

ISOMETER® iso165C

Insulation Monitoring Device (IMD)

for unearthed DC drive systems (IT systems) in electric vehicles



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Device features

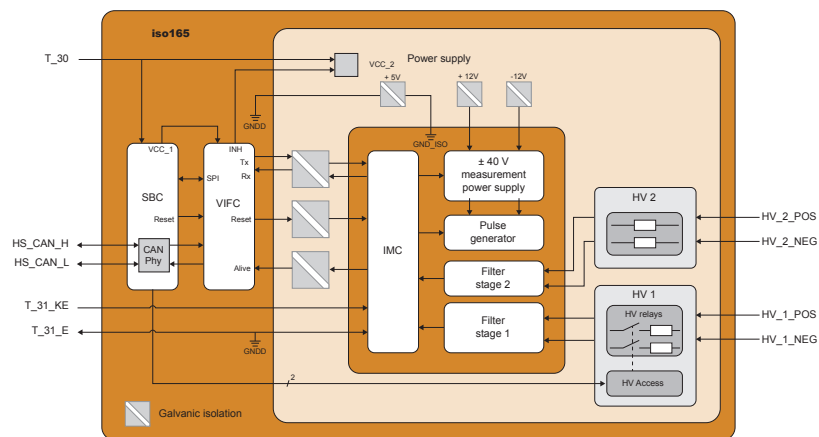
- Insulation monitoring of AC and DC insulation faults for unearthed systems (IT systems) from 0 V...600 V peak
- Power supply for all internal voltages
- Continuous measurement of insulation resistance from 0 Ω...50 MΩ
- Response time of ≤ 20 s for measured insulation resistance (using Direct Current Pulse (DCP))
- Automatic adaptation to the existing system leakage capacitance (≤ 1 μF)
- Detection of earth faults and lost earth line
- Measurement of a second voltage
- The device works when:
 - HV is unstable
 - HV is powered off
 - There are symmetric or asymmetric insulation faults
 - Faults exist between HV lines and the supply voltage
- Galvanic separation of all signals from the HV side
- HV coupled network
- CAN bus interface
- Light weight: < 220 g (including housing and connection frame)

Product description

The ISOMETER® iso165C monitors the insulation resistance between the active HV components of an electrical drive system ($U_n = DC\ 0\ V \dots 600\ V$) 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 is 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 device meets the increased automotive requirements with regard to environmental conditions (e.g. temperatures and vibration, EMC). The ISOMETER® iso165C CAN bus interface allows it to integrate seamlessly into an existing CAN environment.



Function

The ISOMETER® iso165C consists of two main components, the Vehicle Interface Controller (VIFC) and the Insulation Monitoring Controller (IMC). The VIFC consists of a microcontroller with a UART communication interface that translates and forwards requests from the HS-CAN bus transparently to the IMC. The corresponding IMC responses are returned to the requesting instance via the HS-CAN bus. The VIFC monitors the running state of the IMC via a signal known as „Alive“, and internally and cyclically requests the insulation value and the running state of the IMC. The results are cyclically sent as an informal message via the HS-CAN bus.

The IMC consists of the HV connectors with HV coupling relays, the measurement circuit and a microcontroller to analyse the measurement results. It generates internal alarm information from the measurement results, which is coded to produce the „Alive“ signal mentioned previously. This signal is transmitted in parallel with the measurements and status information to the VIFC and from there over the HS-CAN bus. The IMC is galvanically separated from the car environment.

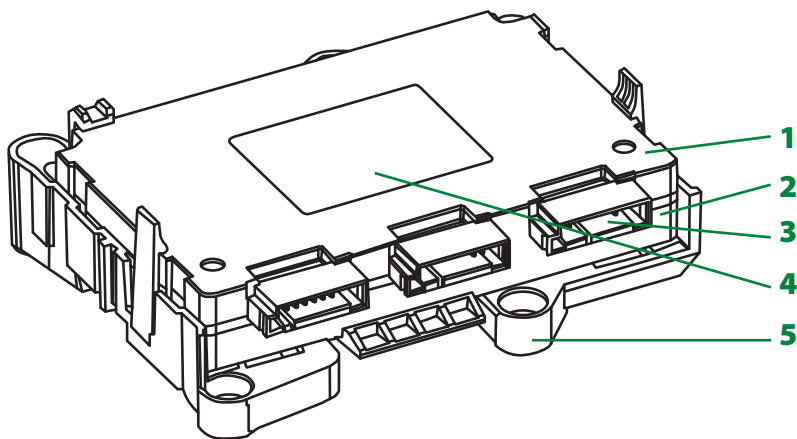
On initial power up, the ISOMETER® iso165C does not carry out any measurements until communication between the VIFC and IMC has been established. In addition, the HV coupling relays of the HV1 voltage path are, by default, open and therefore no valid measurement of voltage HV1 and the insulation resistance 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.

The initial measurement values after power up are:

	HV relays open	HV relays closed
Insulation resistance	50,000 kΩ	Value in kΩ
Voltage of HV1	0 V	Value in V
Voltage of HV2	Value in V	Value in V

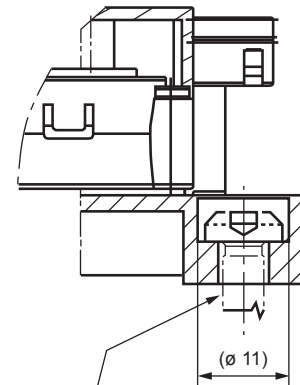
The ISOMETER® iso165C generates a pulsed measuring voltage that is superimposed on the IT system by terminals T_31_E/KE (chassis). Because the connection between the terminals E/KE and the chassis ground (T_31) is continuously monitored, it is necessary to install two separated conductors from terminals T_31_E/KE to chassis ground.

Wiring diagram



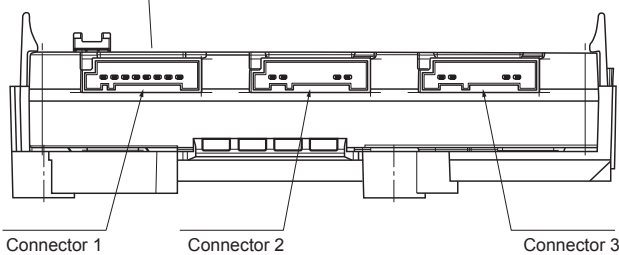
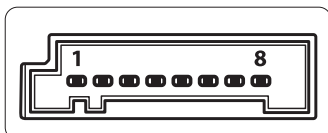
- 1 - Enclosure PBT GF30 black, UL Standard: UL94 V0
- 2 - Cover PBT GF30 black, UL Standard: UL94 V0
- 3 - Connector pin Cu-alloy, tin plated
- 4 - Label White Polyester foil
- 5 - Bracket PBT GF30 black, UL Standard: UL94 V0

Section view A-A
Scale: 2:1



recommended screws (not included)
4 x M5
fastening torque: 2,25 ± 0,25 Nm

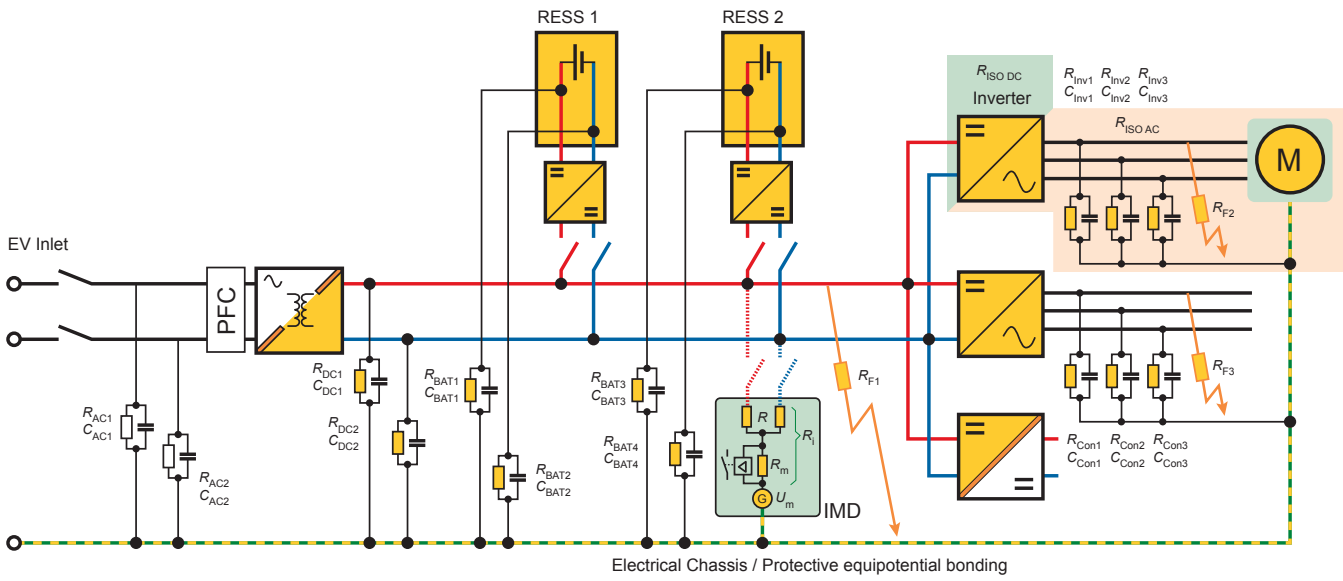
Connectivity



Connector ^{*)}	Type	Code	Colour
1	1719183-1	A	Black
2	1719183-2	B	White
3	1719183-3	C	Blue

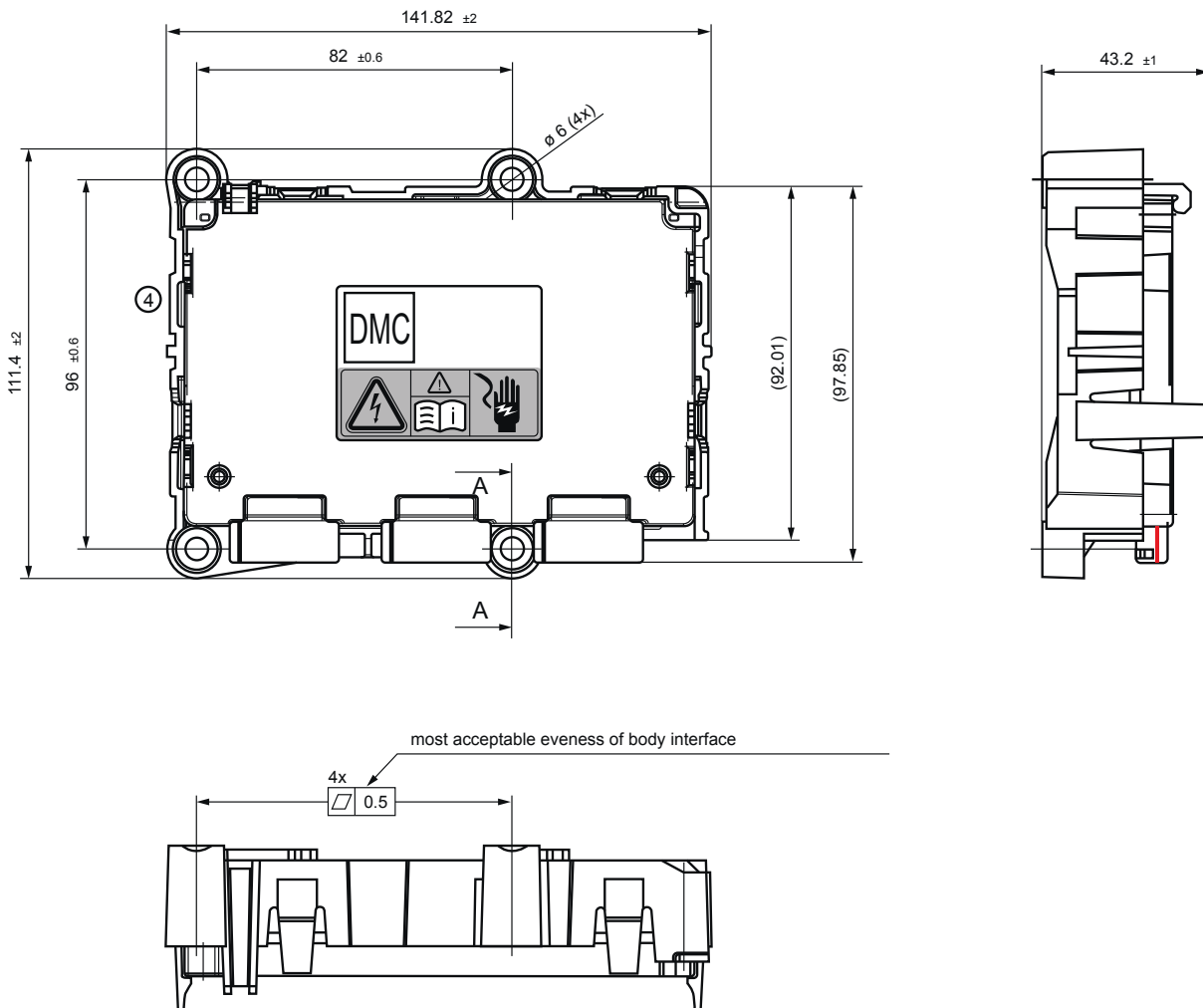
^{*)} Please refer to „Technical Data“ for detailed connector information.

Typical application



Dimension diagram

Dimensions in mm



Technical data
Supply voltage

Supply voltage U_S	DC 9...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

Monitored IT system

Rated voltage range U_n	DC 0...600 V
Tolerance	+ 15%
Frequency range	10 Hz...1 kHz
System leakage capacity C_e	≤ 1 μF
Withstand voltage test	AC 1.9 kV/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...600V
High-voltage tolerance	0...100 V, ±5 V 100...600 V, ±5 %

Response values

Response Alarm 1 (Error)	30 kΩ...1 MΩ (default 100 kΩ)
Response Alarm 2 (Warning)	40 kΩ...2 MΩ (default 200 kΩ)
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 t_{ab} (DCP) (changeover $R_F: R_{an}/2...10 MΩ$; at $C_e = 1 μF$; $U_n = DC 600 V$)	$t_{ab} ≤ 40 s$ (at $F_{ave} = 10$) during self test $t_{ab} + 10 s$

Interface

Protocol	HS-CAN
Data rate	250 kbaud
Terminating resistor	124 Ω internally

Environment/EMC

EMC	IEC 61326-2-4
Overvoltage category	II
Pollution degree	2
Range of application	5,000 m above sea level

Connectors (Tyco)

Receptor enclosure 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

Mounting

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

* $F_{ave} = 10$ is recommended for electric vehicles

Ordering information

Response value range	Nominal voltage		Supply voltage	Type	Art. No.
	DC	DC	DC		
Alarm1 (Error): 30 kΩ...1 MΩ (default 100 kΩ); Alarm2 (Warning): 40 kΩ...2 MΩ (default 200 kΩ)	0...600 V		12 V	iso165C	B 9106 8175
Alarm1 (Error): 30 kΩ...1 MΩ (customer setting xxx kΩ); Alarm2 (Warning): 40 kΩ...2 MΩ (customer setting xxx kΩ)	0...600 V		12 V	iso165C	B 9106 8175 C

Accessories

Type	Art. No.
iso165C connecting kit	B 9106 8503



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