Special documentation

Special documentation for SAE J1939, model MH-4-CAN

EN

Pressure sensor, model MH-4-CAN

WIKA
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Contents

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1. Model MH-4-CAN

1. Model MH-4-CAN J1939

1.1 General Information

The MH-4-CAN is a pressure sensor providing measurements through a SAE J1939 interface.

1.2 Features

Sample rate (pressure): 640µs
Settling time: 2ms

1.3 J1939 feature Summary

J1939 feature summary	
Physical Layer	According to ISO 11898-2
CAN Data Frame	Extended frame format, 29-Bit-Identifier (CAN 2.0B)
Bitrate	250 kBit/s, 500 kBit/s
Independent PGN Channels	2 (Pressure, Temperature)
Default Settings	
Source Address	128
Bitrate	250 kBit/s

1.4 Supported Bitrates

- 500 kBit/s
- 250 kBit/s

1.5 Extended frame - 29-bit CAN-identifier (CAN 2.0B)

J1939 is based on a 29-bit CAN-identifier and is structured as following:

Priority	Extended Data Page	Data Page	PDU Format	PDU Specific	Source Address
			< 240: PDU1	Destination Address	
			≥ 240: PDU2	Group Extension	
	Parameter Group Number - PGN				
3 bit	1 bit	1 bit	8 bit	8 bit	8 bit

Structure of the 29 bit identifier

Priority (P)

The priority field of the identifier are used for prioritization of the CAN messages during the arbitration process. The priority of any message can be set from highest 0 to lowest 7.

Extended Data Page (EDP) / Data Page (DP)

The DP and EDP are also part of the PGN and selects the page of a PDU Format.

1. Model MH-4-CAN

PDU Format (PF) / PDU Specific (PS)
If the value of PF is smaller than 240, the content of PS is interpreted as the destination address and is called PDU1 Format. In case of values higher or equal than 240, the content of PS is interpreted as the group extension. Since there is no destination address the message will be send always to all network nodes.

Source Address (SA)
The unique source address represents the address of a controller application (CA), it is 8-bit wide and is included in every J1939 message.

2. Quick start guide

2.1 Introduction

This chapter describes setting up the sensor by using a simple CAN-Software without specialized J1939 support. The sensor may be configured entirely using raw CAN messages. We recommend to use a software with build-in J1939 support.

Note: The default device-source address in almost all examples of this document is 128 / 80h, the master address is 248 / F8h.

2.2 Start procedure

- Connect the CAN interface to your PC (e.g. PEAK PCAN-USB, Ixxat USB-to-CAN) and to the MH-4-CAN. Afterwards start the CAN-Software (e.g. PEAK PCAN-View, Ixxat canAnalyser3 Mini).
- Ensure to use the correct bitrate and source address of the pressure transmitter and power on the sensor.
- After bootup of the MH-4-CAN will send an Address-Claimed-Message (see chapter 3.1)

ID	DLC	Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
18EEFF80h	8	10h	66h	80h	38h	19h	80h	08h	80h
		Data							

Address claim message with SA = 128

- After obtaining a valid address, the MH-4-CAN starts sending measured values to the bus.
- The configuration of the MH-4-CAN can be done via the proprietary parametergroup A (PGN 61184) or with the CANopen bridge functionality (see chapter 5).

3. Network Management

3.1 NAME and Address Requirements

Every CA that sends messages on a SAE J1939 network must be capable of providing its 64-bit NAME and successfully acquire an address before the CA (Controller Application) may transmit data to the bus.

After bootup the MH4-CAN will send an CAN message, the address claimed message, a global message which can be received by other participants on the bus and it contains the NAME and the desired address. If the desired address is already taken, the address is negotiated via the so-called address claiming procedure.

3.2 NAME

The NAME must be unique to each J1939 device worldwide and is an 8 byte numerical value composed of 10 fields:

AAC	Industry	Vehicle	Vehicle System	Res.	Function	Function Instance	ECU Instance	Manufacturer Code	Identity Number
1 bit	3 bit	4 bit	7 bit	1 bit	8 bit	5 bit	3 bit	11 bit	21 bit
Byte 7			Byte 6		Byte 5	Byte 4		Byte 3.0	

Definition of the NAME

Arbitrary Address Capable (AAC)

This 1-bit filed indicates whether a CA (Controller Application) is able to use an arbitrary source address to resolve an address claim conflict. If this bit is set to “1”, the CA is capable of resolving an address conflict.

Manufacturer code

The manufacturer code assigned by SAE for WIKA is 452.

Identity Number

The Identity Number is a 21-bit field in the name assigned by the ECU manufacturer. The Identity Number is necessary in circumstances where it is possible that the NAME would not be unique among multiple instances of the ECU (i.e. could be identical). This field shall be unique and non-varying with removal of power.

Example:

ID	DLC	Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
18EEFF80h	8	10h	66h	80h	38h	19h	80h	08h	80h
		Data							

NAME example

3. Network Management

Identity Number	26128 (unique)
Manufacturer Code	452 (WIKA Alexander Wiegand SE & Co. KG)
ECU Instance	1
Function Instance	3
Function	128
Vehicle System	4
Vehicle System Instance	0
Industry Group	0
Arbitrary address capable	1 (CA is capable of selecting alternate source address)

3.2.1 Address

J1939 devices have 8-bit addresses identifying a particular CA (Controller Application) in a network. The address can be set in a range of 0 and 253. The network address 254, also known as the NULL address, is used in J1939 network management to indicate the CA has not yet successfully claimed an address. The network address 255 (0xFF), also known as the Global Address, is used as the broadcast address.

The source address of the MH-4-CAN can be configured via the Commanded Address (see chapter 3.3.1) or via proprietary parametergroup A (see chapter 5.2).

3.2.2 Commanded Address – CA

The volatile configuration of the source address of the sensor can be done by sending the Commanded Address Message (PGN 65240).

Because the message contains 9 bytes of data, the Broadcast Announce Message (BAM) of the Transport Protocol must be used. The first 8 bytes of the message contains the NAME of the sensor to be changed. The last byte contains the preferred new source address.

In case of successful address claiming procedure, the device will send an ACM with the new source address.

ID (hex.)	Symbol	Rx/Tx	Type	Prio	PGN	SA	DA	Length	Data (hex.)
18ECFFF8	TPCM.BAM	Tx	Data	6	60416	248	255	8	20 09 00 02 FF D8 FE 00
18EBFFF8	TPDT	Tx	Data	6	60160	248	255	8	01 10 66 80 38 19 80 08
18EBFFF8	TPDT	Tx	Data	6	60160	248	255	8	02 80 81 FF FF FF FF FF
18EEFF81	ACM	Rx	Data	6	60928	129	255	8	10 66 80 38 19 80 08 80

Example of setting the source address to 129 with the use of BAM of Transport Protocol

4. Supported PGNs

Usually the MH-4-CAN sends its process data to a defined PGN in a specific cycle (TRR) after start-up. The following PGNs can be selected in the ordering process of the MH-4-CAN.

A later change of the configured PGN, transmission rate etc. can be done with the CANopen Bridge functionality (see chapter 5.3).

4.1 PGNs defined by SAE Standard

PGN	PGN Label	SPN	SP Label	TRR [ms]	Prio	Byte Offset in PGN	Slot
1792	General Purpose Valve Pressure	4087	Valve Pilot Pressure	100	6	2	SAEpr14
64817	Fan Drive #2	1707	Hydraulic Fan 2 Motor Pressure	1000	6	4	SAEpr06
64836	Aftertreatment 2 Fuel Control 2	4303	Aftertreatment 2 Fuel Pressure 2	500	6	0	SAEpr03
64869	Aftertreatment 1 Fuel Control 2	4077	Aftertreatment 1 Fuel Pressure 2	500	6	0	SAEpr03
64876	Aftertreatment 2 Air Control 2	3838	Aftertreatment 2 Secondary Air Pressure	500	6	6	SAEpr03
64877	Aftertreatment 1 Air Control 2	3837	Aftertreatment 1 Secondary Air Pressure	500	6	6	SAEpr03
64900	Engine Fluid Level/Pressure 9	3640	Engine Intake Valve Actuation Oil Pressure for Cylinder #17	500	6	0	SAEpr03
	Engine Fluid Level/Pressure 9	3641	Engine Intake Valve Actuation Oil Pressure for Cylinder #18	500	6	2	SAEpr03
	Engine Fluid Level/Pressure 9	3642	Engine Intake Valve Actuation Oil Pressure for Cylinder #19	500	6	4	SAEpr03
	Engine Fluid Level/Pressure 9	3643	Engine Intake Valve Actuation Oil Pressure for Cylinder #20	500	6	6	SAEpr03
64901	Engine Fluid Level/Pressure 8	3636	Engine Intake Valve Actuation Oil Pressure for Cylinder #13	500	6	0	SAEpr03
	Engine Fluid Level/Pressure 8	3637	Engine Intake Valve Actuation Oil Pressure for Cylinder #14	500	6	2	SAEpr03
	Engine Fluid Level/Pressure 8	3638	Engine Intake Valve Actuation Oil Pressure for Cylinder #15	500	6	4	SAEpr03
	Engine Fluid Level/Pressure 8	3639	Engine Intake Valve Actuation Oil Pressure for Cylinder #16	500	6	6	SAEpr03
64902	Engine Fluid Level/Pressure 7	3632	Engine Intake Valve Actuation Oil Pressure for Cylinder #9	500	6	0	SAEpr03
	Engine Fluid Level/Pressure 7	3633	Engine Intake Valve Actuation Oil Pressure for Cylinder #10	500	6	2	SAEpr03
	Engine Fluid Level/Pressure 7	3634	Engine Intake Valve Actuation Oil Pressure for Cylinder #11	500	6	4	SAEpr03
	Engine Fluid Level/Pressure 7	3635	Engine Intake Valve Actuation Oil Pressure for Cylinder #12	500	6	6	SAEpr03
64903	Engine Fluid Level/Pressure 6	3628	Engine Intake Valve Actuation Oil Pressure for Cylinder #5	500	6	0	SAEpr03
	Engine Fluid Level/Pressure 6	3629	Engine Intake Valve Actuation Oil Pressure for Cylinder #6	500	6	2	SAEpr03
	Engine Fluid Level/Pressure 6	3630	Engine Intake Valve Actuation Oil Pressure for Cylinder #7	500	6	4	SAEpr03
	Engine Fluid Level/Pressure 6	3631	Engine Intake Valve Actuation Oil Pressure for Cylinder #8	500	6	6	SAEpr03

4. Supported PGNs

64904	Engine Fluid Level/Pressure 5	3624	Engine Intake Valve Actuation Oil Pressure for Cylinder #1	500	6	0	SAEpr03
	Engine Fluid Level/Pressure 5	3625	Engine Intake Valve Actuation Oil Pressure for Cylinder #2	500	6	2	SAEpr03
	Engine Fluid Level/Pressure 5	3626	Engine Intake Valve Actuation Oil Pressure for Cylinder #3	500	6	4	SAEpr03
	Engine Fluid Level/Pressure 5	3627	Engine Intake Valve Actuation Oil Pressure for Cylinder #4	500	6	6	SAEpr03
64907	Aftertreatment 2 Gas Parameters	3611	Aftertreatment 2 Diesel Particulate Filter Intake Pressure	500	6	0	SAEpr03
	Aftertreatment 2 Gas Parameters	3612	Aftertreatment 2 Diesel Particulate Filter Outlet Pressure	500	6	2	SAEpr03
64908	Aftertreatment 1 Gas Parameters	3609	Aftertreatment 1 Diesel Particulate Filter Intake Pressure	500	6	0	SAEpr03
	Aftertreatment 1 Gas Parameters	3610	Aftertreatment 1 Diesel Particulate Filter Outlet Pressure	500	6	2	SAEpr03
64926	Aftertreatment 2 Air Control 1	3499	Aftertreatment 2 Supply Air Pressure	500	6	0	SAEpr03
	Aftertreatment 2 Air Control 1	3500	Aftertreatment 2 Purge Air Pressure	500	6	2	SAEpr03
64927	Aftertreatment 1 Air Control 1	3485	Aftertreatment 1 Supply Air Pressure	500	6	0	SAEpr03
	Aftertreatment 1 Air Control 1	3486	Aftertreatment 1 Purge Air Pressure	500	6	2	SAEpr03
64928	Aftertreatment 2 Fuel Control 1	3494	Aftertreatment 2 Fuel Pressure 1	500	6	0	SAEpr03
64929	Aftertreatment 1 Fuel Control 1	3480	Aftertreatment 1 Fuel Pressure 1	500	6	0	SAEpr03
64993	Cab Climate System Information 1	2609	Cab A/C Refrigerant Compressor Outlet Pressure	1000	6	0	SAEpr14
64998	Hydraulic Braking System	2580	Hydraulic Brake Pressure Circuit 1	100	3	0	SAEpr15
	Hydraulic Braking System	2581	Hydraulic Brake Pressure Circuit 2	100	3	1	SAEpr15
65112	Air Suspension Control 4	1725	Bellow Pressure Front Axle Left	100	6	0	SAEpr03
	Air Suspension Control 4	1726	Bellow Pressure Front Axle Right	100	6	2	SAEpr03
	Air Suspension Control 4	1727	Bellow Pressure Rear Axle Left	100	6	4	SAEpr03
	Air Suspension Control 4	1728	Bellow Pressure Rear Axle Right	100	6	6	SAEpr03
65130	Engine Fuel/Lube Systems	3549	Engine Oil Filter Outlet Pressure	500	6	4	SAEpr10
65143	Auxiliary Pressures	136	Auxiliary Vacuum Pressure Reading	On request	7	0	SAEpr06
	Auxiliary Pressures	137	Auxiliary Gage Pressure Reading 1	On request	7	2	SAEpr06
65145	Tire Pressure Control Unit Target Pressures	141	Trailer, Tag Or Push Channel Tire Pressure Target	On request	7	0	SAEpr06
	Tire Pressure Control Unit Target Pressures	142	Drive Channel Tire Pressure Target	On request	7	2	SAEpr06
	Tire Pressure Control Unit Target Pressures	143	Steer Channel Tire Pressure Target	On request	7	4	SAEpr06
65146	Tire Pressure Control Unit Current Pressures	144	Trailer, Tag Or Push Channel Tire Pressure	On request	7	0	SAEpr06
	Tire Pressure Control Unit Current Pressures	145	Drive Channel Tire Pressure	On request	7	2	SAEpr06
	Tire Pressure Control Unit Current Pressures	146	Steer Channel Tire Pressure	On request	7	4	SAEpr06
65164	Auxiliary Analog Information	1387	Auxiliary Pressure #1	On request	7	2	SAEpr14
	Auxiliary Analog Information	1388	Auxiliary Pressure #2	On request	7	3	SAEpr14
65167	Supply Pressure 2	1320	Engine External Shutdown Air Supply Pressure	1000	6	0	SAEpr06

4. Supported PGNs

65170	Engine Information 1	1208	Engine Oil Filter Intake Pressure	100	7	0	SAEpr10
65172	Engine Auxiliary Coolant	1203	Engine Auxiliary Coolant Pressure	500	6	0	SAEpr10
65174	Turbocharger Wastegate	1192	Engine Turbocharger Wastegate Actuator Control Air Pressure	100	6	4	SAEpr10
65179	Turbocharger Information 1	1168	Engine Turbocharger Lube Oil Pressure 2	1000	7	0	SAEpr10
65190	Intake Manifold Information 1	1127	Engine Turbocharger 1 Boost Pressure	500	6	0	SAEpr04
	Intake Manifold Information 1	1128	Engine Turbocharger 2 Boost Pressure	500	6	2	SAEpr04
	Intake Manifold Information 1	1129	Engine Turbocharger 3 Boost Pressure	500	6	4	SAEpr04
	Intake Manifold Information 1	1130	Engine Turbocharger 4 Boost Pressure	500	6	6	SAEpr04
65197	Wheel Application Pressure High Range Information	1091	Brake Application Pressure High Range, Front Axle, Left Wheel	100	6	0	SAEpr11
	Wheel Application Pressure High Range Information	1092	Brake Application Pressure High Range, Front Axle, Right Wheel	100	6	1	SAEpr11
	Wheel Application Pressure High Range Information	1093	Brake Application Pressure High Range, Rear Axle #1, Left Wheel	100	6	2	SAEpr11
	Wheel Application Pressure High Range Information	1094	Brake Application Pressure High Range, Rear Axle #1, Right Wheel	100	6	3	SAEpr11
	Wheel Application Pressure High Range Information	1095	Brake Application Pressure High Range, Rear Axle #2, Left Wheel	100	6	4	SAEpr11
	Wheel Application Pressure High Range Information	1096	Brake Application Pressure High Range, Rear Axle #2, Right Wheel	100	6	5	SAEpr11
	Wheel Application Pressure High Range Information	1097	Brake Application Pressure High Range, Rear Axle #3, Left Wheel	100	6	6	SAEpr11
	Wheel Application Pressure High Range Information	1098	Brake Application Pressure High Range, Rear Axle #3, Right Wheel	100	6	7	SAEpr11
65198	Air Supply Pressure	46	Pneumatic Supply Pressure	1000	6	0	SAEpr13
	Air Supply Pressure	1086	Parking and/or Trailer Air Pressure	1000	6	1	SAEpr13
	Air Supply Pressure	1087	Service Brake Circuit 1 Air Pressure	1000	6	2	SAEpr13
	Air Supply Pressure	1088	Service Brake Circuit 2 Air Pressure	1000	6	3	SAEpr13
	Air Supply Pressure	1089	Auxiliary Equipment Supply Pressure	1000	6	4	SAEpr13
65198	Air Supply Pressure	1090	Air Suspension Supply Pressure 1	1000	6	5	SAEpr13
65213	Fan Drive #1	4211	Hydraulic Fan Motor Pressure	1000	6	4	SAEpr06
65245	Turbocharger	104	Engine Turbocharger Lube Oil Pressure 1	1000	6	0	SAEpr10
65246	Engine Air Start Pressure	82	Engine Air Start Pressure	On request	6	0	SAEpr10
65263	Engine Fluid Level/Pressure 1	94	Engine Fuel Delivery Pressure	500	6	0	SAEpr10
	Engine Fluid Level/Pressure 1	100	Engine Oil Pressure 1	500	6	3	SAEpr10
65268	Tire Condition Message 1	241	Tire Pressure	10000	6	1	SAEpr10
65272	Transmission Fluids 1	123	Transmission Clutch 1 Pressure	1000	6	0	SAEpr14
	Transmission Fluids 1	127	Transmission 1 Oil Pressure	1000	6	3	SAEpr14
65273	Axle Information	579	Drive Axle Lift Air Pressure	1000	6	2	SAEpr10
	Axle Information	2613	Drive Axle Lube Pressure	1000	6	4	SAEpr10
	Axle Information	2614	Steering Axle Lube Pressure	1000	6	7	SAEpr10
65274	Brakes 1	116	Brake Application Pressure	1000	6	0	SAEpr10
	Brakes 1	117	Brake Primary Pressure	1000	6	1	SAEpr10
	Brakes 1	118	Brake Secondary Pressure	1000	6	2	SAEpr10

65275	Retarder fluids	119	Hydraulic Retarder Pressure	1000	6	0	SAEpr14
65277	Alternate Fuel 1	159	Engine Gaseous Fuel Supply Pressure 1	500	6	2	SAEpr06
65278	Auxiliary Water Pump Pressure	73	Auxiliary Pump Pressure	1000	6	4	SAEpr14

SAE specific PGNs

4.2 Manufacturer Specific PGNs

PGN	PGN Label	SPN	SP Label	TRR [ms]	Prio	Byte Offset in PGN	Slot
65280	WIKA specific - 60 bar / 6 MPa	516096	General purpose 60 bar / 6 MPa	100	6	0	WIKApr01
65281	WIKA specific - 100 bar / 10 MPa	516097	General purpose 100 bar / 10 MPa	100	6	0	WIKApr02
65282	WIKA specific - 160 bar / 16 MPa	516098	General purpose 160 bar / 16 MPa	100	6	0	WIKApr03
65283	WIKA specific - 250 bar / 25 MPa	516099	General purpose 250 bar / 25 MPa	100	6	0	WIKApr04
65284	WIKA specific - 400 bar / 40 MPa	516100	General purpose 400 bar / 40 MPa	100	6	0	WIKApr05
65285	WIKA specific - 600 bar / 60 MPa	516101	General purpose 600 bar / 60 MPa	100	6	0	WIKApr06
65286	WIKA specific - 1000 bar / 100 MPa	516102	General purpose 1000 bar / 100 MPa	100	6	0	WIKApr07
65287	WIKA specific - 1000 psi	516103	General purpose 1000 psi	100	6	0	WIKApr08
65288	WIKA specific - 1500 psi	516104	General purpose 1500 psi	100	6	0	WIKApr09
65289	WIKA specific - 2000 psi	516105	General purpose 2000 psi	100	6	0	WIKApr10
65290	WIKA specific - 3000 psi	516106	General purpose 3000 psi	100	6	0	WIKApr11
65291	WIKA specific - 5000 psi	516107	General purpose 5000 psi	100	6	0	WIKApr12
65292	WIKA specific - 10000 psi	516108	General purpose 10000 psi	100	6	0	WIKApr13
65293	WIKA specific - 40 bar / 4 MPa	516109	General purpose 40 bar / 4 MPa	100	6	0	WIKApr14
65294	WIKA specific - 800 bar / 80 MPa	516110	General purpose 800 bar / 80 MPa	100	6	0	WIKApr15
65295	WIKA specific - 500 psi	516111	General purpose 500 psi	100	6	0	WIKApr16
65296	WIKA specific - 8000 psi	516112	General purpose 8000 psi	100	6	0	WIKApr17
65408	WIKA specific - Temperature °C	516113	General purpose -40 to 125 °C	On request	6	0	WIKApr18
65409	WIKA specific - Temperature °F	516114	General purpose -40 to 257 °F	On request	6	0	WIKApr19

Manufacturer specific PGNs

4. Supported PGNs

4.3 Slot Specifications

4.3.1 SAE specific slots

Name	Scaling [kPa / bit]	Data Range	Data Range [digits]	Data Length
SAEpr03	0.1	0..6425.5 kPa	0..64255	2
SAEpr04	0.125	0..8031.875 kPa	0..64255	2
SAEpr06	0.5	0..32127.5 kPa	0..64255	2
SAEpr10	4	0..1000 kPa	0..250	1
SAEpr11	5	0..1250 kPa	0..250	1
SAEpr13	8	0..2000 kPa	0..250	1
SAEpr14	16	0..4000 kPa	0..250	1
SAEpr15	100	0..25000 kPa	0..250	1

SAE specific Slots

4.3.2 WIKA specific slots

Name	Scaling	Data Range	Data Range [digits]	Data Length
WIKApr01	0.006 bar/bit	0..60 bar	0..10000	2
WIKApr02	0.01 bar/bit	0..100 bar	0..10000	2
WIKApr03	0.016 bar/bit	0..160 bar	0..10000	2
WIKApr04	0.025 bar/bit	0..250 bar	0..10000	2
WIKApr05	0.04 bar/bit	0..400 bar	0..10000	2
WIKApr06	0.06 bar/bit	0..600 bar	0..10000	2
WIKApr07	0.1 bar/bit	0..1000 bar	0..10000	2
WIKApr08	0.1 psi/bit	0..1000 psi	0..10000	2
WIKApr09	0.15 psi/bit	0..1500 psi	0..10000	2
WIKApr10	0.2 psi/bit	0..2000 psi	0..10000	2
WIKApr11	0.3 psi/bit	0..3000 psi	0..10000	2
WIKApr12	0.5 psi/bit	0..5000 psi	0..10000	2
WIKApr13	1 psi/bit	0..10000 psi	0..10000	2
WIKApr14	0.004 bar/bit	0..40 bar	0..10000	2
WIKApr15	0.08 bar/bit	0..800 bar	0..10000	2
WIKApr16	0.05 psi/bit	0..500 psi	0..10000	2
WIKApr17	0.8 psi/bit	0..8000 psi	0..10000	2
WIKApr18	0.5 °C/bit	-40..125 °C	0..330	2
WIKApr19	1 °F/bit	-40..257 °F	0..297	2

WIKA specific Slots

5. Configuration

5.1 Introduction

The MH-4-CAN offers the possibility to write or read different settings via SAE J1939 messages. This can be done via the proprietary parametergroup A (PGN 61184) or for advanced features with the CANopen bridge (PGN 1280 / 1536) functionality.

Note: To prevent unintentional changes, the respective configuration service must be unlocked with a PropA command before (see chapter 5.2.1).

5.2 Proprietary A Commands – PropA

The following message structure is necessary to execute a proprietary A command:

ID	DLC	Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
18EF80F8h	8	Cmd	LSB						MSB
			Data						

PropA command on PGN 61184 (Prio = 6; SA = F8h; DA = 80h)

After sending a PropA command to the MH-4-CAN, the sensor responds with an PDU acknowledge message on PGN 59392:

ID	DLC	Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
18E8FF80h	8	ACK	Cmd	FFh	FFh	ADR	LSB		MSB
							PGN-Number		

PDU Acknowledge message on PGN 59392 (Prio = 6; SA = 80h; DA = FFh)

Possible values for the acknowledge field ACK:

0 Positive Acknowledge (standard)
1 Negative Acknowledge / NACK
2 Access Denied
3 Cannot Respond

The field Cmd of the acknowledge contains the previously sent PropA command number and the field ADR contains the acknowledged address.

The following commands are available with the proprietary parametergroup A (PGN 61184):

Command / Cmd	Description
100	Unlocking of the PropA commands / CANopen bridge
101	Firmware-Reset of the sensor
102	Setting the bitrate to non-volatile memory
103	Setting the source address to non-volatile memory

Available PropA commands

5.2.1 Cmd 100 – Unlocking

Unlocking PropA Commands

To enable the PropA commands an unlocking sequence-string (“conf” / 0x636F6E66) must be sent to the command number 100:

ID (hex.)	Symbol	Rx/Tx	Type	Prio	PGN	SA	DA	Length	Data (hex.)
18EF80F8	PropA	Tx	Data	6	61184	248	128	8	64 66 6E 6F 63 00 00 00
18E8FF80	ACKM.ACK	Rx	Data	6	59392	128	255	8	00 64 FF FF F8 00 EF 00

PropA Command unlocking commands with “conf”

Unlocking CANopen bridge

To enable the CANopen bridge functionality an unlocking sequence-string (“cano” / 0x63616E6F) must be sent to the command number 100:

ID (hex.)	Symbol	Rx/Tx	Type	Prio	PGN	SA	DA	Length	Data (hex.)
18EF80F8	PropA	Tx	Data	6	61184	248	128	8	64 6F 6E 61 63 00 00 00
18E8FF80	ACKM.ACK	Rx	Data	6	59392	128	255	8	00 64 FF FF F8 00 EF 00

PropA Command unlocking CANopen bridge functionality with “cano”

5.2.2 Cmd 101 – Firmware-Reset of the sensor

With this command a restart of the sensor can be executed.

ID (hex.)	Symbol	Rx/Tx	Type	Prio	PGN	SA	DA	Length	Data (hex.)
18EF80F8	PropA	Tx	Data	6	61184	248	128	8	65 00 00 00 00 00 00 00
18E8FF80	ACKM.ACK	Rx	Data	6	59392	128	255	8	00 65 FF FF F8 00 EF 00

PropA Command Firmware-Reset

5.2.3 Cmd 102 – Set Bitrate

This command can be used to configure the bitrate. The configuration of the bitrate is non-volatile. Possible values for the bitrate are:

- 0: 250 kBit/s
- 1: 500 kBaud

To set the bitrate, the following command needs to be executed:

ID (hex.)	Symbol	Rx/Tx	Type	Prio	PGN	SA	DA	Length	Data (hex.)
18EF80F8	PropA	Tx	Data	6	61184	248	128	8	66 00 00 00 00 00 00 00
18E8FF80	ACKM.ACK	Rx	Data	6	59392	128	255	8	00 66 FF FF F8 00 EF 00

Example of Setting the bitrate to 250 kbit/s

ID (hex.)	Symbol	Rx/Tx	Type	Prio	PGN	SA	DA	Length	Data (hex.)
18EF80F8	PropA	Tx	Data	6	61184	248	128	8	66 01 00 00 00 00 00 00
18E8FF80	ACKM.ACK	Rx	Data	6	59392	128	255	8	00 66 FF FF F8 00 EF 00

Example of Setting the bitrate to 500 kbit/s

Please do note, the changes to the bitrate take effect on the next restart of the sensor.

5.2.4 Cmd 103 – Set Source Address

This command can be used to configure the preferred source address. The configuration of the source address is non-volatile. The address can be set in a range of 0 and 253.

ID (hex.)	Symbol	Rx/Tx	Type	Prio	PGN	SA	DA	Length	Data (hex.)
18EF80F8	PropA	Tx	Data	6	61184	248	128	8	67 80 00 00 00 00 00 00
18E8FF80	ACKM.ACK	Rx	Data	6	59392	128	255	8	00 67 FF FF F8 00 EF 00

Example of Setting the source address to 128 (80h)

ID (hex.)	Symbol	Rx/Tx	Type	Prio	PGN	SA	DA	Length	Data (hex.)
18EF80F8	PropA	Tx	Data	6	61184	248	128	8	67 F9 00 00 00 00 00 00
18E8FF80	ACKM.ACK	Rx	Data	6	59392	128	255	8	00 67 FF FF F8 00 EF 00

Example of Setting the source address to 249 (F9h)

Please do note, the changes to the source address take effect on the next restart of the sensor.

5.3 CANopen Bridge functionality - CAM11 / CAM21

5.3.1 Overview

The MH-4 CAN J1939 implements furthermore a CANopen dictionary to provide extended configuration of the sensor.

These configuration parameters can be written by means of SDO services. The CAM11 (PGN 1280) parameter group contains in its 8-byte payload the SDO client/server protocol and the CAM21 (PGN 1536) parameter group maps the SDO response (server-to-client).

Note:
To prevent unintentional changes, the CANopen bridge functionality must be unlocked with a PropA command before (see chapter 5.2.1). Changes in the CANopen bridge will only take effect after saving the changes into the non-volatile memory via object 1010h – Store parameters (see chapter 5.3.4) and a subsequent restart.

Service data object (SDO)

Service Data Objects are used to access the entries of the transmitters object dictionary. Therefore the dictionary entries are accessed by index and subindex.

The master sends a specific request message followed by an reply from the sensor.

SDO read object

The SDO read object to read an dictionary entry:

ID	DLC	Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
1C0580F8h	8	CS = 40h	LSB	MSB	Sub-index	00h	00h	00h	00h
			Index						

Master transmits (Prio = 7; SA = F8h; DA = 80h)

ID	DLC	Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
1C06F880h	8	CS	LSB	MSB	Sub-index	LSB			MSB
			Index			Data			

MH-4-CAN responds (Prio = 7; SA = 80h; DA = F8h)

CS - Command Specifier		Valid Byte Nr in the message
40h	Read request	Identity Number
43h	Read response 4 Bytes	Manufacturer Code
4Bh	Read response 2 Bytes	ECU Instance
4Fh	Read response 1 Bytes	Function Instance

SDO write object

The SDO write object to write data to an dictionary entry:

ID	DLC	Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
1C0580F8h	8	CS	LSB	MSB	Sub-index	LSB			MSB
			Index			Data			

Master transmits (Prio = 7; SA = F8h; DA = 80h)

ID	DLC	Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
1C06F880h	8	CS =	LSB	MSB	Sub-index	00h	00h	00h	00h
			Index						

MH-4-CAN responds (Prio = 7; SA = 80h; DA = F8h)

CS - Command Specifier		Valid Byte Nr in the message
60h	Read request	
23h	Read response 4 Bytes	Byte4 … Byte7
2Bh	Read response 2 Bytes	Byte4 … Byte5
2Fh	Read response 1 Bytes	Byte4

Other values for CS than 60h are abort codes, indicating a failed SDO write.

Abort SDO Transfer

If an error occurred while reading or writing an object, the transmitter answers:

ID	DLC	Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
1C06F880h	8	CS = 80h	LSB	MSB	Sub-	LSB			MSB
			Index			Abort code			

SDO Abort transfer

SDO Abort Codes
Possible SDO abort codes are:

Abort Code	Description
0503 0000h	Toggle bit not altered
0504 0000h	SDO protocol timed out
0504 0001h	Client/server command specifier not valid or unknown
0504 0002h	Invalid block size (block mode only)
0504 0003h	Invalid block sequence number (block mode only)
0504 0004h	Invalid block CRC value (block mode only)
0504 0005h	Out of memory
0601 0000h	Unsupported access to an object
0601 0001h	Attempt to read a write only object
0601 0002h	Attempt to write a read only object
0602 0000h	Object does not exist in the object dictionary
0604 0041h	Object cannot be mapped to the PDO
0604 0042h	The number and length of the objects to be mapped would exceed PDO length
0604 0043h	General parameter incompatibility reason
0604 0047h	General internal incompatibility in the device
0606 0000h	Access failed due to an hardware error
0607 0010h	Data type does not match, length of service parameter does not match
0607 0012h	Data type does not match, length of service parameter too high
0607 0013h	Data type does not match, length of service parameter too low
0609 0030h	Invalid value for parameter (download only)
0609 0031h	Value of parameter written too high (download only)
0609 0032h	Value of parameter written too low (download only)
0609 0036h	Maximum value is less than minimum value
060a 0023h	Resource not available: SDO connection
0800 0000h	General error
0800 0020h	Data cannot be transferred or stored to the application
0800 0021h	Data cannot be transferred or stored to the application because of local control
0800 0022h	Data cannot be transferred or stored to the application because of the present device state
0800 0023h	Object dictionary dynamic generation fails or no object dictionary is present (e.g. object dictionary is generated from file and generation fails because of an file error).
0800 0024h	No data available

SDO Abort codes

5.3.2 Object 3000h: NAME Definition

This object contains the NAME of the device (see chapter 3.2).

The Sub-index 1, NAME_Definition_1 contains the lower 4 bytes of the NAME, therefore the Manufacturer Code and the Identity Number. These fields are manufacturer-specific and must be unique, which is why they are read only.

The Sub-index 2, NAME_Definition_2 contains the rest of the NAME which are readable and writable.

Examples:

ID (hex.)	Symbol	Rx/Tx	Type	Prio	PGN	SA	DA	Length	Data (hex.)
1C0580F8		Tx	Data	7	1280	248	128	8	40 00 30 01 00 00 00 00
1C06F880		Rx	Data	7	1536	128	248	8	43 00 30 01 10 66 80 38

Example – Readout NAME_Definition_1

ID (hex.)	Symbol	Rx/Tx	Type	Prio	PGN	SA	DA	Length	Data (hex.)
1C0580F8		Tx	Data	7	1280	248	128	8	40 00 30 02 00 00 00 00
1C06F880		Rx	Data	7	1536	128	248	8	43 00 30 02 19 80 08 80

Example – Readout NAME_Definition_2

ID (hex.)	Symbol	Rx/Tx	Type	Prio	PGN	SA	DA	Length	Data (hex.)
1C0580F8		Tx	Data	7	1280	248	128	8	23 00 30 02 11 12 13 14
1C06F880		Rx	Data	7	1536	128	248	8	60 00 30 02 00 00 00 00

Example – Writing NAME_Definition_2 with dummy data 11h, 12h, 13h, 14h

Identity Number	26128 (unique)
Manufacturer Code	452 (WIKA Alexander Wiegand SE & Co. KG)
ECU Instance	1

Identity Number	26128 (unique)
Manufacturer Code	452 (WIKA Alexander Wiegand SE & Co. KG)
ECU Instance	1
Function Instance	3
Function	128

Sub-Index	1
Parameter Name	NAME_Definition_1
Object Type	VAR
Data Type	UNSIGNED32
Access	ro

Sub-Index	2
Parameter Name	NAME_Definition_2
Object Type	VAR
Data Type	UNSIGNED32
Access	rw

5.3.3 Object 3001h/3002h: PGN, SPN Configuration

With these objects, the cyclically transmitted PGNs can be configured.

The MH-4-CAN consist of two independent configurable PGN channels. On one channel the measured pressure value is transmitted, on the other the sensor electronic temperature.

PGN

Numeric value assigned uniquely to each PG. The maximum value that can be set is 0x3FFFF.

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SPN
Numeric value of the SPN assigned to the specific PGN. This option is purely informative and has no effect on the transmission. The maximum value that can be set is 0x7FFFF.

Priority
Priority of the specific PGN. The priority of any message can be set from highest 0 to lowest 7.

Transmission Repetition Rate (TRR):
Transmission repetition rate in milli-seconds of the specific PGN. A Value 0 means the PGN can only be requested. The maximum value that can be set is 0xFFFF.

SP Byte Offset
Starting byte position of the parameter within a PG. The first byte position is the value 0. The maximum value that can be set is 7.

SP Length
Data length for the encoded parameter data in the PG data field. The Length is expressed in units of bytes. The values 1 (UINT8), 2 (UINT16), 4 (UINT32) can be set.

Clamping Low / High
The clamping values set the minimum and maximum value of the SP data range in digits. The maximum value that can be set is 0xFFFFFFFF.

Offset / Gain
With these objects it is possible to scale the process data of the sensor to any SP data range.
In order to calculate the Offset and Gain for the specific SPN range you will need the measuring range of the sensor (see product label) and the scaling factor.

Note: The scaling factor must have the same unit as the measuring range, if necessary it must be converted into the unit of the sensors measuring range.

$$Gain = \frac{\frac{Measuring\ range}{in\ unit\ of\ sensor}}{10000\ digits \times \frac{SPN\ Scaling}{in\ unit\ of\ sensor}}$$

$$Offset = -Gain \times 2500\ digits$$

Example:
The objective in this example is to perform the configuration for PGN 64902 / SPN 3633 (see Table 4). Measuring Range of the sensor for this example: 0..60 bar.

Step 1: Unlock the CANopen bridge via PropA command (see chapter 5.2.1)

Step 2: Write the following configuration to the sub-indices of the object 3001_h

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The specification SAE J1939™-71 „Application Layer“ for this PGN/SPN provides the following data, which can be directly written to the corresponding sub indices:

- PGN = 64902
- SPN = 3633
- Priority = 6
- TRR = 500
- SP Byte Offset = 2
- SP Length = 2 (see slot specification for SAEpr03)
- Clamping Low / Data range start = 0 (see slot specification for SAEpr03)
- Clamping High / Data range end = 64255 (see slot specification for SAEpr03)

To calculate the value for Offset and Gain, the scaling factor needs to be converted into the unit of the measuring range of the sensor:

- Scaling factor defined by slot specification SAEpr03: 0.1 kPa/bit
- Converted scaling factor in unit bar: 0.001 bar/bit or 0.001 bar/digits

Gain and Offset Calculation:

$$Gain = \frac{60\ bar}{10000\ digits \times\ 0.001 \frac{bar}{digits}} = 6$$

$$Offset = -6\ \times 2500\ digits = -15000\ digits$$

Step 3: Perform a Store Parameters command via object 1010h (see chapter 5.3.4)

Step 4: Perform a Firmware Reset (see chapter 5.2.2) or Power-On reset of the sensor

After this procedure, the process value will be transmitted cyclically to the PGN 64902.

Object 3001h: PGN, SPN Configuration Pressure

Index	3001h
Parameter Name	PGN, SPN Configuration Pressure
Object Type	ARRAY

Sub-Index	0
Parameter Name	Number of entries
Object Type	VAR
Data Type	UNSIGNED8
Access	ro

Sub-Index	1
Parameter Name	PGN
Object Type	VAR
Data Type	UNSIGNED32
Access	rw

Sub-Index	2
Parameter Name	SPN
Object Type	VAR
Data Type	UNSIGNED32
Access	rw

Sub-Index	3
Parameter Name	Priority
Object Type	VAR
Data Type	UNSIGNED8
Access	rw

Sub-Index	4
Parameter Name	Transmission Rate
Object Type	VAR
Data Type	UNSIGNED8
Access	rw

Sub-Index	5
Parameter Name	SP Byte Offset
Object Type	VAR
Data Type	UNSIGNED8
Access	rw

Sub-Index	6
Parameter Name	SP Length
Object Type	VAR
Data Type	UNSIGNED8
Access	rw

Sub-Index	7
Parameter Name	Clamping Low
Object Type	VAR
Data Type	INTEGER32
Access	rw

Sub-Index	8
Parameter Name	Clamping High
Object Type	VAR
Data Type	INTEGER32
Access	rw

Sub-Index	9
Parameter Name	Offset
Object Type	VAR
Data Type	REAL32
Access	rw

Sub-Index	10
Parameter Name	Gain
Object Type	VAR
Data Type	REAL32
Access	rw

Object 3002h: PGN, SPN Configuration Temperature

Index	3002h
Parameter Name	PGN, SPN Configuration Temperature
Object Type	ARRAY

Sub-Index	0
Parameter Name	Number of entries
Object Type	VAR
Data Type	UNSIGNED8
Access	ro
Default Value	10

Sub-Index	1
Parameter Name	PGN
Object Type	VAR
Data Type	UNSIGNED32
Access	rw

Sub-Index	2
Parameter Name	SPN
Object Type	VAR
Data Type	UNSIGNED32
Access	rw

Sub-Index	3
Parameter Name	Priority
Object Type	VAR
Data Type	UNSIGNED8
Access	rw

Sub-Index	4
Parameter Name	Transmission Rate
Object Type	VAR
Data Type	UNSIGNED8
Access	rw

Sub-Index	5
Parameter Name	SP Byte Offset
Object Type	VAR
Data Type	UNSIGNED8
Access	rw

Sub-Index	6
Parameter Name	SP Length
Object Type	VAR
Data Type	UNSIGNED8
Access	rw

Sub-Index	7
Parameter Name	Clamping Low
Object Type	VAR
Data Type	INTEGER32
Access	rw

Sub-Index	8
Parameter Name	Clamping High
Object Type	VAR
Data Type	INTEGER32
Access	rw

Sub-Index	9
Parameter Name	Offset
Object Type	VAR
Data Type	REAL32
Access	rw

Sub-Index	10
Parameter Name	Gain
Object Type	VAR
Data Type	REAL32
Access	rw

5.3.4 Object 1010h: Store parameters

This entry supports saving of the configured parameters via the CANopen bridge in non-volatile memory. For saving the signature “save” (0x65766173) must be written.

ID	DLC	Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
1C0580F8h	8	23h	10h	10h	01h	73h	61h	76h	65h
			Index			Data			

Command to Store Parameters via CANopen Bridge

Please do note, that changes take effect on the next restart of the sensor.

Index	1010h
Parameter Name	Store Parameter Field
Object Type	ARRAY

Sub-Index	0
Parameter Name	Number of entries
Object Type	VAR
Data Type	UNSIGNED8
Lower Limit	0x0
Higher Limit	0x7F
Access	ro
Default Value	4
PDO Mapping	No

Sub-Index	1
Parameter Name	Save all Parameters
Object Type	VAR
Data Type	UNSIGNED32
Access	rw
PDO Mapping	No

5.3.5 Object 1011h: Restore default parameters

This entry supports restoring of default parameters.
For restoring the signature “load” (0x64616F6C) must be written.

ID	DLC	Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
1C0580F8h	8	23h	11h	10h	01h	6Ch	6Fh	61h	64h
			Index			Data			

Table 28: Command to Restore Parameters via CANopen Bridge

Please do note, that changes take effect on the next restart of the sensor.

Index	1011h
Parameter Name	Restore Default Parameters
Object Type	ARRAY

Sub-Index	0
Parameter Name	Number of entries
Object Type	VAR
Data Type	UNSIGNED8
Lower Limit	0x0
Higher Limit	0x7F
Access	ro
Default Value	4
PDO Mapping	No

Sub-Index	1
Parameter Name	Restore all Default Parameters
Object Type	VAR
Data Type	UNSIGNED32
Access	rw
PDO Mapping	No

6. Diagnosis and Identification

6.1 Proprietary Diagnosis

With a request of PropB1_00 (PGN 130816) the status of the sensor can be evaluated.

The returned sensor status is bit coded in a 16bit value:

- Bit 0: Generic/General Error
- Bit 1: Positive overload
- Bit 2: Negative overload
- Bit 3: Device Temperature
- Bit 4: Sensor fault
- Bit 5-15: 0 (reserved)

If one of an error occurs, the process value changes to an error indication value:

- Datalength = 1 / UINT8: 0xFE
- DataLength = 2 / UINT16: 0xFE00

ID (hex.)	Symbol	Rx/Tx	Type	Prio	PGN	SA	DA	Length	Data (hex.)
18EA80F8	RQST	Tx	Data	6	59904	248	128	3	00 FF 01
19FF0080	PropB1_00	Rx	Data	6	130816	128	255	8	00 00 FF FF FF FF FF FF

Example of requesting the sensor status via PGN 130816

6.2 Software Identification

The firmware revision can be readout by requesting the Software Identification (PGN 65242).
Note: The Software Identification can only be requested with the global address 255.

Because the payload data contains more than 8 bytes, the Broadcast Announce Message (BAM) is used in the response.

Symbol	Rx/Tx	Type	Prio	PGN	SA	DA	Length	Data (hex.)
RQST	Tx	Data	6	59904	248	255	3	DA FE 00
TPCM.BAM	Rx	Data	7	60416	128	255	8	20 17 00 04 FF DA FE 00
TPDT	Rx	Data	7	60160	128	255	8	01 01 56 65 72 73 69 6F
TPDT	Rx	Data	7	60160	128	255	8	02 6E 20 31 2E 32 2E 30
TPDT	Rx	Data	7	60160	128	255	8	03 2D 61 6C 70 68 61 2E
TPDT	Rx	Data	7	60160	128	255	8	04 34 2A FF FF FF FF FF

Example of Software Identification via PGN 65242 (TP Reassembled: “Version 1.2.0-alpha.4*”)

7. Abbreviations

AAC	Arbitrary Address Capable
ACM	Address Claiming Message
BAM	Broadcast Announce Message
CA	Controller Application
CAN	Controller Area Network
CAN-ID	CAN Identifier
CAM	CANopen Application Message
CAM11	PG Acronym for „CANopen Application Message #1/1“
CAM21	PG Acronym for „CANopen Application Message #2/1“
DA	Destination Address
DP	Data Page
ECU	Electronic Control Unit
EDP	Extended Data Page
NACK	Negative Acknowledgement
PDU	Protocol Data Unit
PF	PDU Format
PG	Parameter Group
PGN	Parameter Group Number
PropA	PG Acronym for „Proprietary A”
PropB1_00	PG Acronym for „Proprietary B – Page 1 (first entry)”
PS	PDU Specific
SA	Source Address
SAE	International Society of Automotive Engineers
SDO	CANopen Service Data Objects
SOFT	PG Acronym for „Software Identification“
SPN	Suspect Parameter Number
TP	Transport Protocol
TRR	Transmission Repetition Rate

8. References

SAE J1939™-21	Data Link Layer Vehicle
SAE J1939™-71	Application Layer Vehicle
SAE J1939™-81	Network Management
ISO 11898-2	Road vehicles — Controller area network (CAN) — Part 2: High-speed medium access unit

9.Change log

9. Change log

Document Version	Reason for change	Date
1.0	First Release Version	xx.xx.2022

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