Content

1 CAN SAE J1939

1.1 Support

If you have any questions, please contact our product support at support@novotechnik.de.
User manuals for previous software versions are available on request.

1.2 J1939 Frame Description

The J1939 interface uses the 29 bits extended CAN-ID according ISO 11898. The identifier contains the following general information:

Name	Priority	Extended data page	Data page	PDU format	PDU specific (Destination address **DA**)	Source address **SA*** (necessary)
Length	3 bits	1 bit	1 bit	8 bits	8 bits	8 bits
Descrip-tion	Message latency for transmission, 0=high ... 7=low			To determine PGN	PDU Format < 240: destination address PDU Format ≥ 240: group extension	Unique address of transmitting unit
Value	0x18					0x80 (default) 0x80…0xF7 128….247 dec

* In case of configuration, the sensor receives data. Therefore, in the identifier the sensor address (0x80…0xF7) must then be used as destination address (DA) and the source address is the address of the transmitting unit (e.g. master)

The entire frame format PDU contains the identifier (29 bits) and the data section (8 byte):

Identifier					Data Bytes (0 ...64 bits)							
Priority	PGN (18 bits)			Source address **SA**	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
	Data page	PDU format	Destination address **DA**									

1.3 Address Claiming (ACL)

Dynamic address claiming is supported. The sensor starts the claiming with the default source address 128 dec = 0x80.
If an address conflict with a higher prior source address occurs, the network management will increase the source address automatically by 1 until 247 is reached. If no free source address is available, the sensor will use address 254 and does not actively send data onto the bus, it can only be addressed using broadcast messages. The new claimed address is used temporary only. After power on, the default source address is 128 dec =0x80 again. If the start address has been changed compared to the default value (e.g. 0x82 instead of 0x80, according to chapter 1.6.1 Set start address), dynamic address claiming begins at this start address.
For use in networks with fixed address assignment, the dynamic address claiming can be deactivated and the start address can be changed by the user with the command "set start address" to the desired source address (128 ... 247, see chapter 1.6 Configuration Data).
The new start address remains even after power off if using the command "Store PGN Configuration".

1.4 Device Name / Name Field

Data in the Name field is not changeable by the user.

Name	Value [dec]	Description
Arbitrary address capable	1 / 0	1 = Yes, 0 = No
Industry Group	0	Global
Vehicle System Instance	0	
Vehicle System	127	Non specific
Reserved	0	
Function	255	Non specific
Function Instance	0	
ECU Instance	0	
Manufacturer	851	Manufacturer ID
Identity Number	> 0	Unique No.

1.5 PGN Default Definitions

1.5.1 Process Data - Message Content PGN 65450 0xFFAA with SA

After the sensor has claimed a source address, the measured position values will be sent automatically with a "Proprietary B" PGN message. It is also possible to request the process data message (Configuration PGN and Reponse PGN see chapter 1.6 and 1.7).
The process data message PGN 65450 contains the process data Rotary Position (P), Velocity (V), Revolution Counter (U) and Status.

	Byte 7		Byte 6		Byte 5		Byte 4		Byte 3		Byte 2		Byte 1		Byte 0	
Sensor Type Redundancy	Bit 7 ... 4	Bit 3 ... 0	Bit 7 ... 4	Bit 3 ... 0	Bit 7 ... 4	Bit 3 ... 0	Bit 7 ... 4	Bit 3 ... 0	Bit 7 ... 4	Bit 3 ... 0	Bit 7 ... 4	Bit 3 ... 0	Bit 7 ... 4	Bit 3 ... 0	Bit 7 ... 4	Bit 3 ... 0
Single PVU	Revolution Counter (Incremental, 32 bits)								Status (4 bits)		Velocity (12 bits)		Rotary Position (16 bits)			
Redundant PPVV	Velocity Ch. 2 (12 bits)			Velocity Ch. 1 (12 bits)			Status (8 bits)		Rotary Position Channel 2 (16 bits)				Rotary Position Channel 1 (16 bits)			
Redundant PPU	Revolution Counter (Incremental, 24 bits)						Status (8 bits)		Rotary Position Channel 2 (16 bits)				Rotary Position Channel 1 (16 bits)			

1.5.2 Definition of the Signals (SLOT)

Position values:
Data length 16 bits (unsigned value)
Resolution Configurable: Range/Resolution (e.g. 360°/14 bits = 0,022° / bit)
Range 0 … 360°
Offset 0°
Transfer Function Position [°] = (Data * Resolution) - Offset

Velocity values:
Data length 12 bits (signed value)
Resolution Configurable: Range/Resolution/ms / bit
Min. 1 LSB = 0,055°/s up to 1 LSB = 2,2°/s
Range Min. -18,75 ... 18,75 rpm up to -750 ... 750 rpm
Transfer Function Velocity [°/ms] = (Data * Resolution)

Revolution counter values:
Data length PVU: 32 bits (signed value), PPU: 24 bits (signed value)
Resolution 1 turn/bit
Range PVU: -2.147.483.648 ... 2.147.483.647 turns, PPU: -8.388.608 ... 8.388.607 turns
Transfer Function Number of turns = (Data * Resolution)

1.6 Configuration Data - Parameter Mode PGN 61184 0xEF00 with DA and SA

The reading and writing of parameters and the triggering of defined actions is done by Configuration PGN 61184 = 0xEF00 with destination and source address.
Each configuration operation is answered with a ACK response.

1.6.1 Configuration (Byte0 = 0x01)

Setting	Description	Value * Default	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
Preset [°]	Position offset x positive values, 1 bit = 1/(2^14)*360° A new written offset will be valid immediately.	0* ≤ x <360° 0x0000* ≤ x <0x4000	0x01	0x00* ... 0xFF	0x00* … 0x3F					
Filter average	Value count for average filter (moving average function for position and speed calculation) 0: moving average function off (2^0) moving average over 2^n values (n= 1 ... 7) A new written filter average will be valid immediately.	Filter 0* Filter 1 Filter 2 Filter 3 Filter 4 Filter 5 Filter 6 Filter 7	0x01					0x00* 0x01 0x02 0x03 0x04 0x05 0x06 0x07		
Counting direction	Switch of counting direction. The counting direction clockwise (cw) or counter-clockwise (ccw) defines whether the signal values are rising or falling when sensor shaft or position marker is rotated cw (view on the position marker or shaft). 0x00: CW 0x08: CCW A new written value will be valid immediately.	cw* ccw	0x01					0x00* 0x08		
Resolution velocity [°/s]	Resolution velocity, independent of position resolution. For redundant outputs, it is effective at once for both channels. 0x00: fast, 1 LSB = 2,2°/s, max. speed 750 rpm 0x10: medium, 1 LSB = 0,22°/s, max. speed 75 rpm 0x20: slow, 1 LSB = 0,055°/s, max. speed 18.75 rpm A new written resolution will be valid immediately.	Fast* Medium Slow	0x01					0x00* 0x10 0x20		
Resolution position [bits]	Measuring steps per turn. For redundant outputs, it is effective at once for both channels 0x00: 14 bits 0x40: 13 bits 0x80: 12 bits A new written resolution will be valid immediately.	14bit* 13bit 12bit	0x01					0x00* 0x40 0x80		
Arbitrary address capable	0x00: Dynamic address claiming 0x10: Dynamic address claiming deactivated, fixed source address has to be set (“set start address”) A new written value is not effective before reboot!	Add.claiming on* Add.claiming off	0x01						0x00* 0x10	
Baud rate [kBaud]	Transmission rate 0x00: 250 kBaud 0x08: 500 kBaud A new written baud rate is not effective before reboot!	250kBaud* 500kBaud	0x01						0x00* 0x08	
Transmit mode	0x00 = Timer: process data is sent cyclically with the selected transmission repetiton mode 0x04 = Request: process data is only sent after a remote request Event triggered transmission of process data is not supported. A new written transmit mode will be valid immediately.	Auto/Fix Cycle* Polling	0x01						0x00* 0x04	
Transmit cycle	0x00 = 10 ms 0x01 = 25 ms 0x02 = 50 ms 0x03 = 100 ms A new written transmit cycle will be valid immediately.	10ms 25ms 50ms* 100ms	0x01						0x00 0x01 0x02* 0x03	
Set start address	Address claiming: desired start address can be set.	0x80 …0xF7	0x01							0x80 … 0xF7

Important Note:

- To write parameters, the 8 data bytes must contain the complete configuration (Byte 0 to Byte 7).
- Newly written parameters are stored non volatile with the defined action “Store PGN Configuration” (see 1.6.2 Trigger flags).
- If a newly written parameter only becomes effective after reboot, sensor reboot must be carried out with defined action “Sensor reboot” (see 1.6.2 Trigger flags)

Example of setting preset, direction, address claiming, baudrate, source address in one configuration:

Setting	Description	Value	Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
		Offset +90° ccw Add. Claiming off 500 kBaud Source address 0x80		0x00	0x10			0x08	0x10 0x08	0x80
Preset, Direction Add.claiming Baudrate Source address	Add up all individual settings bytewise to one configuration	PGN 0x18EF8000	0x01	0x00	0x10	0x00	0x00	0x08	0x18	0x80

1.6.2 Trigger flags (Byte0 = 0x00)

To trigger a defined action, the 8 data bytes have to contain the following trigger flags in Byte1:

Setting	Description	Byte0	Byte1	Byte2…Byte7
Store PGN Configuration	Non-volatile storage of new configuration	0x00	0x01	0x00
Reset of Status Bits		0x00	0x02	0x00
Sensor reboot	like Power OFF/ON, wait 200 ms until further actions	0x00	0x04	0x00
Factory Reset	Reset to default configuration	0x00	0x08	0x00
Zero Counter	Reset counter, will be valid immediately	0x00	0x10	0x00
Store Counter	Current revolution value will be stored non-volatile and is put out after reboot as start value	0x00	0x20	0x00
Read Configuration PGN		0x00	0x80	0x00

Important Note:

- Only one trigger flag can be set in each operation! If more than one trigger flag is set, there is no action executed.
- If the trigger flag “Read Configuration PGN” is set, it is answered by the PGN Response “Configuration”
- A stable and uninterrupted power supply shall be ensured prior to any write operations on sensor settings.
  The supply voltage shall not fall below the minimum permissible value as specified in the datasheet. Failure to comply may result in corruption of the sensor settings.

1.7 Response PGN 65452 0xFFAC

Each configuration operation is answered with a ACK response or with the requested data (actual used configuration) by Response PGN 65452 = 0xFFAC (8 bytes).

	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
Acknowledge ACK	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00
Configuration	Index	Basic Configuration					Interface Configuration	

1.8 Request Commands

In the sensor, requests are implemented for Name Identification, Process Data Message, Software Identification (firmware version) and Component Identification (serial number).
DA: Destination Adress **SA**: Source Address

1.8.1 Name Identification PGN 60928 0x00EE00 + DA and SA

Request 0x00EA, DA = 0x80, SA = 0x00:

COB-ID	Read/ Transmit	Size	Data							
			Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
0x18EA8000	Rx	3 Bytes	0x00	0xEE	0x00	-	-	-	-	-

Name Identifcation

COB-ID	Read/ Transmit	Size	Data							
			Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
0x18EEFF80	Tx	8 Bytes	Identity number (21 bits)	Identity number (21 bits)	Identity number (21 bits) / Manufac-turer Code (11 bits)	Manufac-turer Code (11 bits)	ECU In-stance (3 bits) / Function Instance (5 bits)	Function (8 bits)	Reserved (1 bit) / Vehicle System (7 bits)	Vehicle System In-stance (4 bits) / In-dustry Group (3 bits) / Arbitrary Address Capable (1 bit)

1.8.2 Process Data Message PGN 65450 0x00FFAA + DA and SA

Request 0x00EA, DA = 0x80, SA = 0x00:

COB-ID	Read/ Transmit	Size	Data							
			Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
0x18EA8000	Rx	3 Bytes	0xAA	0xFF	0x00	-	-	-	-	-

Process Data Message:

COB-ID	Read/ Transmit	Size	Data							
			Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
0x18FFAA80	Tx	8 Byte	see chapter 1.5.1							

1.8.3 Software Identification PGN 65242 0x00FEDA + DA and SA

Request 0x00EA, DA = 0x80, SA = 0x00:

COB-ID	Read/ Transmit	Size	Data							
			Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
0x18EA8000	Rx	3 Bytes	0xDA	0xFE	0x00	-	-	-	-	-

Software Identification

COB-ID	Read/ Transmit	Size	Data							
			Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
0x18FEDA80	Tx	8 Bytes	Major SW ver-sion	Minor SW ver-sion	Patch SW version		Sensor pro-cess data configura-tion	Product code 0x00		0x00

Sensor process data configuration in byte 3 (see chapter 1.5.1):
0x00: PVU (1x position, 1x speed, 1x counter)
0x01: PPVV (2x position, 2x speed)
0x02: PPU (2x position, 1x counter)

Product code:
0x0C44: RFC-4800 series,
0x0C57: RSA-3200 series
0x0C21: RFE-3200 series

1.8.4 Component Identification PGN 65259 0xFEEB00 + DA and SA

Request 0x00EA, DA = 0x80, SA = 0x00:

COB-ID	Read/ Transmit	Size	Data							
			Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
0x18EA8000	Rx	3 Bytes	0xEB	0xFE	0x00	-	-	-	-	-

Component Identification

COB-ID	Read/ Transmit	Size	Data							
			Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
0x18FEEB80	Tx	8 Bytes	Serial number (xxxxxx batch no. + yyy consec-utive number, same B/N as on product label)				0x00	0x00	0x00	0x00

1.9 Diagnosis

1.9.1 Process Data in Error Case

Position value: 0x7FF0
Velocity value: 0
Revolution counter: last value

1.9.2 Sensor Status

A flag is set if an error or warning has occurred since the last reboot or flag reset.
Caution: please be aware that the error flags are once set, they are not being reset automatically !

- **Single output (see 1.5.1: PVU):** the sensor status is flagged in last 4 bits of Byte 3.

Sensor Data	Byte 3			
	Bit 4	Bit 5	Bit 6	Bit 7
	Internal system error	Position marker missing or out of signal range	Revolution counter	Speed limit overflow
Normal functionality, all values are valid	0	0	0	0
Error	1	1	1	1

- **Redundant output (see 1.5.1: PPVV, PPU):** the sensor status is flagged in 8 bits of Byte 4.

Sensor Data	Byte 4				
	Bit 0	Bit 1	Bit 2	Bit 3	Bit 4 ... 7
	Internal system error	Position marker missing or out of signal range	Revolution counter	Speed limit overflow	Not used
Normal functionality, all values are valid	0	0	0	0	
Error	1	1	1	1	

1.9.3 Manufacturing Mode


If the sensor is out of function (no data frames transmitted) and a single boot-up message with a non-extended data frame and data = 0 came up, the sensor is in manufacturing mode. This mode can be left by power off-on.

1.10 Network Termination

Optionally, models with internal 120 Ω network termination resistor inside the sensor are available.

1.11 Abbreviations

ACL	Address Claiming
CAN	Controller Area Network
Ch	Channel
DA	Destination Address
P	Position
PD	Process Data
PDU	Process Data Unit
PG	Parameter Group
PGN	Parameter Group Number
rw	Read Write
ro	Read only
SLOT	**S**caling, **L**imit, **O**ffset and **T**ransfer Function
SA	Source address
V	Velocity

1.12 Document Changes

Revision	Changes	Date	Who
V00	First edition	23.04.19	VM/mm
V01	1.4.1 Process Data: more detailed presentation of bit format (sequence of bits rotated)	17.06.19	VM/mm
V02	1.1 chapter “support” added , 1.8.3 software version Byte 0-2 instead of Byte 1-2, 1.9.3 Manufacturing Mode added, 1.6 Configuration: information of byte 3 (filter average etc.) transferred to byte 5; byte 3 and 4 are now empty; 1.6 table 2: trigger flag factory reset added	29.04.22	VM/mm

Revision	Changes	Date	Who
V03	Total textual revision, DA (destination address) was SA (sensor address), SA (source address) was MA (master address)	25.02.24	VM/mm
V04	1.3 null adress 254 instead of 255, 1.6.1 default values marked with *	03.04.24	VM/mm
V05	1.12 Document history V1 … V04 completed	12.07.24	VM/mm
V06	1.5.2 Range revolution counter: PVU: -2.147.483.648 … 2.147.483.647 instead of -2.147.483.648 … 2.147.483.648, PPU -8.388.608 … 8.388.607 statt -8.388.608 … 8.388.608	18.07.24	VM/mm
V07	1.3 Missing reference to chapter 1.61 added, 1.8.3 Software identification (documentation change): Patch SW version: byte 2+3 instead of byte 2), sensor process data configuration: byte 4 instead of byte 3, product code: byte 5+6 instead of byte 4+5	19.11.24	VM/mm
V08	1.6.2 Note added regarding the requirement for a stable power supply prior to write operations	18.03.26	VM/mm