
Xizhi Dist., New Taipei City 22101, Taiwan
☏ 886-2-8698-3698
886-2-8698-3699
www.locosystech.com/

8 Mechanical specification

8.1 Outline dimensions



8.2 Installation and alignment

The receiver must be rigidly fixed on the vehicle before power-on. Do not install the receiver on anything that moves or absorbs the shock. No requirement for installation orientation. Do not move the receiver after power-on. The receiver is only suitable for vehicle navigation with acceleration less than 4g.

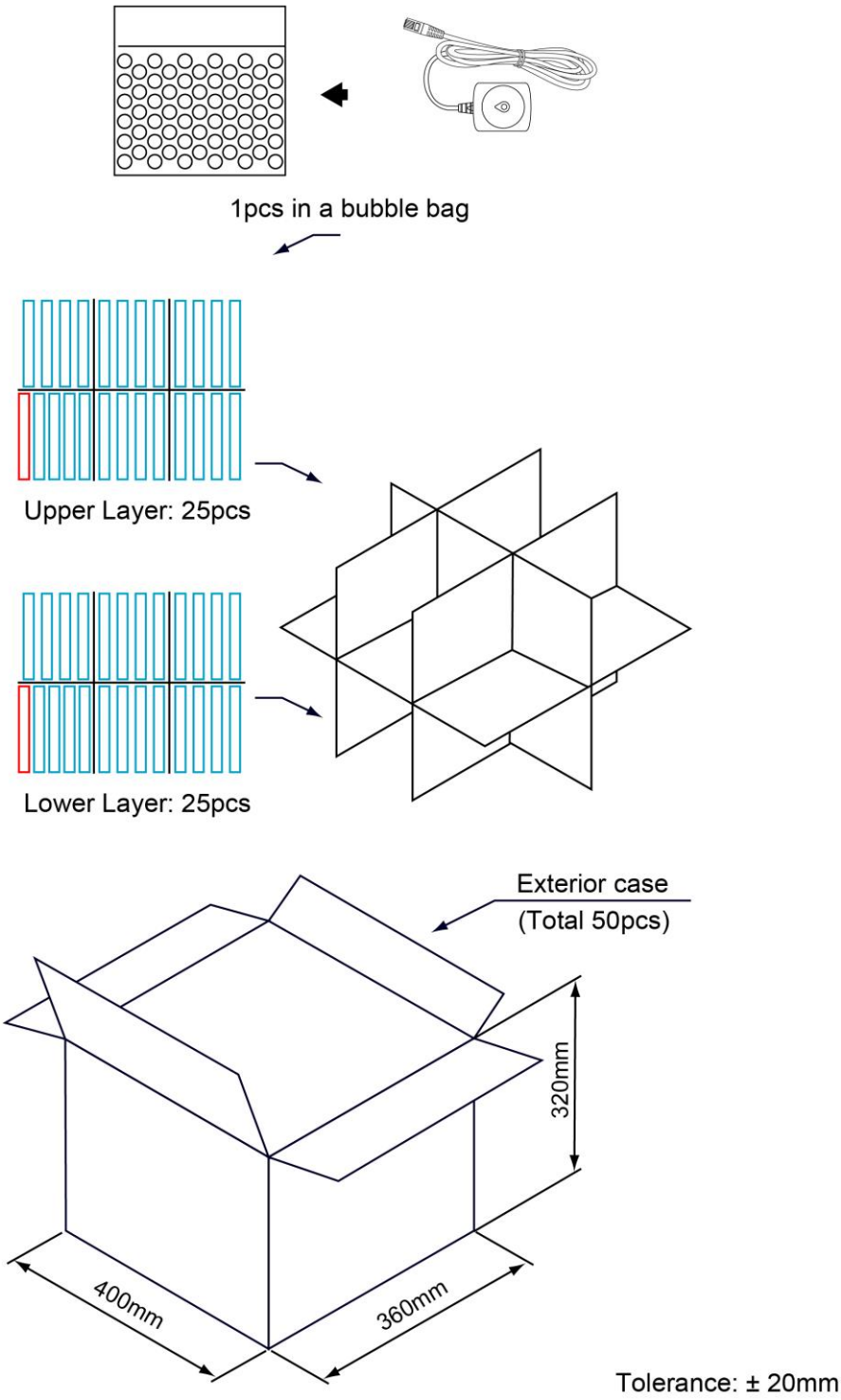
In order to get the better fused navigation, the initialization and alignment steps are suggested in the following.

1. Power on the receiver and wait GNSS position fix in the open sky environment.
2. Stay still for 3 minutes with vehicle idling.
3. Drive around the block with the speed > 10 km/h and < 50 km/h in the open sky environment.
4. Drive straight for more than 500 meters with the speed > 10 km/h and < 50 km/h in the open sky environment.
5. The DR algorithm stage in the message "**$PLSATTIT**" shows if the alignment is done.

If the receiver is moved after rigidly fixing on the vehicle, it can automatically start initialization and alignment.

LOCOSYS Technology Inc.
20F.-13, No.79, Sec. 1, Xintai 5th Rd.,
Xizhi Dist., New Taipei City 22101, Taiwan
☎ 886-2-8698-3698
886-2-8698-3699
www.locosystech.com/

9 Packing information



LOCOSYS Technology Inc.
20F.-13, No.79, Sec. 1, Xintai 5th Rd.,
Xizhi Dist., New Taipei City 22101, Taiwan
☏ 886-2-8698-3698
886-2-8698-3699
www.locosystech.com/

10 Ordering information

Product name	Description	Remark
LS23236	High precision dead reckoning GNSS receiver.	GPS/QZSS: L1 C/A, L5C GLONASS: L1OF GALILEO: E1, E5a BEIDOU: B1I, B2a

LOCOSYS

LOCOSYS Technology Inc.
20F.-13, No.79, Sec. 1, Xintai 5th Rd.,
Xizhi Dist., New Taipei City 22101, Taiwan
☏ 886-2-8698-3698
886-2-8698-3699
www.locosystech.com/

Document change list

Revision 0.1

- Draft release on July 14, 2023.

Revision 0.2 (August 4, 2023)

- Added section 5.2, 5.3 and 8.2
- Added packing diagram in section 9.

Revision 0.3 (August 17, 2023)

- Changed the input current from 66mA to 69mA in section 7.1

Revision 1.0 (September 27, 2023)

- Changed the maximum height from 45 to 45.2 in section 8
- Changed the packing diagram in section 9