FORSENSE
原极科技

# Industrial-Grade Single-Axis MEMS Gyroscope Sensor

# G200

# Product manual




Forsense (Shanghai) Technology Co., Ltd

Please read this user manual carefully before using this product.

# Industrial-Grade Single-Axis MEMS Gyroscope Sensor

# FSS-G200-Product Manual（en)

## Features

### Tactical-Grade MEMS Gyroscope

- 5.0°/h Bias instability
- Better than 0.1°/s Bias Repeatability;
- 0.08°/sUltra-Low Output Noise

### High-Intensity Operating Condition Tolerance

- Superior Shock Tolerance: 2000g (0.5ms, Half-Sine, 3-Axis)
- Superior Vibration Resistance: 10g (10~2KHz,3-Axis)
- Stable Operation Across Full Temperature Range: -40°C ~ 85°C
- 100% Magnetic Shielding

### Real-time and Flexible Digital Interface, Compact Size

- Configurable Output Sampling Rate up to 400Hz
- Supports CAN Interfaces for Mainstream Agricultural Machinery Controllers
- 45*45*22.8mm, Weight Only 50g

## Product Overview

G200 is a single-axis MEMS inertial sensor module developed by Forsense Technology.

High precision and high resolution capture subtle vibrations and tilts. Wide-range output enables motion perception under large dynamic conditions. All modules undergo fine-grained temperature compensation and independent calibration across an ultra-wide temperature range before shipment, ensuring stable performance under extreme operating conditions and high consistency across all products.

The reserved Integrated Navigation interface is compatible with mainstream satellite navigation solutions.

## Application Fields

- Autonomous Driving: Agricultural Machinery, Construction Vehicles

Based on standard performance and output Parameter, Forsense also provides**customized software and LOGO customization services**, to support your product needs!



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# 1. Performance Parameter

## 1.1 Gyroscope Key Metrics

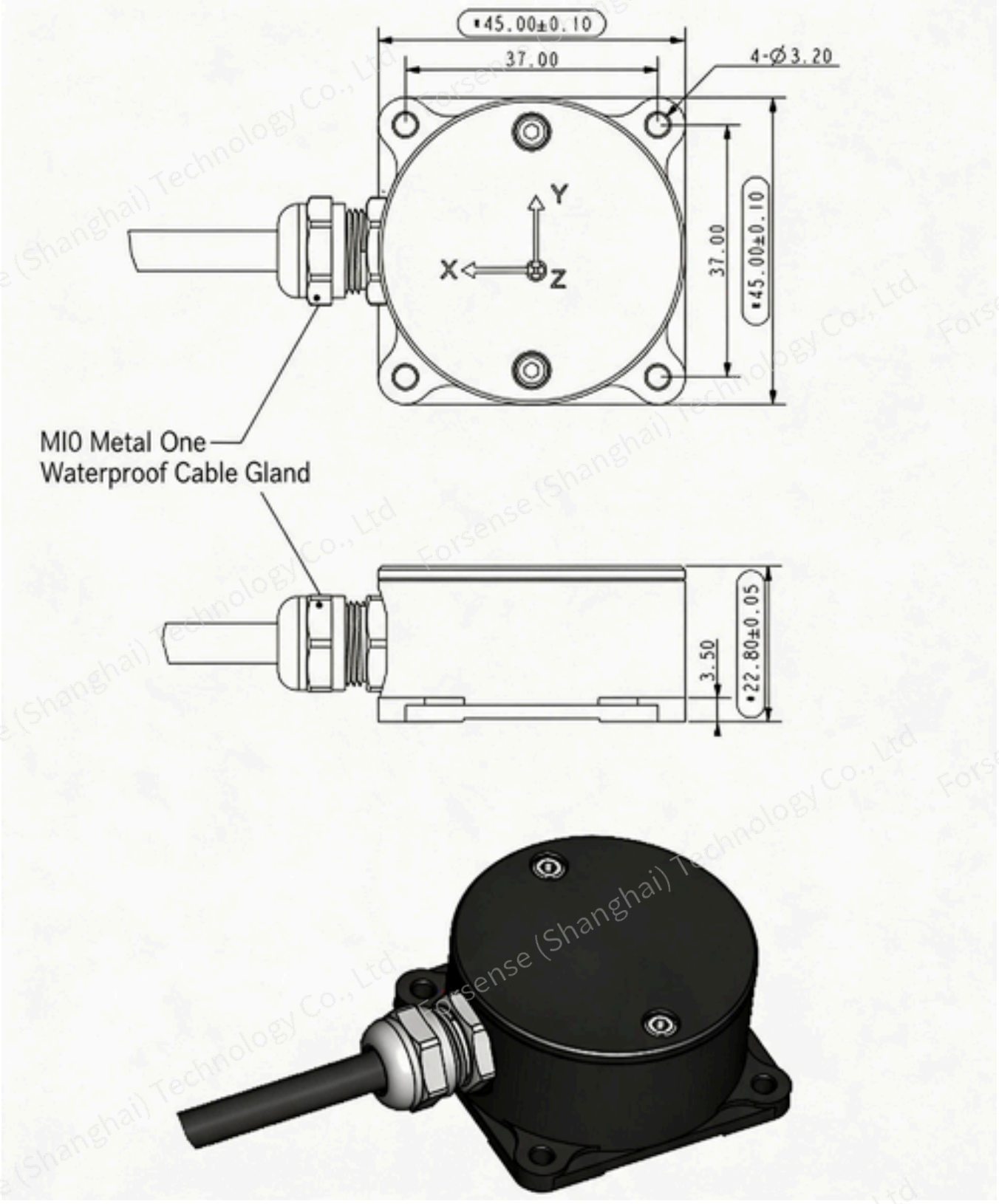
Table 1 Gyroscope Key Metrics

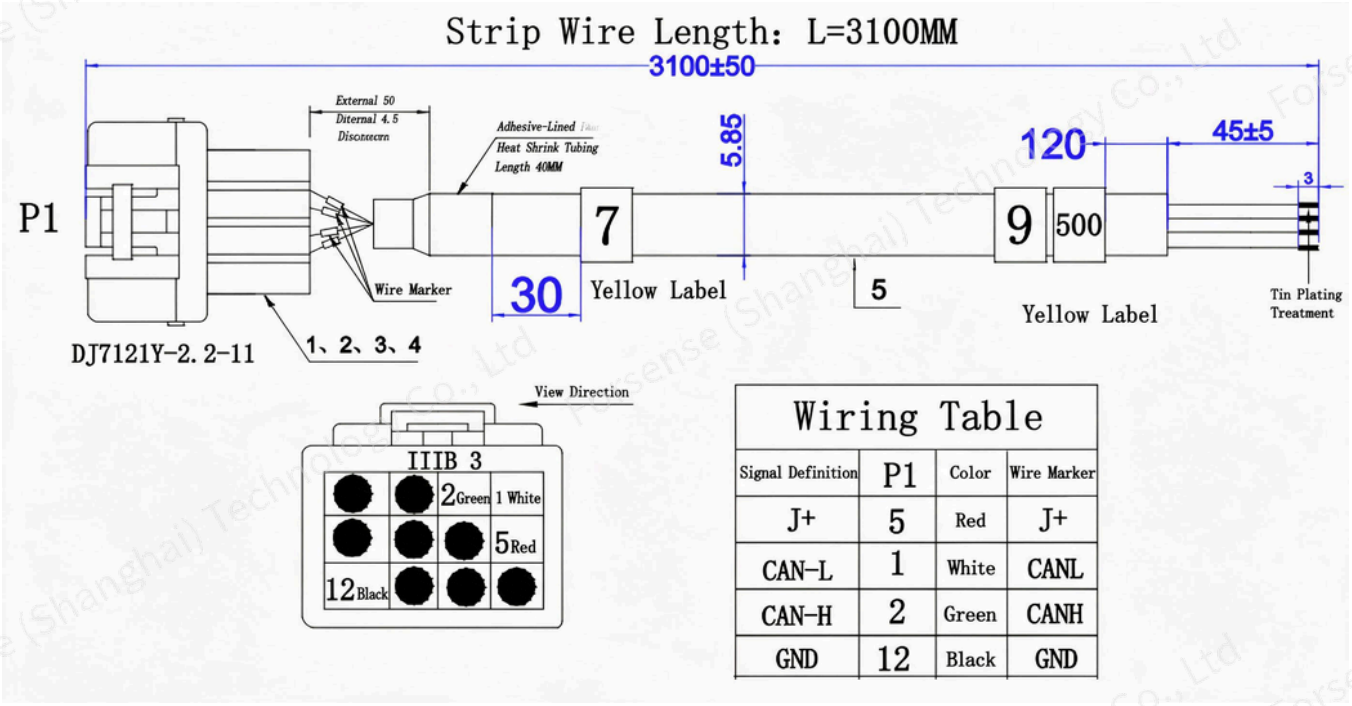
| Parameter | Test Conditions/Remarks | Min | Typical | Max | Unit |
|---|---|---|---|---|---|
| Measurement Range | | | ±500 | | °/s |
| Bias instability[1] | @25℃, Allan Variance, 1σ | | 5.0 | | °/hr |
| Bias Repeatability | @25℃, Allan Variance, 1σ | | 0.1 | | °/s |
| Internal low-pass cutoff frequency | Software Adjustable | 1.0 | 15 | 47 | Hz |
| ODR | | 1 | 100 | 200 | Hz |
| measure delay | | | 7.0 | | ms |
| Random Walk | @25℃, Allan Variance, 1σ | | 0.3 | | °/√hr |

Note 1: IEEE standard, Allan variance curve provided under static conditions at 25°C

# 2. Physical Structure

Figure 1 Outline Structure and Dimensions (Unit: mm)






| Wiring Table | | | |
|---|---|---|---|
| Signal Definition | P1 | Color | Wire Marker |
| J+ | 5 | Red | J+ |
| CAN-L | 1 | White | CANL |
| CAN-H | 2 | Green | CANH |
| GND | 12 | Black | GND |

Figure 2 Connector Definition

# 3. Electrical Characteristics

Table 2 Electrical Characteristics

| Parameter | Symbol | Min | Typical | Max | Unit |
|---|---|---|---|---|---|
| supply voltage | VCC | 4.5 | 5 | 15 | V |
| Max VCC Ripple | Vrpp | 0 | | 40 | mV |
| Power Consumption | P | | 0.25 | | W |
| Operating Temperature (Tot) | T | -40 | | 85 | ℃ |
| Storage Temperature (Tstg) | T | -40 | | 85 | ℃ |

Table 3 Pin Definition

| Parameter | Wire Color | Remarks |
|---|---|---|
| Power Input | Red | 5V DC Input |
| Ground (GND) | Black | |
| CAN_L | WhiteColor | CAN BUS |
| CAN_H | Green | |

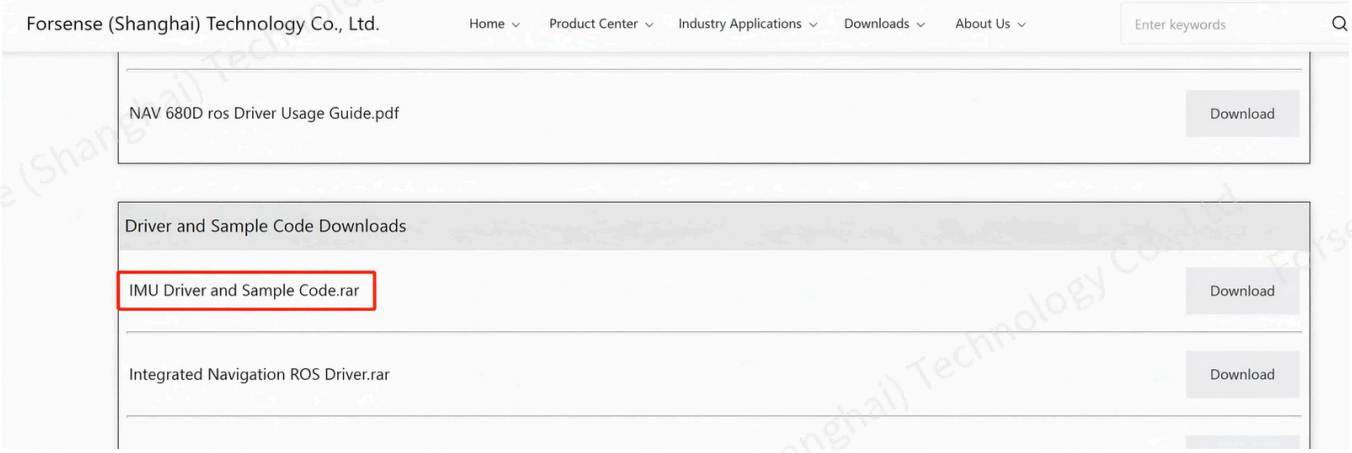
Note: CAN CommunicationDefaultBaud Rate is 500kbps, Built-in Matching Resistor 120 Ω

# 4. Communication Protocol

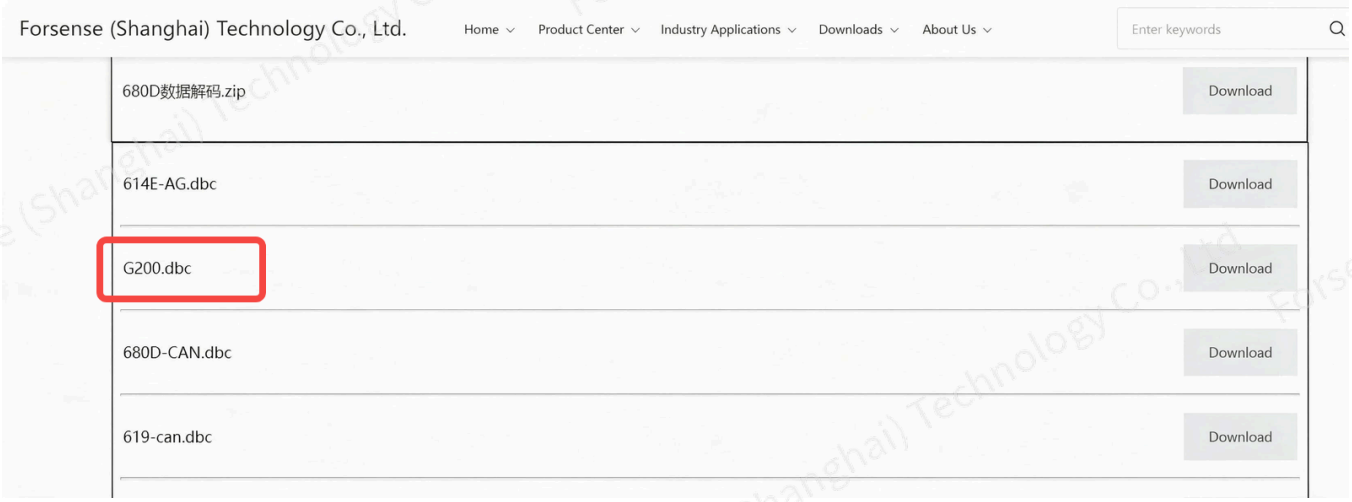
## 4.1 CAN Communication Protocol

Example of CAN Master Read Driver Based on STM32:

https://data.forsense-imu.com/page/download.html




DBC File




### 4.1.1 Communication Parameter

Interface Type: CAN, Standard Frame

CAN Rate:Default is 500 kbps (configurable from 250 to 1 Mkbps)

### 4.1.2 Standard Frame Format

Table4CAN Standard Frame Format 101

| Standard Frame ID | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| 0x65 + Node | ROLL | | | | PITCH | | | |

Table5CAN Standard Frame Format 102

| Standard Frame ID | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| 0x66+Node | YAW | | | | Gx | | | |

Table6CAN Standard Frame Format 103

| Standard Frame ID | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| 0x67 + Node | Gy | | | | Gz | | | |

Table7 CAN Standard Frame Format 104

| Standard Frame ID | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| 0x68+Node | Ax | | | | Ay | | | |

Table 8 CAN Standard Frame Format 105

| Standard Frame ID | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| 0x69 + Node | Az | | | | TEMP | | INDEX | |

Note 1: Attitude angles, gyroscope, and Accelerometer data are represented as float; temperature and count values are represented as int16.

Note 2: TEMP unit is 100*°C, Gyroscope output unit is °/s, Accelerometer output unit is g, and attitude output unit is degrees.

### 4.1.3 Configure CAN Parameter Command

- Configure CAN Baud Rate

Send Command:

ID=0x619,DATA=0x20 0x21 0x22 0x23 0xXX 0x00 0x00 0x00

IMU Response:

ID=0x519,DATA=0xXX 0xFF 0xFF 0xFF 0xFF 0xFF 0xFF 0xFF

Query CAN Baud Rate

Send Command:

ID=0x619,DATA=0x20 0x21 0x22 0x23 0x0A 0x00 0x00 0x00

IMU Response:

ID=0x519,DATA= 0xXX 0x0A 0xFF 0xFF 0xFF 0xFF 0xFF 0xF

Where:

XX=01 Baud Rate is 250 Kbps

XX=02 Baud Rate is 500 Kbps

XX=03 Baud Rate is 1000 Kbps

- Configure CAN Node ID

Example: Set Node ID to 0X0102

Send Command:

ID=0x61A,DATA=0x30 0x31 0x32 0x33 0x01 0x02 0x00 0x00

IMU Response:

ID=0x51A,DATA=0x01 0x02 0xFF 0xFF 0xFF 0xFF 0xFF 0xFF

- Configure Output Frequency

Set Output Frequency:

ID=0x61C,DATA=0x10 0x11 0x12 0x13 0xXX 0xFF 0xFF 0xFF

IMU Response:

ID=0x51C,DATA=0xXX 0xFF 0xFF 0xFF 0xFF 0xFF 0xFF 0xFF

Query Output Frequency:

Send Command:

ID=0x61C,DATA=0x10 0x11 0x12 0x13 0x0A 0xFF 0xFF 0xFF

IMU Response:

ID=0x51C,DATA=0x**XX** 0x0A 0xFF 0xFF 0xFF 0xFF 0xFF 0xFF

Where:

XX=01 Output Frequency is 1Hzz

XX=02 Output Frequency is 10Hzz

XX=03 Output Frequency is 50Hzz

XX=04 Output Frequency is 100Hzz

XX=05 Output Frequency is 200Hzz

- Query Version Number

Example:

Send Command:

ID=0x618,DATA=0x10 0x11 0x12 0x13 0x00 0x00 0x00 0x00

IMU Response:

ID=0x518,DATA=0x00 0xC9 0xBB 0xE9 0xFF 0xFF 0xFF 0xFF

The version number is 0x00C9BBE9, which corresponds to firmware version 13220841.

# 5. CRC Lookup Table Calculation

It is recommended to refer directly to the sample code.

Note 1: Data is transmitted in little-endian format, with the low byte first and the high byte last.

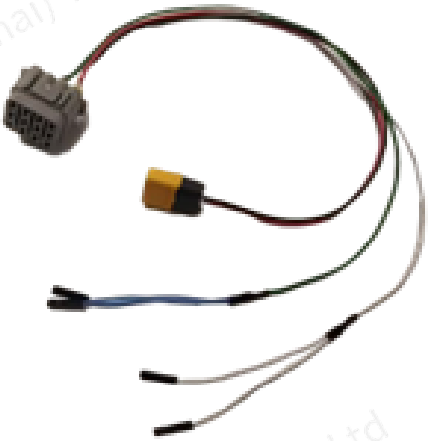
Note 2: The initial value of crc32 is 1, and the CRC calculation excludes this field itself for all data in the current frame.

```
static  const  uint32_t  crc32_tab [ ]  =  {
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  crc_crc32 (uint32_t  crc,  const  uint8_t  *buf,  uint32_t size ) {
for   (uint32_t  i=0;  i<size ;  i++)  {
crc  =  crc32_tab [ (crc  ^  buf [i ] )  &  0xff]  ^   (crc  >>  8 ) ;
}
return  crc;
}
```

# 6. OptionalAccessories





USBConvert to CAN Power + CANHarness

# 7. Update Record

Latest Manual Version: G200_Datasheet_Product Manual（en)

| Version | Date | Status/Notes |
|---|---|---|
| Version 1.0 | 2023.07.18 | Initial Release |
| Version 1.1 | 2023.12.14 | Added Attachments |
| Version 1.2 | 2024.6.17 | Removed Serial Port Section |
| Version 1.3 | 2025.01.23 | Adjusted Table and Figure Numbering |

Forsense (Shanghai) Technology Co., Ltd