CAN-to-ADR Test Guidelines

GADN / ANNA-FG Series with

u-blox NEO-M8L

ANNA-F9 High Precision Series with

u-blox ZED-F9R

Version 4.1

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Antzer Tech In-Vehicle Module User Manual

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Change History

Version	Date	Author	Description
1.0	2019/8/1	Haney Huang	First version release
2.0	2020/1/9	Vincent Cheng	Modified the document according to GADN-FG firmware settings.
3.0	2020/2/11	Haney Huang Vincent Cheng	Added Introduction and the Commands for Forward/Backward Algorithm
4.0	2020/10/15	Haney Huang	Added new series related information to the document. (GADN-F, ANNA-F, ANNA-F9)
4.1	2020/10/16	Haney Huang	1. Changed the serial port baud rate for NEO-M8L from 9600 to 115200 bps 2. Modified the pictures in Ch 6.2

1. Introduction

For general ADR application, there are two input signals that are required to be connected to the NEO-M8L / ZED-F9R module:

1. Wheel-tick signal
2. Forward/Backward Signal

(Note: The forward and backward information only affect the positioning accuracy when the module loses or with poor satellite signals.)

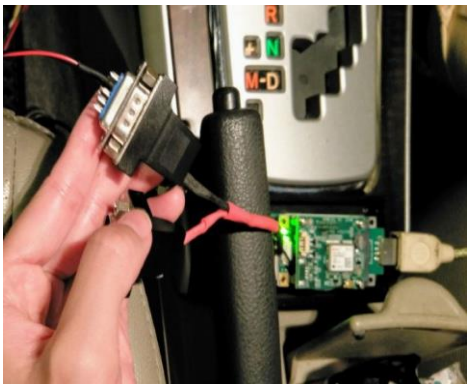
Antzer Tech's CAN-to-ADR solution utilizes the speed information on vehicle CAN bus and an algorithm for direction discrimination which is developed using accelerometer on the GADN/ANNA card.

	Speed	Direction	
General ADR	Wheel-tick signal	Forward/Backward Signal	Need Extra Cabling Effort
Antzer Tech CAN-to-ADR	Speed Information from Vehicle CAN Bus	Algorithm for Direction Discrimination (*)	

(*) Since the algorithm needs to be initialed with specific calibration procedures, the default setting of the algorithm is "OFF" and the direction signal will keep on "High" signal level ("Forward") to the GNSS module. Please follow the steps in Chapter 5 to enable the algorithm.

2. CAN Bus Connection to the Vehicle

Please connect the vehicle CAN bus to the card.



◆ **GADN Series**

Connect the CAN PORT_1 on GADN card with vehicle CAN Bus (J1939 or OBDII connecter)

◆ **ANNA-FG / ANNA-F9 High Precision Series**

Connect the CAN PORT_0 on ANNA card with vehicle CAN Bus (J1939 or OBDII connecter)

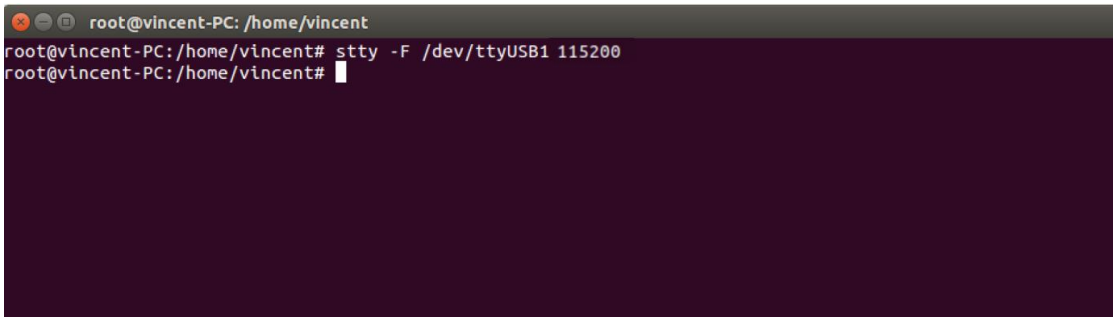
3. Enable CAN-to-ADR Function Under Linux

Step 1 OPEN the serial port of GNSS module on the card to change the configuration required for DR.

The configure process (Step 2 ~Step 4) of GNSS module only needs to be done once. The settings will be kept in the module after Step 4.

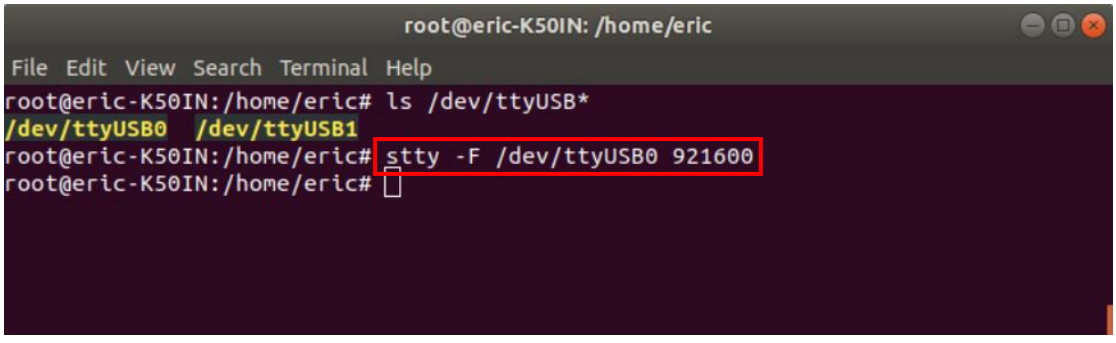
◆ GADN / ANNA-FG Series

- Serial port for GNSS module: ttyUSB1
- The baud rate for factory setting is 115200 bps
  (NEO-M8L module default: 9600 bps)



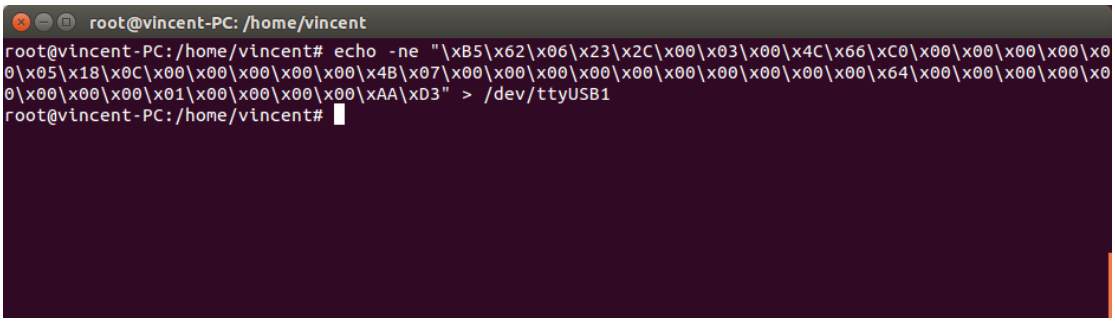
◆ ANNA-F9 High Precision Series

- Serial port for GNSS module: ttyUSB0
- The baud rate for factory setting is 921600 bps
  (ZED-F9R module default: 38400 bps)



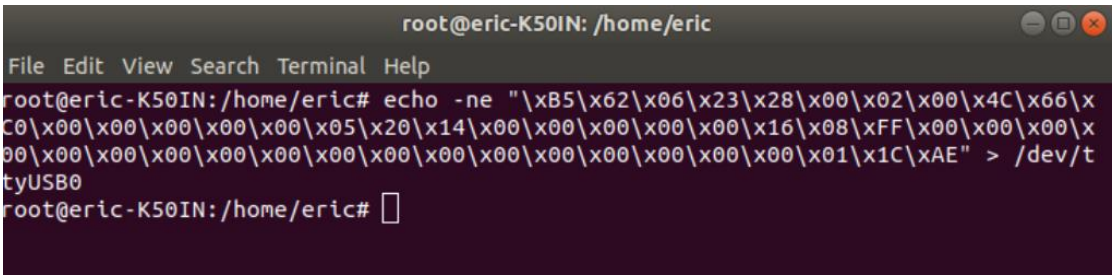
Step 2　Enable ADR/UDR function of the GNSS module

◆ GADN / ANNA-FG Series




```
// Use ADR/UDR
echo -ne
"\xB5\x62\x06\x23\x2C\x00\x03\x00\x4C\x66\xC0\x00\x00\x00\x00\x00\x05\x18\x0C\x0
0\x00\x00\x00\x00\x4B\x07\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x64\x00\x00\x
00\x00\x00\x00\x00\x00\x01\x00\x00\x00\x00\xAA\xD3" > /dev/ttyUSB1
```

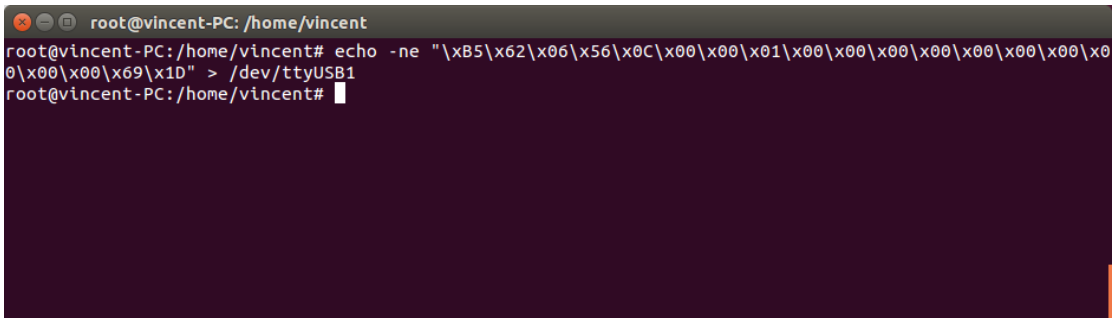
◆ ANNA-F9 High Precision Series




```
// Use ADR/UDR
echo -ne
"\xB5\x62\x06\x23\x28\x00\x02\x00\x4C\x66\xC0\x00\x00\x00\x00\x00\x05\x20\x14\x0
0\x00\x00\x00\x00\x16\x08\xFF\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x
00\x00\x00\x00\x00\x00\x01\x1C\xAE" > /dev/ttyUSB0
```

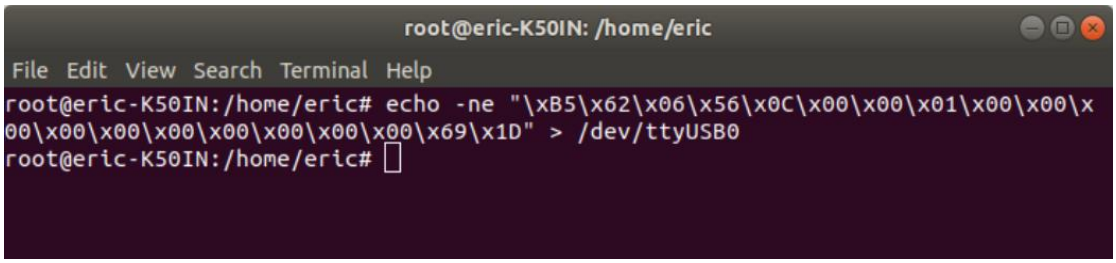
Step 3　Enable Automatic IMU-mount Alignment of the GNSS module

◆ GADN / ANNA-FG Series




```
// Automatic IMU-mount Alignment
echo -ne
"\xB5\x62\x06\x56\x0C\x00\x00\x01\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x69\x1
D" > /dev/ttyUSB1
```

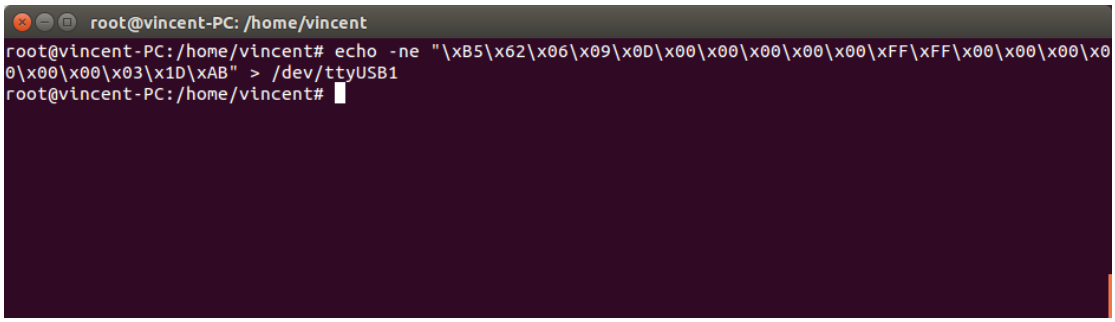
◆ ANNA-F9 High Precision Series




```
// Automatic IMU-mount Alignment
echo -ne
"\xB5\x62\x06\x56\x0C\x00\x00\x01\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x69\x1
D" > /dev/ttyUSB0
```

Step 4 Save the configuration

◆ GADN / ANNA-FG Series



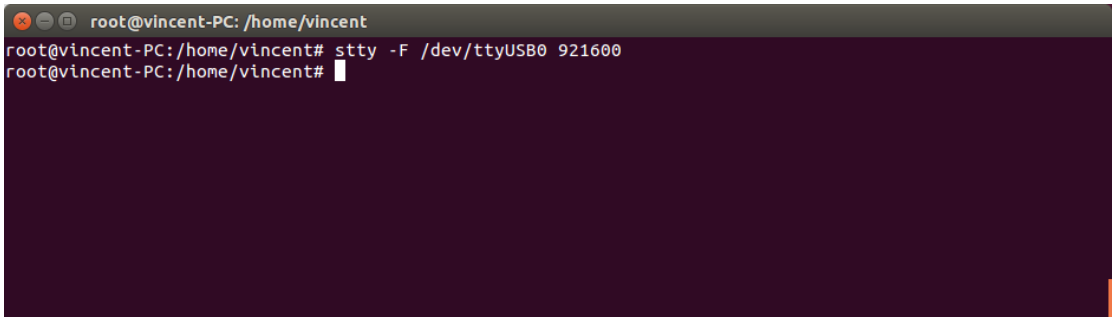

```
// Save the configuration
echo -ne
"\xB5\x62\x06\x09\x0D\x00\x00\x00\x00\x00\xFF\xFF\x00\x00\x00\x00\x00\x00\x03\x
1D\xAB" > /dev/ttyUSB1
```

◆ ANNA-F9 High Precision Series


```
// Save the configuration
echo -ne
"\xB5\x62\x06\x09\x0D\x00\x00\x00\x00\x00\xFF\xFF\x00\x00\x00\x00\x00\x00\x03\x
1D\xAB" > /dev/ttyUSB0
```

Step 5 OPEN the serial port of the MCU on the card (ttyUSB0) to change the settings in the firmware.

- The default baud rate is 921600 bps

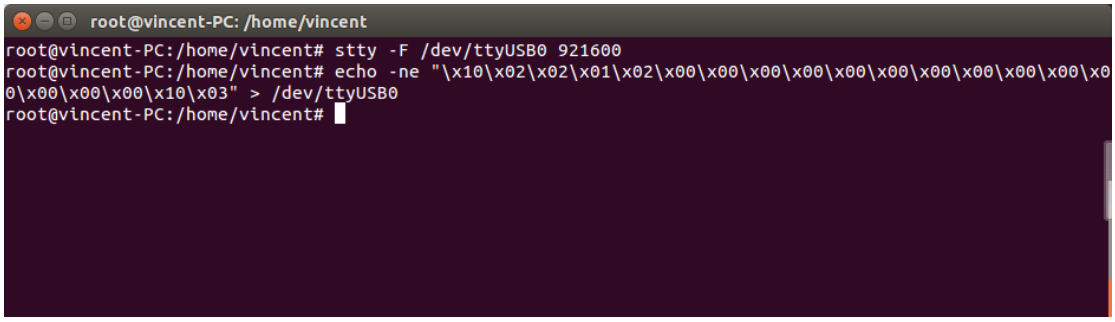


Step 6 Set the CAN Bus baud rate.

- The default baud rate is 250K bps.
- The picture shown below is the setting example of 500K bps.
- Please choose the same baud rate as it on the vehicle CAN Bus

◆ GADN Series

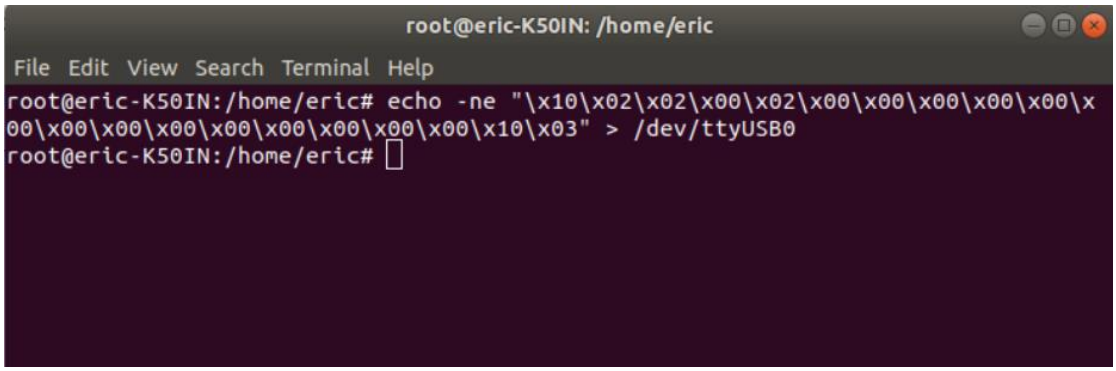
- CAN Port for CAN-to-ADR application: CAN PORT_1




```
//set CAN port baud rate (Port1, 500k)
echo -ne
"\x10\x02\x02\x01\x02\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x1
0\x03" > /dev/ttyUSB0

//set CAN port baud rate (Port1, 250k)
echo -ne
"\x10\x02\x02\x01\x03\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x1
0\x03" > /dev/ttyUSB0
```

◆ ANNA-FG / ANNA-F9 High Precision Series

- CAN Port for CAN-to-ADR application: CAN PORT_0



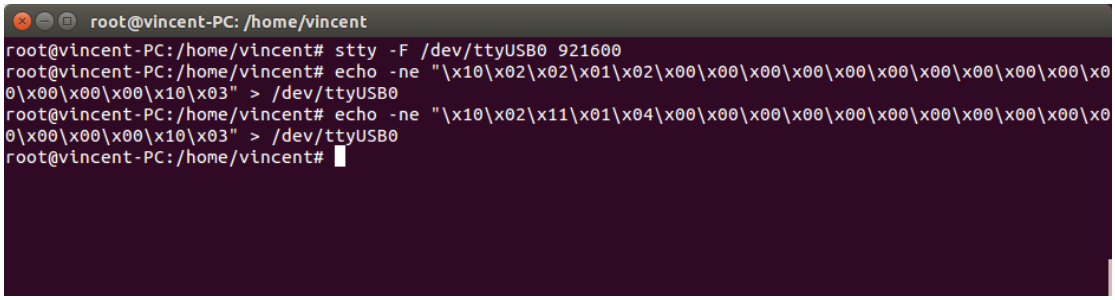

```
//set CAN port baud rate (Port0, 500k)
echo -ne
"\x10\x02\x02\x00\x02\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x1
0\x03" > /dev/ttyUSB0

//set CAN port baud rate (Port0, 250k)
echo -ne
"\x10\x02\x02\x00\x03\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x1
0\x03" > /dev/ttyUSB0
```

Step 7 Use mode active command to enable CAN to ADR function

- The picture shown below is the setting example of OBDII protocol.

◆ GADN Series

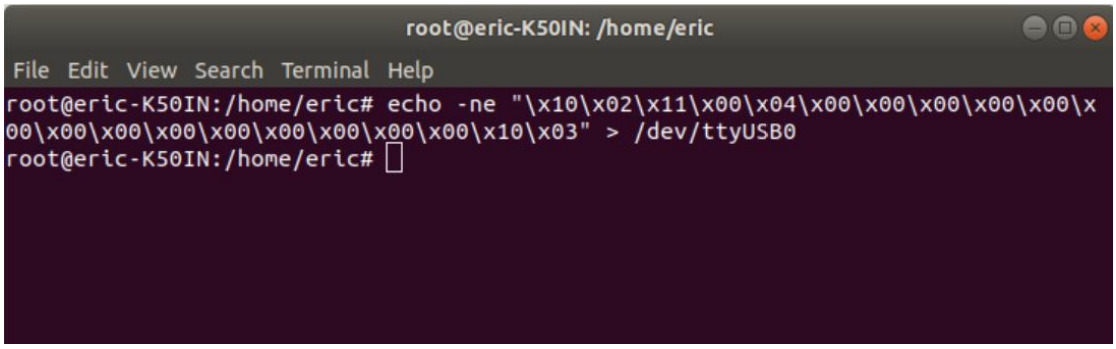
- CAN Port for CAN-to-ADR application: CAN PORT_1




```
//set mode active (CAN Port 1, OBDII protocol)
echo -ne
"\x10\x02\x11\x01\x04\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x1
0\x03" > /dev/ttyUSB0


// set mode active (CAN Port 1, J1939 protocol)
echo -ne
"\x10\x02\x11\x01\x05\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x1
0\x03" > /dev/ttyUSB0
```

◆ ANNA-FG / ANNA-F9 High Precision Series

- CAN Port for CAN-to-ADR application: CAN PORT_0

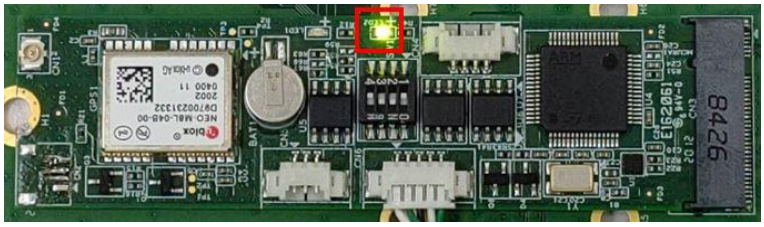



```
//set mode active (CAN Port 0, OBDII protocol)
echo -ne
"\x10\x02\x11\x00\x04\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x1
0\x03" > /dev/ttyUSB0

// set mode active (CAN Port 0, J1939 protocol)
echo -ne
"\x10\x02\x11\x00\x05\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x1
0\x03" > /dev/ttyUSB0
```

Step 8 If the CAN-to-ADR function is enabled and received speed information from vehicle CAN bus successfully. The LED indicator will be turned ON.

[GADN-F Series]

[ANNA-F Series]



[GADN-M Series]

4. Enable CAN-to-ADR Function Under Windows

Step 1 Configure the GNSS module under windows using u-center

- Please follow the instructions in Chapter 2 of the document: *"Antzer Tech GPS DR Calibration Instructions.pdf."* to configure the GNSS module.
- The configure process of GNSS module only needs to be done once. The settings will be kept in the module after saving.

◆ GADN / ANNA-FG Series

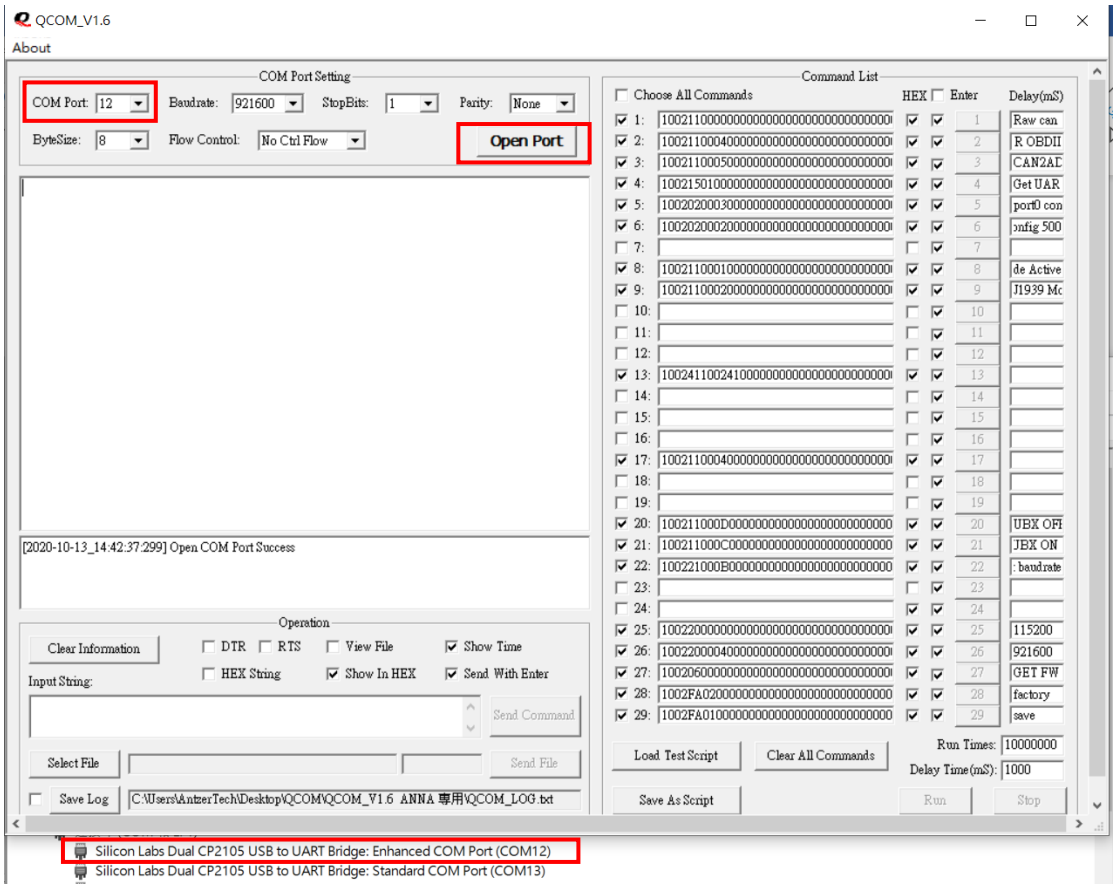
- Serial port for GNSS module: Standard COM port
- The baud rate for factory setting is 115200 bps
  (NEO-M8L module default: 9600 bps)

◆ ANNA-F9 High Precision Series

- Serial port for GNSS module: Enhanced COM port
- The baud rate for factory setting is 921600 bps
  (ZED-F9R module default: 38400 bps)

Step 2 OPEN Serial Port to change the setting of the MCU on the card (Enhanced COM Port shown in device manager)

- The default baud rate is 921600 bps

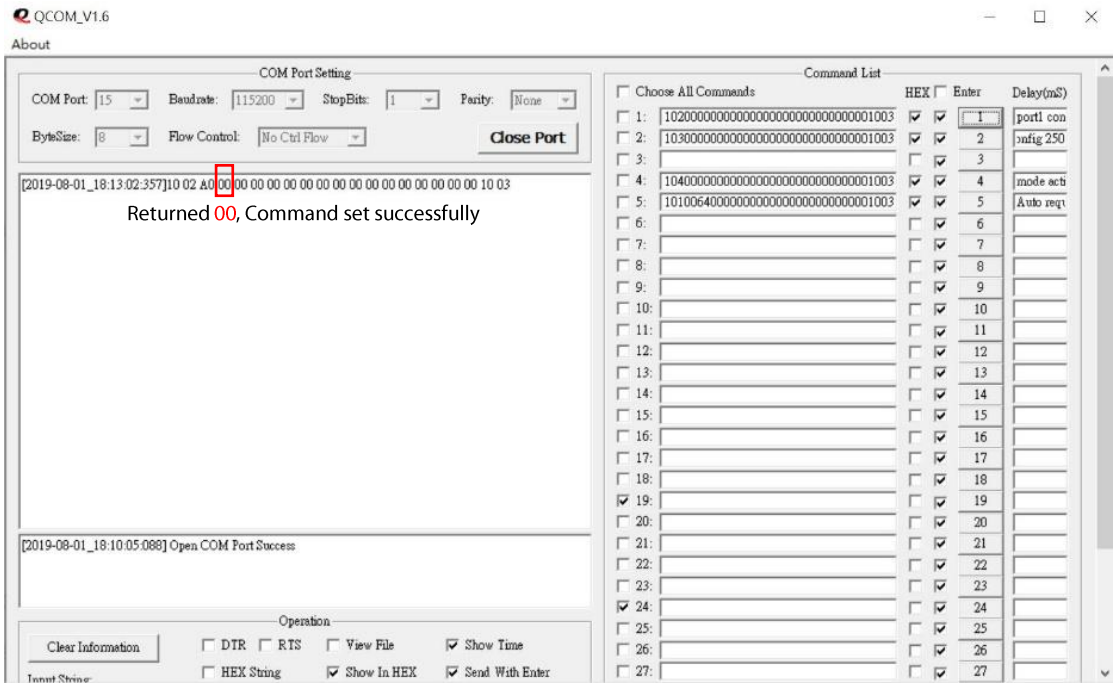


Step 3 Set the CAN Bus baud rate.

- The default baud rate is 250K bps.
- The picture shown below is the setting example of 500K bps.
- Please choose the same baud rate as it on the vehicle CAN Bus

◆ GADN Series

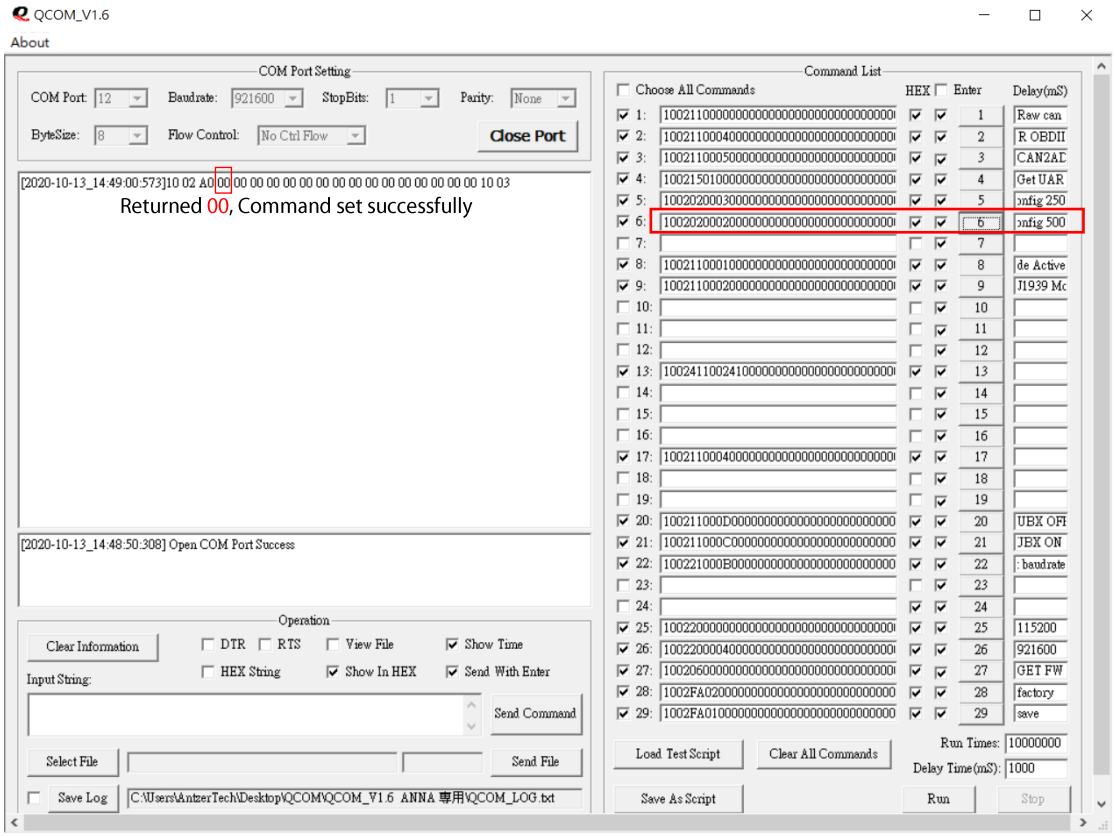
- CAN Port for CAN-to-ADR application: CAN PORT_1




```
//set CAN port baud rate (Port1, 500k)
10020201020000000000000000000000000001003

//set CAN port baud rate (Port1, 250k)
10020201030000000000000000000000000001003
```

◆ ANNA-FG / ANNA-F9 High Precision Series

- CAN Port for CAN-to-ADR application: CAN PORT_0



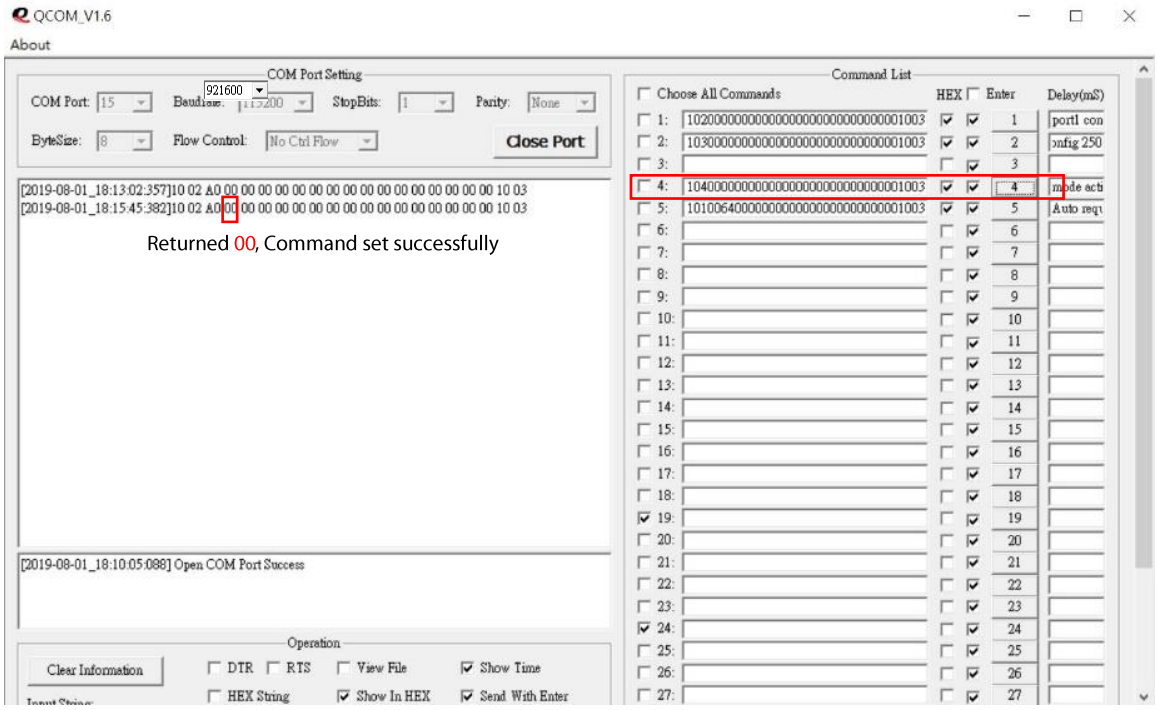

```
//set CAN port baud rate (Port0, 500k)
10020200020000000000000000000000000001003

//set CAN port baud rate (Port0, 250k)
10020200030000000000000000000000000001003
```

Step 4 Use mode active command to enable CAN to ADR function

- The picture shown below is the setting example of OBDII protocol.

◆ GADN Series

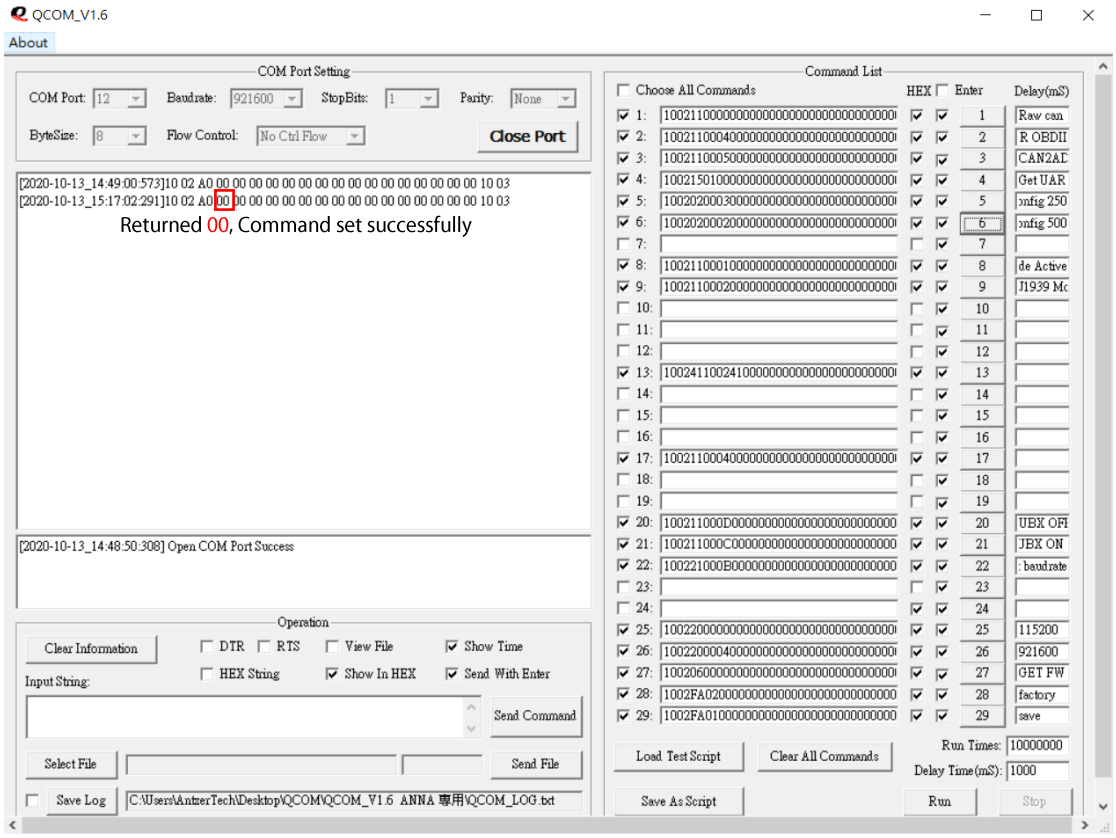
- CAN Port for CAN-to-ADR application: CAN PORT_1




```
//set mode active (CAN Port 1, OBDII Protocol)
10021101040000000000000000000000000001003

// set mode active (CAN Port 1, J1939 Protocol)
10021101050000000000000000000000000001003
```

◆ ANNA-FG / ANNA-F9 High Precision Series

- CAN Port for CAN-to-ADR application: CAN PORT_0

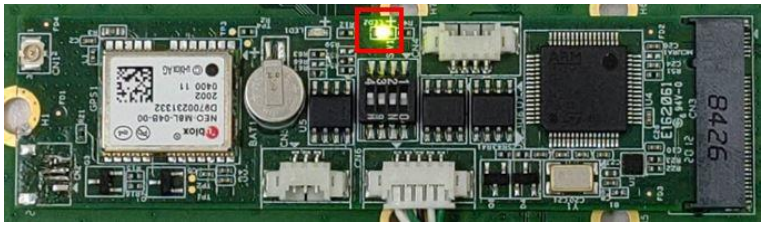



```
//set mode active (CAN Port 0, OBDII Protocol)
10021100040000000000000000000000000001003

// set mode active (CAN Port 0, J1939 Protocol)
10021100050000000000000000000000000001003
```

Step 5 If the CAN-to-ADR function is enabled and received speed information from vehicle CAN bus successfully. The LED indicator will be turned ON.

[GADN-F Series]

[ANNA-F Series]



[GADN-M Series]

5. Get GNSS Module Calibrated and Check the Status

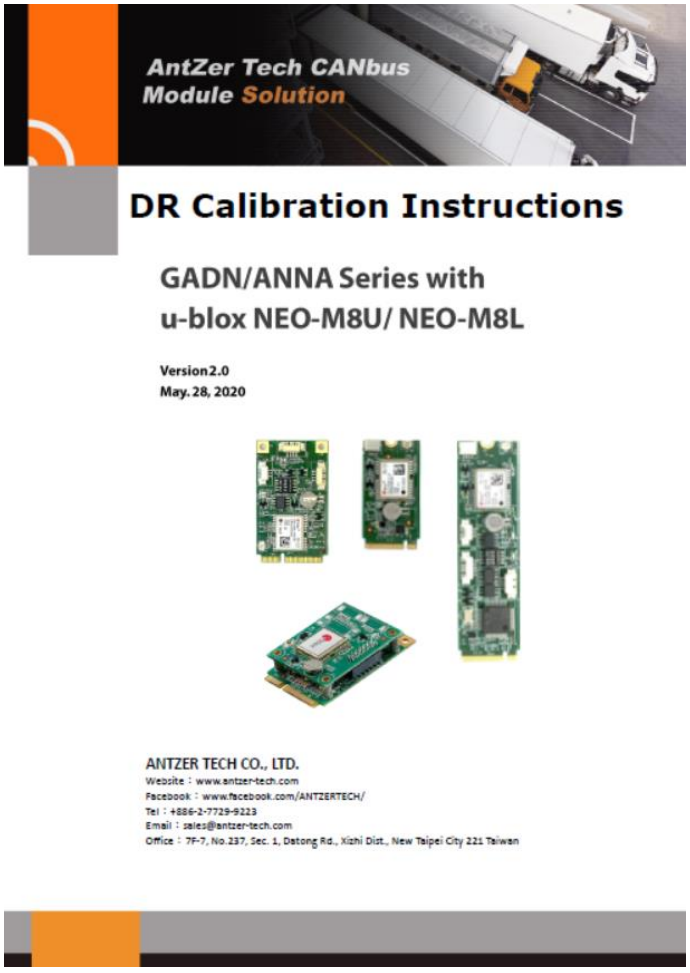
Step 1 Start Calibration

Please follow the instructions in Chapter 3 of the document: *"Antzer Tech GPS DR Calibration Instructions.pdf."* to finish calibration and the GNSS module will enter DR mode.

Note:

The instruction in Chapter 3 is the standard procedure to do the calibration and to make sure the module enter DR mode in short time while testing.

In practical applications, the GNSS module will also do the calibration automatically while driving and enter DR mode after some distance.

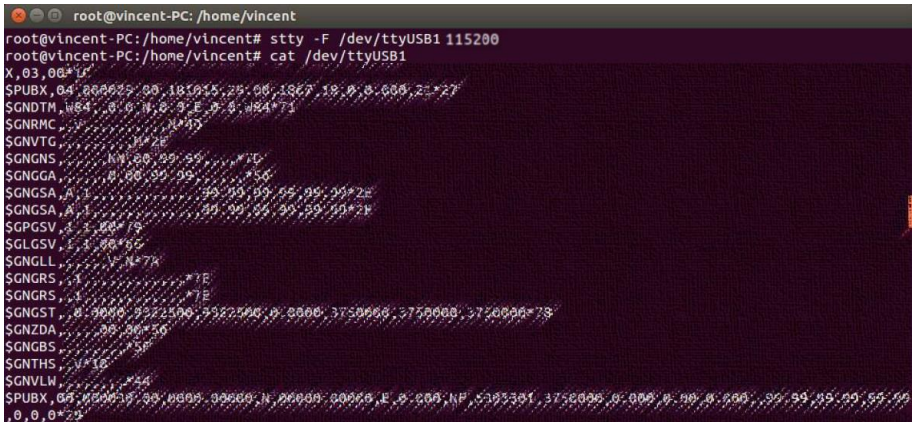


Step 2 Make sure the GNSS module is calibrated and enter DR Mode

You could check the status of GNSS module from the NEMA Information through the serial port of GNSS model

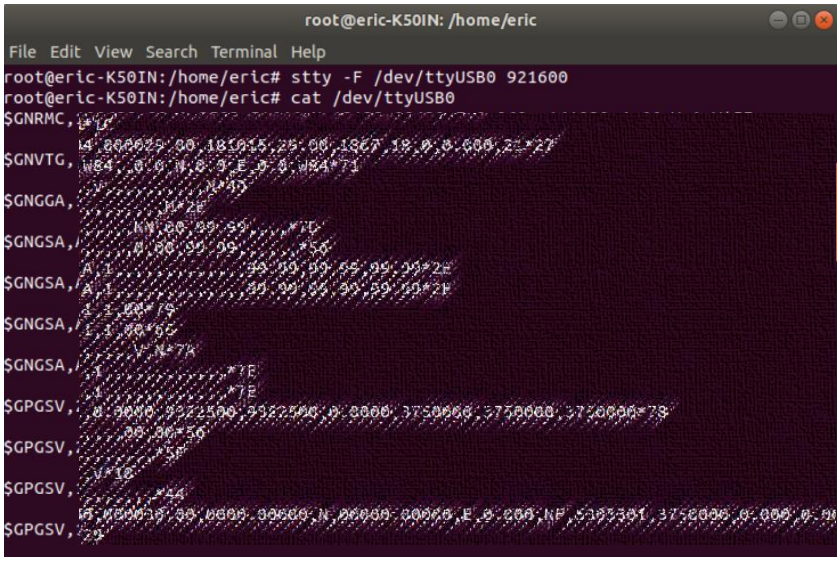
◆ GADN / ANNA-FG Series

- Serial port for NMEA data: ttyUSB1
- The baud rate for factory setting is 115200 bps (NEO-M8L module default: 9600 bps)



◆ ANNA-F9 High Precision Series

- Serial port for NMEA data: ttyUSB0
- The baud rate for factory setting is 921600 bps (ZED-F9R module default: 38400 bps)



If the GNSS module is calibrated and enter DR Mode, the fifth value in $GPGGA message will turn to be “6”.

GGA - essential fix data which provide 3D location and accuracy data.

```
 $GPGGA,123519,4807.038,N,01131.000,E,1,08,0.9,545.4,M,46.9,M,,*47

Where:
     GGA          Global Positioning System Fix Data
     123519       Fix taken at 12:35:19 UTC
     4807.038,N   Latitude 48 deg 07.038' N
     01131.000,E  Longitude 11 deg 31.000' E
     1            Fix quality: 0 = invalid
                               1 = GPS fix (SPS)
                               2 = DGPS fix
                               3 = PPS fix
                               4 = Real Time Kinematic
                               5 = Float RTK
                               6 = estimated (dead reckoning) (2.3 feature)
                               7 = Manual input mode
                               8 = Simulation mode
     08           Number of satellites being tracked
     0.9          Horizontal dilution of position
     545.4,M      Altitude, Meters, above mean sea level
     46.9,M       Height of geoid (mean sea level) above WGS84
                      ellipsoid
     (empty field) time in seconds since last DGPS update
     (empty field) DGPS station ID number
     *47          the checksum data, always begins with *
```

:

Detailed NEMA information →
https://www.gpsinformation.org/dale/nmea.htm#GGA

6. Test with CAN Bus Simulator

6.1 Connect to CAN Bus simulator

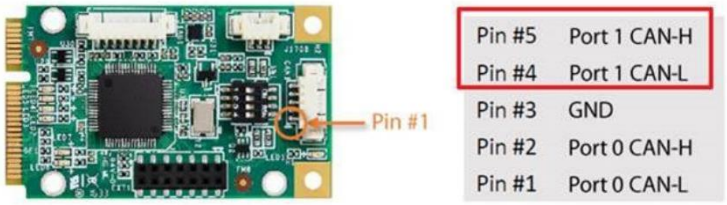
To test CAN-to-ADR with CAN Bus simulator, please connect the simulator signals to CAN port on the card.

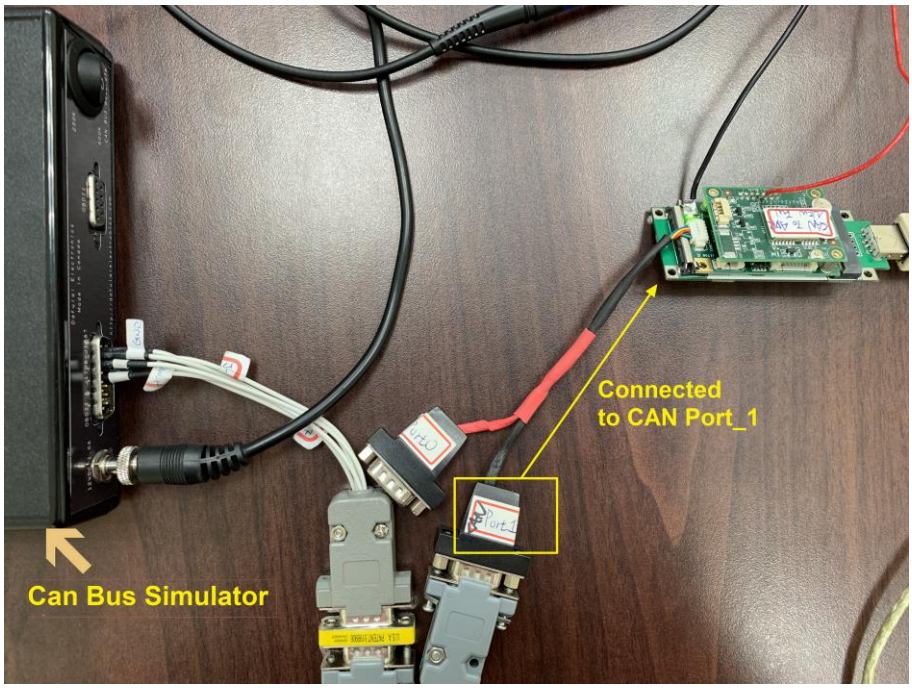
After the CAN Bus Signal is connected, please use commands to enable CAN-to-ADR function on GADN.

** Please refer to Chapter 3 or 4 for the instructions of commands.

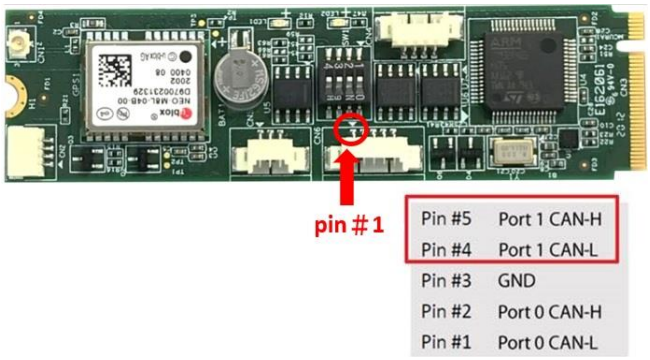
◆ GADN-F Series

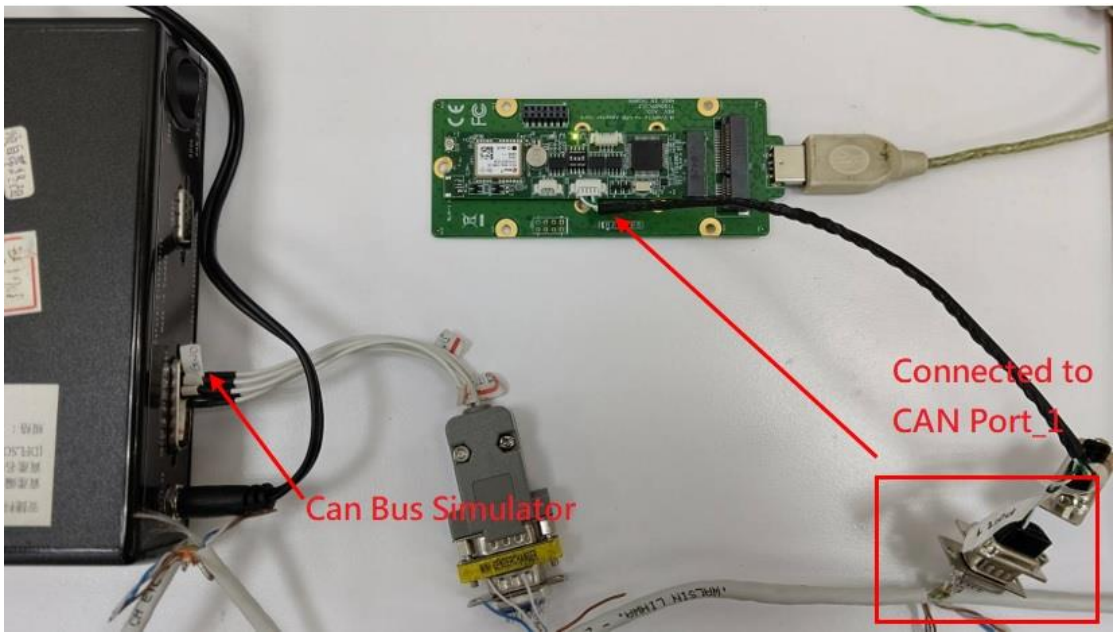
- Please connect to CAN Port_1 on the card.



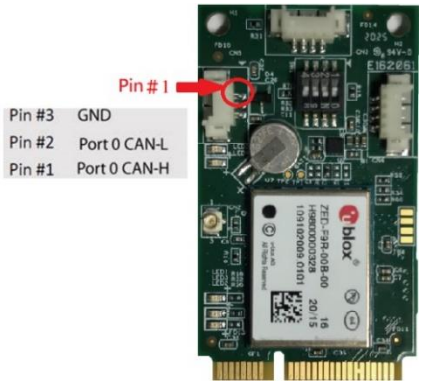


◆ GADN-M Series

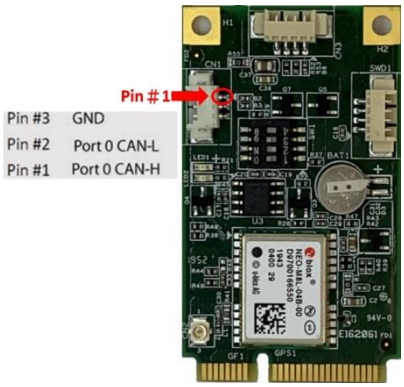




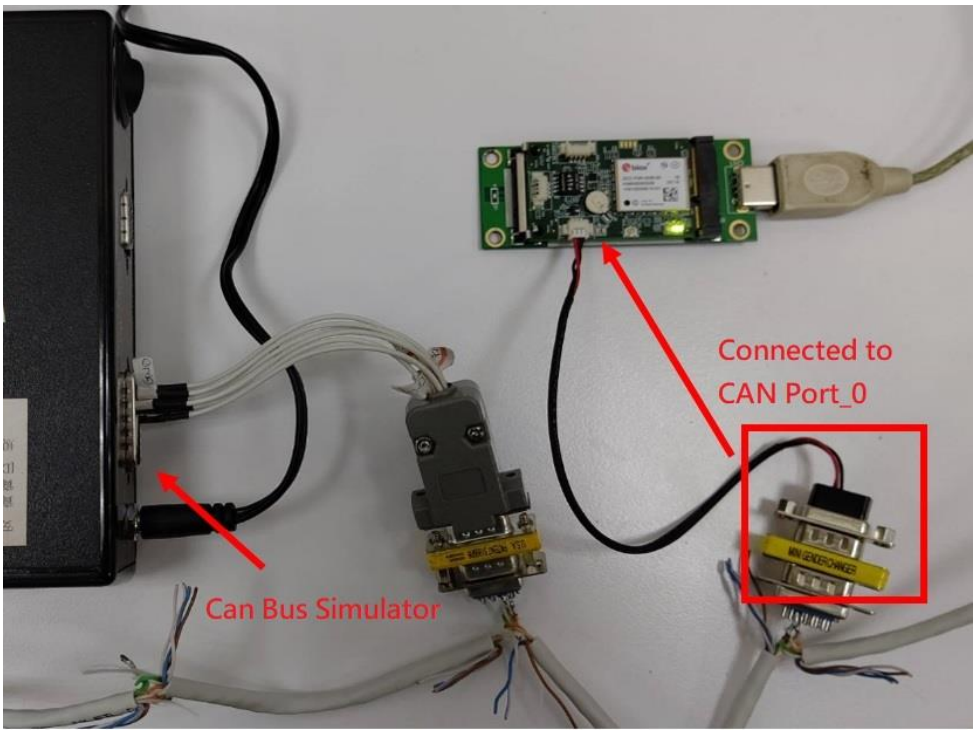
◆ ANNA-F Series



[ANNA-F9 High Precision Series]



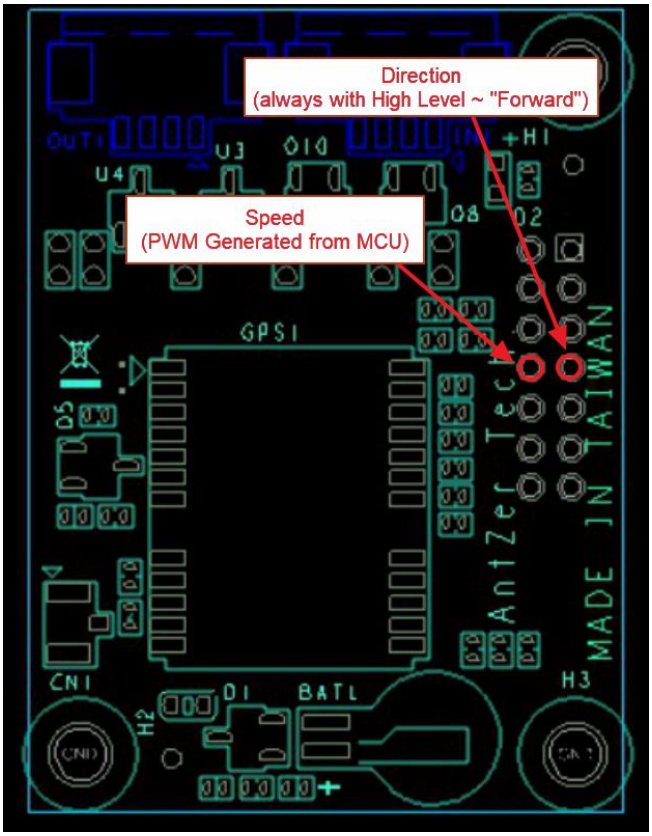
[ANNA-FG Series]



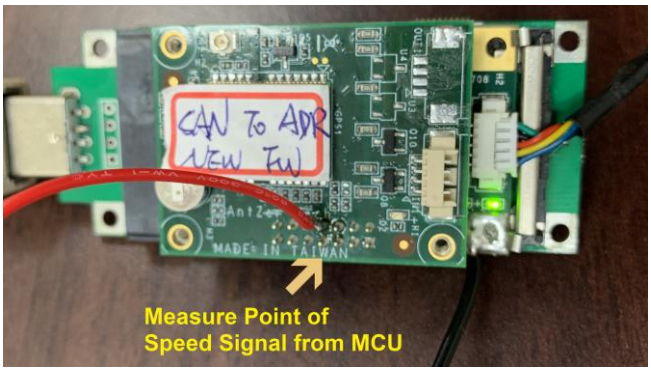
6.2 Check the Waveform

If the CAN-to-ADR mode has been set successfully, the PWM signal will be generated from MCU to the GNSS module. You could use a scope to check the waveform.

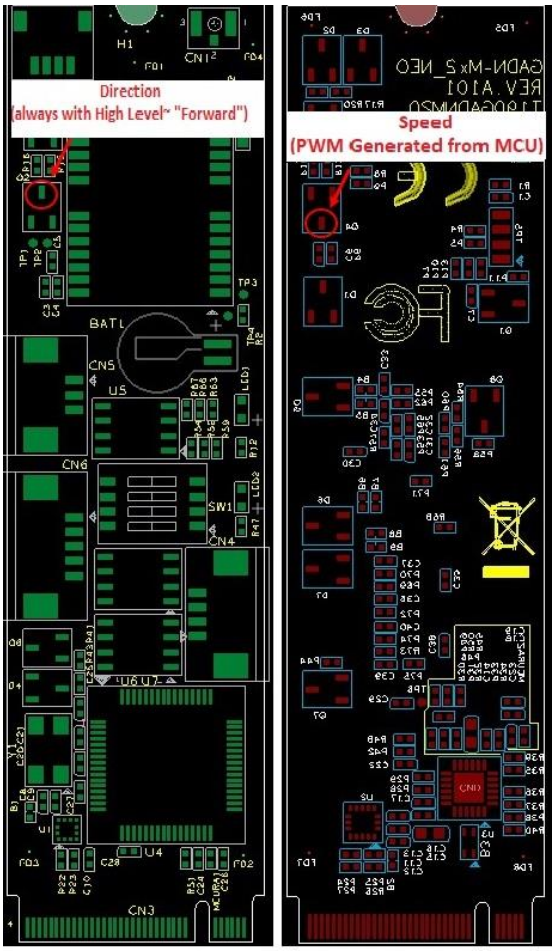
◆ **GADN-F Series**



[Measurement Point on GADN-F, Extension Board]

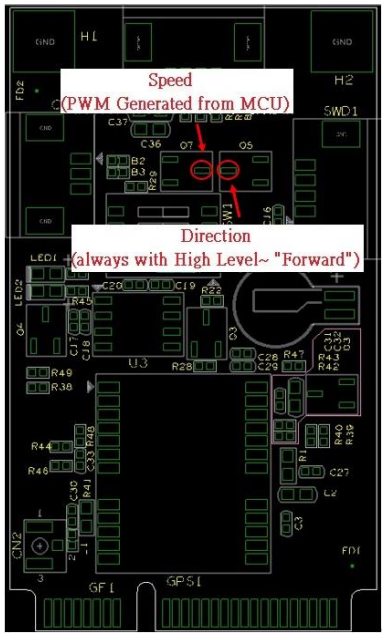


◆ GADN-M Series



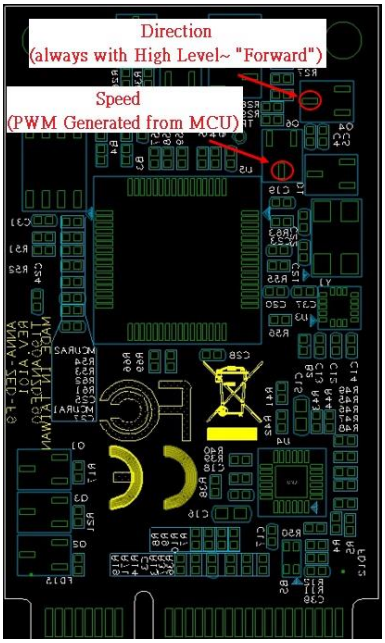
[Measurement Point on GADN-M]

◆ ANNA-FG Series



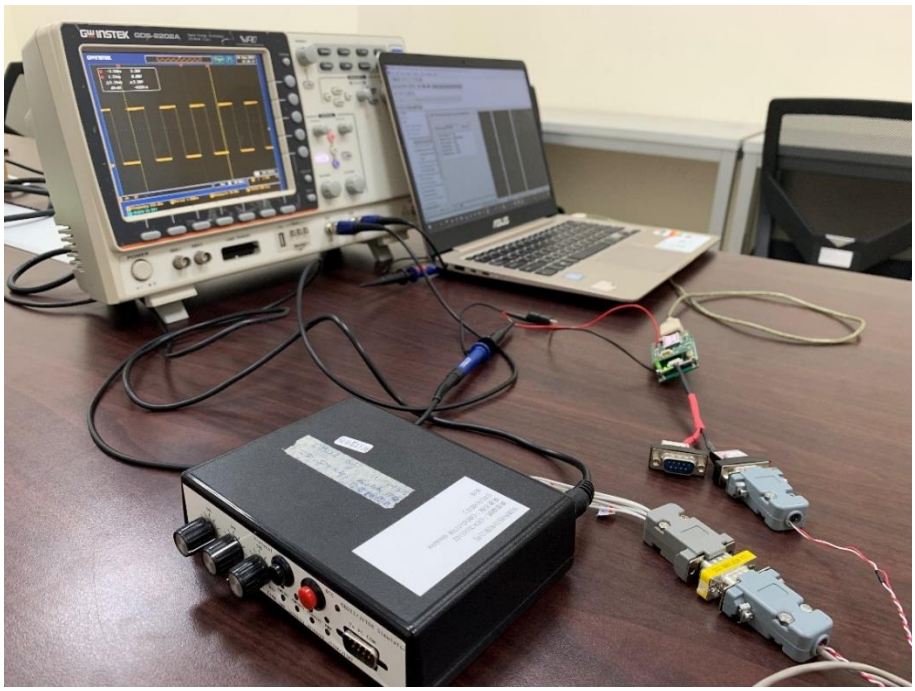
[Measurement Point on ANNA-FG]

◆ ANNA-F9 High Precision Series

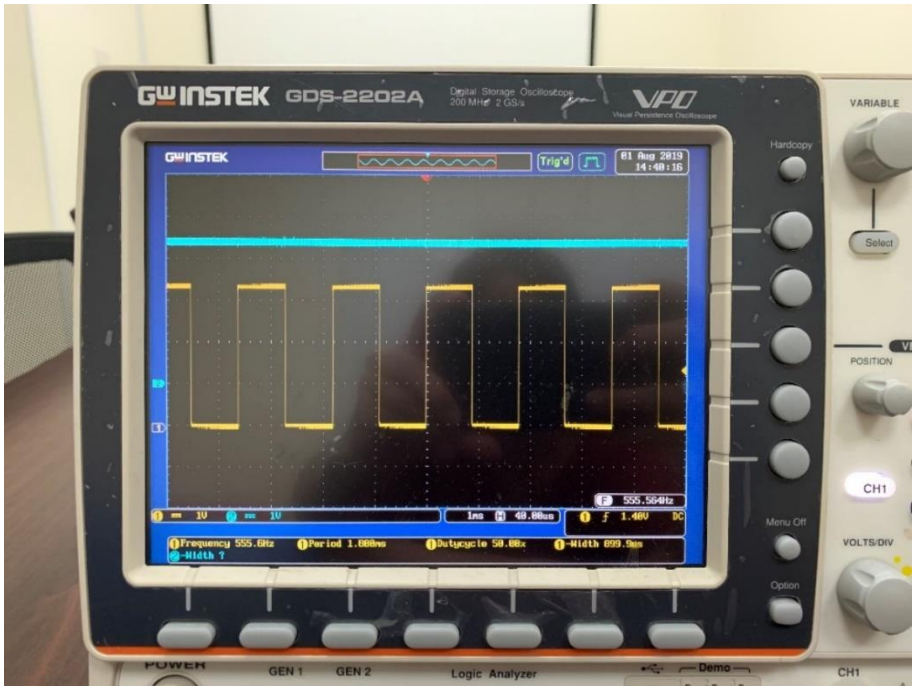


[Measurement Point on ANNA-F9]

The waveform of speed signal shown on the scope will differ from the speed from the simulator.



If the direction signal is not connected to the card, it will keep at the high level as light blue line shown in the scope below. (There's a pull-high resistor on the card)

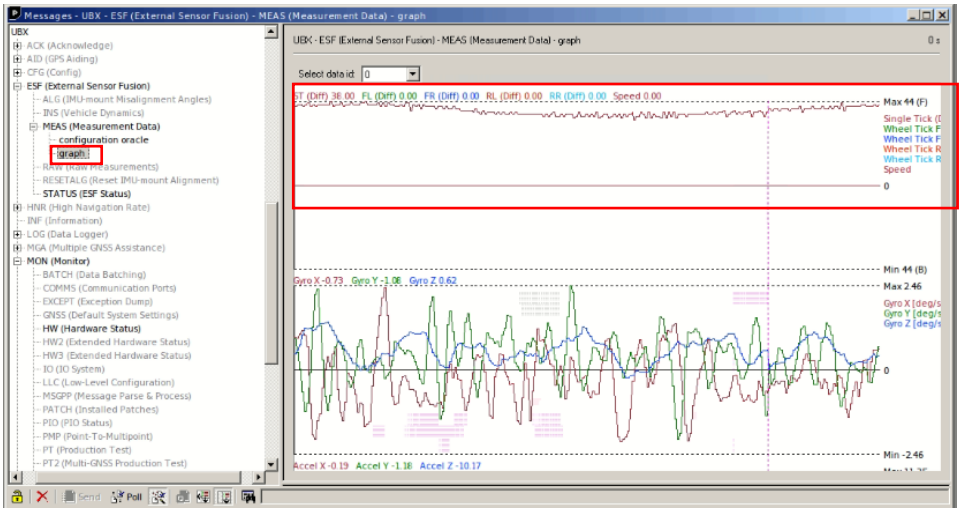


7. Speed Information shown in u-center

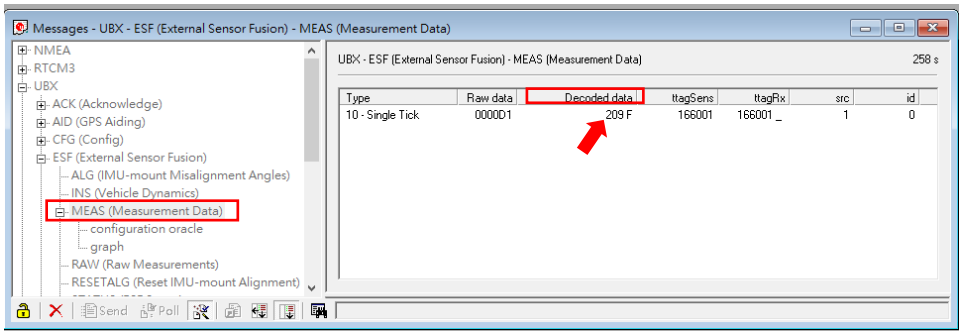
Step 1 On the main page of u-center, click on **View** on the upper left menu bar **→Messages View**

Step 2 Click on **graph** under **UBX→ ESF → MEAS**

If the Wheel-tick signal has been connected correctly you will see the value changing in the graph.



Note: The number in **Decode data** shouldn't change when the speed of the vehicle is the same. If it changes when the car doesn't move or change the speed, you might connect the wrong signal from the vehicle.



8. Forward/Backward Algorithm

Step 1 Install the PC with the card onto the vehicle.

Step 2 Use command below to enable Forward/Backward algorithm

Command = 0x6D: Set Forward/Backward Algorithm Enable/Disable

Framing: Total = 21 bytes						
DLE	**STX**	**CMD**	**Enable/Disable**	**Reserved**	**DLE**	**ETX**
1 byte	1 byte	1 byte	1 byte	15 bytes	1 byte	1 byte
0x10	0x02	0x6D	0x00 - Disable 0x01 - Enable		0x10	0x03

Response = 0xA0: ACK (Acknowledgements)

Framing: Total = 21 bytes						
DLE	**STX**	**CMD**	**Code**	**Reserved**	**DLE**	**ETX**
1 byte	1 byte	1 byte	1 byte	15 bytes	1 byte	1 byte
0x10	0x02	0xA0	0x00 - Succeed 0x01 - Error		0x10	0x03

Step 3 Start calibration procedures for the Forward/Backward algorithm

A. Keep the vehicle in static mode for 10 seconds.

B. Operate the vehicle straight forward and speed up to 40 km per hour.

Step 4 Check the status of the calibration in the response of the command below.

Command = 0x6E: Get States of Forward/Backward Algorithm

Framing: Total = 21 bytes					
DLE	**STX**	**CMD**	**Reserved**	**DLE**	**ETX**
1 byte	1 byte	1 byte	16 bytes	1 byte	1 byte
0x10	0x02	0x6E		0x10	0x03

Response = 0xB5: Get States of Forward/Backward Algorithm

	Framing: Total = 21 bytes						
DLE	**STX**	**CMD**	**Enable/Disable**	**Calibration**	**Reserved**	**DLE**	**ETX**
1 byte	1 byte	1 byte	1 byte	1 byte	14 bytes	1 byte	1 byte
0x10	0x02	0xB5	0x00 - Disable 0x01 - Enable	0x00 – No Calibrated 0x01 - 1 Calibrated 0x02 - 2 Calibrated 0x03 - 3 Calibrated 0x04 - 4 Calibrated 0x05 - 5 Calibrated		0x10	0x03

- **Enable / Disable:** The status of the forward/backward algorithm
- **Calibration:**
  "0x00" means the calibration is not finished or failed.
  "0x01"~"0x05" means the calibration has been done successfully

Step 5 If success, the calibration process is done. If the response of the "calibration" in Step 4 shows "0x00", please use command below to clear the calibration values and then go back to Step 3.

Command = 0x6C: Clear calibration value of Forward/Backward Algorithm

Framing: Total = 21 bytes					
DLE	**STX**	**CMD**	**Reserved**	**DLE**	**ETX**
1 byte	1 byte	1 byte	16 bytes	1 byte	1 byte
0x10	0x02	0x6C		0x10	0x03

Response = 0xA0: ACK (Acknowledgements)

Framing: Total = 21 bytes						
DLE	**STX**	**CMD**	**Code**	**Reserved**	**DLE**	**ETX**
1 byte	1 byte	1 byte	1 byte	15 bytes	1 byte	1 byte
0x10	0x02	0xA0	0x00 - Succeed 0x01 - Error		0x10	0x03

