



# iso175 SAE J1939 Specification

Insulation monitoring device for unearthed drive systems  
(IT systems) in electric vehicles

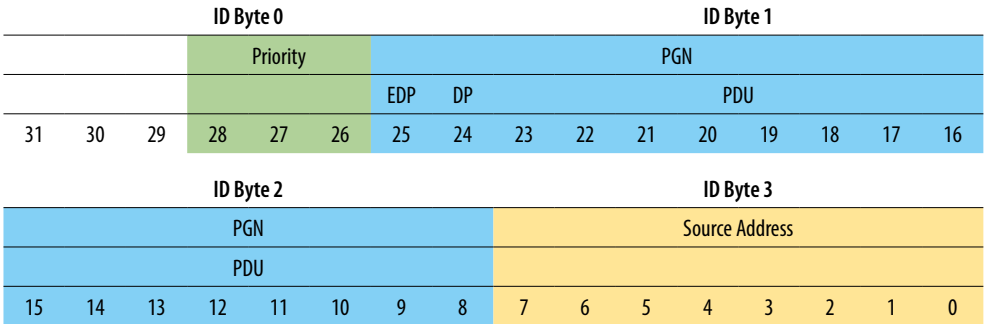
## Table of contents

<b>1</b>	<b>Operation .....</b>	<b>2</b>
1.1	SAE J1939 CAN-ID Structure.....	2
1.2	Data Structure.....	2
1.3	Messages.....	2
1.3.1	DeviceInfo Message.....	2
1.3.2	Cyclic Messages.....	3
1.3.3	Message Content.....	3
1.4	PGN Request.....	4
1.4.1	Read PGN Info.....	4
1.4.2	Read parameters.....	4
1.4.2.1	PGN_Response.....	4
1.4.2.2	Error Message.....	5
<b>2</b>	<b>Command descriptions.....</b>	<b>5</b>
2.1	Control commands (CTL).....	5
2.2	Set commands.....	6
2.3	GET commands.....	7
<b>3</b>	<b>Technical data.....</b>	<b>12</b>
3.1	Interface protocol.....	12

# 1 Operation

## 1.1 SAE J1939 CAN-ID Structure

By Default a SAE J1939 CAN-ID with 29 Bit identifier is structured as follows:



Priority: 6 (cyclic), 7 (TP) (!); PGN: see message table; Source Address (Default 244<sup>1</sup>)

<sup>1</sup> For firmware version  $\geq D720V1.01$  each PGN and cycle time is configurable via can interface. For more details please check chapter „2.2 Set commands“. Alternatively a customized device can be ordered, for more details please contact our local sale representative.

**i** For internal diagnostic purposes, we reserve the right to use the following addresses:

- 0x400 and 0x400 + diagnostic address (default: 0x401)
- 0x500 and 0x500 + diagnostic address (default: 0x501)

If a message is sent to one of these reserved addresses, the device may respond with a reply to 0x410 or 0x510.

If cyclic communication with these reserved addresses is carried out at very short intervals (e.g. every 50 ms), this can result in an overload of the internal communication. As a result, the device may enter an error state and generate an error message. Cyclic communication with these addresses must therefore be avoided at all costs.

## 1.2 Data Structure

The messages contain either DataByte, DataWord or DataDWord values. The byte order for the DataWord values is:

Byte order (Intel)	DataByte			
	7.....0			
	DataWord			
	LowByte	HighByte		
	7.....0	15.....8		
	DataDWord			
	LowWord		HiWord	
	LowByte	HighByte	LowByte	HighByte
7.....0	15.....8	23.....16	31.....24	

## 1.3 Messages

### 1.3.1 DeviceInfo Message

The *DeviceInfo* message is realized as a multi-package message and will be automatically send within 2 s after device is powered on. The messages look like the following:

#### TP.CM\_BAM message

CAN-ID	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
0x1CECFFF4	0x20 (broadcast)	42 (total number of bytes)		6 (number of packets)	0xFF (reserved)	0x00 <sup>1</sup>	0xFF <sup>1</sup>	0x00

<sup>1</sup> 0xFF 00 (65280) PGN\_DeviceInfo (PGN is fixed)

#### TP.DT message

CAN-ID	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8	
0x1CEBFFF4	Packet number	Data 0...6							

#### Data 0...41

Data 0...13	Data 14...27	Data 28...41
Device type „iso175“	Serial number	Part number

### 1.3.2 Cyclic Messages

Communication between the requesting instance in the vehicle environment and the ISOMETER® takes place via the HS-CAN-bus. The ISOMETER® can process the following messages:

Message	PGN	Direction	Cycle Time (Default)
PGN_Info_General	65281*	Tx	100 ms*
PGN_Info_IsolationDetail	65282*	Tx	0 (deactivated)*
PGN_Info_Voltage	65283*	Tx	0 (deactivated)*
PGN_Info_IT-System	65284*	Tx	0 (deactivated)*

\*For firmware version  $\geq D720V1.01$  each PGN and cycle time is configurable via CAN interface. For more details please check chapter „2.2 Set commands“. Alternatively a customized device can be ordered, for more details please contact our local sale representative.

### 1.3.3 Message Content

	Data 0	Data 1	Data 2	Data 3	Data 4	Data 5	Data 6	Data 7
PGN_Info_General	Isolation: R_iso_corrected (neg. tolerance shifted)		Isolation: R_iso_status	Isolation: Measurement counter	Status: Warnings and alarms		Status: Device activity	N/A or 0xFF
PGN_Info_Isolation- Detail	Isolation: R_iso_neg		Isolation: R_iso_pos		Isolation: R_iso_original		Isolation: Measur- ement counter	Isolation: Quality

	Data 0	Data 1	Data 2	Data 3	Data 4	Data 5	Data 6	Data 7
PGN_Info_Voltage	Voltage: HV system		Voltage: HV_neg to earth		Voltage: HV_pos to earth		Voltage: Measu- rement counter	N/A or 0xFF
PGN_Info_IT-System	Capacity: Measured value		Capacity: Measurement counter	Unbalance: Measured value	Unbalance: Measurement counter	0xFF		N/A or 0xFF

## 1.4 PGN Request

**i** This command has to be send with a data byte length of 3 Bytes. The max. cyclic request rate should not exceed 10 Hz. After each request the master has to wait for the response. After the response a new request can be send. Typical reaction time is less than 100 ms.

### 1.4.1 Read PGN Info

In case a PGN\_Info message is deactivated (cycle time = 0), it can be read by sending the following command:

Name	CAN-ID	Data 0	Data 1	Data 2
Read PGN_Info_xx	0x18EAF17	PGN_Device_Info (fixed: 0x00)	0xFF	0x00
		PGN_Info_General (Default: 0x01)	0xFF	0x00
		PGN_Info_IsolationDetail (Default: 0x02)	0xFF	0x00
		PGN_Info_Voltage (Default: 0x03)	0xFF	0x00
		PGN_Info_IT-System (Default: 0x04)	0xFF	0x00

### 1.4.2 Read parameters

Request read out parameters - Standard data format of a request:

PGN	Data 0 (Index)
PGN_Request 0xEFgg <sup>1</sup>	Index

#### 1.4.2.1 PGN\_Response

Response read out parameters - Standard data format of a response:

PGN	Data 0	Data 1	Data 2	Data 3	Data 4	Data 5	Data 6	Data 7
PGN_Request 0xEFgg <sup>1</sup>	Index	AA	BB	CC	DD	EE	FF	GG

<sup>1</sup> gg Device Source Address (range: 0x80...0xF7, Default: 0xF4)

The parameters data length is always 8 bytes (index + 7 bytes user data). Unused memory locations are filled with 0xFF.

### 1.4.2.2 Error Message

Standard data format of an error message:

PGN	Data 0	Data 1	Data 2	Data 3	Data 4	Data 5	Data 6	Data 7
PGN_Request 0xEFgg <sup>1</sup>	0xFF	0x23 - unknown/ invalid request	requested index			0xFF		
		0x24 - Set command failed, parameter locked						
		0x25 - Data[1] range overflow <sup>2</sup>						
		0x26 - Data[2] range overflow <sup>2</sup>						
		0x27 - PGN already in use <sup>2</sup>						
		0x28 - Write failed <sup>2</sup>						
		0x29 - Read failed <sup>2</sup>						

<sup>1</sup> gg Device Source Address (range: 0x80...0xF7, Default: 0xF4)

<sup>2</sup> available only for index > 0x75 and firmware version ≥ D720V1.01

## 2 Command descriptions

### 2.1 Control commands (CTL)

Standard data format of a control command:

PGN	Data 0	Data 1
PGN_Request 0xEFgg <sup>1</sup>	Index	AA

Overview of all available control commands:

PGN_Request 0xEFgg <sup>1</sup>	Data 0 (Index)	Data 1
Self-holding Iso-Alarm: Reset Alarm	0x33	0: false = No action 1: true = Reset alarm
Self test: Trigger_self_test	0x57	0: SNV = No action 1: Offline test 2: Offline and communication test <b>i</b> Selftest can only be triggered in R_iso_status = 0xFE
Status: Factory reset	0x6F	0: false = No action 1: true = Factory reset <b>i</b> Requires Status Lock = 0xFC (Parameter write enable)
Earthlift: Status	0x71	0: false = Earth connection closed 1: true = Connection open <b>i</b> Maximum delay time for execution: 5s (*)



**\*) Caution!** Switching earth connection could be delayed in case of self diagnosis is currently running while user command is send (higher priority as normal user command).

## 2.2 Set commands

PGN	Data 0	Data 1	Data 2
PGN_Request 0xEFgg <sup>1</sup>	Index	AA	BB

<sup>1</sup> gg Device Source Address (range: 0x80...0xF7, Default: 0xF4)

Parameter = 0xBBAA

Overview off all parameter, which can be changed by the user:

Name	Data 0 (Index)	Data 1	Data 2	Additional information
Unbalance: Threshold	0x2F	0 = Deactivated 15...45: Unbalance alarm threshold [%]	N/A	Data length = 2
Self-holding Iso-Alarm: Activation	0x31	0xFC: False = Automatic Iso-alarm reset 0xFD: True = Self-holding Iso-alarm (must be reset via command)	N/A	Data length = 2
Isolation: Active Profile	0x39	1: Standard with fast startup 2: Standard 3: High capacity with fast startup 4: High capacity 5: Disturbed 6: Service	N/A	Data length = 2
Isolation: Power-On Profile	0x3B	1: Standard with fast startup 2: Standard 3: High capacity with fast startup 4: High capacity 5: Disturbed 6: Service	N/A	Data length = 2
Isolation: Threshold Error	0x47	30...2000: Isolation error threshold [kΩ]		Data length = 3
Isolation: Threshold Timeout Measurement	0x49	0 = Alarm deactivated 1...64255: Treshold timeout [s]		Data length = 3
Isolation: Threshold Warning	0x4B	30...2000: Isolation warning threshold [kΩ]		Data length = 3
Self test: Period	0x59	0: Automatic selftest deactivated 1...64255: Period [10s]		Data length = 3
Voltage: Mode	0x65	0xFD: AC 0xFE: DC	N/A	Data length = 2
Voltage: Threshold Undervoltage	0x67	0 = deactivated 1...1000: Voltage [V]		Data length = 3
Status: Lock	0x6B	0xFC: false = Parameter write enable 0xFD: true = Parameter write disable	N/A	Data length = 2

Name	Data 0 (Index)	Data 1	Data 2	Additional information
Isolation: Threshold_first_reference_ estimation	0x73	1...1000: Threshold voltage for estimation reference [V]		Data length = 3
Isolation: Pre_estimation_max_difference	0x75	1...64255: Maximum voltage difference for estimation evaluation [0.01 V]		Data length = 3

The following information in this chapter is available starting with firmware version D720V1.01.

Name	Data 0 (Index)	Data 1	Data 2	Additional information
Interface: PGN	0x77	0x00 - PGN_Info_General 0x01 - PGN_Info_IsolationDetail 0x02 - PGN_Info_Voltage 0x03 - PGN_Info_IT-System	0x01...0xF9 <sup>1*</sup>	Data length = 3
Interface: Periodic cycle time	0x79	0x00 - PGN_Info_General 0x01 - PGN_Info_IsolationDetail 0x02 - PGN_Info_Voltage 0x03 - PGN_Info_IT-System	0x00 - deactivated 0x01...0xFA- [100ms]	Data length = 3
Interface: Baudrate	0x7B	0x01 - 1 MBit/s 0x02 - 800 kBit/s 0x03 - 666 kBit/s 0x04 - 500 kBit/s (Default) 0x05 - 250 kBit/s 0x06 - 125 kBit/s		Data length = 2
Interface: Source address	0x7D	0x80...0xF7 (Default: 0xF4)		Data length = 2
Isolation: Isolnit	0x7F	0x0000...0xC350 (0...50.000) [kΩ]		Data length = 3 Default value: 0x0000

<sup>1\*</sup> Each request, response and the PGN\_Info\_xx message must have an unique ID.

## 2.3 GET commands

SNV = Signal not valid

N/A = not available

General request format (Data length 1): PGN, Data 0 (Index)

Data 1...Data 7: contains the requested informations

Name	Data 0 (Index)	Data 1	Data 2	Data 3	Data 4... Data 7	Additional information
Bootloader Identification: Build number	0x0A	1...64255 65535: SNV		0xFF		
Bootloader Identification: D-Number	0x0C	1...64255 65535: SNV		0xFF		

Name	Data 0 (Index)	Data 1	Data 2	Data 3	Data 4... Data 7	Additional information
Bootloader Identification: Version	0x0E	1...64255 65535: SNV		0xFF		
Hardware Identification: AH-History	0x10	0...255 per byte				
Hardware Identification: AH-Number	0x12	0...255 per byte				
au8AH_NumberPartB	0x14	0...255 per byte				
au8ArticleNumber-PartA	0x16	0...255 per byte				
au8ArticleNumber-PartB	0x18	0...255 per byte				
Hardware Identification: Serial number	0x1A	0...255 per byte				
au8SerialNumber-PartB	0x1C	0...255 per byte				
Software Identification: Build Number	0x1E	1...64255 65535: SNV		0xFF		
Software Identification: D-Number	0x20	1...64255 65535: SNV		0xFF		
Software Identification: Version	0x22	1...64255 65535: SNV		0xFF		e. g. → 100 V 1.00
Unbalance: Measured value	0x2A	0...100: Measured value [%] 255: SNV		0xFF		(0 % = HV+, 50 % = HV/2, 100 % = HV-)
Unbalance: Measurement Counter	0x2C	0...255		0xFF		Counter will be incremented with each new measured unbalance value
Unbalance: Alarm Threshold	0x2E	0: Unbalance alarm deactivated 15...45: Unbalance alarm threshold [%]		0xFF		Default: 0
Self-holding Iso-Alarm: Activation	0x30	0xFC: False = Automatic alarm reset 0xFD: True = Self-holding alarm (must be reset via command)		0xFF		Default: 0xFC

Name	Data 0 (Index)	Data 1	Data 2	Data 3	Data 4... Data 7	Additional information
Isolation: Measurement Counter	0x36	0...255		0xFF		Counter will be incremented with each new measured isolation resistance value
Isolation: Active Profile	0x38	1: Standard with fast startup 2: Standard 3: High capacity with fast startup 4: High capacity 5: Disturbed 6: Service		0xFF		Default: 1
Isolation: Power-On Profile	0x3A	1: Standard with fast startup 2: Standard 3: High capacity with fast startup 4: High capacity 5: Disturbed 6: Service		0xFF		Default: 1
Isolation: Quality	0x3E	0...100 [%] 255: SNV		0xFF		
Isolation: R_iso_neg	0x40	0...50000: Isolation resistance on HV_ne [kΩ] 65535: SNV		0xFF		
Isolation: R_iso_pos	0x42	0...50000: Isolation resistance on HV_pos [kΩ] 65535: SNV		0xFF		
R_iso_status	0x44	0xFC: estimated isolation value during startup 0xFD: First measured isolation value during startup 0xFE: Isolation value in normal operation 0xFF: SNV		0xFF		
Isolation: Threshold Error	0x46	30...2000: Isolation error threshold [kΩ]		0xFF		Default: 100
Isolation: Threshold Timeout Measurement	0x48	0: Alarm deactivated 1 - 64255: Threshold timeout [s]		0xFF		Default: 60

Name	Data 0 (Index)	Data 1	Data 2	Data 3	Data 4... Data 7	Additional information
Isolation: Threshold Warning	0x4A	30...2000: Isolation warning threshold [kΩ]		0xFF		Default: 500
Isolation: R_iso_corrected (neg. Tolerance shifted)	0x4C	0...40500: corrected isolation value [kΩ] 65535: SNV		0xFF		<b>i</b> Maximum value depends on the defined tolerance of the current active profile
Isolation: R_iso_original	0x4E	0...50000: Original isolation value [kΩ] 65535: SNV		0xFF		
Isolation: Time elapsed since last measurement	0x50	0...64255: elapsed time [s]		0xFF		
Capacity: Measured value	0x52	1...200: Capacity value [0.1μF] 65535: SNV		0xFF		
Capacity: Measurement Counter	0x54	0...255		0xFF		Counter will be incremented with each new measured capacity value
Self test: Period	0x58	0: automatic selftest deactivated 1...64255: [10 s]		0xFF		Default: 360 (equals 1h)
Voltage: Measurement Counter	0x5C	0...255		0xFF		Counter will be incremented with each new measured voltage value
Voltage: HV sytem	0x5E	0...64255: HV system voltage [0.05V] 65535: SNV		0xFF		Offset: 32128 (1606.4V) valid range: -1606.4V...+1606.35V
Voltage: HV_neg to Earth	0x60	0...64255: HV_neg to earth voltage [0.05V] 65535: SNV		0xFF		Offset: 32128 (1606.4V) valid range: -1606.4V...+1606.35V
Voltage: HV_pos to Earth	0x62	0...64255: HV_pos to earth voltage [0.05V]		0xFF		Offset: 32128 (1606.4V) valid range: -1606.4V...+1606.35V
Voltage: Mode	0x64	0xFD: AC 0xFE: DC		0xFF		Default: 0xFE
Voltage: Threshold Under-voltage	0x66	0: Deactivate 1...1000: Voltage [V]		0xFF		Default: 0

Name	Data 0 (Index)	Data 1	Data 2	Data 3	Data 4... Data 7	Additional information
Status: Device Activity	0x68	0: Initialization 1: Normal operation 2: Self test	0xFF			
Status: Lock	0x6A	0xFC: Parameter Write Enable 0xFD: Parameter Write Disable	0xFF			Default: 0xFC
Status: Warnings and Alarms	0x6C	1)*		0xFF		
Earthlift: Status	0x70	0xFC: Earth disconnector closed 0xFD: Earth disconnector open	0xFF			Default: 0xFC
Isolation: Threshold_first_reference_estimation	0x72	1...1000: Threshold voltage for estimation reference [V]		0xFF		Default: 100
Isolation: Pre_estimation_max_difference	0x74	0...64255: Maximum voltage difference for estimation evaluation [0.01V]		0xFF		Default: 200

1)\*

Bit 0:	true = Device error active
Bit 1:	true = HV_pos connection failure
Bit 2:	true = HV_neg connection failure
Bit 3:	true = Earth connection failure
Bit 4:	true = Iso alarm (iso value below threshold error)
Bit 5:	true = Iso warning (iso value below threshold warning)
Bit 6:	true = Iso outdated (value „time elapsed since last measurement“ > = „measurement timeout“)
Bit 7:	true = Unbalance alarm (unbalance value below threshold)
Bit 8:	true = Undervoltage alarm
Bit 9:	true = Unsafe to start
Bit 10:	true = Earthlift open

The following information in this chapter is available starting with firmware version D720V1.01.

Name	Data 0 (Index)	Data 1*	Data 2	Data 3	Data 4... Data 7	Additional information
Interface: PGN	0x76	0x00 - PGN_Info_General 0x01 - PGN_Info_IsolationDetail 0x02 - PGN_Info_Voltage 0x03 - PGN_Info_IT-System	0x01...0xF9 <sup>1*</sup>		0xFF	
Interface: Priodic cycle time	0x78	0x00 - PGN_Info_General 0x01 - PGN_Info_IsolationDetail 0x02 - PGN_Info_Voltage 0x03 - PGN_Info_IT-System	0x00 - deactivated 0x01...0xFA- [100ms]		0xFF	
Isolation: Isolnit	0x7E	0x00	0x0000...0xC350 (0...50.000) [kΩ]		0xFF	Default value: 0x0000

\* Data 1 must also be transmitted within requestmessage

<sup>1\*</sup> each PGN\_Info\_xx message must have an unique ID

### 3 Technical data

#### 3.1 Interface protocol

Data transmission rate HS-CAN .....125, 250, 500, 666, 800, 1000 kBaud

Terminating resistance HS-CAN ..... 120 Ω (Jumper)

**i** This document applies to the standard settings. PGN addresses, cycle times and Default values may differ for customised devices.



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