

High-voltage test stations and component qualification for electric and hybrid vehicles

Continuous monitoring of the insulation level (megohms to gigohms)
increases test efficiency and product quality

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Walther Bender's vision 80 years ago:

Comprehensive protection against the hazards of electric current.



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BENDER
FOUNDSTHE
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COMPANY AT
THE AGE OF 42.**



- Third-generation family business with headquarters in Grünberg (Germany)
- 1,000 employees on four continents, more than 15% of them in research and development
- 170 million euros turnover (2020)



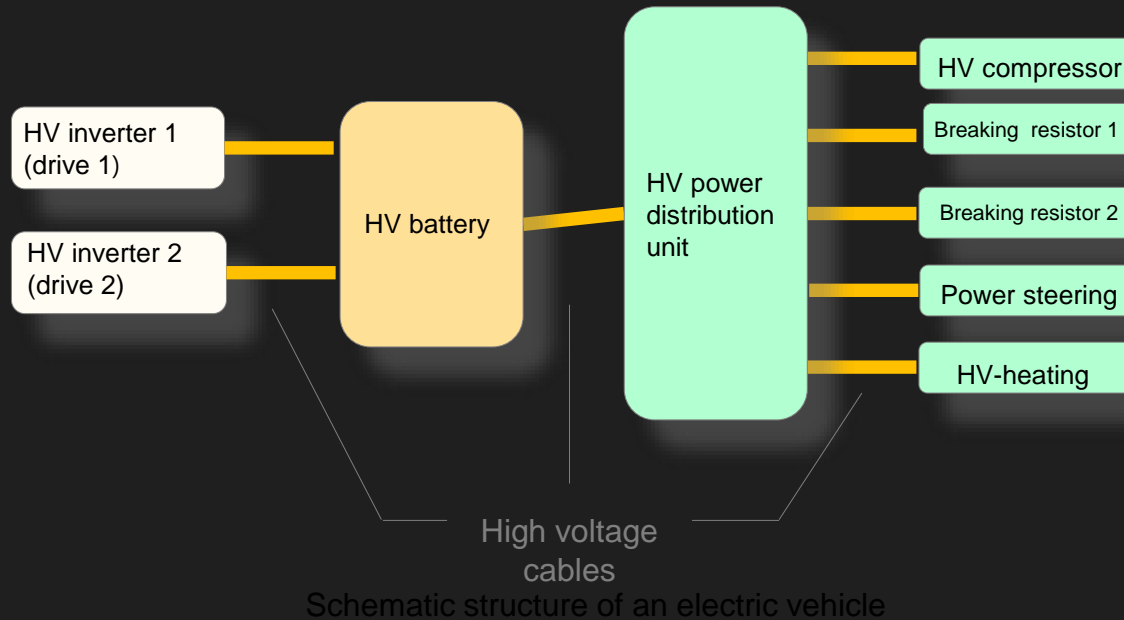
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Electric and hybrid vehicles



- Electric or hybrid vehicles are becoming more and more common on the roads
- Manufacturers have high requirements for the insulation level over the entire lifetime (EOL = 15 years)
- Factory standards such as Mercedes MBN LV 123, BMW GS 95023 or Volkswagen VW 80303 must be complied with

Technical challenges



In addition to the parallel connection of the individual components, there is also the aspect of material wear over the entire life cycle, penetrating moisture, contamination and developing corrosion during the operation of an electric vehicle.

Therefore, vehicles must have much higher insulation values when delivered in order to function safely throughout their entire life cycle. Insulation values of up to 10 GΩ (gigohms) are therefore not uncommon.

- The parallel connection of the individual HV components reduces the overall resistance (insulation value)

$$\frac{1}{R_{Ges}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \dots + \frac{1}{R_N}$$

Standards requirements

- DIN EN 50191 (VDE 0104): 2011-10
Erection and operation of electrical test equipment
- DIN VDE 0100-410 (VDE 0100-410):2018-10
Low voltage electrical installations
Part 4-41: Protection for safety - Protection against electric shock
- DIN EN 61557-8 (VDE 0413-8):2015-12
Electrical safety in low voltage distribution systems up to AC 1000 V and DC 1500 V
Equipment for testing, measuring or monitoring of protective measures
Part 8: Insulation monitoring devices for IT systems

plus factory standards such as:

Mercedes MBN LV 123

BMW GS 95023

Volkswagen VW 80303

etc.

Requirements for the testing process

- Normative specifications for the test station must be fulfilled
- Factory standards or specifications by the car manufacturer must be fulfilled
- Manufacturers of HV components must test during development
- Insulation values of the HV components must also be fulfilled at the end of the life cycle (EOL=15 years), as the HV components are affected by ageing processes, moisture and contamination
- This results in very high initial values in the 3-digit megohm range up to 10 gigohms
- Measured values and results should not be available randomly but continuously

ISOMETER® isoHR685W or isoHR1685 from Bender

isoHR685W – High Resistance Application

Power supply

Connection L1-3,
PE

Status LED/display

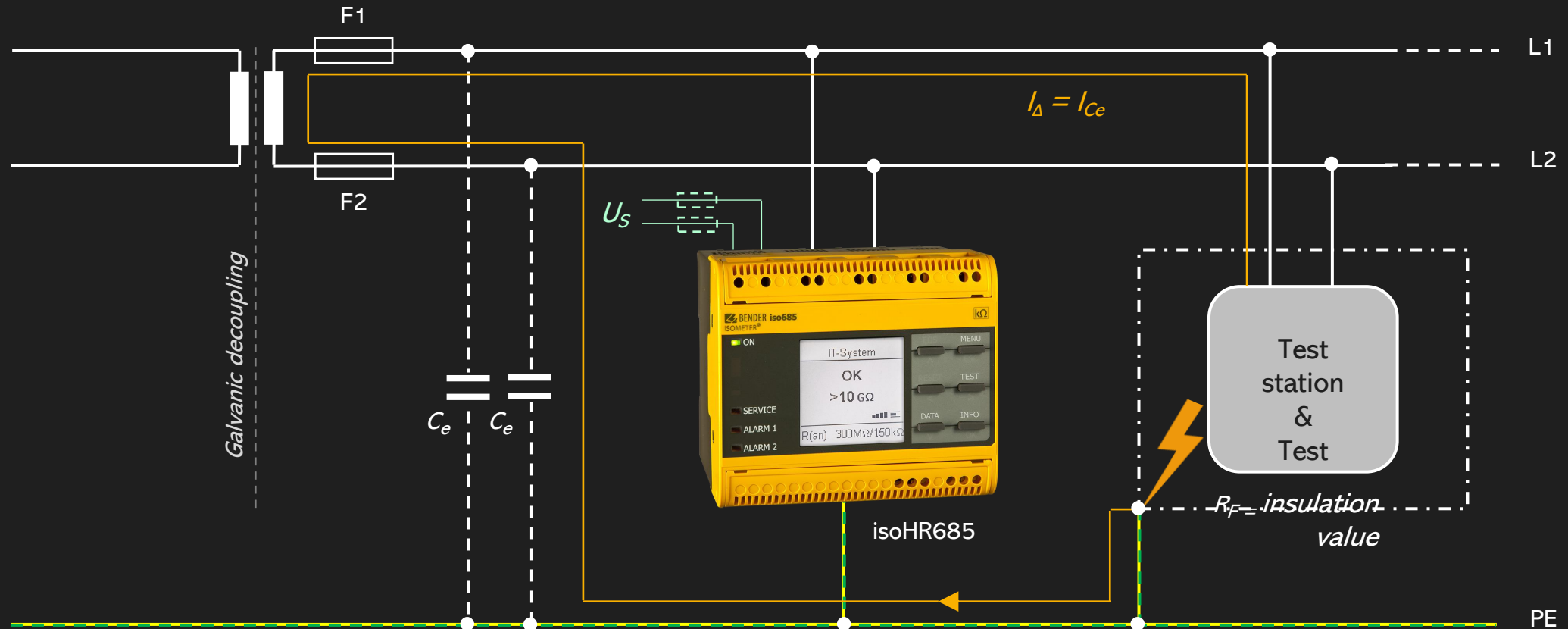
Control buttons

Web server,
Modbus TCP, BCOM

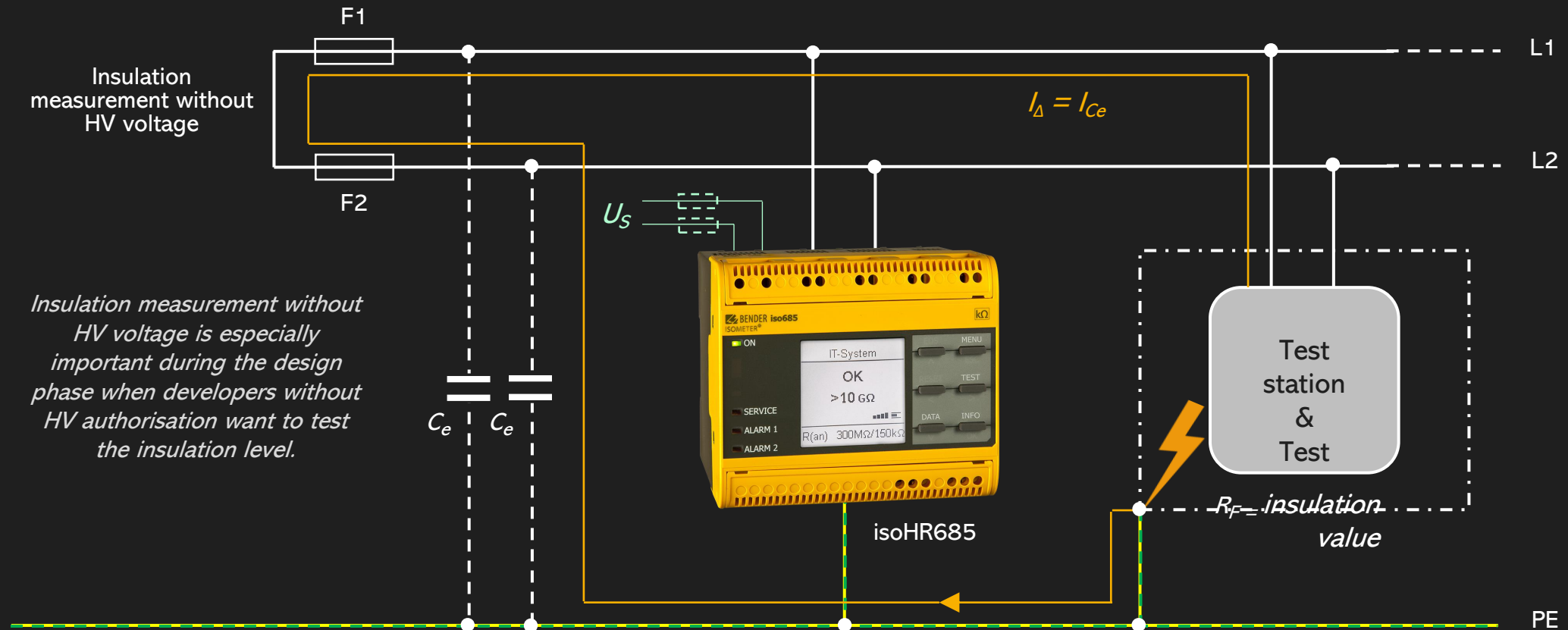
Alarm relay



isoHR685W – High Resistance Application (test station)



isoHR685W – High Resistance Application (test station)



- ISOMETER® isoHR685W or isoHR1685 for high-voltage test stations
- Insulation measurement/monitoring in the gigohm range (also without HV voltage)
- Continuous measurement value acquisition during the test process or during development (DV/PV)
- No need to interrupt the simulation of life cycles for HV components for insulation monitoring
- Advice and commissioning by Bender application engineers



Bender GmbH & Co. KG
Londorfer Straße 65
35305 Grünberg

Telefon +49 6401 807-0
Telefax +49 6401 807-259
E-mail info@bender.de
Internet www.bender.de