LG290P (03)&LGx80P (03) Firmware Upgrade Guide

GNSS Module Series

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About the Document

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Version	Date	Description
-	2024-05-23	Creation of the document
1.0	2024-07-15	First official release
1.1	2025-07-22	1. Added applicable modules LG580P (03) and LG680P (03). 2. Updated the time of waiting for entire firmware to be fully upgraded (*Figure 4*). 3. Updated the firmware upgrade example (*Chapter 3*). 4. Updated the version of QGNSS tool and related contents (*Chapter 4*).

Contents

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1 Introduction

This document explains the firmware upgrading process on Quectel LG290P (03), LG580P (03) and LG680P (03) GNSS module.

Once the module is connected to the host via UART, the firmware upgrade process can be initiated.

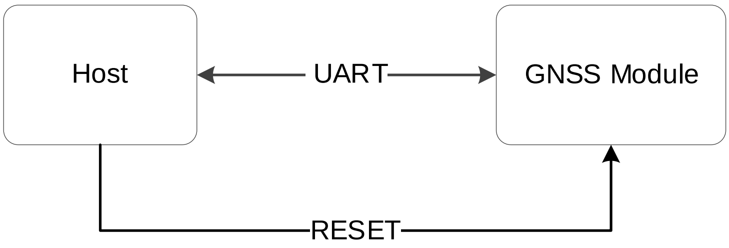


Figure 1: Firmware Upgrade Connection

NOTE

If the process fails or is manually stopped, no backup firmware can be executed. The only solution is to reset the module and initiate a new upgrade process to reprogram a functional firmware.

2 Firmware Upgrade Process

This chapter explains all the relevant steps in the firmware upgrade process. All constants in this document are defined in the following table.

Table 1: Constant List

Constant Name	Constant Value
SYNC_WORD1	0x514C1309
RSP_WORD1	0xAAFC3A4D
SYNC_WORD2	0x1203A504
RSP_WORD2	0x55FD5BA0

2.1. Connect Module

Connect the module to the host via UART to decode NMEA messages. For LG290P (03), LG580P (03), and LG680P (03), UART1, UART2 and UART3 support firmware upgrade.

The parameters of UART interface should be configured as follows:

- Baud rate: 460800 bps
- Data bit: 8
- Stop bit: 1
- Parity bit: None
- Flow control: None

2.2. Synchronize Module

Synchronization steps between host and module.

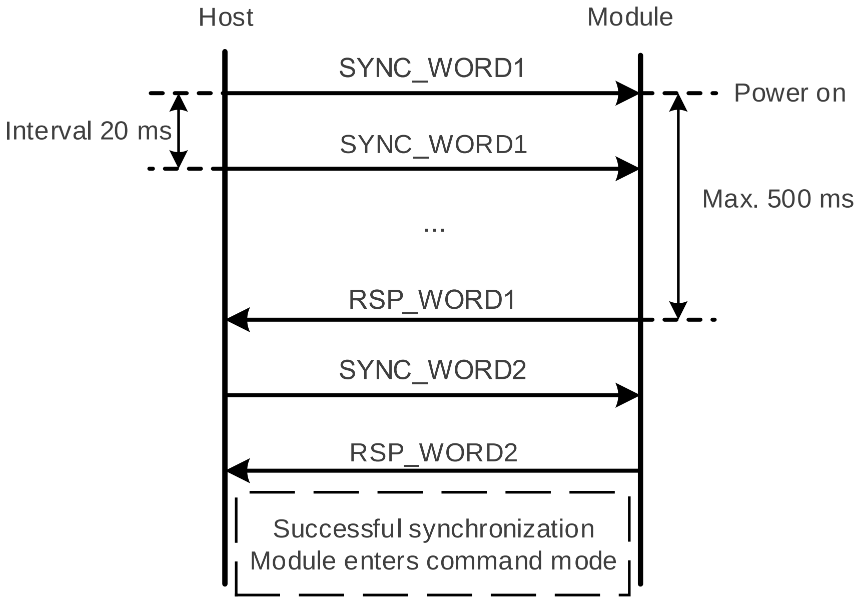


Figure 2: Synchronization Sequence

Step 1: Host continuously sends the **SYNC_WORD1** to the module at 20 ms intervals. If the module receives **SYNC_WORD1** within 500 ms from power up, the module will respond with **RSP_WORD1** and go to Step 2. Otherwise, the module exits firmware upgrade mode and continues to run the firmware already stored in Flash.

Step 2: Host sends **SYNC_WORD2** to the module once. When the module receives **SYNC_WORD2**, it will respond with **RSP_WORD2** to indicate that the host successfully synchronized with module and the module entered command mode. Otherwise, the module exits firmware upgrade mode and continues to run the firmware already stored in Flash.

NOTE

The **SYNC_WORD** and **RSP_WORD** are transmitted in little-endian format.

2.3. Firmware Upgrade Protocol

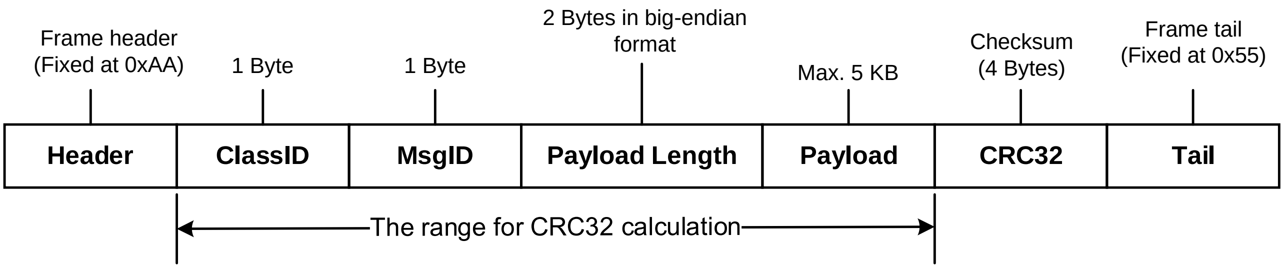


Figure 3: Structure of Upgrade Protocol

Table 2: Field Description

Field	Description
Header	Frame header, fixed at 0xAA.
ClassID	Class ID indicates the group that the message belongs to, see *Table 3: Messages Overview* for more details.
MsgID	Message ID indicates the specific message identifier, see *Table 3: Messages Overview* for more details.
Payload Length	2-byte payload content in **big-endian** format.
Payload	Message content. Maximum length: 5 KB.
CRC32	CRC32 checksum in **big-endian** format.
Tail	Frame tail, fixed at 0x55.

Table 3: Messages Overview

ClassID	MsgID	Description
0x02	0x00	Module responds to the message whose ClassID is 0x02.
	0x02	Host sends the firmware information.
	0x03	Host sends the command to erase the firmware.
	0x04	Host sends the firmware package.
	0x31	Host sends the command to reset module.
	0x71	Host queries the bootloader version.

Table 4: Response Status

Status (2 Bytes)	Description
0x0000	Message received and executed successfully.
0x0001	Unknow error.
0x0002	CRC32 checksum error.
0x0003	Timeout.
0x0004	Unsupported message.
0x0005	Message package error.
0x0020	Firmware area erase error.
0x0021	Firmware write to Flash error.

NOTE

ClassID and **MsgID** contained in the **Payload** of the module response in this document are the same as **ClassID** and **MsgID** of the command sent by the host. The **Payload** of the module response contains **ClassID** (Class ID), **MsgID** (message ID) and **Response Status**.

2.4. Upgrade Procedure (ClassID = 0x02)

This chapter outlines the module firmware upgrade procedure and related messages.

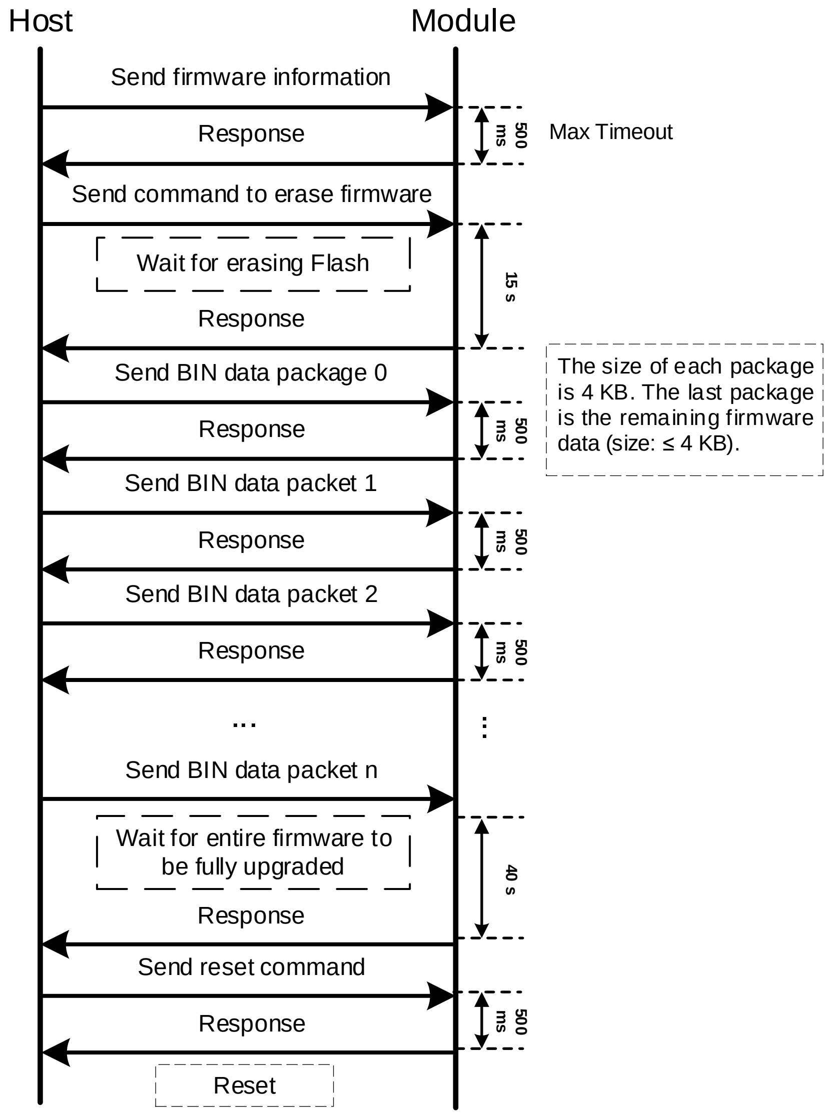


Figure 4: Firmware Upgrade Procedure

2.4.1. Send Firmware Information

2.4.1.1. Host Message (MsgID = 0x02)

Header	ClassID	MsgID	Payload Length	Payload	CRC32	Tail
0xAA	0x02	0x02	0x0010	See *Table 5: Firmware Information*	4 Bytes	0x55

Table 5: Firmware Information

Name	Byte	Description
FW Size	4	Firmware size (unit: byte, big-endian).
FW CRC32	4	Checksum (big-endian), which contains the firmware size in little-endian format and the entire firmware.
DestAddr	4	Start address of firmware. Fixed at 0x00000000 (big-endian).
Reversed	4	Reserved parameters. Set to 0x0000000.

2.4.1.2. Module Response (MsgID = 0x00)

Header	ClassID	MsgID	Payload Length	Payload			CRC32	Tail
				ClassID	MsgID	Response Status		
0xAA	0x02	0x00	0x0004	0x02	0x02	See *Table 4: Response Status*	4 Bytes	0x55

2.4.2. Send Erase Firmware Command

2.4.2.1. Host Message (MsgID = 0x03)

Header	ClassID	MsgID	Payload Length	Payload	CRC32	Tail
0xAA	0x02	0x03	0x0000	-	4 Bytes	0x55

2.4.2.2. Module Response (MsgID = 0x00)

Header	ClassID	MsgID	Payload Length	Payload			CRC32	Tail
				ClassID	MsgID	Response Status		
0xAA	0x02	0x00	0x0004	0x02	0x03	See *Table 4: Response Status*	4 Bytes	0x55

2.4.3. Send Firmware

2.4.3.1. Host Message (MsgID = 0x04)

Header	ClassID	MsgID	Payload Length	Payload		CRC32	Tail
				Packet Sequence [1)]	Firmware Content [2)]		
0xAA	0x02	0x04	2 Bytes	4 Bytes	4 KB per packet except the last packet	4 Bytes	0x55

NOTE

1. [1)] **Packet Sequence** starts from 0x00000000 (big-endian).
2. [2)] **Firmware Content** contains several data packets. The size of each packet is 4 KB except the last packet which contains the remaining firmware data (size: ≤ 4 KB).

2.4.3.2. Module Response (MsgID = 0x00)

Header	ClassID	MsgID	Payload Length	Payload			CRC32	Tail
				ClassID	MsgID	Response Status		
0xAA	0x02	0x00	0x0004	0x02	0x04	See *Table 4: Response Status*	4 Bytes	0x55

2.4.4. Send Reset Command

2.4.4.1. Host Message (MsgID = 0x31)

Header	ClassID	MsgID	Payload Length	Payload	CRC32	Tail
0xAA	0x02	0x31	0x0000	-	4 Bytes	0x55

2.4.4.2. Module Response (MsgID = 0x00)

Header	ClassID	MsgID	Payload Length	Payload			CRC32	Tail
				ClassID	MsgID	Response Status		
0xAA	0x02	0x00	0x0004	0x02	0x31	See *Table 4: Response Status*	4 Bytes	0x55

2.4.5. Query Bootloader Version

This chapter explains how to query bootloader version. Ensure that the module has entered the command mode before query.

2.4.5.1. Host Send (MsgID = 0x71)

Header	ClassID	MsgID	Payload Length	Payload	CRC32	Tail
0xAA	0x02	0x71	0x0000	-	4 Bytes	0x55

2.4.5.2. Module Response (MsgID = 0x00)

Header	ClassID	MsgID	Payload Length	Payload					
				ClassID	MsgID	Response Status	Major	Minor	Build
0xAA	0x02	0x00	0x0007	0x02	0x71	See *Table 4: Response Status*	1 Byte	1 Byte	1 Byte
CRC	**Tail**								
4 Bytes	0x55								

3 Firmware Upgrade Example

This chapter takes LG290P (03) as an example to provide the example of firmware upgrade procedure.

```
//Host is continuously sending SYNC_WORD1 at 20 ms intervals.
09 13 4C 51
09 13 4C 51
09 13 4C 51
…
09 13 4C 51
09 13 4C 51
09 13 4C 51
09 13 4C 51
//Module responds with RSP_WORD1.
4D 3A FC AA
//Host sends SYNC_WORD2.
04 A5 03 12
//Module responds with RSP_WORD2.
A0 5B FD 55
//Host sends firmware information.
AA 02 02 00 10 00 26 5D B4 A5 D1 82 54 00 00 00 00 00 00 00 00 18 50 BC BC 55
//Module responds.
AA 02 00 00 04 02 02 00 00 7B 0A 62 31 55
//Host sends command for erasing firmware.
AA 02 03 00 00 89 0B A9 CE 55
//Module responds.
AA 02 00 00 04 02 03 00 00 7A C8 08 06 55
//Host sends firmware binary data packet 1
AA 02 04 10 04 00 00 00 70 00 00 00 00 00 10 00 03 00 …
//Module responds.
AA 02 00 00 04 02 04 00 00 7F 87 1E 83 55
//Host sends firmware binary data packet 2
AA 02 04 10 04 00 00 00 01 58 14 10 00 58 14 10 00 D8 13 …
//Module responds.
AA 02 00 00 04 02 04 00 00 7F 87 1E 83 55
…
//Host sends firmware the last binary packet n.
AA 02 04 0D B8 00 00 02 65 00 00 00 00 00 00 00 00 00 00 …
```

```
//Module responds.
AA 02 00 00 04 02 04 00 00 7F 87 1E 83 55
//Host sends reset command.
AA 02 31 00 00 AE E4 98 30 55
//Module responds.
AA 02 00 00 04 02 31 00 00 5D 27 39 F8 55
//Module restarts.
```

4 Upgrade Example by QGNSS

This chapter provides a step-by-step guide to upgrade module firmware via QGNSS tool. Quectel GNSS MODULE EVB (V1.3) and the LG290P (03) module are used as an example in this chapter. For details about the EVB, see *document [1] EVB user guide*.

Connect the EVB to your PC through the GNSS-USB interface as shown below:

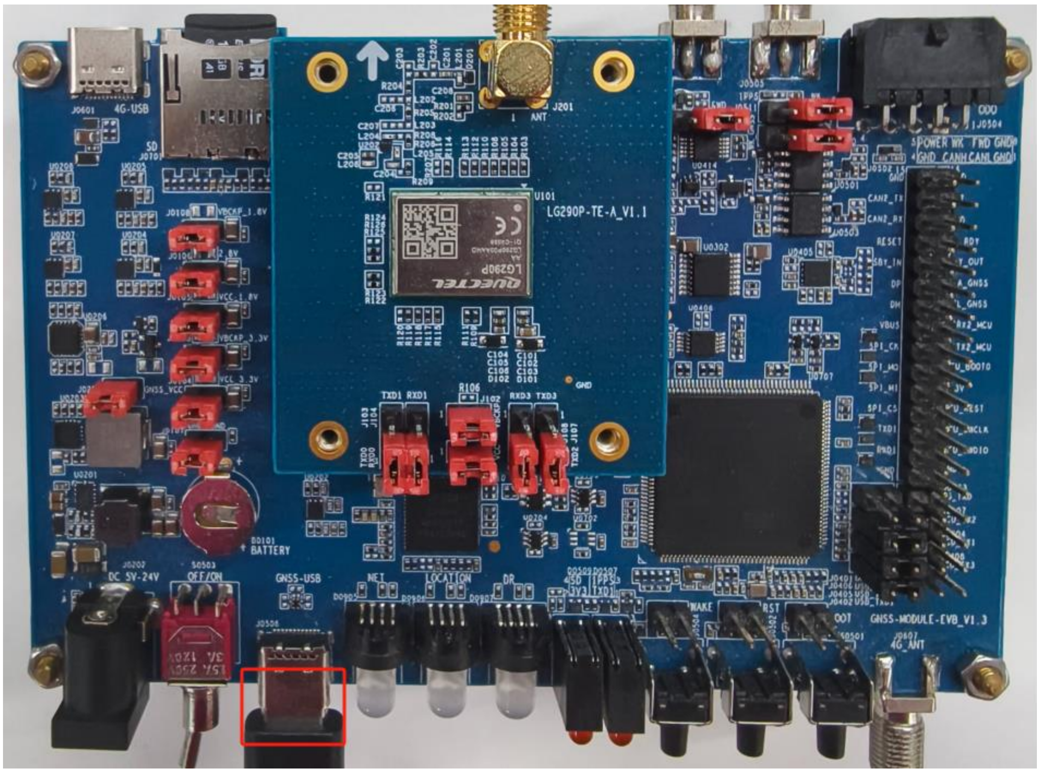
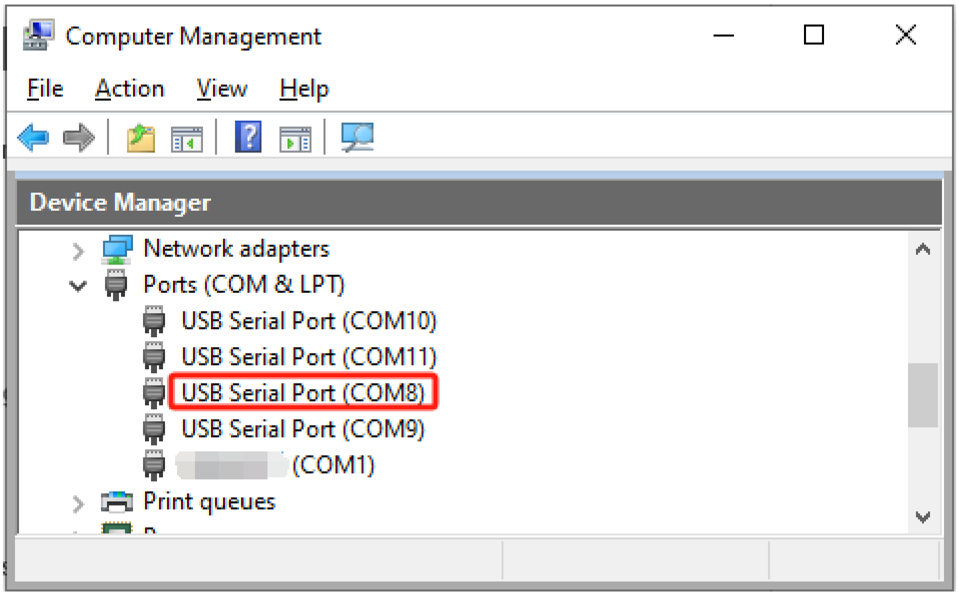


Figure 5: EVB Connection

Notes:

1. Before initiating the firmware upgrade, ensure that the module is connected to the PC and powered on normally as shown below:



- Network adapters
- Ports (COM & LPT)
  - USB Serial Port (COM10)
  - USB Serial Port (COM11)
  - USB Serial Port (COM8)
  - USB Serial Port (COM9)
  - [redacted] (COM1)
- Print queues

Figure 6: Device Manager

2. Ensure QGNSS V2.0 or a later version is used.

Firmware upgrade steps are as follows:

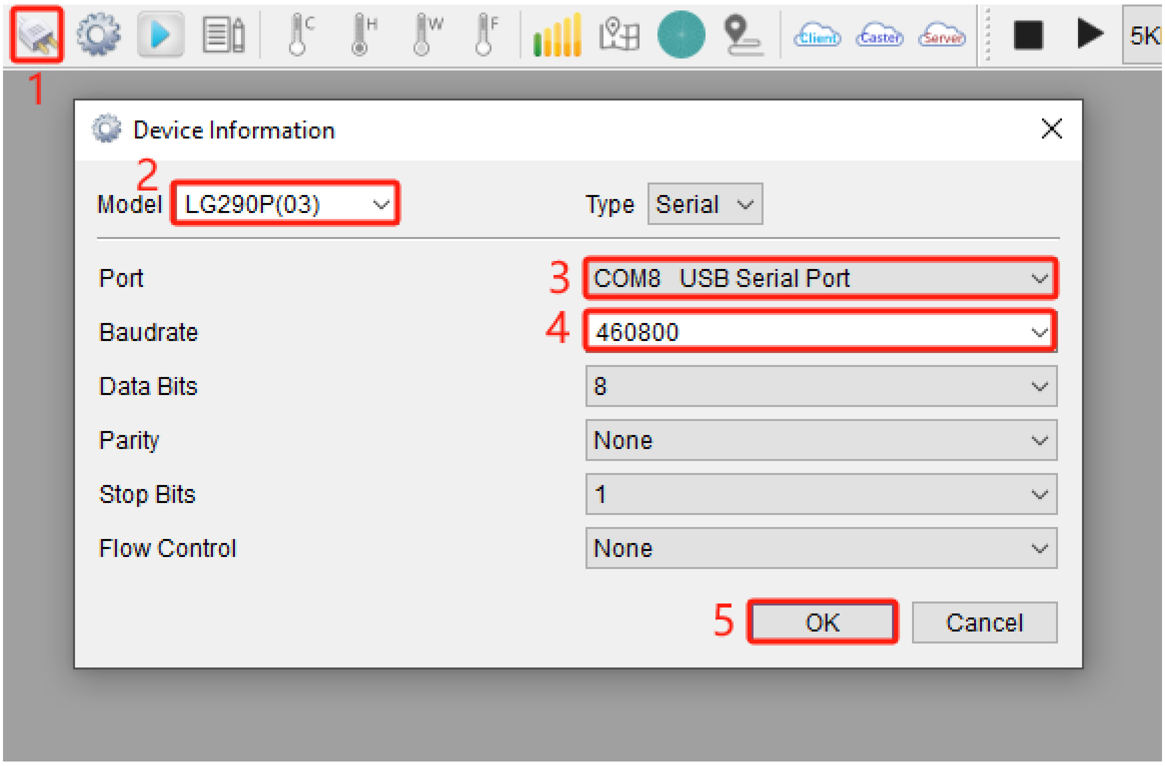
Step 1: Open QGNSS tool and click to access the "**Device Information**" window as shown in *Figure 7: Device Information*.

Step 2: Choose the module to be upgraded.

Step 3: Choose port number.

Step 4: Choose baudrate. Default baudrate: 460800.

Step 5: Click "**OK**".



Device Information

Model LG290P(03)

Type Serial

Port COM8 USB Serial Port

Baudrate 460800

Data Bits 8

Parity None

Stop Bits 1

Flow Control None

Figure 7: Device Information

Step 6: Click “**Tools**” as shown in *Figure 8: Firmware Download*.

Step 7: Choose “**Firmware Download**” in the drop-down menu of “**Tools**”.

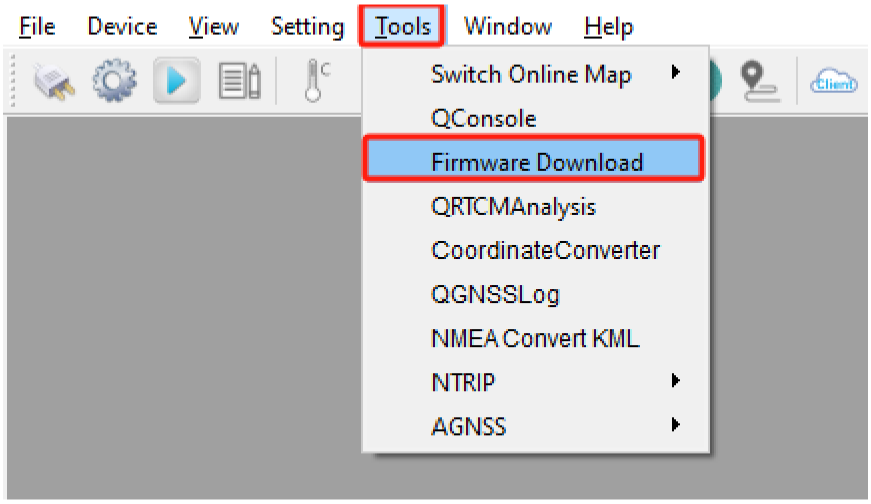
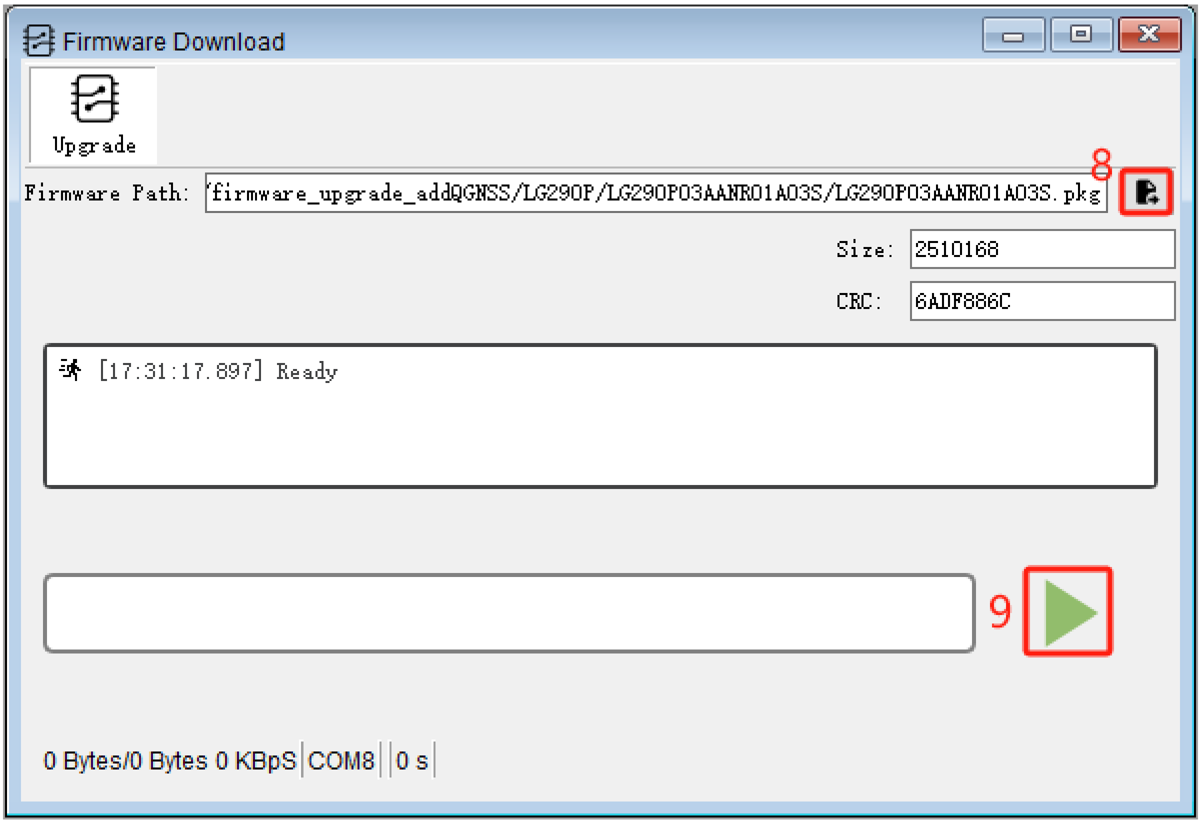


Figure 8: Firmware Download

Step 8: Click to choose the firmware upgrade package whose name is identifiable by the presence of “pkg” before the extension name as shown in *Figure 10: Firmware Selection*.

Step 9: Click ▶ to start the firmware upgrade process and wait for synchronization between the module and the PC as shown in *Figure 11: Wait for Synchronization*. Manually reset the module within 90 s; otherwise, the firmware upgrade will fail. In this case, you can retry from **Step 9:**.


Firmware Download

Firmware Path: firmware_upgrade_addQGNSS/LG290P/LG290P03AANR01A03S/LG290P03AANR01A03S.pkg

Size: 2510168

CRC: 6ADF886C

[17:31:17.897] Ready

0 Bytes/0 Bytes 0 KBpS COM8 0 s

Figure 9: Load Firmware

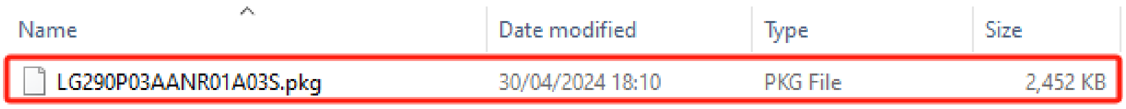
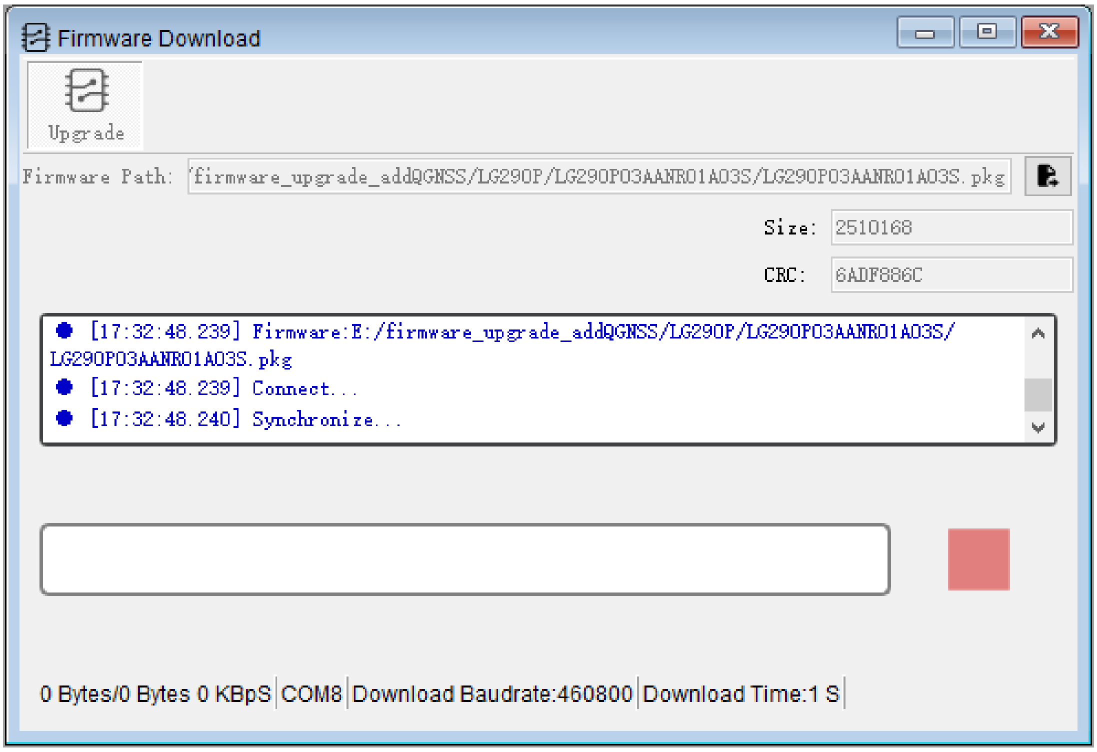

Name	Date modified	Type	Size
LG290P03AANR01A03S.pkg	30/04/2024 18:10	PKG File	2,452 KB

Figure 10: Firmware Selection



Firmware Path: 'firmware_upgrade_addQGNSS/LG290P/LG290P03AANR01A03S/LG290P03AANR01A03S.pkg

Size: 2510168

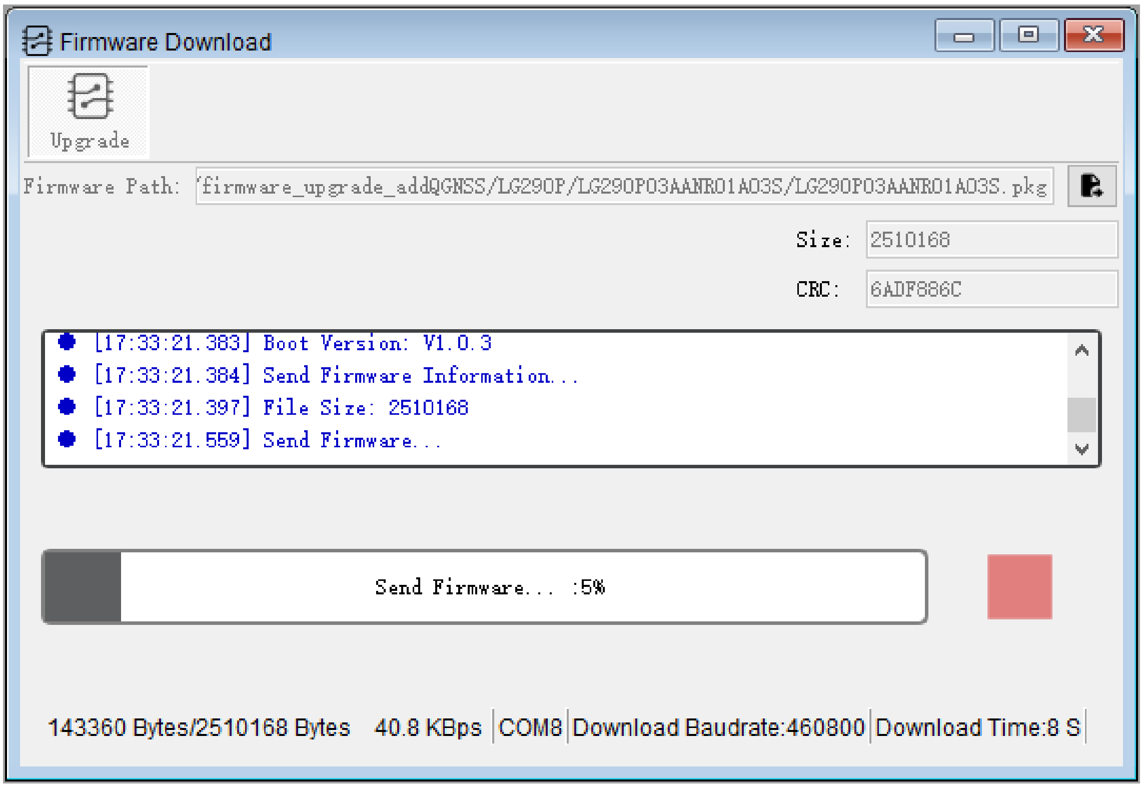
CRC: 6ADF886C

```
● [17:32:48.239] Firmware:E:/firmware_upgrade_addQGNSS/LG290P/LG290P03AANR01A03S/
LG290P03AANR01A03S.pkg
● [17:32:48.239] Connect...
● [17:32:48.240] Synchronize...
```

0 Bytes/0 Bytes 0 KBpS | COM8 | Download Baudrate:460800 | Download Time:1 S

Figure 11: Wait for Synchronization

Step 10: Wait for upgrading to complete.



Firmware Path: 'firmware_upgrade_addQGNSS/LG290P/LG290P03AANR01A03S/LG290P03AANR01A03S.pkg

Size: 2510168

CRC: 6ADF886C

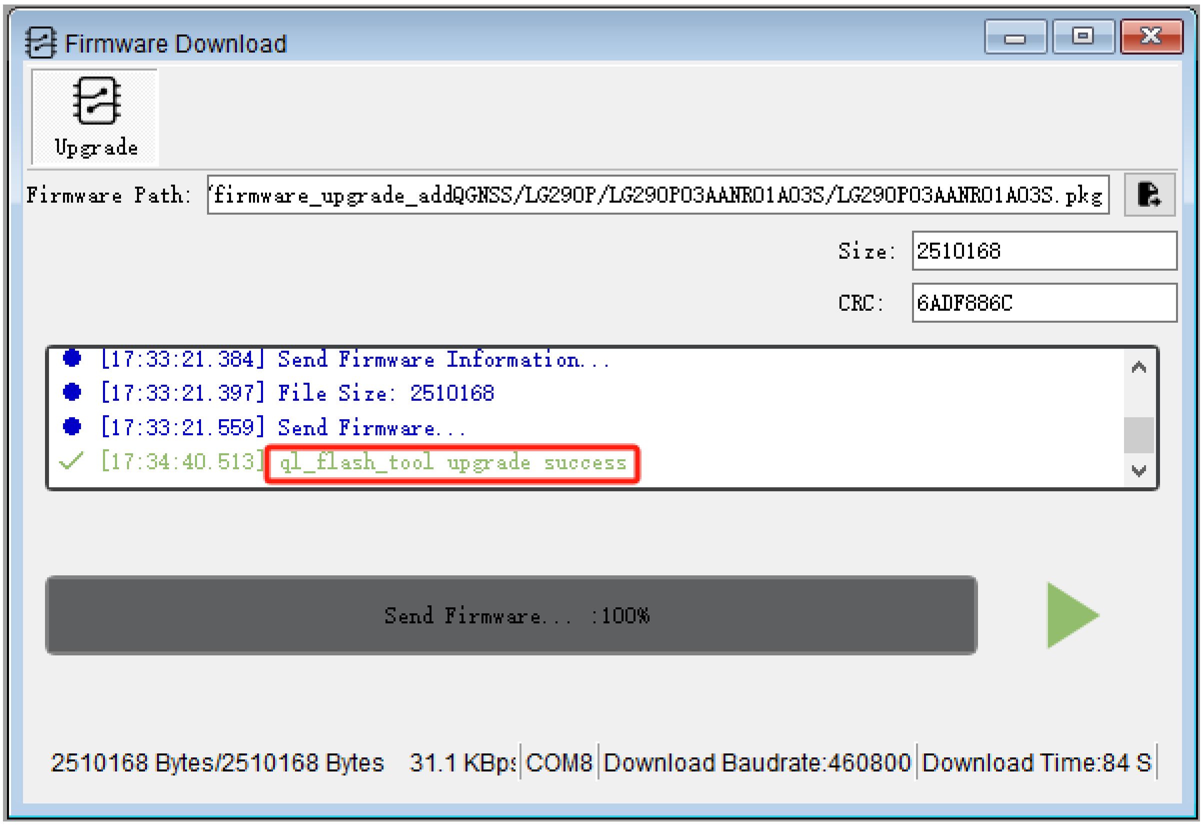
```
● [17:33:21.383] Boot Version: V1.0.3
● [17:33:21.384] Send Firmware Information...
● [17:33:21.397] File Size: 2510168
● [17:33:21.559] Send Firmware...
```

Send Firmware... :5%

143360 Bytes/2510168 Bytes 40.8 KBps | COM8 | Download Baudrate:460800 | Download Time:8 S

Figure 12:Wait for Upgrading to Complete

Step 11: Firmware upgrade is successful. After the upgrade is complete, the module will automatically restart.



Firmware Path: firmware_upgrade_addQGNSS/LG290P/LG290P03AANR01A03S/LG290P03AANR01A03S.pkg

Size: 2510168

CRC: 6ADF886C

```
● [17:33:21.384] Send Firmware Information...
● [17:33:21.397] File Size: 2510168
● [17:33:21.559] Send Firmware...
✓ [17:34:40.513] ql_flash_tool upgrade success
```

Send Firmware... :100%

2510168 Bytes/2510168 Bytes 31.1 KBps COM8 Download Baudrate:460800 Download Time:84 S

Figure 13: Firmware Upgrade Completed

5 Appendix A References

Table 6: Related Document

Document Name
[1] Quectel_GNSS-MODULE_EVB_User_Guide

Table 7: Terms and Abbreviations

Abbreviation	Description
CRC32	Cyclic Redundancy Check 32
FW	Firmware
GNSS	Global Navigation Satellite System
RSP	Response
SYNC	Synchronization
UART	Universal Asynchronous Receiver/Transmitter

6 Appendix B CRC32 Calculation

Sample code for calculating CRC32.

```
const uint32_t Table_CRC32[256] =
{
    0x00000000, 0x77073096, 0xee0e612c, 0x990951ba, 0x076dc419,
    0x706af48f, 0xe963a535, 0x9e6495a3, 0x0edb8832, 0x79dcb8a4,
    0xe0d5e91e, 0x97d2d988, 0x09b64c2b, 0x7eb17cbd, 0xe7b82d07,
    0x90bf1d91, 0x1db71064, 0x6ab020f2, 0xf3b97148, 0x84be41de,
    0x1adad47d, 0x6ddde4eb, 0xf4d4b551, 0x83d385c7, 0x136c9856,
    0x646ba8c0, 0xfd62f97a, 0x8a65c9ec, 0x14015c4f, 0x63066cd9,
    0xfa0f3d63, 0x8d080df5, 0x3b6e20c8, 0x4c69105e, 0xd56041e4,
    0xa2677172, 0x3c03e4d1, 0x4b04d447, 0xd20d85fd, 0xa50ab56b,
    0x35b5a8fa, 0x42b2986c, 0xdbbbc9d6, 0xacbcf940, 0x32d86ce3,
    0x45df5c75, 0xdcd60dcf, 0xabd13d59, 0x26d930ac, 0x51de003a,
    0xc8d75180, 0xbfd06116, 0x21b4f4b5, 0x56b3c423, 0xcfba9599,
    0xb8bda50f, 0x2802b89e, 0x5f058808, 0xc60cd9b2, 0xb10be924,
    0x2f6f7c87, 0x58684c11, 0xc1611dab, 0xb6662d3d, 0x76dc4190,
    0x01db7106, 0x98d220bc, 0xefd5102a, 0x71b18589, 0x06b6b51f,
    0x9fbfe4a5, 0xe8b8d433, 0x7807c9a2, 0x0f00f934, 0x9609a88e,
    0xe10e9818, 0x7f6a0dbb, 0x086d3d2d, 0x91646c97, 0xe6635c01,
    0x6b6b51f4, 0x1c6c6162, 0x856530d8, 0xf262004e, 0x6c0695ed,
    0x1b01a57b, 0x8208f4c1, 0xf50fc457, 0x65b0d9c6, 0x12b7e950,
    0x8bbeb8ea, 0xfcb9887c, 0x62dd1ddf, 0x15da2d49, 0x8cd37cf3,
    0xfbd44c65, 0x4db26158, 0x3ab551ce, 0xa3bc0074, 0xd4bb30e2,
    0x4adfa541, 0x3dd895d7, 0xa4d1c46d, 0xd3d6f4fb, 0x4369e96a,
    0x346ed9fc, 0xad678846, 0xda60b8d0, 0x44042d73, 0x33031de5,
    0xaa0a4c5f, 0xdd0d7cc9, 0x5005713c, 0x270241aa, 0xbe0b1010,
    0xc90c2086, 0x5768b525, 0x206f85b3, 0xb966d409, 0xce61e49f,
    0x5edef90e, 0x29d9c998, 0xb0d09822, 0xc7d7a8b4, 0x59b33d17,
    0x2eb40d81, 0xb7bd5c3b, 0xc0ba6cad, 0xedb88320, 0x9abfb3b6,
    0x03b6e20c, 0x74b1d29a, 0xead54739, 0x9dd277af, 0x04db2615,
    0x73dc1683, 0xe3630b12, 0x94643b84, 0x0d6d6a3e, 0x7a6a5aa8,
    0xe40ecf0b, 0x9309ff9d, 0x0a00ae27, 0x7d079eb1, 0xf00f9344,
    0x8708a3d2, 0x1e01f268, 0x6906c2fe, 0xf762575d, 0x806567cb,
    0x196c3671, 0x6e6b06e7, 0xfed41b76, 0x89d32be0, 0x10da7a5a,
    0x67dd4acc, 0xf9b9df6f, 0x8ebeeff9, 0x17b7be43, 0x60b08ed5,
    0xd6d6a3e8, 0xa1d1937e, 0x38d8c2c4, 0x4fdff252, 0xd1bb67f1,
    0xa6bc5767, 0x3fb506dd, 0x48b2364b, 0xd80d2bda, 0xaf0a1b4c,
    0x36034af6, 0x41047a60, 0xdf60efc3, 0xa867df55, 0x316e8eef,
    0x4669be79, 0xcb61b38c, 0xbc66831a, 0x256fd2a0, 0x5268e236,
    0xcc0c7795, 0xbb0b4703, 0x220216b9, 0x5505262f, 0xc5ba3bbe,
    0xb2bd0b28, 0x2bb45a92, 0x5cb36a04, 0xc2d7ffa7, 0xb5d0cf31,
    0x2cd99e8b, 0x5bdeae1d, 0x9b64c2b0, 0xec63f226, 0x756aa39c,
    0x026d930a, 0x9c0906a9, 0xeb0e363f, 0x72076785, 0x05005713,
    0x95bf4a82, 0xe2b87a14, 0x7bb12bae, 0x0cb61b38, 0x92d28e9b,
    0xe5d5be0d, 0x7cdcefb7, 0x0bdbdf21, 0x86d3d2d4, 0xf1d4e242,
    0x68ddb3f8, 0x1fda836e, 0x81be16cd, 0xf6b9265b, 0x6fb077e1,
    0x18b74777, 0x88085ae6, 0xff0f6a70, 0x66063bca, 0x11010b5c,
    0x8f659eff, 0xf862ae69, 0x616bffd3, 0x166ccf45, 0xa00ae278,
    0xd70dd2ee, 0x4e048354, 0x3903b3c2, 0xa7672661, 0xd06016f7,
    0x4969474d, 0x3e6e77db, 0xaed16a4a, 0xd9d65adc, 0x40df0b66,
    0x37d83bf0, 0xa9bcae53, 0xdebb9ec5, 0x47b2cf7f, 0x30b5ffe9,
    0xbdbdf21c, 0xcabac28a, 0x53b39330, 0x24b4a3a6, 0xbad03605,
    0xcdd70693, 0x54de5729, 0x23d967bf, 0xb3667a2e, 0xc4614ab8,
    0x5d681b02, 0x2a6f2b94, 0xb40bbe37, 0xc30c8ea1, 0x5a05df1b,
    0x2d02ef8d
};

uint32_t Ql_CRC32(const unsigned char *pData, const uint32_t Length)
{
    uint32_t i = 0;
    uint32_t CRC_Result = 0xFFFFFFFF;

    if((NULL == pData) || (Length == 0))
    {
        return 0;
    }

    for (i = 0; i < Length; i++)
    {
        CRC_Result = Table_CRC32[(CRC_Result ^ pData[i]) & 0xFF] ^ (CRC_Result >> 8);
    }

    return (CRC_Result ^ 0xFFFFFFFF);
}
```