APAC Sales Meeting
Renewable energies | Photovoltaics

Dec 2022

BU-I-BD / Bender GmbH & Co KG
Peter Neumann

What have we done?

Where did we get our information from

Which architectures are there

and what possibilities do we have to measure them?

Insulation fault location

Which devices are suitable for this purpose?

isoPVxxx Portfolio

Which devices do we have?

isoPV1685xxx vs. LK5896

INTERNAL ONLY!!

IRDH275(PV) vs. LK5896

INTERNAL ONLY!!

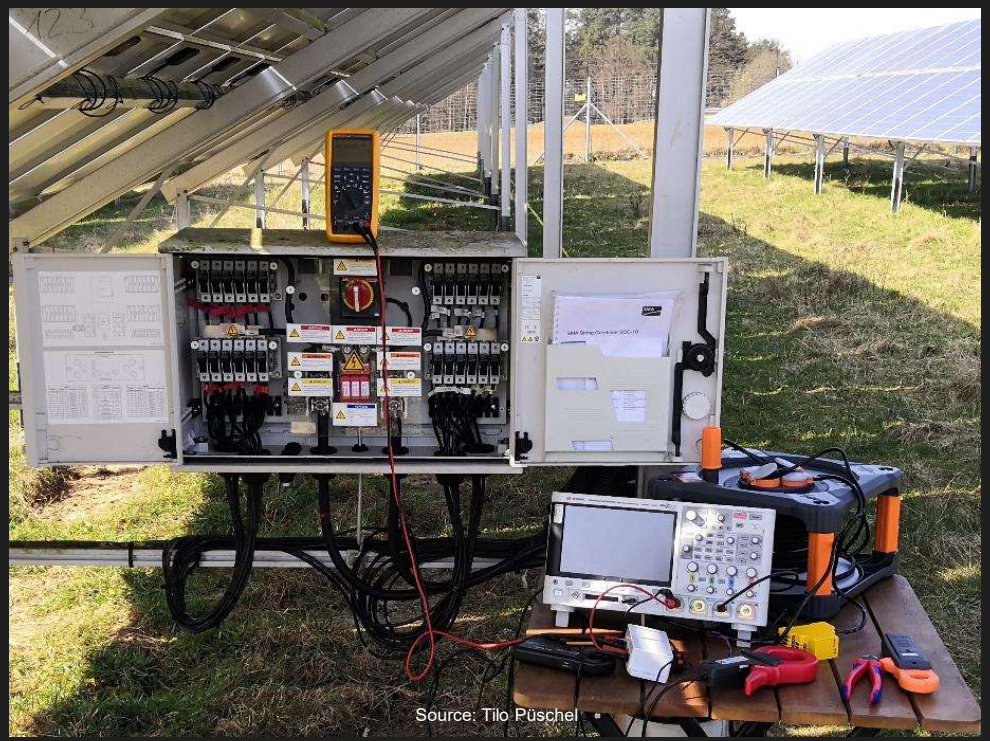
What have we done?

Where did we get our information from

Getting information

We have visited customers, taken measurements and tested our products.

Source: Tilo Püschel


Source: Tilo Püschel

Getting information

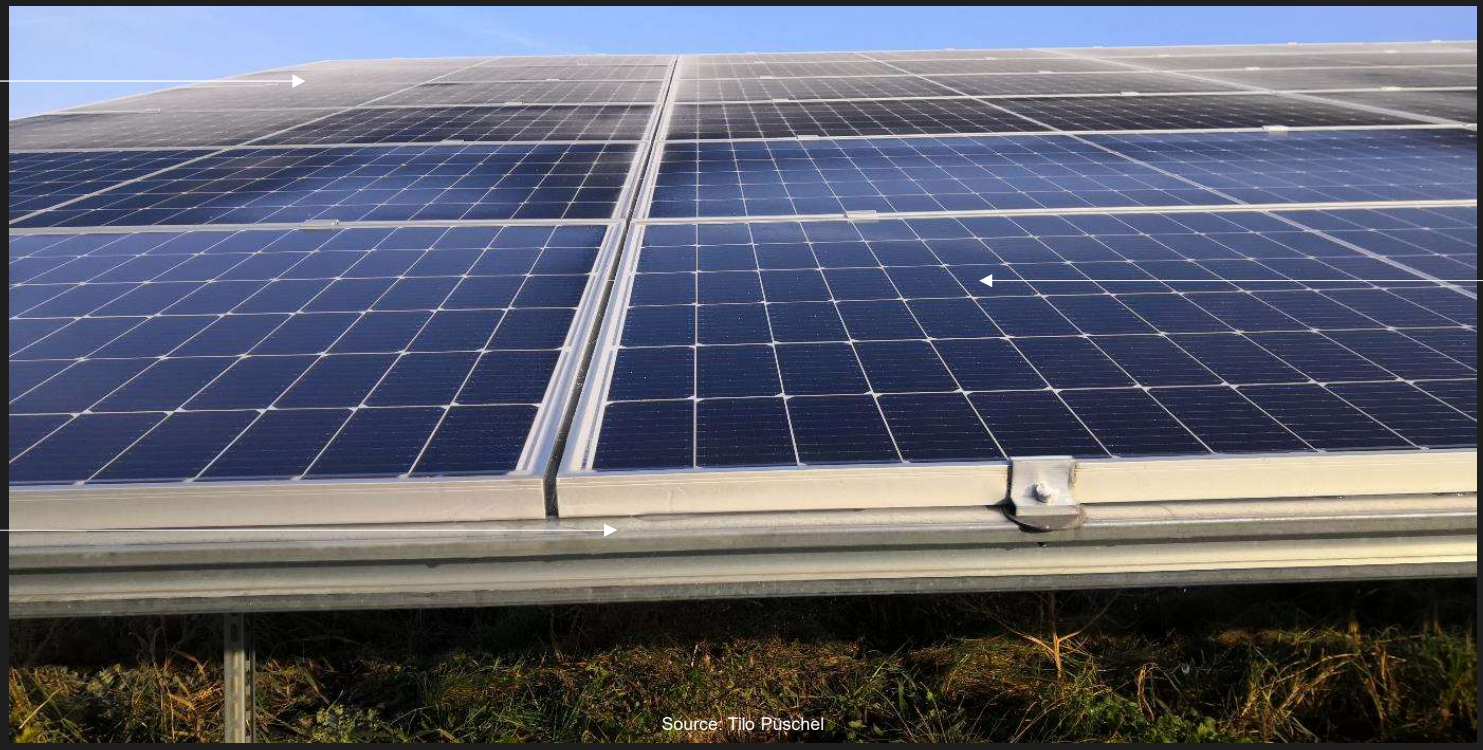
PV plants in:

- Nardò (Italy)
- Walddrehna (Germany)
- Teilenhofen (Germany)

Getting information

We dealt with the challenges and looked for optimal solutions.

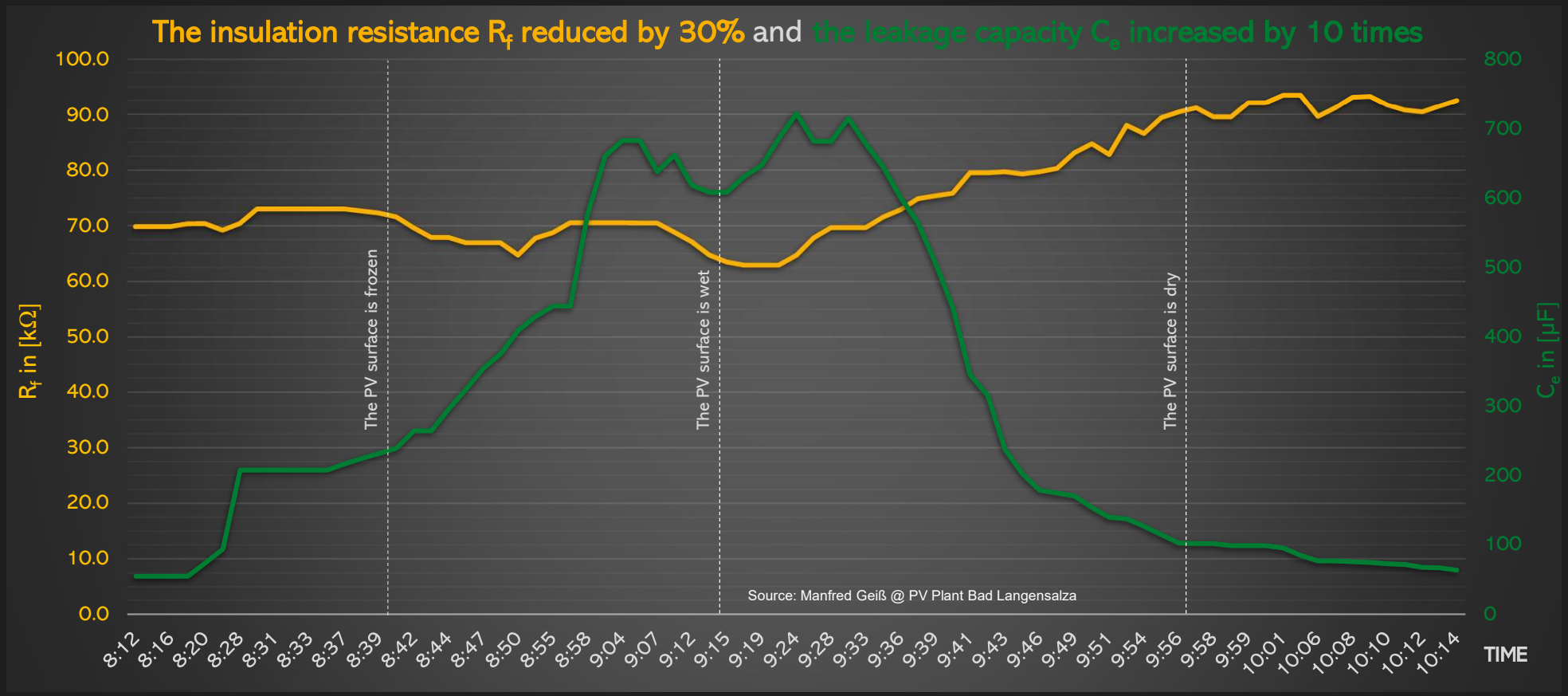
The PV surface is frozen



The PV surface is dry

Drops of water

Getting information



Getting information

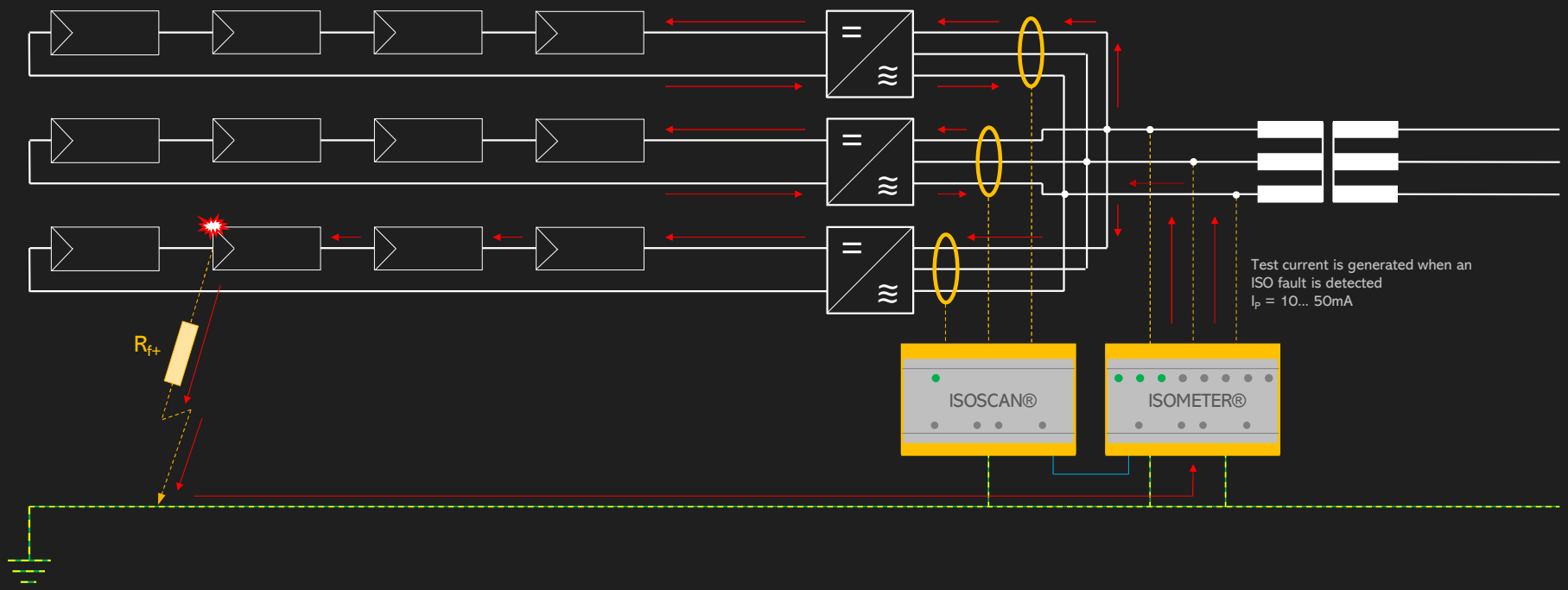
How does the branch think and work and how has the technology changed?

Which architectures are there

and what possibilities do we have to measure them?

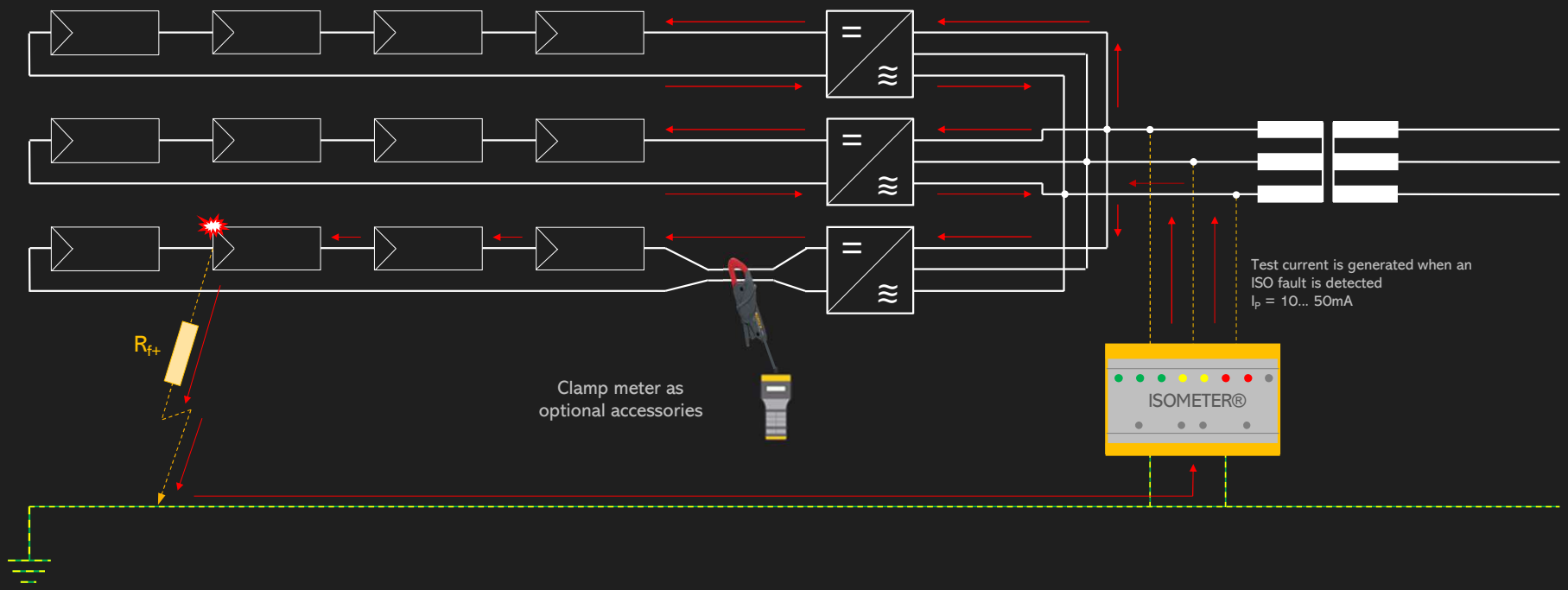
String inverters

Insulation measurement and automated troubleshooting of PV systems with string inverters



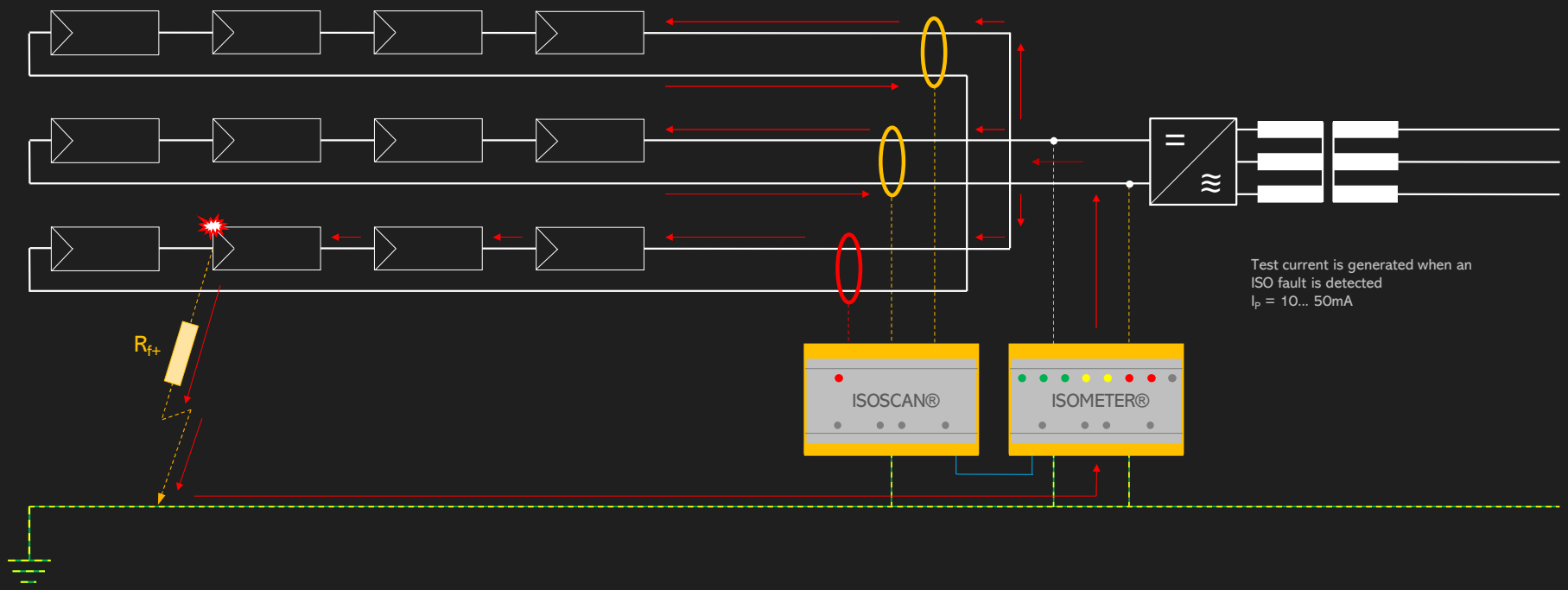
String inverters

Insulation measurement and automated troubleshooting of PV systems with string inverters



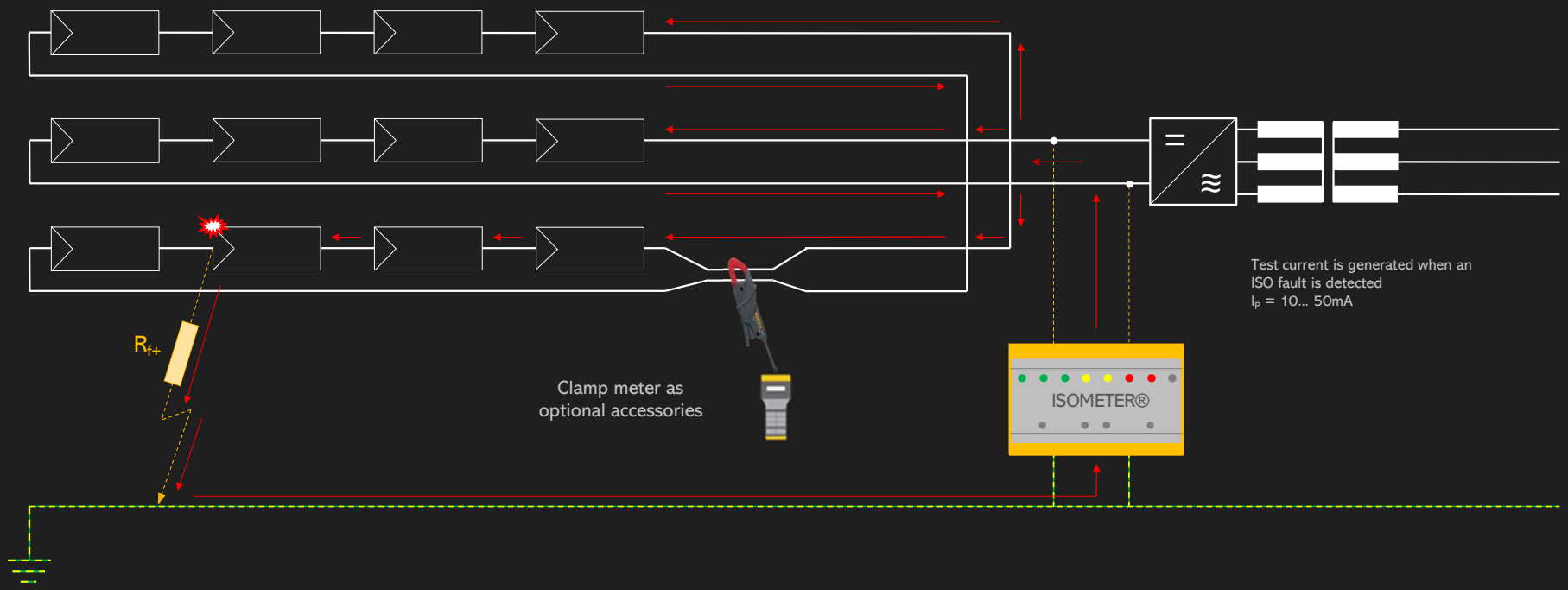
Central inverters

Insulation measurement and automated troubleshooting of PV systems with central inverters



Central inverters

Insulation measurement and automated troubleshooting of PV systems with central inverters



Insulation fault location

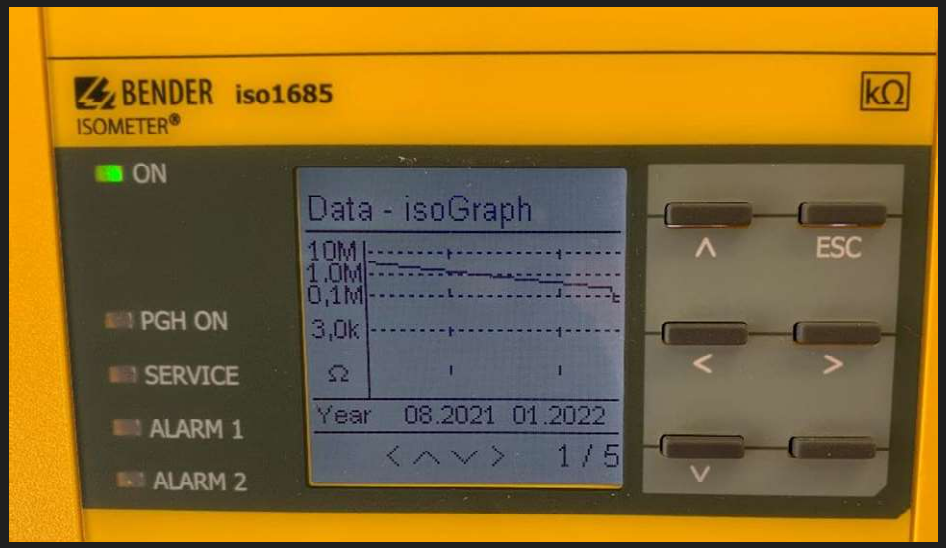
Which devices are suitable for this purpose?

Insulation fault location

Automated troubleshooting (fixed installation) for large-scale PV systems up to several MW

Type CTAC 20 … 210mm

Type EDS 440



Insulation fault location

troubleshooting of PV systems: Optional clamp meter

Please note that the negative pole and the positive pole are clamped by the clamp meter

Insulation fault location

- We found an Insulation fault!

PV Installation

Insulation monitoring devices for large-scale PV systems up to several MW

Low class

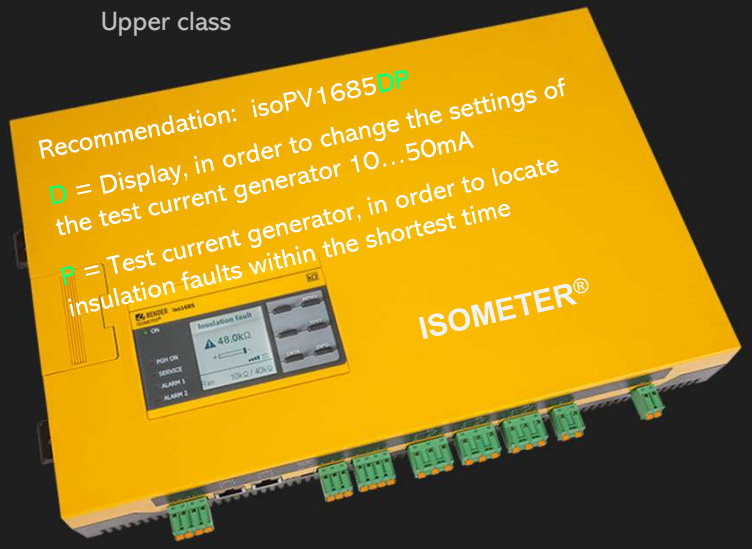
isoPV425 + AGH420
DIN rail device
Voltages AC 0...690 V
Voltages DC 0...1000 V

Medium class

WORK IN PROGRESS

More details are given
at the end of this session.

Upper class

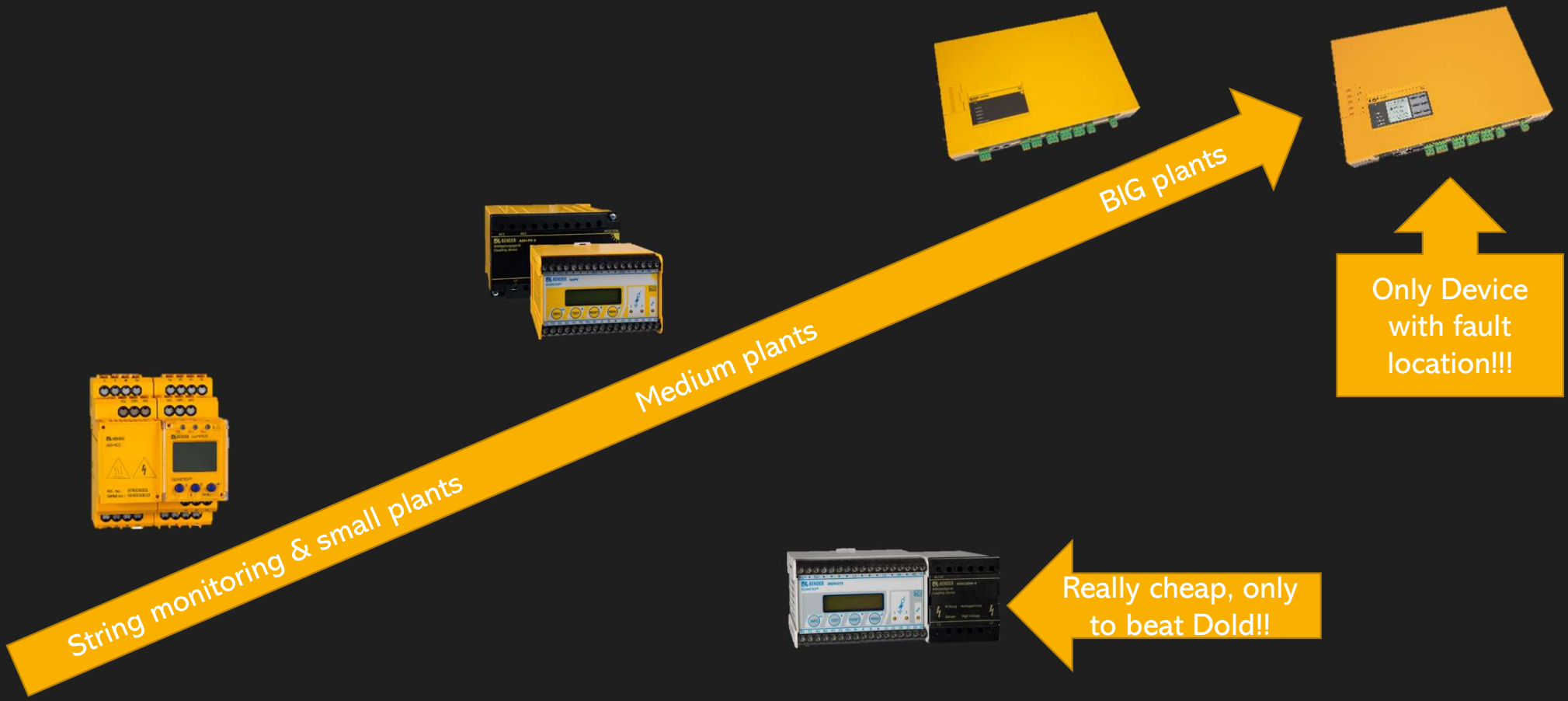


isoPV1685DP with display and test current generator
Mounting: e.g. Control cabinet door
Voltages AC 0...1000 V
Voltages DC 0...1500 V

isoPVxxx Portfolio

Which devices do we have?

Isometer® for PV-applications



isoPV425+AGH420

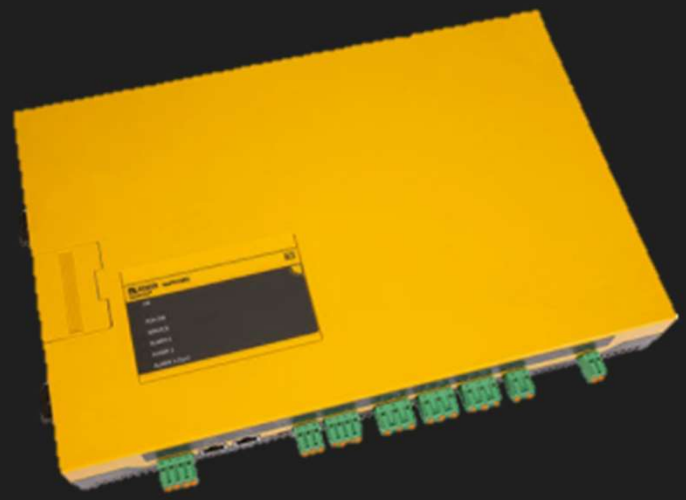
- AC 690V
- DC 1000 V
- ≤ 500 µF
- For small PV-applications

isoPV+AGH-PV

- AC 793 V
- DC 1100 V
- ≤ 2000 µF
- Display
- RS-485 interface (BMS)

isoPV1685RTU

- AC 1000 V
- DC 1500 V
- ≤ 2000 µF
- Modbus RTU interface
- ~20.000 in use (SMA)

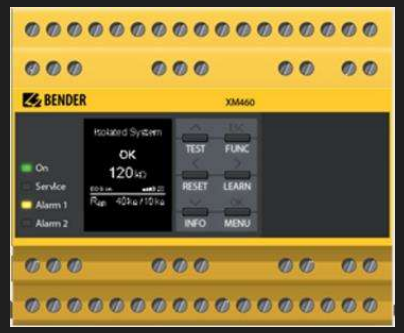


isoPV1685DP

- AC 1000 V
- DC 1500 V
- up to 4000 µF
- Display
- Insulation fault location (PGH)

New Mid-Class PV-IMD „Triton“

- AC 1000 V
- DC 1500 V
- ≤ 4000 µF
- With or w/o Display
- NFC, Modbus, 4…20mA
- WORK IN PROGRESS



IRDH275 (PV)

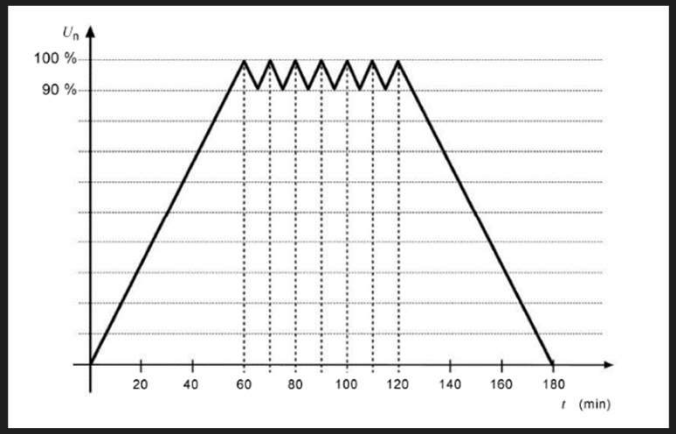
- AC 1150 V
- DC 1760 V
- Up to 3000 µF
- !! Cheap to beat Dold !!

Overview isoPVxxx

Work in progress…

	isoPV425	isoPV+AGH-PV	IRDH275(PV)	isoPV1685RTU	isoPV1685DP	Triton
Voltage AC (V)	690	793	1150	1000	1000	1000
Voltage DC (V)	1000	1100	1760	1500	1500	1500
Capacitance (µF)	500	2000	3000	2000	4000	4000
Min. resp. value	1 kΩ	200 Ω	1 kΩ	200 Ω	200 Ω	200 Ω
Display	Yes	Yes	Yes	No	Yes	Yes
Fault location	No	No	No	No	Yes	No
Interface	BMS, RTU	BMS	RS-485	BMS, RTU	BMS, RTU	RTU, NFC
Analogue output	No	4-20mA	0-400µA	No	No	4-20mA

IMPORTANT – PV-label



- IEC 61557-8 Annex C.2.4.3

- PV-IMD shall perform as intended under the dynamic reference characteristics of the d.c. voltage of the PV system

- IMDs which fullfill Annex C get this marking

Competitors

What competitorts do you know?

Competitors (Survey)

- Which competitors do you know?
  - ABB
  - Siemens
  - Socomec
  - Dold
  - Schneider
  - LS electric
  - Other (please specify)

isoPV1685xxx vs. LK5896

INTERNAL ONLY!!

What disadvantages Dold has

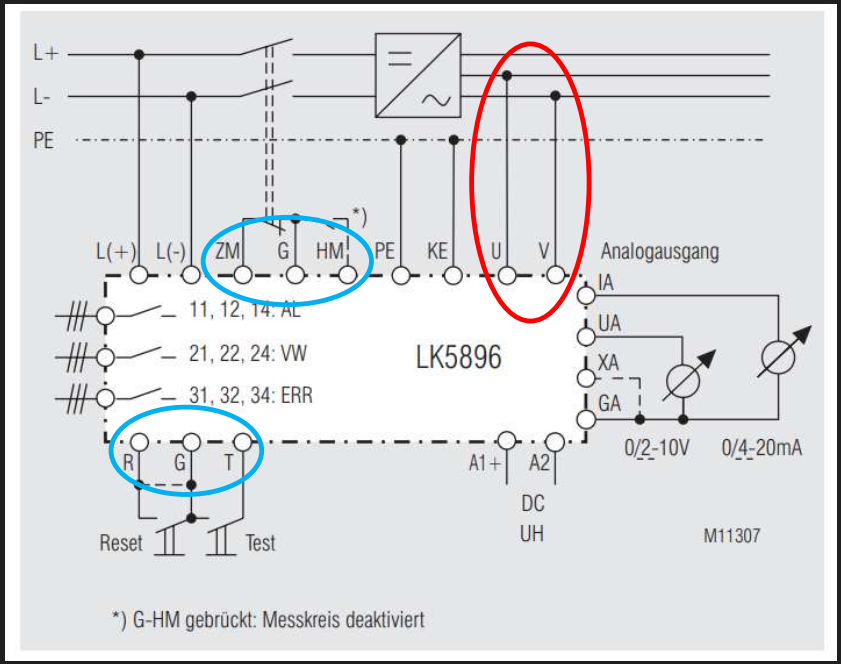
- No UL Approval
  - Only up to AC/DC 600 V!
- With higher capacitances between L+ / L-, the wire detection functions worse or not at all!
  - Especially parallel lines should be prevented over larger distances
- Response inaccuracy +/-1.5kΩ @1 kΩ
  - That is +/- 150%
- Operating temperature
  - +60°C mounted away from heat generating components
  - +45°C mounted without distance to other devices

isoPV1685 vs. LK5896

	isoPV1685xx	LK 5896
Max. voltage (DC)	1500 V +6% = 1590 V ✓	max.1500 V
Max. capacitance	4000 µF ✓	3000 µF
Min. response value	0.2 kΩ ✓	1 kΩ
Relative uncertainty	+/- 200 Ω ✓	+/- 1.5 kΩ → 150%!
Max. operating temp.	70°C ✓	45°/ 60°C*
UL approval (iso1685RTU only)	UL508 up to AC 1000 V / DC1500 V ✓	AC/DC max. 600V!
Interface	BMS, Modbus RTU, CAN ✓	No interface

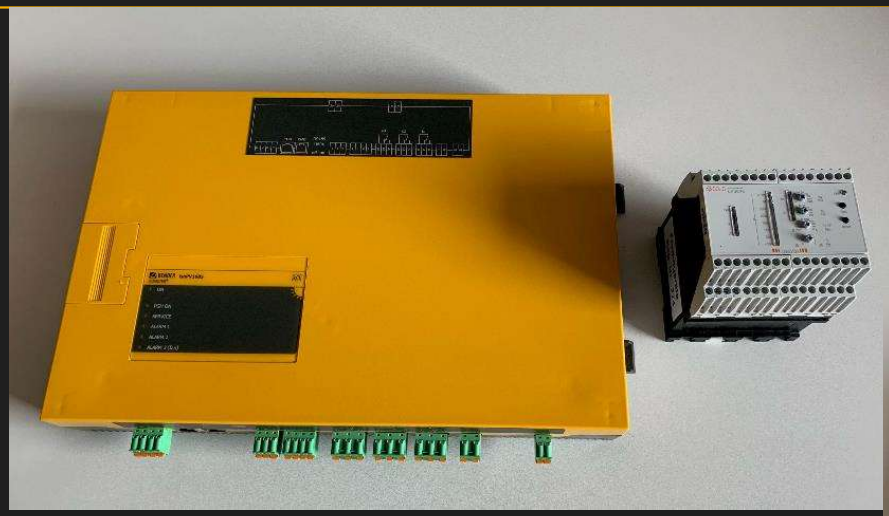
* = 45°C (unit mounted away from other units) 60°C (unit mounted away from heat-generating components)!!!!

Weaknesses

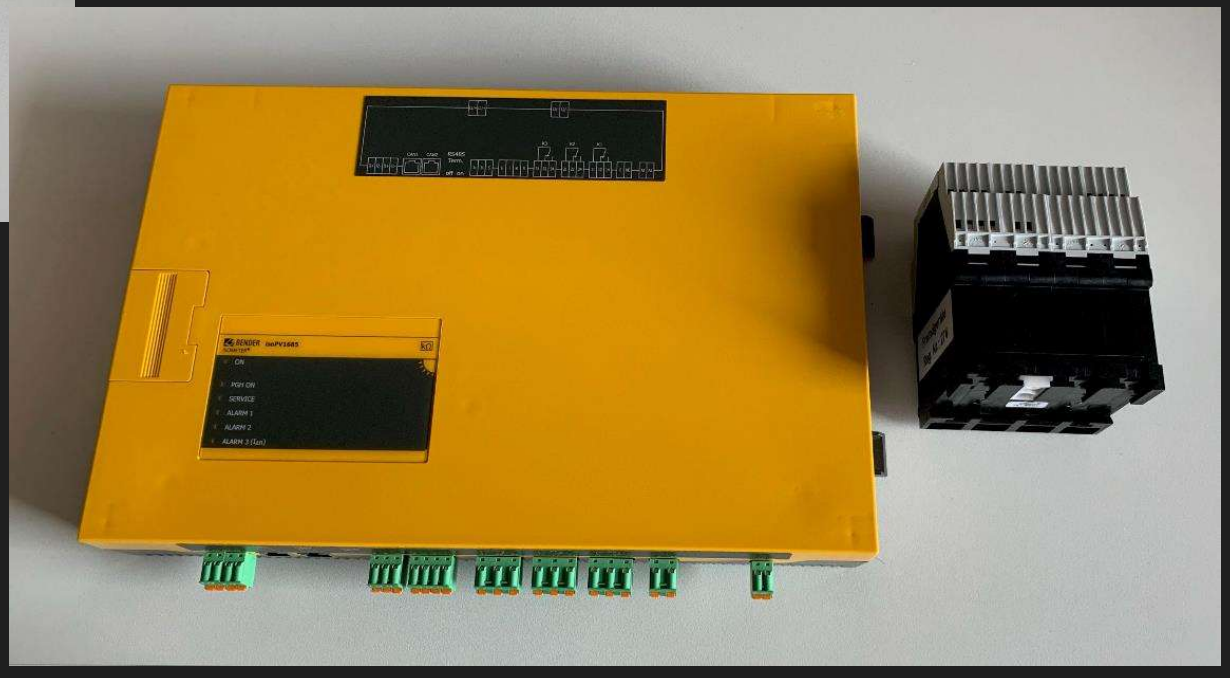


- U & V
  - Max. AC/DC 690 V
    - UL = max. AC 600V!
  - Max. 10 µF
- ZM, G, HM & R, G, T
  - Not galvanically separated!
  - These are connected to L+/L-!

How can they build such a small device?!



… or – why is our device that big?



The physics will tell us

	Bender isoPV1685xxx	Dold LK5896
Dimensions (mm)	401,5 * 246 * 55,7	90 * 90 * 121
Volume (cm^3)	5.501,4	980,1
Ri (Internal resistance)	70 kΩ	280 kΩ

Due to this small dimensions the Dold device can‘t measure as far down as the isoPV1685.

Example: Voltage = DC 1500 V
Dold R_i = 280 kΩ → I = 5,35 mA → P = 8,035 W
Bender R_i = 70 kΩ → I = 21,42 mA → P = 32,14 W

But, why is the internal resistance of the iso1685 so ”low”?

That’s why we can Measure down to 200 Ω whereas Dold can only measure down to 1 kΩ!

IRDH275(PV) vs. LK5896

INTERNAL ONLY!!

IRDH275(PV) vs. LK5896

	IRDH275(PV)	LK 5896
Max. voltage (DC)	max. 1760 V ✓	max.1500 V
Max. capacitance	3000 µF	3000 µF
Min. response value	1 kΩ	1 kΩ
Relative uncertainty	+/- 15%	+/- 1.5 %
Max. operating temp.	55°C ✓	45°/ 60°C*
UL approval	UL508 up to AC 1150 V / DC 1600 V ✓	AC/DC max. 600V!
Interface	RS485, isoData ✓	No interface

* = 45°C (unit mounted away from other units) 60°C (unit mounted away from heat-generating components)!!!!

Thank you for your attention!

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