LC29D DR&RTK(2) Application Note

GNSS Module Series

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-	2021-06-21	Creation of the document
1.0	2021-06-21	First official release.

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1 Introduction

The dead reckoning (DR) and real-time kinematic (RTK) features, mounting, calibration, and messages related to DR and RTK of Quectel LC29D module are described in this document.

This document is applicable to the following variants of Quectel LC29D module:

- LC29D (E)
- LC29D (F)

2 Configuration

2.1. Orientation

The orientation of the module is shown below:

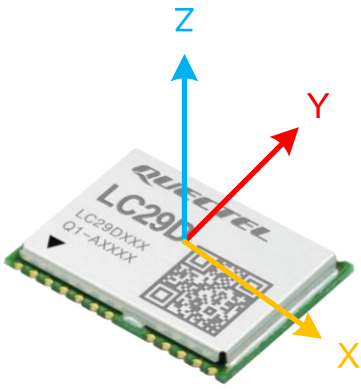

Figure 1: Module Orientation

2.2. Mounting

LC29D supports free-mounting feature, which means that the device incorporating Quectel LC29D module can be mounted on a vehicle in any orientation, but one axis must be in line with the forward direction of the vehicle and another axis perpendicular to the ground.

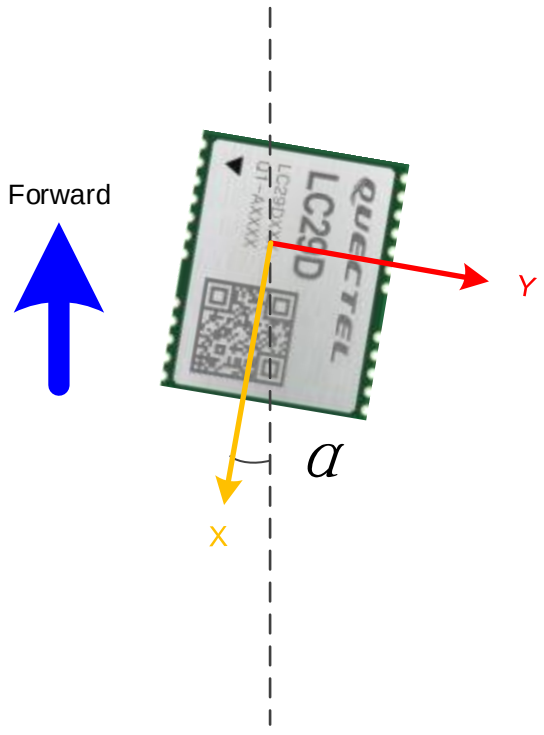

Figure 2: Yaw Angle

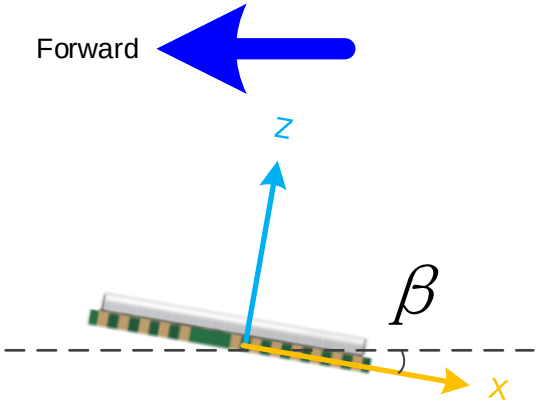

Figure 3: Pitch and Roll Angles

When mounting the Quectel LC29D module, make sure that -15° ≤ *β* ≤ 15°. There is no restriction on yaw angle (0° ≤ *α* ≤ 360°).

2.3. DR Calibration

DR calibration steps:

Step 1: Fix the module on the vehicle frame. Any displacement, turn or tilt of the device, however small, will cause performance issues and/or void calibration.

Step 2: Calibration should be performed under good GNSS signal and clear sky conditions.

Step 3: Power up the module, then start the vehicle on a plain surface and keep it still for at least 30 s.

Step 4: Start driving the vehicle under good GNSS signal conditions. The module will start self-calibration, which would be completed in a few minutes.

Step 5: The calibration process ends when the **<NavMode>** of **$PQTMSOL** message indicates a combined solution. See ***Chapter 3.1.1*** for details about the message.

2.4. RTCM Input

Quectel LC29D (E) module supports the RTCM version 3.3 input messages listed in table below.

Table 1: Supported RTCM Input Messages

Message Type	Description
1005	Stationary RTK Reference Station ARP
1006	Stationary RTK Reference Station ARP with Antenna Height
1074	GPS MSM4
1124	BeiDou MSM4

NOTE

Quectel LC29D (F) module does not support RTCM input messages.

3 Messages

3.1. PQTM Messages

This chapter introduces the PQTM messages (proprietary NMEA messages defined by Quectel) supported by Quectel LC29D (E, F) module.

3.1.1. PQTMSOL

This message outputs navigation results.

Type:

Output.

Synopsis:

```
$PQTMSOL,<SubID>,<Year>,<Month>,<Day>,<Hour>,<Minute>,<Millisecond>,<Timestamp>,<WN_Ext>,<TOW>,<NavMode>,<Lat>,<Lon>,<AltElli>,<AltMSL>,<N_Vel>,<E_Vel>,<D_Vel>,<GroundSpeed>,<TravelDist>,<Roll>,<Pitch>,<Heading>,<MotionStatus>,<Res1>,<N_Uncertain>,<E_Uncertain>,<D_Uncertain>,<VN_Uncertain>,<VE_Uncertain>,<VD_Uncertain>,<Roll_Uncertain>,<Pitch_Uncertain>,<Yaw_Uncertain>,<RollMisAng>,<PitchMisAng>,<YawMisAng>,<RefStaID>,<SecSinceLastDiff>,<Res2>,<Res3>*<Checksum><CR><LF>
```

Parameter:

Field	Format	Unit	Description
<SubID>	Numeric	-	Fixed as 1.
<Year>	Numeric	Year	UTC Year.
<Month>	Numeric	Month	UTC Month.
<Day>	Numeric	Day	UTC Day.
<Hour>	Numeric	Hour	UTC Hour.
<Minute>	Numeric	Minute	UTC Minute.

<Millisecond>	Numeric	ms	UTC Millisecond.
<Timestamp>	Numeric	ms	Milliseconds since power on. 32-bit unsigned integer.
<WN_Ext>	Numeric	Week	GPS week number, including rollover.
<TOW>	Numeric	ms	Time of week.
<NavMode>	Numeric	-	Navigation mode. 0 = No navigation. Bit 0: Reserved. Bit 1: GNSS only. Bit 2: DR only. Bit 3: Combined solution (GNSS + DR). Bit 4-8: Reserved. Bit 9: Odometer (Wheel Tick) in use. Bit 10,11: Reserved. Bit 12: DGNSS (Not include satellite-based correction source). Bit 13: RTK in use, fixed. Bit 14: RTK in use, float. Bit 15–31: Reserved.
<Lat>	Numeric	Degree	Latitude. Scaled by 10^7.
<Lon>	Numeric	Degree	Longitude. Scaled by 10^7.
<AltElli>	Numeric	cm	Ellipsoidal height.
<AltMSL>	Numeric	cm	Height above mean sea level.
<N_Vel>	Numeric	cm/s	Northward velocity.
<E_Vel>	Numeric	cm/s	Eastward velocity.
<D_Vel>	Numeric	cm/s	Downward velocity.
<GroundSpeed>	Numeric	cm/s	Speed over ground.
<TravelDist>	Numeric	cm	Traveled distance since power on.
<Roll>	Numeric	Degree	Roll, scaled by 100.
<Pitch>	Numeric	Degree	Pitch, scaled by 100.
<Heading>	Numeric	Degree	Heading, scaled by 100.
<MotionStatus>	Numeric	-	Motion status. 0 = Unknow. Bit 0: Stationary.

			Bit 1: In moving. Bit 2: Dramatic accelerating or decelerating. Bit 3: Sharp turning. Bit 4: Falling or flip over. Bit 5: Collision. Bit 6–31: Reserved.
<Res1>	Numeric	-	Reserved.
<N_Uncertain>	Numeric	cm	Uncertainty of position in northward direction.
<E_Uncertain>	Numeric	cm	Uncertainty of position in eastward direction.
<D_Uncertain>	Numeric	cm	Uncertainty of position in downward direction.
<VN_Uncertain>	Numeric	cm/s	Northward velocity uncertainty.
<VE_Uncertain>	Numeric	cm/s	Eastward velocity uncertainty.
<VD_Uncertain>	Numeric	cm/s	Downward velocity uncertainty.
<Roll_Uncertain>	Numeric	Degree	Roll uncertainty, scaled by 100.
<Pitch_Uncertain>	Numeric	Degree	Pitch uncertainty, scaled by 100.
<Yaw_Uncertain>	Numeric	Degree	Yaw uncertainty, scaled by 100.
<RollMisAng>	Numeric	Degree	Roll angle misalignment, scaled by 100.
<PitchMisAng>	Numeric	Degree	Pitch angle misalignment, scaled by 100.
<YawMisAng>	Numeric	Degree	Yaw angle misalignment, scaled by 100.
<RefStaID>	Numeric	-	Reference Station ID. Only supported in RTK mode.
<SecSinceLastDiff>	Numeric	Second	Seconds since last differential correction. Only supported in RTK mode.
<Res2>	Numeric	-	Reserved. Only available for RTK mode.
<Res3>	Numeric	-	Reserved. Only available for RTK mode.

Example:

```
//DR only mode:
$PQTMSOL,1,2021,1,19,12,1,58000,743400,2141,216136000,2,318220478,1171152086,5223,5584,-1,0,1,1,1482,-791,614,0,0,5000,311,311,440,100,100,282,13,10,10,0,0,0*6B
//DR + RTK mode:
$PQTMSOL,1,2021,3,5,11,35,30000,14699500,2147,473748000,16386,318220502,1171152312,5203,5565,0,0,0,0,0,-19,-66,0,0,5000,277,293,413,200,200,565,10,10,10,0,0,0,1941,1,13,2*50
```

3.1.2. PQTMALT

This message outputs attitude status.

Type:

Output.

Synopsis:

```
$PQTMALT,<SubID>,<Alert>,<PeakAcceleration>,<PeakAngularRate>,<GYRO_X>,<GYRO_Y>,<GYRO_Z>,<Accel_X>,<Accel_Y>,<Accel_Z>*<Checksum><CR><LF>
```

Parameter:

Field	Format	Unit	Description
<SubID>	Numeric	-	Fixed as 1.
<Alert>	Numeric	-	Alert. 0 = No alert. Bit 0: Dramatic accelerating. Threshold: > 2.5 m/s^2. Bit 1: Dramatic decelerating. Threshold: < -4.5 m/s^2. Bit 2: Sharp turning. Threshold: > 45 deg/s. Bit 3–31: Reserved.
<PeakAcceleration>	Numeric	m/s^2	Peak acceleration, scaled by 100.
<PeakAngularRate>	Numeric	deg/s	Peak angular velocity, scaled by 10.
<GYRO_X>	Numeric	deg/s	X-axis angular velocity of gyroscope, scaled by 10.
<GYRO_Y>	Numeric	deg/s	Y-axis angular velocity of gyroscope, scaled by 10.
<GYRO_Z>	Numeric	deg/s	Z-axis angular velocity of gyroscope, scaled by 10.
<Accel_X>	Numeric	m/s^2	X-axis acceleration of accelerometer, scaled by 100.
<Accel_Y>	Numeric	m/s^2	Y-axis acceleration of accelerometer, scaled by 100.
<Accel_Z>	Numeric	m/s^2	Z-axis acceleration of accelerometer, scaled by 100.

Example:

```
$PQTMALT,1,0,0.40,0.24,0.13,0.13,0.16,24.86,19.67,-980.61*6F
```

3.1.3. PQTMGNSSFIX

This message outputs the positioning information in GNSS only mode.

Type:

Output.

Synopsis:

```
$PQTMGNSSFIX,<SubID>,<Year>,<Month>,<Day>,<Hour>,<Minute>,<Second>,<WN>,<TOW>,<NumSV>,<Lat>,<Lon>,<AltElli>,<GroundSpeed>,<Heading>,<Accuracy>,<N_Vel>,<E_Vel>,<D_Vel>,<ClockBias>,<ClockDrift>,<N_Uncertain>,<E_Uncertain>,<D_Uncertain>,<VN_Uncertain>,<VE_Uncertain>,<VD_Uncertain>,<LeapSec>,<Res1>,<MeanSeaLevel>,<Res2>*<Checksum><CR><LF>
```

Parameter:

Field	Format	Unit	Description
<SubID>	Numeric	-	Fixed as 6.
<Year>	Numeric	Year	UTC Year.
<Month>	Numeric	Month	UTC Month.
<Day>	Numeric	Day	UTC Day.
<Hour>	Numeric	Hour	UTC Hour.
<Minute>	Numeric	Minute	UTC Minute.
<Second>	Numeric	Second	UTC Second.
<WN>	Numeric	Week	GPS week number, including rollover.
<TOW>	Numeric	ms	Time of week.
<NumSV>	Numeric	-	Number of satellites in use.
<Lat>	Numeric	Degree	Latitude. Scaled by 10^7.
<Lon>	Numeric	Degree	Longitude. Scaled by 10^7.
<AltElli>	Numeric	cm	Ellipsoidal height.
<GroundSpeed>	Numeric	cm/s	Speed over ground.
<Heading>	Numeric	Degree	Heading. Scaled by 100.
<Accuracy>	Numeric	cm	Horizontal accuracy.

<N_Vel>	Numeric	cm/s	Northward velocity.
<E_Vel>	Numeric	cm/s	Eastward velocity.
<D_Vel>	Numeric	cm/s	Downward velocity.
<ClockBias>	Numeric	cm	Clock bias.
<ClockDrift>	Numeric	cm/s	Clock drift.
<N_Uncertain>	Numeric	cm	Uncertainty of position in northward direction.
<E_Uncertain>	Numeric	cm	Uncertainty of position in eastward direction.
<D_Uncertain>	Numeric	cm	Uncertainty of position in downward direction.
<VN_Uncertain>	Numeric	cm/s	Northward velocity uncertainty.
<VE_Uncertain>	Numeric	cm/s	Eastward velocity uncertainty.
<VD_Uncertain>	Numeric	cm/s	Downward velocity uncertainty.
<LeapSec>	Numeric	Seconds	Leap seconds.
<Res1>	-	-	Reserved.
<MeanSeaLevel>	Numeric	cm	Height above mean sea level.
<Res2>	-	-	Reserved.

Example:

```
$PQTMGNSSFIX,6,2021,6,14,7,26,54,2162,113232000,26,318222148,1171152179,5846,1,18069,354,0
,0,0,19,3,250,250,1096,12,12,12,18,0,6208,1*6D
```

3.1.4. PQTMMEAS

This message outputs information for Quectel's internal debugging purpose only.

3.1.5. PQTMSF

This message outputs information for Quectel's internal debugging purpose only.

3.1.6. PQTMSNR,21

This message outputs sensor data.

Type:

Output.

Synopsis:

```
$PQTMSNR,21,<NumSets>[,<TimeTag>,<X_GYRO>,<Y_GYRO>,<Z_GYRO>,<X_ACC>,<
Y_ACC>,<Z_ACC>,<VehSpeed>,<Reverse>]*<Checksum><CR><LF>
```

Parameter:

Field	Format	Unit	Description
<NumSets>	Numeric	-	Repeat number of data set.
Start of repeat block. Repeat times: 0–<NumSets>.			
<TimeTag>	Numeric	ms	Milliseconds since power on. 32-bit unsigned integer.
<X_GYRO>	Numeric	Deg/s	X-axis angular velocity of gyroscope, scaled by 1000.
<Y_GYRO>	Numeric	Deg/s	Y-axis angular velocity of gyroscope, scaled by 1000.
<Z_GYRO>	Numeric	Deg/s	Z-axis angular velocity of gyroscope, scaled by 1000.
<X_ACC>	Numeric	m/s^2	X-axis acceleration of accelerometer, scaled by 1000.
<Y_ACC>	Numeric	m/s^2	Y-axis acceleration of accelerometer, scaled by 1000.
<Z_ACC>	Numeric	m/s^2	Z-axis acceleration of accelerometer, scaled by 1000.
<VehSpeed>	Numeric	m/s	Vehicle speed, scaled by 100.
<Reverse>	Numeric	-	0 = Forward 1 = Reverse
End of repeat block.			

Example:

```
$PQTMSNR,21,10,742500,461,-696,-358,1053,-1385,9744,0,0,742600,455,-696,-363,1050,-1388,9744,
0,0,742700,468,-700,-337,1053,-1389,9745,0,0,742800,458,-693,-341,1051,-1386,9745,0,0,742900,427
,-705,-349,1053,-1385,9745,0,0,743000,446,-685,-355,1051,-1388,9745,0,0,743100,448,-675,-345,1051
,-1387,9744,0,0,743200,443,-682,-332,1053,-1388,9745,0,0,743300,444,-700,-339,1050,-1389,9745,0,0
,743400,472,-684,-355,1051,-1387,9745,0,0*5E
```

3.1.7. PQTMSNR,23

This message outputs sensor data.

Type:

Output.

Synopsis:

```
$PQTMSNR,23,<TimeTag>,<X_GYRO>,<Y_GYRO>,<Z_GYRO>,<X_ACC>,<
Y_ACC>,<Z_ACC>*<Checksum><CR><LF>
```

Parameter:

Field	Format	Unit	Description
<TimeTag>	Numeric	ms	Milliseconds since power on. 32-bit unsigned integer.
<X_GYRO>	Numeric	Deg/s	X-axis angular velocity of gyroscope, scaled by 1000.
<Y_GYRO>	Numeric	Deg/s	Y-axis angular velocity of gyroscope, scaled by 1000.
<Z_GYRO>	Numeric	Deg/s	Z-axis angular velocity of gyroscope, scaled by 1000.
<X_ACC>	Numeric	m/s^2	X-axis acceleration of accelerometer, scaled by 1000.
<Y_ACC>	Numeric	m/s^2	Y-axis acceleration of accelerometer, scaled by 1000.
<Z_ACC>	Numeric	m/s^2	Z-axis acceleration of accelerometer, scaled by 1000.

Example:

```
$PQTMSNR,23,3100,399,-519,-454,466,-511,9906*45
$PQTMSNR,23,3200,394,-500,-471,470,-509,9902*4E
```

3.1.8. PQTMSRAW

This message outputs filtered and bias compensated sensor data.

Type:

Output.

Synopsis:

```
$PQTMSRAW,<SensorType>,<NumSets>[,<TimeTag>,<X_GYRO>,<Y_GYRO>,<Z_GYRO>,<X_ACC>,
<Y_ACC>,<Z_ACC>]*<Checksum><CR><LF>
```

Parameter:

Field	Format	Unit	Description
<SensorType>	Numeric	-	Fixed as 53.
<NumSets>	Numeric	-	Repeat number of data set.
Start of repeat block. Repeat times: 0–<NumSets>.			
<TimeTag>	Numeric	ms	Milliseconds since power on. 32-bit unsigned integer.
<X_GYRO>	Numeric	Deg/s	X-axis angular velocity of gyroscope.
<Y_GYRO>	Numeric	Deg/s	Y-axis angular velocity of gyroscope.
<Z_GYRO>	Numeric	Deg/s	Z-axis angular velocity of gyroscope.
<X_ACC>	Numeric	m/s^2	X-axis acceleration of accelerometer.
<Y_ACC>	Numeric	m/s^2	Y-axis acceleration of accelerometer.
<Z_ACC>	Numeric	m/s^2	Z-axis acceleration of accelerometer.
End of repeat block.			

Example:

```
$PQTMSRAW,53,10,742500,0.015,0.009,0.012,1.044,1.330,-9.666,742600,0.009,0.009,0.017,1.041,1.333,-9.666,742700,0.022,0.013,-0.009,1.044,1.334,-9.667,742800,0.012,0.006,-0.005,1.042,1.331,-9.667,742900,-0.019,0.018,0.003,1.044,1.330,-9.667,743000,0.000,-0.002,0.009,1.042,1.333,-9.667,743100,0.002,-0.012,-0.001,1.042,1.332,-9.666,743200,-0.003,-0.005,-0.014,1.044,1.333,-9.667,743300,-0.002,0.013,-0.007,1.041,1.334,-9.667,743400,0.026,-0.003,0.009,1.042,1.332,-9.667*0B
```

3.1.9. PQTMEND

This message outputs the end of an epoch.

Type:

Output.

Synopsis:

```
$PQTMEND,<EndFlag1>,<EndFlag2>*<Checksum><CR><LF>
```

Parameter:

Field	Format	Unit	Description
<EndFlag1>	Numeric	-	Fixed as 255.
<EndFlag2>	Numeric	-	Fixed as 255.

Example:

```
$PQTMEND,255,255*57
```

3.1.10. PQTMSETDRMODE

This message sets the vehicle information input method for DR mode.

Type:

Set.

Synopsis:

```
$PQTMSETDRMODE,<Mode>*<Checksum><CR><LF>
```

Parameter:

Field	Format	Unit	Description
<Mode>	Numeric	-	0 = No vehicle information input. UDR mode. 2 = Input vehicle speed or wheel tick through UART. 3 = Input vehicle information through hardware wheel tick interface (default).

Result:

If successful, the module returns:

```
$PQTMSETDRMODEOK*4B
```

If failed, the module returns:

```
$PQTMSETDRMODEERROR*17
```

Example:

```
$PQTMSETDRMODE,2*51
$PQTMSETDRMODEOK*4B
```

3.1.11. PQTMGETDRMODE

This message gets the vehicle information input method for DR mode.

Type:

Get.

Synopsis:

```
$PQTMGETDRMODE*<Checksum><CR><LF>
```

Result:

If successful, the module returns:

```
$PQTMDRMODE,<Mode>*<Checksum><CR><LF>
```

Field	Format	Unit	Description
<Mode>	Numeric	-	0 = No vehicle information input. UDR mode. 2 = Input vehicle speed or wheel tick through UART. 3 = Input vehicle information through hardware wheel tick interface.

If failed, the module returns:

```
$PQTMGETDRMODEERROR*03
```

Example:

```
$PQTMGETDRMODE*5B
$PQTMDRMODE,2*13
```

3.1.12. PQTMSETNMEAMSGMASK

This message sets the NMEA message mask.

Type:

Set.

Synopsis:

```
$PQTMSETNMEAMSGMASK,<Mask>*<Checksum><CR><LF>
```

Parameter:

Field	Format	Unit	Description
<Mask>	Hexadecimal	-	Message mask. Setting a bit to 0 disables the message output. Setting a bit to 1 enables the message output. Bit 31: Reserved Bit 30: PQTMVEHMSG Bit 29: PQTMSOL Bit 28: PQTMSNR,21 Bit 27: PQTMSNR,23 Bit 26: PQTMSRAW,53 Bit 25: PQTMGNSSFIX,6 Bit 24: PQTMEND Bit 23: PQTMMEAS,3 Bit 22: PQTMMEAS,4 Bit 21: PQTMMEAS,9 Bit 20: PQTMSF Bit 19: PQTMALT Bit 18–0: Reserved

Result:

If successful, the module returns:

```
$PQTMSETNMEAMSGMASKOK*14
```

If failed, the module returns:

```
$PQTMSETNMEAMSGMASKERROR*48
```

Example:

```
$PQTMSETNMEAMSGMASK,0x7FF00000*73
$PQTMSETNMEAMSGMASKOK*14
```

3.1.13. PQTMGETNMEAMSGMASK

This message gets the NMEA message mask.

Type:

Get.

Synopsis:

```
$PQTMGETNMEAMSGMASK*<Checksum><CR><LF>
```

Parameter:

None.

Result:

If successful, the module returns:

```
$PQTMNMEAMSGMASK,<Mask>*<Checksum><CR><LF>
```

Field	Format	Unit	Description
<Mask>	Hexadecimal	-	Message mask. Setting a bit to 0 disables the message output. Setting a bit to 1 enables the message output. Bit 31: Reserved Bit 30: PQTMVEHMSG Bit 29: PQTMSOL Bit 28: PQTMSNR,21 Bit 27: PQTMSNR,23 Bit 26: PQTMSRAW,53 Bit 25: PQTMGNSSFIX,6 Bit 24: PQTMEND Bit 23: PQTMMEAS,3 Bit 22: PQTMMEAS,4 Bit 21: PQTMMEAS,9 Bit 20: PQTMSF Bit 19: PQTMALT Bit 18–0: Reserved

If failed, the module returns:

```
$PQTMGETNMEAMSGMASKERROR*5C
```

Example:

```
$PQTMGETNMEAMSGMASK*04
$PQTMNMEAMSGMASK,0x3FF00000*35
```

3.1.14. PQTMVEHMSG

This message inputs/outputs vehicle infomation.

Type:

Output/Input.

Synopsis:

```
$PQTMVEHMSG,<MSgID>,<Timestamp>,<Par1>[,<Par2>]*<Checksum><CR><LF>
```

Parameter:

Field	Format	Unit	Description
<MSgID>	Numeric	-	Message ID. 1 = Input/Output vehicle speed 2 = Input/Output vehicle wheel tick
<Timestamp>	Numeric	ms	Milliseconds since power on. 32-bit unsigned integer. While inputting vehicle information, keep this field as 0.
<ParN>	-	-	This field varies with the message ID. See ***Chapter 3.1.14.1*** and ***Chapter 3.1.14.2*** for details.

3.1.14.1. Vehicle Speed Message (<MsgID> = 1)

Type:

Input/Output

Synopsis:

```
$PQTMVEHMSG,1,<TimeStamp>,<VehSpeed>*<Checksum><CR><LF>
```

Parameter:

Field	Format	Unit	Description
<TimeStamp>	Numeric	ms	Milliseconds since power on. 32-bit unsigned integer. While inputting vehicle speed, keep this field as 0.
<VehSpeed>	Numeric	m/s	Vehicle speed. A minus value indicates reverse speed. Range: -100 to 100.

Example:

```
$PQTMVEHMSG,1,0,3.6*1C
$PQTMVEHMSG,1,3748292,3.600000*2D
```

NOTE

Make sure the input rate is at least 10 Hz.

3.1.14.2. Vehicle Wheel Tick Message (<MsgID> = 2)

Type:

Input/Output

Synopsis:

```
$PQTMVEHMSG,2,<TimeStamp>,<WheelTickCount>,<FWD_Ind>*<Checksum><CR><LF>
```

Parameter:

Field	Format	Unit	Description
<TimeStamp>	Numeric	ms	Milliseconds since power on. 32-bit unsigned integer. While inputting cumulative wheel ticks, keep this field as 0.
<WheelTickCount>	Numeric	-	Cumulative wheel ticks
<FWD_Ind>	Numeric	-	Forward/Reverse indicator. 0 = Invalid state 1 = Forward 2 = Reverse

Example:

```
//Input cumulative wheel ticks
$PQTMVEHMSG,2,0,20,1*2B
//Result: output cumulative wheel ticks with timestamp
$PQTMVEHMSG,2,86500631,20,1*14
```

NOTE

Make sure the input rate is at least 10 Hz.

3.1.15. PQTMSAVEPAR

This message saves command settings to the NVM.

Type:

Command.

Synopsis:

```
$PQTMSAVEPAR*<Checksum><CR><LF>
```

Parameter:

None.

Result:

If successful, the module returns:

```
$PQTMSAVEPAROK*5E
```

If failed, the module returns:

```
$PQTMSAVEPARERROR*02
```

Example:

```
$PQTMSAVEPAR*5A
$PQTMSAVEPAROK*5E
```

3.1.16. PQTMRESTOREPAR

This message restores all command settings to default values.

Type:

Command.

Synopsis:

```
$PQTMRESTOREPAR*<Checksum><CR><LF>
```

Parameter:

None.

Result:

If successful, the module returns:

```
$PQTMRESTOREPAROK*17
```

If failed, the module returns:

```
$PQTMRESTOREPARERROR*4B
```

Example:

```
$PQTMRESTOREPAR*13
$PQTMRESTOREPAROK*17
```

4 Appendix A References

Table 2: Related Documents

Document Name
[1] Quectel_LC29D_Protocol_Specification
[2] Quectel_LC29D_Hardware_Design

Table 3: Terms and Abbreviations

Abbreviation	Description
ARP	Antenna Reference Point
DR	Dead Reckoning
GNSS	Global Navigation Satellite System
MSM4	Type 4 Multiple Signal Messages
NMEA	NMEA (National Marine Electronics Association) 0183 Interface Standard
NVM	Non-Volatile Memory
PQTM	Proprietary Quectel Message
RTCM	Radio Technical Commission for Maritime Services
RTK	Real Time Kinematic
UART	Universal Asynchronous Receiver/Transmitter
UDR	Untethered Dead Reckoning
UTC	Coordinated Universal Time