Technical Documentation

– 0631 –

Digital Pressure Transmitter

CANJ1939 Protocol

1-6-30-628-059

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1 History

Version	Date	Name	Change
1.00	05.06.2018	RW	document created
1.01	20.06.2018	RW	chapter assignment
1.02	15.07.2018	RW	include chapter 5

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2 General Information

The SAE J1939 protocol is a communication profile based on CAN (Controller Area Network), a bus system developed for data transfer in motor vehicles. The protocol was developed by the Society of Automotive Engineers (SAE®) to provide standardized communication and diagnosis in commercial and special vehicles with several electronic control units (ECU) from different manufacturers. It is used in a wide range of application, from agriculture and construction through commercial and rail vehicles to truck and trailer platforms.

This technical documentation describes the basics for the transmission of pressure values, which are measured with the 0631 SUCO CANJ1939 pressure transmitter. This documentation doesn't represent the final stage of development of the pressure transmitter 0631. That means further changes or implementations are possible.
There is no warranty that all features described in this version of the document will be available for future development stages.

The following numeral systems are used in this documentation:

Index	Decimal	Binary	Hexadecimal
0	0d0	0b0000	0x0
1	0d1	0b0001	0x1
2	0d2	0b0010	0x2
3	0d3	0b0011	0x3
4	0d4	0b0100	0x4
5	0d5	0b0101	0x5
6	0d6	0b0110	0x6
7	0d7	0b0111	0x7
8	0d8	0b1000	0x8
9	0d9	0b1001	0x9
10	0d10	0b1010	0xA
11	0d11	0b1011	0xB
12	0d12	0b1100	0xC
13	0d13	0b1101	0xD
14	0d14	0b1110	0xE
15	0d15	0b1111	0xF
	d is the decimal notation	***b*** is the binary notation	***x*** is the hexadecimal notation

Leading zeros are only written down if they are necessary for the meaning of the value.

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3 J1939 Default Settings & Definitions

3.1 Default Settings

The physical CAN transmission of the SUCO 0631 pressure transmitter is defined according to ISO 11898-2 (high-speed CAN) and can be used up to transmission rates of 1 Mbit/s. The standard bitrate of the 0631 Transmitter is 250 kbit/s, according to the SAE.

The device supports the Extended CAN Identifier (29 bit) specified according to CAN 2.0B.
By default, the source address is set to 0x5A (0d90).
The device uses the dynamic address claim configuration for its network management.

3.1.1 PGN

The PGN is part of the 29-bit long identifier and uniquely assigns the transmitted message to a parameter group (PG). In addition, a PGN consists of the following characteristics: priority, transmission repetition rate, length of data and position of the SPNs. The structure of the PGNs is described in SAE document J1939/71. In addition, proprietary formats (see table 1 and table 2) can be used. These are divided into Prop A and Prop B.

Proprietary A PGNs serve as a peer-to-peer connection and use the PDU1 format.

Proprietary B-PGNs are sent in PDU2 format and used as broadcast messages.

3.1.1.1 Priority

The priority is a 3-bit field in the identifier that determines the arbitration priority of the information to be transmitted, ensuring fast transmission of important messages. The highest priority is zero and the lowest priority is seven.

3.1.1.2 Transmission Repetition Rate

The transmission repetition rate (TRR) defines the interval between the transmissions of two pressure values.

3.1.2 SPN

The SPN (Suspect Parameter Number) is a defined number that describes the structure of a signal by defining the range, resolution, offset and length of the data in bytes (see table 1 and table 2). SPNs with common properties are bundled into parameter groups and transmitted with the same parameter group number.

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4 CAN (J1939) Message Format

4.1 Identifier (PGN)

CAN-Identifier – 29 bit																										
Priority			Parameter Group Number (PGN)																	Source Address (SA)						
			R	DP	PDU Format (PF)								PDU Specific (PS)													
29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1

PDU 1 Format (peer-to-peer)															
Values: 0x00 – 0xEF								Destination Address (DA)							
24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9

PDU 2 Format (global / broadcast)															
Values: 0xF0 – 0xFF								Group Extension (GE)							
24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9

4.2 Payload Format (SPN)

Data Payload – 64 bit							
Not Used						SPN: SUCOb101	
0xFF	0xFF	0xFF	0xFF	0xFF	0xFF	0x02	0xB9
Byte 8	Byte 7	Byte 6	Byte 5	Byte 4	Byte 3	Byte 2	Byte 1

In the 8-byte payload field, the first two bytes are typically used for the pressure value. Unused bits are filled with a binary '1' and thus displayed byte wise as 255 (0xFF). In order to obtain the exact pressure value from the data acquired, the following calculation must be carried out. The values for offset and resolution can be found in table 1 and table 2 for our pressure ranges.

Example pressure calculation:

$$\begin{aligned} Pressure &= Digits \cdot Resolution - Offset \\ &= 697\ (0x02B9) \cdot 0.01 - 0 \\ &= 6.97\ bar \end{aligned}$$

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5 Network Management

The device supports the dynamic network described in SAE document J1939/81. In addition to the address claim command, this includes the resolving of any address conflicts that may occur if several devices with the same address are on the network. This includes support for automatic address alterations during operation.

5.1 Address Claiming

After switching on, the device sends a CAN "Address Claimed"-message according to the following example:

CAN-ID	DLC	Device Name							
0x18EEFF5A	8	0xF1	0xFB	0x89	0x6D	0x31	0x04	0x0E	0xD1

If there are two devices with the same device address in the network or if another device with the same device address is added, the name of the device determines who may use the claimed address and who must search for a new one. The following applies: The lower the number in the name, the higher its priority and thus the rights to claim the address.
The name of a device consists of a 64-bit value and is unique worldwide.

Device Name		
Addressing Ability	Function Specific Parts	Manufacturer Specific Parts

Addressing Ability
AAC
1 bit (1_{dez})

Function Specific Parts						
Industry Group	Vehicle System Instance	Vehicle System	Reserved	Function	Function Instance	ECU Instance
3 bit (5_{dez})	4 bit (1_{dez})	7 bit (7_{dez})	1 bit (0_{dez})	8 bit (4_{dez})	5 bit (6_{dez})	3 bit (1_{dez})

Manufacturer Specific Parts	
Manufacturer Code	Identity Number
11 bit (876_{dez})	21 bit (device-specific)

5.1.2 Device Address

The device address is an 8-bit long value and can be used as source address (SA) to identify the origin of a CAN message, or in PDU-specific format for peer-to-peer messages.

6 SUCO Specific PGNs/SPNs

Pressure – bar	PGN	Priority	TRR	Position	SPN	Range	Resolution	Offset	Length
0 – 1 bar	65280 (0xFF 00)	7	100 ms	1-2 Byte	SUCOb100	1 bar	0.001 bar/bit	0 bar	2 byte
0 – 2.5 bar	65281 (0xFF 01)	7	100 ms	1-2 Byte	SUCOb250	2.5 bar	0.0025 bar/bit	0 bar	2 byte
0 – 4 bar	65282 (0xFF 02)	7	100 ms	1-2 Byte	SUCOb400	4 bar	0.004 bar/bit	0 bar	2 byte
0 – 6 bar	65283 (0xFF 03)	7	100 ms	1-2 Byte	SUCOb600	6 bar	0.006 bar/bit	0 bar	2 byte
0 – 10 bar	65284 (0xFF 04)	7	100 ms	1-2 Byte	SUCOb101	10 bar	0.01 bar/bit	0 bar	2 byte
0 – 16 bar	65285 (0xFF 05)	7	100 ms	1-2 Byte	SUCOb161	16 bar	0.016 bar/bit	0 bar	2 byte
0 – 25 bar	65286 (0xFF 06)	7	100 ms	1-2 Byte	SUCOb251	25 bar	0.025 bar/bit	0 bar	2 byte
0 – 40 bar	65287 (0xFF 07)	7	100 ms	1-2 Byte	SUCOb401	40 bar	0.04 bar/bit	0 bar	2 byte
0 – 60 bar	65288 (0xFF 08)	7	100 ms	1-2 Byte	SUCOb601	60 bar	0.06 bar/bit	0 bar	2 byte
0 – 100 bar	65289 (0xFF 09)	7	100 ms	1-2 Byte	SUCOb102	100 bar	0.1 bar/bit	0 bar	2 byte
0 – 160 bar	65290 (0xFF 0A)	7	100 ms	1-2 Byte	SUCOb162	160 bar	0.16 bar/bit	0 bar	2 byte
0 – 250 bar	65291 (0xFF 0B)	7	100 ms	1-2 Byte	SUCOb252	250 bar	0.25 bar/bit	0 bar	2 byte
0 – 400 bar	65292 (0xFF 0C)	7	100 ms	1-2 Byte	SUCOb402	400 bar	0.4 bar/bit	0 bar	2 byte
0 – 600 bar	65293 (0xFF 0D)	7	100 ms	1-2 Byte	SUCOb602	600 bar	0.6 bar/bit	0 bar	2 byte

Table 1

Pressure – PSI	PGN	Priority	TRR	Position	SPN	Range	Resolution	Offset	Length
0 – 150 PSI	65380 (0xFF 64)	7	100 ms	1-2 Byte	SUCOp152	150 PSI	0.15 PSI/bit	0 bar	2 byte
0 – 200 PSI	65381 (0xFF 65)	7	100 ms	1-2 Byte	SUCOp202	200 PSI	0.2 PSI/bit	0 bar	2 byte
0 – 300 PSI	65382 (0xFF 66)	7	100 ms	1-2 Byte	SUCOp302	300 PSI	0.3 PSI/bit	0 bar	2 byte
0 – 600 PSI	65383 (0xFF 67)	7	100 ms	1-2 Byte	SUCOp602	600 PSI	0.6 PSI/bit	0 bar	2 byte
0 – 1000 PSI	65384 (0xFF 68)	7	100 ms	1-2 Byte	SUCOp103	1000 PSI	1.0 PSI/bit	0 bar	2 byte
0 – 1500 PSI	65385 (0xFF 69)	7	100 ms	1-2 Byte	SUCOp153	1500 PSI	1.5 PSI/bit	0 bar	2 byte
0 – 2500 PSI	65386 (0xFF 6A)	7	100 ms	1-2 Byte	SUCOp253	2500 PSI	2.5 PSI/bit	0 bar	2 byte
0 – 3000 PSI	65387 (0xFF 6B)	7	100 ms	1-2 Byte	SUCOp303	3000 PSI	3.0 PSI/bit	0 bar	2 byte
0 – 6000 PSI	65388 (0xFF 6C)	7	100 ms	1-2 Byte	SUCOp603	6000 PSI	6.0 PSI/bit	0 bar	2 byte
0 – 8700 PSI	65389 (0xFF 6D)	7	100 ms	1-2 Byte	SUCOp873	8700 PSI	8.7 PSI/bit	0 bar	2 byte

Table 2

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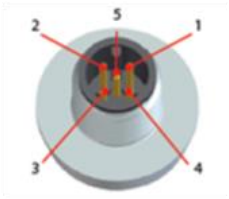
7 Electrical Characteristics and Specifications

7.1 Operation Conditions

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{CC}	Supply Voltage		9[1)]	32	35	V
I_{CC}	Supply Current	V_{CC} = 9 V[1)]	12		14	mA
		V_{CC} = 32 V	3		5	mA
T_{op}	Operating temperature		-40		125	°C
		If Switchable Termination is included	-40		105	°C
T_{amb}	Ambient temperature		-40		105	°C
T_{comp}	Compensated temperature range		-20		85	°C
$V_{CAN\_H/L}$	Voltage on CANH / CANL	Related to GND	-32		32	V

The device is protected against miswiring at voltages up to 32 volts

7.2 Electrical Connector and Pin Assignment

M12 DIN EN 61076 – 2 – 101 A CiA–DR303–1

1: NC
2: U_{V+}
3: GND
4: CAN–High
5: CAN–Low
x ~ 60 mm
d ~ Ø 22 mm

1) Absolute Minimum - When designing the application network, consider the wiring resistances

8 List of abbreviations

CAN: Controller Area Network
DA: Destination Address
ECU: Electronic Control Unit
PDU: Protocol Data Unit
PGN: Parameter Group Number
SA: Source Address
SAE®: Society of Automotive Engineers
SPN: Suspect Parameter Number
AAC: Arbitrary Address Capable
TRR: Transmission Repetition Rate
DP: Data Page
PDU: Protocol Data Unit
PF: PDU Format
PS: PDU Specific

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