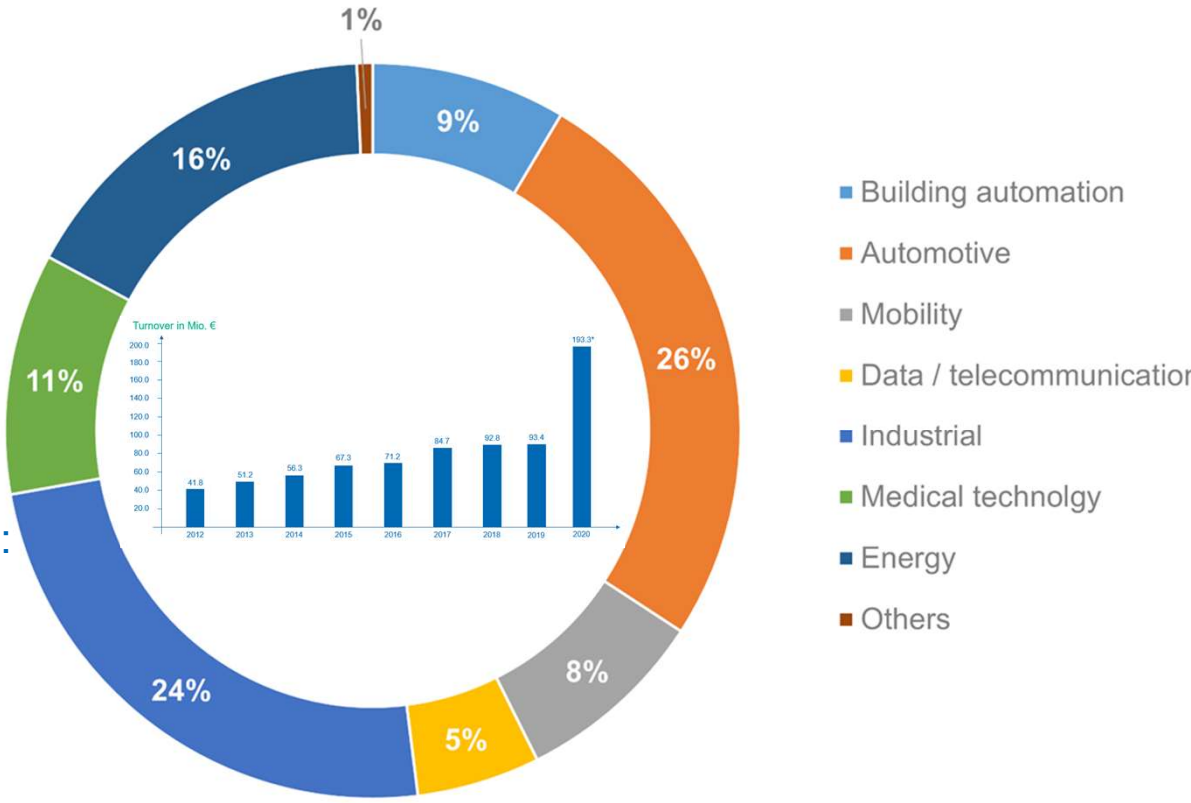
duotec.

ABOUT DUOTEC

COMPANY PRESENTAION IN 1 SLIDE

- Founded 1965 by Hans & Werner Turck, & family ownership until today
- Natural growing up to today: Headquarter in Halver, first site in USA, Interprox CH, subsidiaries in Germany, Mexico and in acqu.
- Acquisitions: mlands, WIS, and Shareholdings: SmartNanotubes, Quantum technologies
- Global footprint: 842 Employees, 5 Production locations, 3 Development sites
- Turnover 2020: 193.3 M€
- EMS, E²MS, ODM platforms & technologies



OUR MOTIVATION

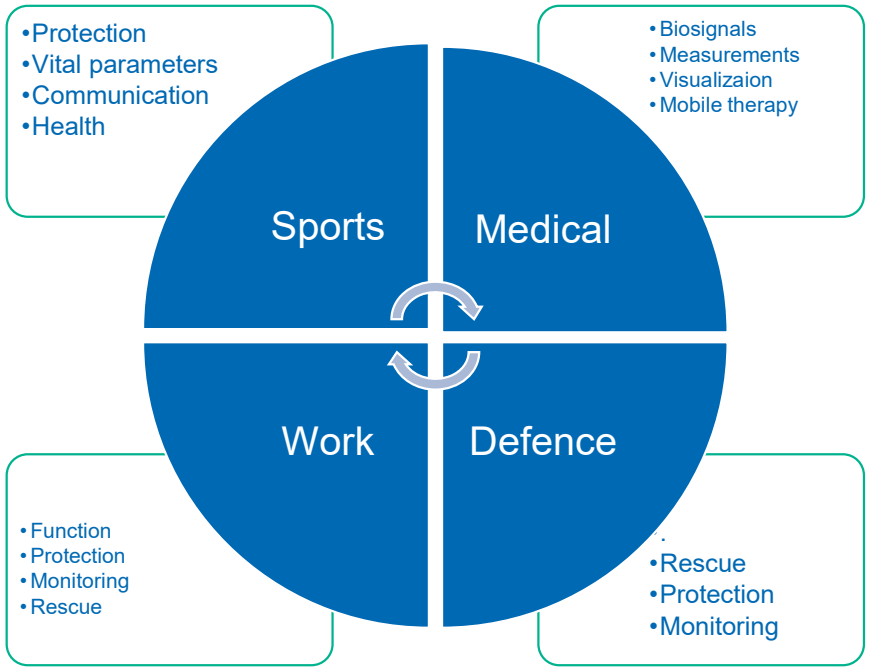
Smart Texiles…
The world of hard electronics meets the soft world of textiles!

Our existing expertises already meets most requirements today:

- Comfort: miniaturization, weight reduction, max. Lifespam:
  - Protection of electronics by overmolding
  - Resistance to environmental influences and various media
  - Demands lower than for autoclavability

- Assembly and connection technology and Interface technology: Full and partial overmolding of PCBAs, cables and metal parts

Market segments & edge requirements

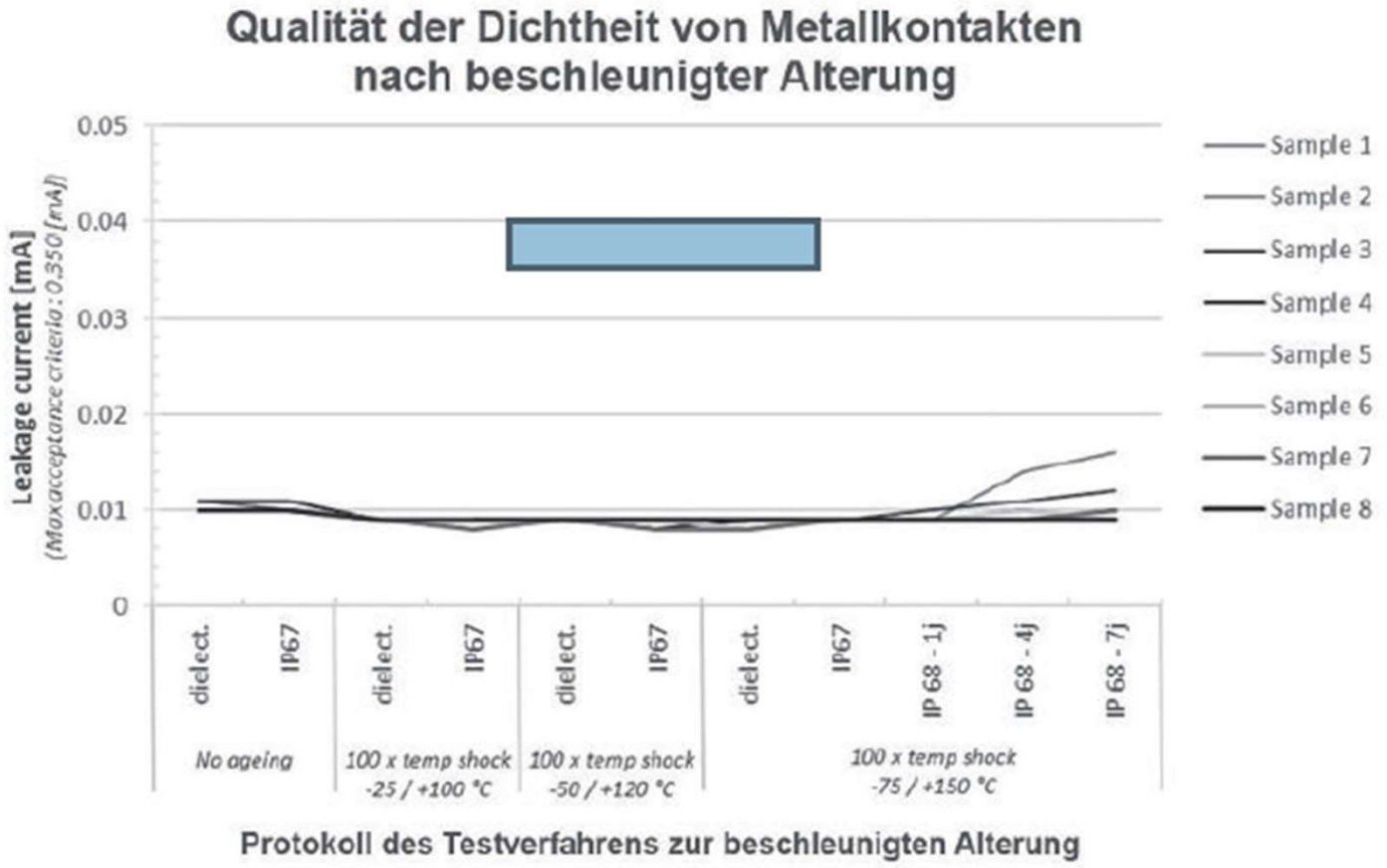


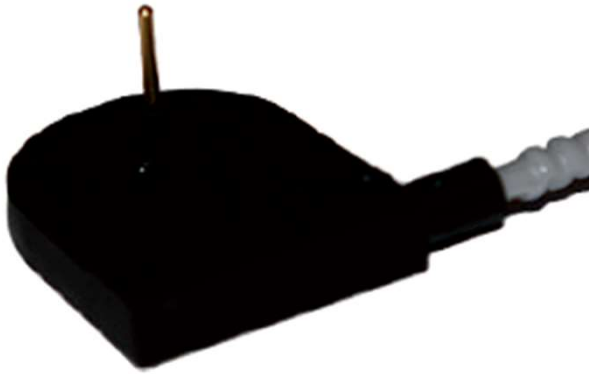
WHERE DO WE COME FROM?

...TO INVEST IN SMART TEXTILE SUITABLE ELECTRONICS (STSE)

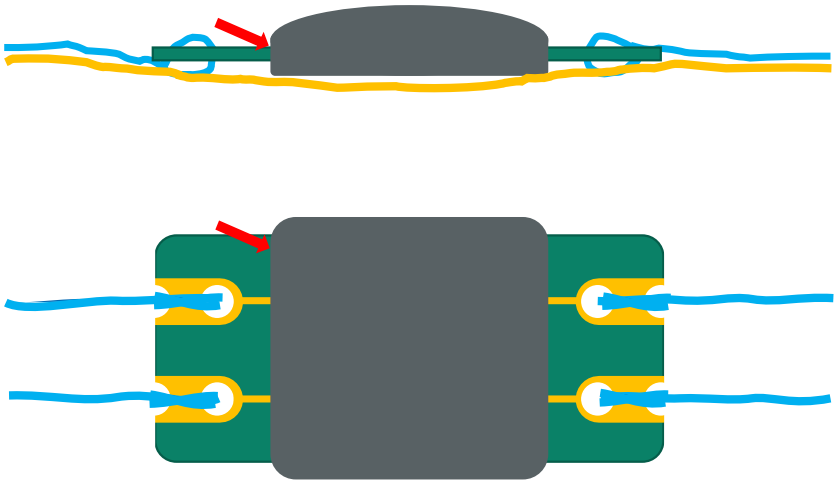
- Sensors factory for global market (mechanical + electronical engineering)
  - hard and soft overmolded
  - miniaturized and CoB (Chip on Board + bonding)
- Industry and automotive requirements
  - high IP Class,
  - tight cables and strands, pins & connector faces,
- Medical requirements
  - acc. to DIN EN 13485 (clean room class 5 and 7)
  - autoclavable (>> 1.000 cycles!) 0 – 2 bar, up to 134°C hot steam

STRESS TESTS





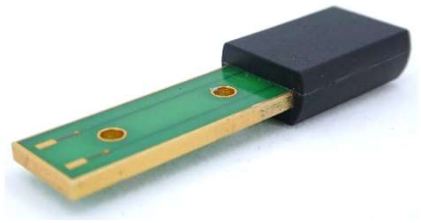
TEXTILE INTEGRATION OF OVERMOLDED MODULES

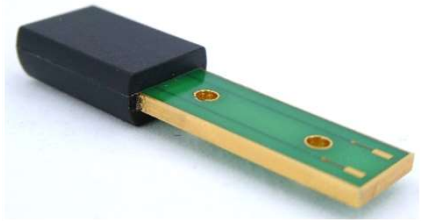


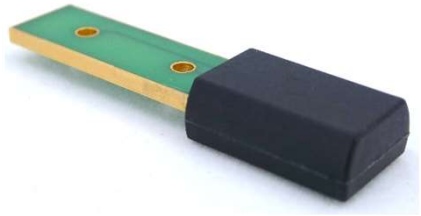
Technology set up depends on application:

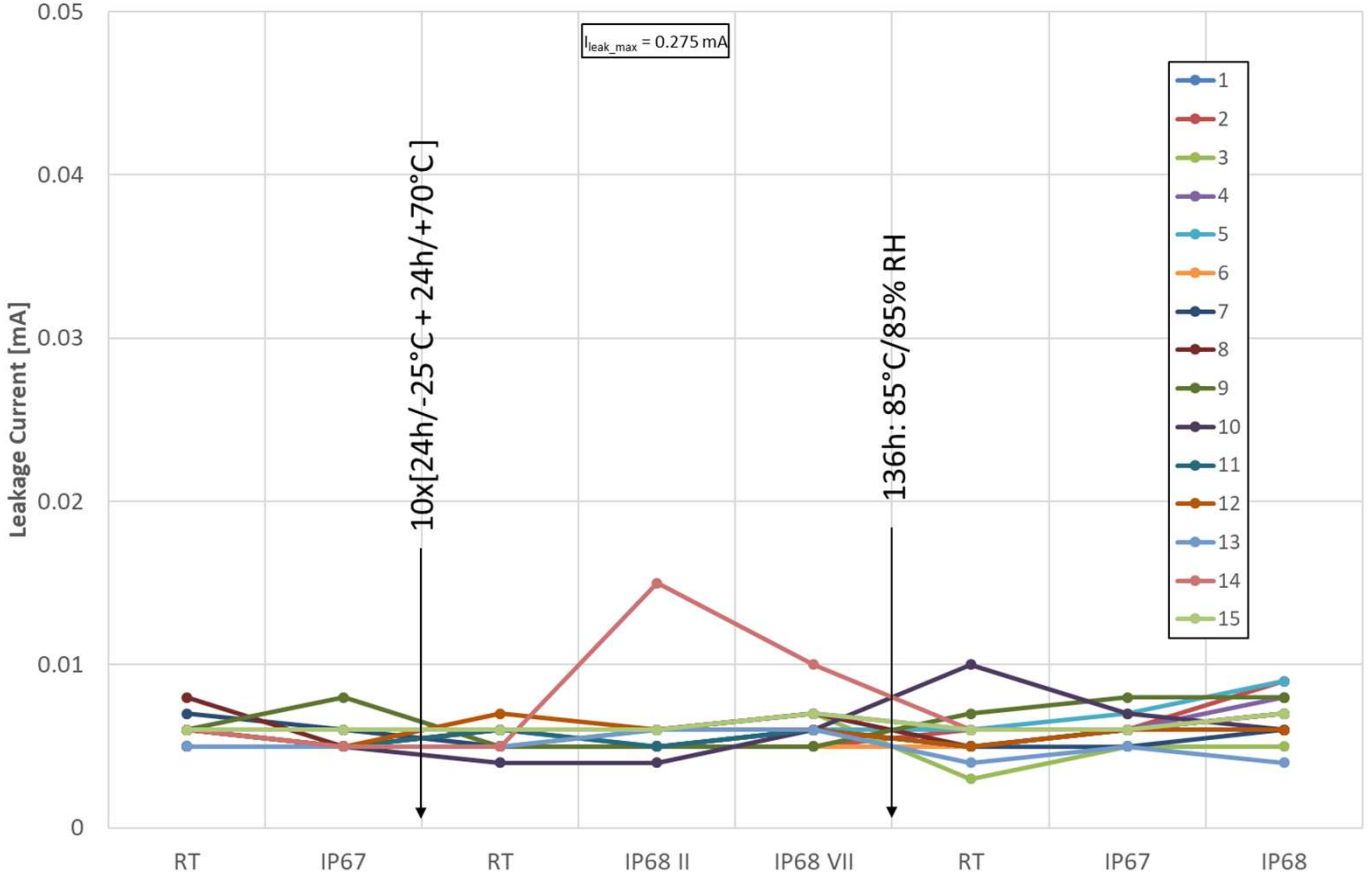
- Topology: single, dasy chain, star
- I²C bus, 4 electrical conductor
- Textile, functional layer (plus top and/or lining fabric),
- Conductive yarn, embroidered contacts and wires
- Standard PCB
- Partly electronic protection, overmolding
- Miniaturization: thin and scalable in X & Y
- Suitable for **automated** processing

TECHNOLOGY RESULTS / STRESS TESTS









ZSK E-TEX TECHNOLOGY – IMPACT OF PCB GEOMERY

(-) Loose connections – Stitches need to be tighter to the board

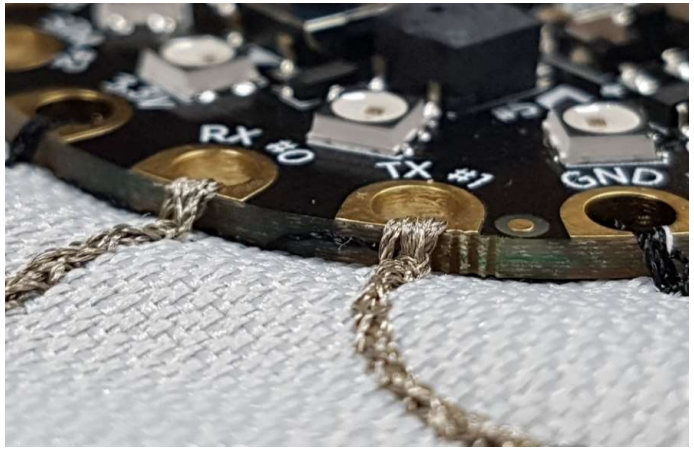
(-) Conductive coating does not cover the edges

(-) Sharp edges → Friction on conductive coating

(-) Size of connection holes too big → movement in the connection → Failure

(-) Thick board geometry

(-) Electronic parts are in embroidery area



(+) Tight connections - Stitches are tighter to the board

(+) Conductive coating covers the edges

(-) Sharp edges → Friction on conductive coating

(-) Size of connection holes too big → movement in the connection → Failure

(-) Thick board geometry

(-) Electronic parts are in embroidery area

ZSK E-TEX TECHNOLOGY – IMPACT OF PCB GEOMERY

(+) Tight connections - Stitches are very tight to the board

(+) Specific outer line design for the stitches

(+) Conductive coating covers the edges

(+) No sharp edges

(+) Small connection hole

(+) Very thin board geometry

(+) No electronic parts are in embroidery area

<u>Successful connection (Relaxation + Resistance) depends on:</u>

Geometry,

Diameter,

Distance

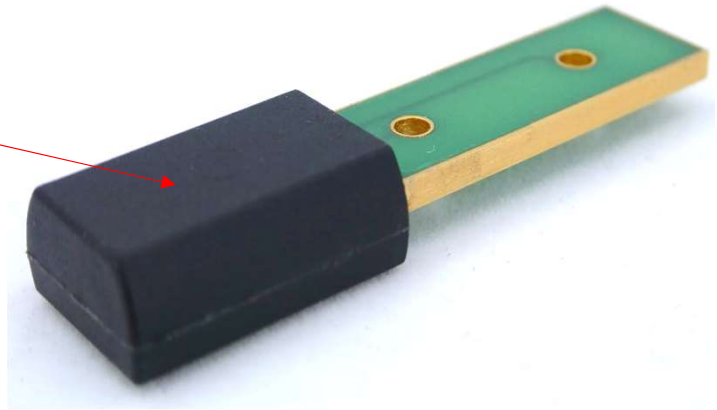
Needle size

Conductive yarn characteristics

AT A GLANCE

Summary

- 1 – „endless“ no. of modules
- Intermediate connection by embroidery technology
- Contact geometry by ZSK
- Integration of various sensors: humidity,force, acceleration, temperaure, even tight openings up to die (e.g. pH)
- Standard PCB
- Electronic protection by overmolding, biocompatible
- Fully washable
- Media tight and media resistable
- Miniaturized, weight: appr. 5-10 g



SEE YOU AGAIN!

Turck duotec GmbH - Halver
Humboldtstraße 8a,
D-58553 Halver
P: +49 (0) 2353 1390-0
F: +49 (0) 2353 1390-6519
E-Mail: halver@turck-duotec.com

Thomas Liewald
Product Management for Smart Textile Suitable Electronics
p: +49 (0)170 9670 216
E-Mail: t.liewald@turck-duotec.com

ABOUT DUOTEC