



iso175 Bender-Standard CAN Specification

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

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1 Operation

1.1 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

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 Messages

1.2.1 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 HS-CAN messages:

Message	CAN-ID	Direction	Cycle Time (Default)
IMD_Info_General	0x37*	Tx	100 ms*
IMD_Info_IsolationDetail	0x38*	Tx	0 (deactivated)*
IMD_Info_Voltage	0x39*	Tx	0 (deactivated)*
IMD_Info_IT-System	0x3A*	Tx	0 (deactivated)*

**For firmware version ≥ D720V1.01 each CAN-ID and cycle time is configurable via CAN interface. For more details please check chapter „2.2 Set commands“ on page 6. Alternatively a customized device can be ordered, for more details please contact our local sale representative.*

1.2.2 Message Content

IMD_Info_General is sent cyclical every 100 ms as a standard. All other info messages are deactivated by default.

	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
IMD_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
IMD_Info_Isolation- Detail	Isolation: R_iso_neg		Isolation: R_iso_pos		Isolation: R_iso_original		Isolation: Measurement counter	Isolation: Quality
IMD_Info_Voltage	Voltage: HV system		Voltage: HV_neg to earth		Voltage: HV_pos to earth		Voltage: Measurement counter	N/A or 0xFF
IMD_Info_IT-System	Capacity: Measured value		Capacity: Measurement counter	Unbalance: Measured value	Unbalance: Measure- ment counter	0xFF		N/A or 0xFF

1.3 IMD_Request



The maximum request rate should not exceed 10 Hz. The typical response time of a request is less than 100 ms. After each request the master should wait for the response of the ISOMETER® before re-sending the request.

IMD_Request is a request to the ISOMETER®. By default, SET and CTL commands are not answered by the IMD at protocol level. To ensure that the command (SET/CTL) has been executed correctly, a corresponding read command must be executed.

1.3.1 Read parameters

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

CAN-ID	Byte 0
0x22 (default)	Index

The message length of the request is not fixed, it can be send with the exact byte lenght described for the relai-ting command. All request messages can be send with exact 8 bytes Data lenght, but then the unused bytes have to be filled up with 0xFF.

1.3.1.1 IMD_Response

IMD_Response is generated exclusively as a response to the IMD_Request command.

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

CAN-ID	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
0x23 (default)	Index	Data 1	Data 2	Data 3	Data 4	Data 5	Data 6	Data 7

The message length is always 8 bytes long. Byte 0 always contains the previously requested index in case of a valid command. If a device information is longer than 7 bytes (e.g. the serial number) the content is distributed to several messages (in case the command is valid), which must be requested in each case.

Example: Read out the serial number (SN)

- Request: 0x22 (CAN-ID), 0x1A (Index SN)
- Response: 0x23 (CAN-ID), 0x1A (Index SN), 0x32, 0x30, 0x32, 0x30, 0x32, 0x38, 0x30, (ASCII →2020280)
- Request: 0x22, 0x1C
- Response: 0x23, 0x1C, 0x30, 0x30, 0x31, 0xFF, 0xFF, 0xFF, 0xFF (ASCII → 001)
- The complete serial number is 2020280001

1.3.1.2 Error Message

In case of an unknown index, an error message will be send back by the device. In case the device write lock is set (Index 0x6B), any set command except „write lock disable“ an error message will be send back.

Standard data format of an error meassage:

CAN-ID	Byte 0	Byte 1	Byte 2
0x22 (default)	0xFF	0x23 unknown / invalid Request	requested index
		0x24 Set command failed, parameter locked	
		0x25 - Data[1] range overflow ¹	
		0x26 - Data[2] range overflow ¹	
		0x27 - CAN-ID already in use ¹	
		0x28 - Write failed ¹	
		0x29 - Read failed ¹	

¹ available only for index > 0x75 and firmware version ≥ D720V1.01

2 Command descriptions

2.1 Control commands (CTL)

Name	Request	Data 0 (Index)	Data 1
Self-holding Iso-Alarm: Reset_Alarm	0x22 (default)	0x33	0: false = No action 1: true = Reset alarm flags which are not active
Self test: Trigger_self_test	0x22 (default)	0x57	0: SNV = No action 1: Offline test 2: Offline and communication test  Selftest can only be triggered in R_iso_status = 0xFE
Status: Factory_Reset	0x22 (default)	0x6F	0: false = No action 1: true = Factory reset  Requires Status: Lock = 0xFC (Parameter Write Enable)

Name	Request	Data 0 (Index)	Data 1
Earthlift: Status	0x22 (default)	0x71	0: false = Earth connection closed 1: true = Earth connection open <i>i</i> 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

Name	Request	Data 0 (Index)	Data 1	Data 2	Additional information
Unbalance: Threshold	0x22 (default)	0x2F	0 = deactivated 15...45: Unbalance alarm threshold [%]	N/A	Data length = 2
Self-holding Iso-Alarm: Activation	0x22 (default)	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	0x22 (default)	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 not affected by „Status: Lock“
Isolation: Power-On_Profile	0x22 (default)	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 not affected by „Status: Lock“
Isolation: Threshold_Error	0x22 (default)	0x47	30...2000: Isolation error threshold [kΩ]		Data length = 3
Isolation: Threshold_Timeout_ Measurement	0x22 (default)	0x49	0 = Alarm deactivated 1...64255: Treshold timeout [s]		Data length = 3
Isolation: Threshold Warning	0x22 (default)	0x4B	30...2000: Isolation warning threshold [kΩ]		Data length = 3
Self test: Period	0x22 (default)	0x59	0: Automatic selftest deactivated 1...64255: Period [10 s] 65535: SNV		Data length = 3

Name	Request	Data 0 (Index)	Data 1	Data 2	Additional information
Voltage: Mode	0x22 (default)	0x65	0xFD: AC 0xFE: DC	N/A	Data length = 2
Voltage: Threshold Under-voltage	0x22 (default)	0x67	0 = Deactivated 1...1000: Voltage [V]		Data length = 3
Status: Lock	0x22	0x6B	0xFC: false = Parameter write enable 0xFD: true = Parameter write disable	N/A	Data length = 2
Isolation: Threshold_first_reference_estimation	0x22 (default)	0x73	1...1000: Threshold voltage for estimation reference [V]		Data length = 3
Isolation: Pre_estimation_max_difference	0x22 (default)	0x75	0...64255: maximum voltage difference for estimation evaluation [0.01V]		Data length = 3

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

Name	Request	Data 0 (Index)	Data 1	Data 2	Additional information
Interface: CAN-ID	0x22 (default)	0x77	0x00 (Request) 0x01 (Response) 0x02 - IMD_Info_General 0x03 - IMD_Info_IsolationDetail 0x04 - IMD_Info_Voltage 0x05 - IMD_Info_IT-System	0x20...0xFE (allowed CAN-ID) ^{1*}	Data length = 3
Interface: Periodic cycle time	0x22 (default)	0x79	0x00 -IMD_Info_General 0x01 - IMD_Info_IsolationDetail 0x02 - IMD_Info_Voltage 0x03 - IMD_Info_IT-System	0x00 - deactivated 0x01...0xFA-[100ms]	Data length = 3
Interface: Baudrate	0x22 (default)	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	N/A	Data length = 2
Isolation: Isolnit	0x22 (default)	0x7F	0x0000...0xC350 (0...50.000) [kΩ]		Data length = 3 default value: 0x0000

^{1*} Each request, response and the IMD_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): CAN-ID, Data 0 (Index)

Data 1...Data7: contains the requested informations

Name	Request	Data 0 (Index)	Data 1	Data 2	Data 3	Data 4... Data 7	Additional information
Bootloader Identification: Build number		0x0A	1...64255 65535: SNV		N/A or 0xFF		
Bootloader Identification: D-Number		0x0C	1...64255 65535: SNV		N/A or 0xFF		
Bootloader Identification: Version		0x0E	1...64255 65535: SNV		N/A or 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				
Hardware Identification: Item_number		0x16	0...255 per byte				
au8ArticleNumberPartB		0x18	0...255 per byte				
Hardware Identification: Serial_number		0x1A	0...255 per byte				
au8SerialNumberPartB		0x1C	0...255 per byte				
Software Identification: Build_Number		0x1E	1...64255 65535: SNV		N/A or 0xFF		
Software Identification: D_Number		0x20	1...64255 65535: SNV		N/A or 0xFF		
Software Identification: Version		0x22	1...64255 65535: SNV		N/A or 0xFF		e.g. 100 → V 1.00
Unbalance: Measured_Value		0x2A	0...100: Measured value [%] 255: SNV		N/A or 0xFF		0% = HV+, 50% = HV/2, 100% = HV-
Unbalance: Measurement_Counter		0x2C	0...255 255: SNV		N/A or 0xFF		Counter will be incremented with each new measured unbalance value
Unbalance: Threshold		0x2E	0 = deactivated 15...45: Unbalance alarm threshold [%]		N/A or 0xFF		Default: 0

Name	Request	Data 0 (Index)	Data 1	Data 2	Data 3	Data 4... Data 7	Additional information
Self-holding Alarm: Activation		0x30	0xFC: false = Automatic alarm reset 0xFD: true = Self-holding alarm (must be reset via command) 0xFE: reserved 0xFF: SNV	N/A or 0xFF			Default: 0xFC
Isolation: Measurement_Counter		0x36	0...255	N/A or 0xFF			Counter will be incremented with each new mea- sured 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	N/A or 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	N/A or 0xFF			Default: 1
Isolation: Quality		0x3E	0...100: Quality [%] 255: SNV	N/A or 0xFF			
Isolation: R_iso_neg		0x40	0...50000: Isolation resistance on HV_neg [kΩ] 65535: SNV	N/A or 0xFF			
Isolation: R_iso_pos		0x42	0...50000: Isolation resistance on HV_pos [kΩ] 65535: SNV	N/A or 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	N/A or 0xFF			

Name	Request	Data 0 (Index)	Data 1	Data 2	Data 3	Data 4 . . . Data 7	Additional information
Isolation: Threshold Error		0x46	30 . . . 2000: Isolation error threshold [kΩ]		N/A or 0xFF		Default: 100
Isolation: Threshold Timeout Measurement		0x48	0: Alarm deactivated 1 - 64255: Threshold Timeout [s]		N/A or 0xFF		Default: 60
Isolation: Threshold_Warning		0x4A	30 . . . 2000: Isolation warning threshold [kΩ]		N/A or 0xFF		Default: 500
Isolation: R_iso_corrected (neg. Tolerance shifted)		0x4C	0 . . . 40500: corrected isolation value [kΩ] 65535: SNV		N/A or 0xFF		 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		N/A or 0xFF		
Isolation: Time_elapsed_since_ last_measurement		0x50	1 . . . 64255: elapsed time [s] 65535: SNV		N/A or 0xFF		
Capacity: Measured_value		0x52	1 . . . 200: Capacity value [0.1 μF] 65535: SNV		N/A or 0xFF		
Capacity: Measurement_Counter		0x54	0 . . . 255		N/A or 0xFF		Counter will be incremented with each new measured capacity value
Self test: Period		0x58	0: automatic selftest deactivated 1 . . . 64255: Period [10 s]			N/A or 0xFF	Default: 360 (equals 1 h)
Voltage: Measurement_Counter		0x5C	0 . . . 255		N/A or 0xFF		Counter will be incremented with each new measured voltage value
Voltage: HV_System		0x5E	0 . . . 64255: HV system voltage [0.05 V] 65535: SNV			N/A or 0xFF	Offset: 32128 (1606.4 V) valid range: -1606.4 V ...+1606.35 V

Name	Request	Data 0 (Index)	Data 1	Data 2	Data 3	Data 4... Data 7	Additional information
Voltage: HV_neg_to_Earth		0x60	0... 64255: HV_neg to Earth voltage [0.05 V] 65535: SNV		N/A or 0xFF		Offset: 32128 (1606.4 V) valid range: -1606.4 V ...+1606.35 V
Voltage: HV_pos_to_Earth		0x62	0... 64255: HV_pos to MarinaEarth voltage [0.05 V] 65535: SNV		N/A or 0xFF		Offset: 32128 (1606.4 V) valid range: -1606.4 V ...+1606.35 V
Voltage: Mode		0x64	0xFD: AC 0xFE: DC		N/A or 0xFF		Default: 0xFE
Voltage: Threshold_Undervoltage		0x66	0: Deactivate 1... 1000: Voltage [V]		N/A or 0xFF		Default: 0
Status: Device_Activity		0x68	0: Initialization 1: Normal operation 2: Self test		N/A or 0xFF		
Status: Lock		0x6A	0xFC: false = Parameter write enable 0xFD: true = Parameter write disable		N/A or 0xFF		Default: 0xFC
Status: Warnings_and_Alarms		0x6C	1)*		N/A or 0xFF		
Earthlift: Status		0x70	0xFC: false = Earth discon- nector closed 0xFD: true = Earth disconnec- tor open		N/A or 0xFF		Default: 0xFC
Isolation: Threshold_first_referen- ce_estimation		0x72	1... 1000: Threshold voltage for estimation reference [V]		N/A or 0xFF		Default: 100
Isolation: Pre_estimation_max_ difference		0x74	0... 64255: Maximum voltage difference for estimation evaluation [0.01V]		N/A or 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: CAN-ID	0x76	0x00 (Request) 0x01 (Response) 0x02 - IMD_Inf General 0x03 - IMD_Inf IsolationDetail 0x04 - IMD_Inf Voltage 0x05 - IMD_Inf IT-System	0x20...0xFE (allowed CAN-ID) ^{1*}		0xFF	Default values: (Request): 0x22 (Response): 0x23 IMD_Inf General: 0x37 IMD_Inf Isolation- Detail: 0x38 IMD_Inf Voltage: 0x39 IMD_Inf IT-System: 0x3A
Interface: Periodic cycle time	0x78	0x00 - IMD_Inf General 0x01 - IMD_Inf IsolationDetail 0x02 - IMD_Inf Voltage 0x03 - IMD_Inf IT-System	0x00 - deacti- vated 0x01...0xFA [100ms]		0xFF	Default values: IMD_Inf General: 0x01(100ms) IMD_Inf Isolation- Detail: 0x00 (deactivated) IMD_Inf Voltage: 0x00 (deactivated) IMD_Inf IT-System: 0x00 (deactivated)
Isolation: Isolnit	0x7E	0x00	0x0000...0xC350 (0...50.000) [kΩ]		0xFF	data length = 2, Default value: 0x0000

* Data 1 must also be transmitted within requestmessage

^{1*} Each request, response and the IMD_Inf_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)



This document applies to the standard settings. IMD request addresses, cycle times and default values may differ for customised devices.



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