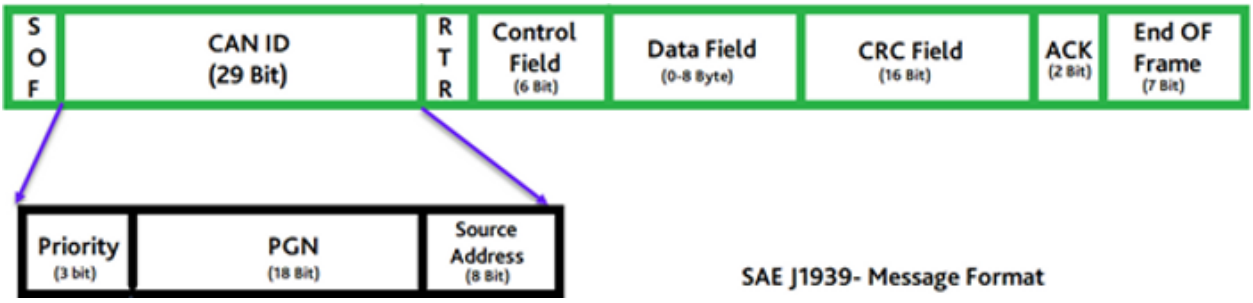
TILT SENSOR - J1939 – CAN PROTOCOL APPLICATION NOTE

Rev 003, Sep 2024 By:R&D

1. Description.

CAN Protocol	SAE J1939 standards
CAN-bus Speed	500 Kbit/s
CAN identifier	29 bits



SAE J1939- Message Format

PGN comprises an 18-bit subset of the 29-bit extended CAN ID. The PGN uniquely identifies the parameter group (PG) that is being transmitted in the message, priority and source address are also part of the CAN ID.

By default, sensor send measure data (signals) with a cycle time of 100ms, device support the parameter groups (PNGs):

- PNG 65280 (FF00h) Angle Output, pitch and roll.
- PNG 65283 (FF03h) Acceleration Output.
- PNG 65284 (FF04h) Gyroscope Output.

It must be possible to update the software, change the default baud rate, sampling rate and configure the source address on the sensor over the CAN bus.

2. Output format.

The device support 3 different parameter groups (PNGs):

- PNG 65280 for pitch and roll.

PGN	0FF00h (65280)
CAN ID	18FF0080h
Data Length	4
Source Address	80 (initial value)
Priority	6
Transmission Rate	100 ms (initial value)

Data Field:

Start Position	Length	Name	Data
0-3	4 Bytes	Angular roll, X-Axis	Range: ±90/45/25 degrees Offset: 0 Factor: 0.001
4-7	4 Bytes	Angular pitch, Y-Axis	Range: ±90/45/25 degrees Offset: 0 Factor: 0.001

- PNG 65283 for x, y and z Acceleration.

PGN	0FF03h (65283)
CAN ID	18FF0380h
Data Length	6
Source Address	80 (initial value)
Priority	6
Transmission Rate	100 ms (initial value)

Data Field:

Start Position	Length	Name	Data
0-1	2 Bytes	Acceleration, X-Axis	Range: ±2000mg Offset: 0
2-3	2 Bytes	Acceleration, Y-Axis	Range: ±2000mg Offset: 0
4-5	2 Bytes	Acceleration, Z-Axis	Range: ±2000mg Offset: 0

- PNG 65284 (FF04h) for x, y and z gyroscope output.

PGN	0FF04h (65284)
CAN ID	18FF0480h
Data Length	6
Source Address	80 (initial value)
Priority	6
Transmission Rate	100 ms (initial value)

Data Field:

Start Position	Length	Name	Data
0-1	2 Bytes	Yaw Rate, X-Axis	Range: ±125 dps Offset: 0 Factor: 0.01
2-3	2 Bytes	Yaw Rate, Y-Axis	Range: ±125 dps Offset: 0 Factor: 0.01
4-5	2 Bytes	Yaw Rate, Z-Axis	Range: ±125 dps Offset: 0 Factor: 0.01

3. Getting started.

When the sensor is turned on, it sends an Address Claimed message according to PGN60928 (EEFFh). The message is composed of:

- Identifier: 18EEFFXXh
- Data: device name.

After the sensor has acquired a valid address, it starts sending acceleration and yaw rate messages according to PNG65283 and PNG 65284. The message is composed of:

- Identifier: 18FF0380h / 18FF0480h
- Data: Acceleration output / Yaw Rate Output

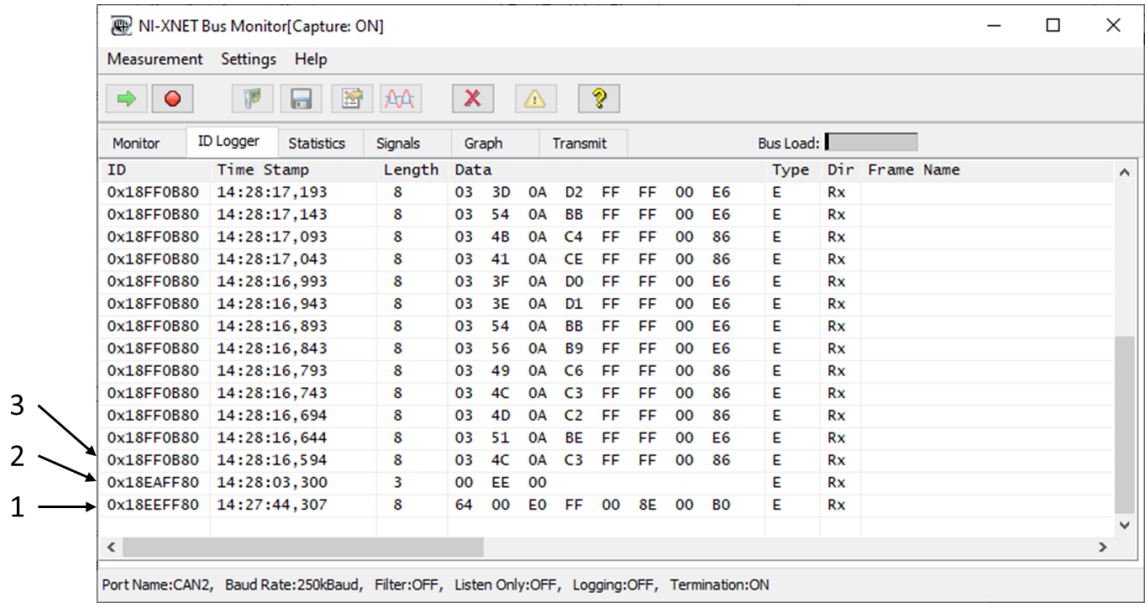


Figure 1. Example Address Claimed message in an angle position sensor.

1- Send response address claimed PGN 59904.
2- Send request address claimed, PGN 60928.
3- Start angle position information, PGN 65291.

4. Sensor configuration (PNG 61184 / EF00h).

Reading and change the sensor configuration, is possible using Prop A PGN 61184 (EF00h) (->PGN (Parameter Group Number)).

8 data bytes are defined in the following table:

Data 7	Data 6	Data 5	Data 4	Data 3	Data 2	Data 1	Data 0
Data 3	Data 2	Data 1	Data 0	Sub index	CMD	Parameter Index	

Parameter Index	Index PNG parameter (table parameter)
CMD	0x01 – Read data 0x02 – Write data Sensor reply ->> 0x80 – Ok 0x81 – Error
Sub Index	Sub index PGN parameter
Data 0 to Data 3	4 bytes of data

Parameter table ->

Index (hex)	Subindex (hex)	Data type	Access	Description	Default
1010	0x01		r/w	Save “0x65766173”	
1011	0x01		r/w	Load “0x64616F6C”	
3001	0x00	U8	r/w	Baud Rate 0x02 – 500 kbit/s 0x03 – 250 kbit/s	0x02
300F	0x00 0x01	U8	w	0x01 -> offset set to 0 0x02 -> Zero adjustment Inclination Offset X-axis and Y-axis 0x01 -> offset set to 0 0x02 -> Zero adjustment Acceleration Offset X-axis, Y-axis and Z-axis	0x00 0x00
3101	0x01	U8	r/w	J1939 id Address	0x80
3102	 0x01 0x02	 U8 U16	 r r/w	PGN 65280 / 0xFF00 Angle output Priority (0 – 7) Transmission Rate (0-desactived)	 0x03 0x64 (100ms)
3103	 0x01 0x02	 U8 U16	 r r/w	PGN 65283 / 0xFF03 Acel. output Priority (0 – 7) Transmission Rate (0-desactived)	 0x03 0x64 (100ms)
3104	 0x01 0x02	 U8 U16	 r r/w	PGN 65284 / 0xFF04 Yaw output Priority (0 – 7) Transmission Rate (0-desactived)	 0x03 0x64 (100ms)

5. Configuration examples.

a. Change device address.

Use Index 3101 and subindex 0x01 to change the device address, the example writes the new identifier (0x82) and store in no volatile memory.

	Data Field								
CAN-ID	DLC	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
0x0CEF8081	8	0x31	0x00	0x02	0x01	0x82	0x00	0x00	0x00

Answer successful storing:

	Data Field								
CAN-ID	DLC	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
0x18EF8180	8	0x31	0x00	0x80	0x00	0x00	0x00	0x00	0x00

Save in memory:

	Data Field								
CAN-ID	DLC	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
0x0CEF8081	8	0x10	0x10	0x02	0x01	0x65	0x76	0x61	0x73

Answer successful storing:

	Data Field								
CAN-ID	DLC	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
0x18EF8180	8	0x31	0x00	0x80	0x00	0x00	0x00	0x00	0x00

b. Change transmission rate.

Use Index 3102 and subindex 0x02 to change the angle transmission rate, the example writes the new rate (50 ms) and store in no volatile memory.

	Data Field								
CAN-ID	DLC	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
0x0CEF8081	8	0x32	0x02	0x02	0x02	0x00	0x32	0x00	0x00

Answer successful storing:

Data Field									
CAN-ID	DLC	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
0x18EF8180	8	0x31	0x00	0x80	0x00	0x00	0x00	0x00	0x00

Save in memory:

Data Field									
CAN-ID	DLC	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
0x0CEF8081	8	0x10	0x10	0x02	0x01	0x65	0x76	0x61	0x73

Answer successful storing:

Data Field									
CAN-ID	DLC	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
0x18EF8180	8	0x31	0x00	0x80	0x00	0x00	0x00	0x00	0x00