ISOMETER®s iso165C and iso165C-1

BENDER
The Power in Electrical Safety©

Insulation Monitoring Devices (IMDs) for unearthed DC drive systems (IT systems) in electric vehicles

This quickstart is designed for electrically skilled persons working in electrical engineering and electronics! It does not replace the operating manual. Make sure that personnel has read this manual and understood all instructions relating to safety. The manual can be found at:
http://www.bender-de.com/manuals

1. Intended use

The ISOMETER® iso165C and ISOMETER® iso165C-1 monitors the insulation resistance between the active high-voltage (HV) components of an electrical drive system (U_n = DC 0 V…600 V) and the reference earth (chassis ground). The patented measurement technology is used to monitor the condition of the insulation on the DC side as well as on the AC motor side of the electrical drive system.

The ISOMETER® **iso165C-1** variant features Error and Warning signals on the separated high-side driver.

Both ISOMETER®s are assembled with three connectors. To achieve internal galvanic separation, connector 1 is connected to low-voltage (LV) areas and connectors 2 and 3 are connected to the HV areas in the car environment. Due to its space saving design and optimized measurement technology, the device is optimized for use in hybrid or fully electric vehicles. The devices meets the increased automotive requirements with regard to environmental conditions (e.g. temperatures and vibration, EMC). The ISOMETER® CAN bus interface allows both the iso165C and iso165C-1 to integrate seamlessly into an existing CAN environment.

Note: At initial power on, the ISOMETER® **iso165C** does not carry out any measurements until communication between the Vehicle Interface Controller (VIFC) and the Insualtion Monitoring Controller (IMC) has been established. In addition, the HV coupling relays of the HV1 voltage path are, by default, open and therefore no valid measurement of voltage HV1 and the insulation resistance is possible until these relays are closed by an external command. Once these conditions have been satisfied, the ISOMETER® iso165C can immediately start measuring voltages HV1, HV2 and the insulation resistance.
In the ISOMETER® **iso165C-1**, however, the HV coupling relays of the HV1 voltage path are automatically closed at power on.

With reference to the general application of an IMD in IT systems, only one active IMD in a galvanically interconnected system is permitted. If IT systems are to be interconnected via a coupling switch, it must be ensured via a controller that all other IMDs are separated from the IT system and switched to inactive. IT systems coupled via capacitors or diodes can also influence the insulation monitoring system. For this reason, central control of the various IMDs must be implemented.

In the event of an ISOMETER® alarm message, the insulation fault should be eliminated as quickly as possible.

2. Safety information

DANGER

Risk of electric shock!
*The terminals HV1 ± / HV2 ± may have nominal voltages measuring up to 600 V. Touching live parts of the system carries the **risk of electric shock**. Therefore, the device is only to be operated with mounted and locked terminal covers.*

CAUTION

In order to check that the device is properly connected, a function test must be carried out before system commissioning by measuring a ground fault using a suitable resistance .

CAUTION

Terminals T_31_E and T_31_KE must be connected separately to the chassis.

CAUTION

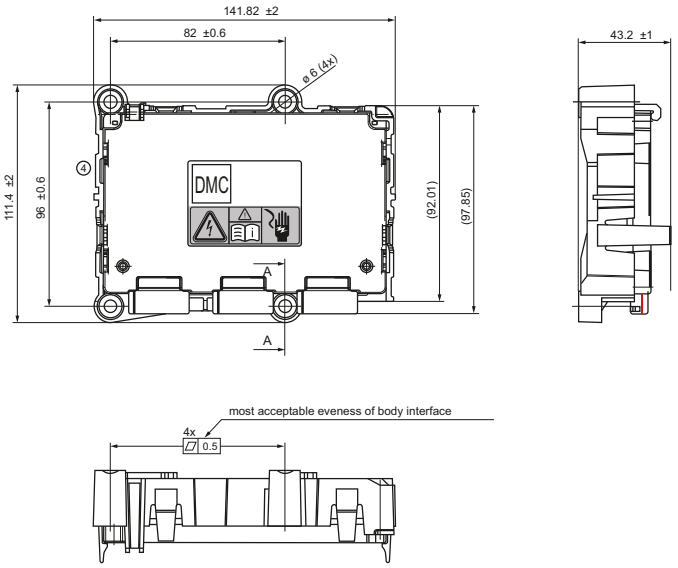
In every conductively connected system only one IMD may be connected. When performing insulation and dielectric tests on the system, the IMD must be disconnected by opening the HV relays for the duration of the test.

When a monitored AC system contains galvanically coupled DC circuits, the following applies: an insulation fault can only be accurately detected if a minimum current of > 10 mA flows through the rectifier valves.

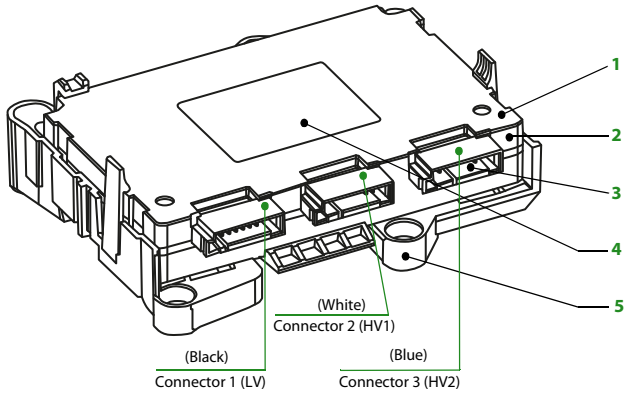
The wiring should be carried out in a way that prevents a short circuit from happening.

3. Dimensions, wiring and connectivity

Dimensions



Wiring and connectivity



1 - Enclosure: PBT GF30 black; UL Standard UL94 V0
2 - Cover: PBT GF30 black; UL Standard UL94 V0
3 - Connector pin: Cu-alloy, tin plated pin
4 - Label: White polyester foil
5 - Bracket: PBT GF30 black; UL Standard UL94 V0

Connector 1: Power supply, Ground loop, CAN interface
Connector 2: Insulation monitoring Voltage measurement
Connector 3: Voltage measurement

Connector pin arrangement

Connector	Pin no.	Signal
Connector 1 (LV) for: - Power supply - CAN interface - High-side driver - Ground loop	1	T_31_KE_2 (vehicle internal earthing structure)
	2	Reserved
	3	HST_2 (High-side driver 2, iso Warning) - **iso165C-1 only**
	4	HST_1 (High-side driver 1, iso Error) - **iso165C-1 only**
	5	HS-CAN_L
	6	HS-CAN_H
	7	T_31_E_2 (vehicle internal earthing structure)
	8	T_30 - 12V switched supply (5A fuse, Ignition and Charging FET)

Connector	Pin no.	Signal
Connector 2 (HV1)	1	HV1_POS
	2-7	Reserved
	8	HV1_NEG

Connector	Pin no.	Signal
Connector 3 (HV2)	1	HV2_NEG
	2-7	Reserved
	8	HV2_POS

4. Ordering information

Response value range				
Type iso165C		**Nominal Voltage**	**Supply Voltage**	**Article number**
Alarm1 (Error): 30 kΩ…1 MΩ (default 100 kΩ); Alarm2 (Warning): 40 kΩ…2 MΩ (default 200 kΩ)		DC 0 . . . 600 V	DC 0 . . . 12 V	B 9106 8175
Alarm1 (Error): 30 kΩ…1 MΩ (customer setting xxx kΩ); Alarm2 (Warning): 40 kΩ…2 MΩ (customer setting xxx kΩ)		DC 0 . . . 600 V	DC 0 . . . 12 V	B 9106 8175 C

Type iso165C-1				
Alarm1 (Error): 30 kΩ…1 MΩ (default 200 kΩ); Alarm2 (Warning): 40 kΩ…2 MΩ (default 400 kΩ)		DC 0 . . . 600 V	DC 0 . . . 12 V	B 9106 8176
Alarm1 (Error): 30 kΩ…1 MΩ (default xxx kΩ); Alarm2 (Warning): 40 kΩ…2 MΩ (default xxx kΩ)		DC 0 . . . 600 V	DC 0 . . . 12 V	B 9106 8176 C

Accessories		Article number
iso165C connecting kit		B 9106 8503

5. Technical Data

Supply voltage

Supply voltage U_S ..... DC 9 V - 16 V
Nominal supply voltage ..... DC 12 V
Max operational current I_S ..... 300 mA (typ. 185 mA)
Max current I_K ..... 5 A
Power dissipation P_S ..... < 2.5 W

Supervised IT system

Rated voltage range U_n ..... DC 0 V . . . 600 V
Tolerance ..... +15%
Frequency range ..... 10 Hz . . . 1 kHz
System leakage capacity C_e ..... ≤ 1 µF
Withstand voltage test ..... 1.9 kV AC / 1 min.

Measuring circuit

Measurement method ..... Bender DCP technology
Measuring voltage U_m ..... ± 40 V
Measuring current I_m at $R_F = 0$ ..... ± 33 µA
Impedance Z_i at 50 Hz (HV1) ..... ≥ 1.2 MΩ (≥ 2.4 MΩ each line, high resistance in off state)
Internal resistance R_i (HV1) ..... ≥ 1.2 MΩ (≥ 2.4 MΩ each line, high resistance in off state)
Impedance Z_i at 50 Hz (HV2) ..... ≥ 10.5 MΩ (≥ 21 MΩ each line)
Internal resistance R_i (HV2) ..... ≥ 10.5 MΩ(≥ 21 MΩ each line)

Measuring ranges

Insulation resistance range ..... 0 Ω . . . 50 MΩ
Insulation resistance duration/Pulse (normal operation) ..... ~ 1.6 s (≤ 1 µF / 0 MΩ)
..... ~ 6 s (≤ 1 µF / 10 MΩ)
Relative error (DCP) ..... 100 kΩ....5 MΩ, ±15 %
Absolute error (DCP) ..... 0 Ω . . . 100 kΩ, ±15 kΩ
High-voltage range ..... 0 V . . . 600V
High-voltage tolerance ..... 0 V . . . 100 V, ±5 V
..... 100 V . . . 600 V, ±5 %

High-side driver output (iso165C-1)

HST_1* ..... High-side driver 1, iso Error
Maximum current, I_{out_max} ..... 80 mA
HST_2* ..... High-side driver 2, iso Warning
Maximum current, I_{out_max} ..... 80 mA
*External 2.2 kΩ pull-down resistor to chassis ground (KL.31) is required.
Not protected against a short circuit in the event that KL.31 is missing. Therefore, a 100 Ω resistor is required on each driver output.

Response Values

iso165C:
Response Alarm 1 (Error) ..... 30 kΩ . . . 1 MΩ (default 100 KΩ)
Response Alarm 2 (Warning) ..... 40 kΩ . . . 2 MΩ(default 200 KΩ)
iso165C-1:
Response Alarm 1 (Error) ..... 30 kΩ . . . 1 MΩ (default 200 KΩ)
Response Alarm 2 (Warning) ..... 40 kΩ . . . 2 MΩ (default 400 KΩ)
iso165C and iso165C-1:
Response uncertainty (according to IEC 61557-8) ..... ±15 %
Hysteresis ..... +25 %
Factor averaging F_{ave} ..... 1 . . . 10 (default:10)
Response time t_{an} (DCP)
(Changeover R_F: 10 MΩ - R_{an}/2; at C_e = 1 µF; U_n = 600 V DC) ..... t_{an} ≤ 20 s (at F_{ave} = 10*)
..... during self test t_{an} + 10 s
Measurement time after power on (and after HV relays are closed) ..... ≤ 3 s (<1 µF / 150 kΩ)
Switch-off time tab (DCP)
(Changeover R_F:R_{an}/2 - 10 MΩ; at C_e = 1 µF; U_n = 600 V DC) ..... t_{ab} ≤ 40 s (at F_{ave} = 10)
..... during self test t_{ab} + 10 s
* F_{ave} = 10 is recommended for electric vehicles interface

Interface

Protocol ..... HS-CAN
iso165C:
Data rate ..... 250 kBaud
Termination resistance ..... 124 Ω internally
iso165C-1:
Data rate ..... 500 kBaud
Termination resistance ..... None

Environment/EMC

EMC ..... IEC 61326-2-4
Overvoltage category II
Degree of pollution 2
Range of application ..... 5,000 m above sea level

Connectors (Tyco)

Receptor housing type ..... 1719183-1, 1719183-2, 1719183-3 (black, white, blue)
Receptor drawing number C-1719183
Contact type (tin plated) 5-963715-1
Contact wire range ..... 0.50 - 0.75 mm^2
Contact drawing number 929454
Crimp hand tool 539635-1

Other

Operating mode ..... Continuous operation
Degree of protection IP5K0
Software version :
iso165C ..... V1.0 - Release S010 (VIFC: V5.0 , IMC V5.0)
iso165C-1 ..... V2.0 - Release S010 (VIFC: V10.0 , IMC V5.0)

Mounting

Recommended screws for mounting ..... 4 x M5 (not included)
Max. tightening torque ..... 2.25 ± 0.25 Nm for the screws

Photos: Bender archives.

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