iso175 Standard CAN Specification

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

Table of contents

BENDER

1 Operation

1.1 Messages

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

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	Cyclic (see IMD_Info, Standard)*
IMD_Info_General	0x37	Tx	1 (100 ms)
IMD_Info_IsolationDetail	0x38	Tx	0 (deactivated)
IMD_Info_Voltage	0x39	Tx	0 (deactivated)
IMD_Info_IT-System	0x3A	Tx	0 (deactivated)
IMD_Request	0x22	Rx	-
IMD_Response	0x23	Tx	-

* Customer Settings: 0 - 250 [100ms stepps], (0 = deactivated)

1.2 IMD_Info

IMD_Info_General is sent cyclically every 100 ms as a standard. All other info messages are deactivated by default, but can be selected as follows for a customer-specific order: 0: no cyclic message, 1...250: Cycle time (100 ms).

	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: Measu-rement Counter	Isolation: Quality

	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
IMD_Info_Voltage	Voltage: HV system		Voltage: HV_neg to earth		Voltage: HV_pos to earth		Voltage: Measu-rement Counter	N/A or 0xFF
IMD_Info_IT-System	Capacity: Measured Value		Capacity: Measurement Counter	Unbalance: Measured Value	Unbalance: Measure-ment	Voltage: Measured Frequency		N/A or 0xFF

1.3 IMD_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.

Format of a request:

CAN-ID	Byte 0
0x22	Index

The message length of the request is not fixed, it can be send with the exact byte lenght described for the relaiting 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.

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.

The format of the error message looks like the following:

Byte 0	Byte 1	Byte 2
0xFF	0x23 unknown / invalid Request	0xXX invalid requested index
0xFF	0x24 set command failed, parameter locked	0xXX set command Index which failed

1.4 IMD_Response

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

Format of a valid response:

CAN-ID	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
0x23	Index	Data1	Data2	Data3	Data4	Data 5	Data 6	Data 7
		DataWord1		DataWord2		DataWord3		0xFF
		DataDWord				0xFF		

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, (ASCI →2020280)
- Request: 0x22, 0x1C
- Response: 0x23, 0x1C, 0x30, 0x30, 0x31, 0xFF, 0xFF , 0xFF ,0xFF (ASCI → 001)
- The complete serial number is 2020280001

2 Command descriptions

2.1 Control commands (CTL)

Name	Request	Data0 (Index)	Data1
Self-holding Iso-Alarm: Reset_Alarm	0x22	0x33	0: false = no action 1: true = reset alarm flags which are not active
Self test: Trigger_self_test	0x22	0x57	0: SNV = no action 1: offline test 2: offline and communication test
Status: Factory_Reset	0x22	0x6F	0: false = No action 1: true = Factory reset Note: requires Status: Lock = 0xFC (Parameter Write Enable)
Earthlift: Status	0x22	0x71	0: false = Earth connection closed 1: true = Earth connection open Note: Maximum delay time for execution: 5s

2.2 Set commands

Note: SNV = Signal not valid

Name	Request	Data0 (Index)	Data1	Data2	additional information
Unbalance: Threshold	0x22	0x2F	0: Unbalance alarm deactivated 5 - 45: Unbalance alarm threshold [%]		data length = 2
Self-holding Iso-Alarm: Activation	0x22	0x31	0xFC: false = automatic Iso-alarm reset 0xFD: true = self-holding Iso-alarm (must be reset via command)		data length = 2
Isolation: Active_Profile	0x22	0x39	0: Custom Profile 1: Standard with fast startup 2: Standard 3: High Capacity with fast startup 4: High Capacity 5: Disturbed 6: Service 7: UG		data length = 2 not affected by „Status: Lock“

Name	Request	Data0 (Index)	Data1	Data2	additional information
Isolation: Power-On_Profile	0x22	0x3B	0: Custom Profile 1: Standard with fast startup 2: Standard 3: High Capacity with fast startup 4: High Capacity 5: Disturbed 6: Service 7: UG		data length = 2 not affected by „Status: Lock“
Isolation: Threshold _Error	0x22	0x47	30…2000: isolation error threshold [kΩ]		data length = 3
Isolation: Threshold_Timeout_ Measurement	0x22	0x49	0 = Alarm deactivated 1…64255: Treshold Timeout [s]		data length = 3
Isolation: Threshold Warning	0x22	0x4B	30…2000: isolation warning threshold [kΩ]		data length = 3
Self test: Period	0x22	0x59	0: automatic selftest deactivated 1…64255: Period [10 s] 65535: SNV		data length = 3
Voltage: Mode	0x22	0x65	0xFC: AC + DC 0xFD: AC 0xFE: DC		data length = 2
Voltage: Threshold Under-voltage	0x22	0x67	0 = Deactivated 1…1000: Voltage [V]		data length = 3
Status: Lock	0x22	0x6B	0xFC: false = Parameter Write Enable 0xFD: true = Parameter Write Disable		data length = 2
Isolation: Threshold_first_refe-rence_estimation	0x22	0x73	1…1000: Threshold voltage for estimation reference [V]		data length = 3
Isolation: Pre_estimation_max_ difference	0x22	0x75	0…64255: maximum voltage difference for estimation evaluation [0.01V]		data length = 3

2.3 GET commands

Note: SNV = Signal not valid

N/A = not available

General request format (data length 1): CAN-ID, Data0 (Index)

Data1...Data7: contains the requested informations

Name	Data0 (Index)	Data1	Data2	Data3… Data7	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	N/A or 0xFF	0% = HV+, 50% = HV/2, 100% = HV-
Unbalance: Measurement_Counter	0x2C	0…255 255: SNV	N/A or 0xFF	N/A or 0xFF	counter will be incremented with each new measured unbalance value
Unbalance: Threshold	0x2E	0: Unbalance alarm deactivated 5…45: Unbalance alarm Threshold [%]	N/A or 0xFF	N/A or 0xFF	default: 0

Name	Data0 (Index)	Data1	Data2	Data3… Data7	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	N/A or 0xFF	default: 0xFC
Isolation: Measurement_Counter	0x36	0…255	N/A or 0xFF	N/A or 0xFF	counter will be incremented with each new measured isolation resistance value
Isolation: Active_Profile	0x38	0: Custom Profile 1: Standard with fast startup 2: Standard 3: High Capacity with fast startup 4: High Capacity 5: Disturbed 6: Service 7: UG	N/A or 0xFF	N/A or 0xFF	default: 1
Isolation: Power-On_Profile	0x3A	0: Custom Profile 1: Standard with fast startup 2: Standard 3: High Capacity with fast startup 4: High Capacity 5: Disturbed 6: Service 7: UG	N/A or 0xFF	N/A or 0xFF	default: 1
Isolation: Quality	0x3E	0…100: Quality [%] 255: SNV	N/A or 0xFF	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	N/A or 0xFF	
Isolation: Threshold Error	0x46	30…2000: isolation error threshold [kΩ]			default: 100

Name	Data0 (Index)	Data1	Data2	Data3… Data7	additional information
Isolation: Threshold Timeout Measurement	0x48	0: Alarm deactivated 1 - 64255: Threshold Timeout [s]			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…35000: corrected isolation value [kΩ] 65535: SNV		N/A or 0xFF	*Note: 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	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: HV_Frequency	0x5A	0…5000: Frequency [0.1 Hz] 65535: SNV		N/A or 0xFF	
Voltage: Measurement_Counter	0x5C	0…255	N/A or 0xFF	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
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	0xFC: AC + DC 0xFD: AC 0xFE: DC	N/A or 0xFF	N/A or 0xFF	default: 0xFE
Voltage: Threshold_Undervoltage	0x66	0: Deactivate 1…1000: Voltage [V]		N/A or 0xFF	default: 0

Name	Data0 (Index)	Data1	Data2	Data3… Data7	additional information
Status: Device_Activity	0x68	0: Initialization 1: Normal operation 2: Self test	N/A or 0xFF	N/A or 0xFF	
Status: Lock	0x6A	0xFC: false = Parameter Write Enable 0xFD: true = Parameter Write Disable	N/A or 0xFF	N/A or 0xFF	default: 0xFC
Status: Warnings_and_Alarms	0x6C	1)*		N/A or 0xFF	
Earthlift: Status	0x70	0xFC: false = Earth Disconnector closed 0xFD: true = Earth Disconnector open	N/A or 0xFF	N/A or 0xFF	default: 0xFC
Isolation: Threshold_first_reference_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 lst 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

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)

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