



## Power Analyzer / Digital Power Meter

### Yokogawa WT 3000

- highly accurate power and efficiency measurement

#### Specification:

- basic measurement accuracy: 0.01 % of measured value
- frequency range 0.1 Hz bis 1 MHz
- 4 input channels
- signal analysis, FFT-analysis, flicker analysis, cycle-by-cycle meas. Function
- Storage of sampled signal data
- interfaces: Ethernet, RS-232, USB, GP-IB



Source: Yokogawa

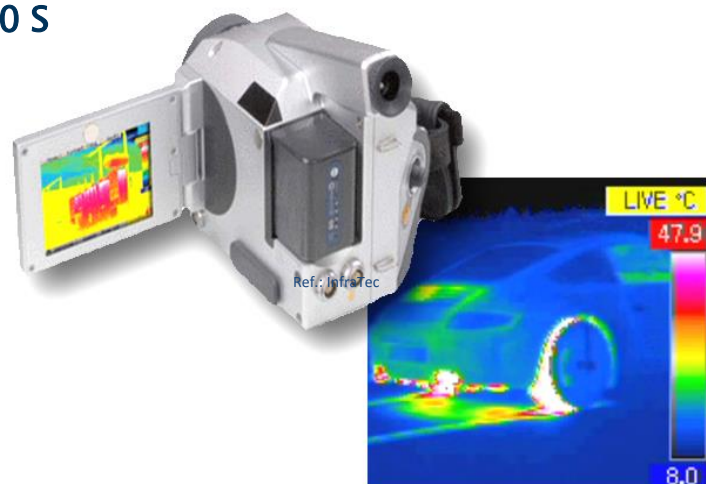
## Thermography System

### InfraTec VarioCAM hr Inspect 680 S

- analysis of surface temperatures in dynamic and static processes

#### Specification:

- resolution (detector) 640x480 pixel
- spectral range 7.5...14  $\mu\text{m}$
- meas. range -40...1200  $^{\circ}\text{C}$
- thermal resolution <0.03 K
- Recording with 0.25...60 Hz



Source: InfraTec



## Electro-chemical analysis equipment

- test of battery systems



Source: Vacuum atmospheres BioLogic und Comsol

## Electric machines, drives and power electronics lab

- E-machines/drives test benches
- vehicle grid simulator
- power electronics test benches
- concentricity analysis
- digital power analysers
- dynamic electronic sources and loads for experimental simulation of effects in vehicle grids battery tester
- test setups for characterisation of power semiconductor devices under lab and climate conditions

### Specifications:

- high voltage source 3kV/10A
- low voltage source 15V, 3000A
- 2 rotating ac-converters 10-100Hz, ... 920V, 100kVA
- 2 rotating dc-converters ... 460V, ... 125kW
- bi-directional dc-source up to 1.200V
- 3 bi-directional dc - sources 30kW, up to 750V
- bi-directional, high-dynamic dc-source 40kW
- 1 ~ac-source up to 6kHz (sinus), 5kW
- passiv loads





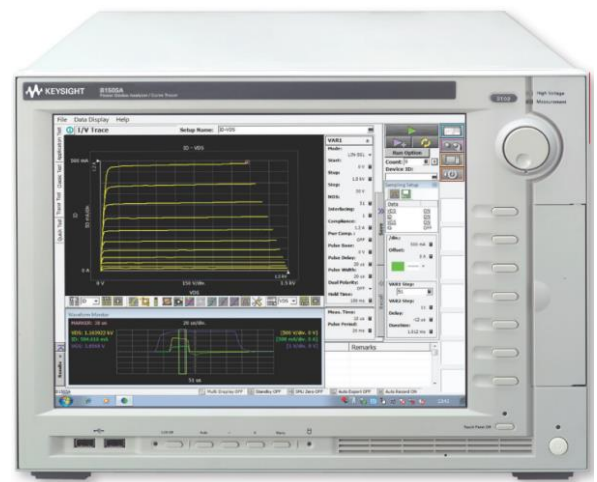
Flexible analysis system for the static characterization  
of power electronic components

## Keysight Technologies

### B1505A Power Device Analyzer/Curve Tracer

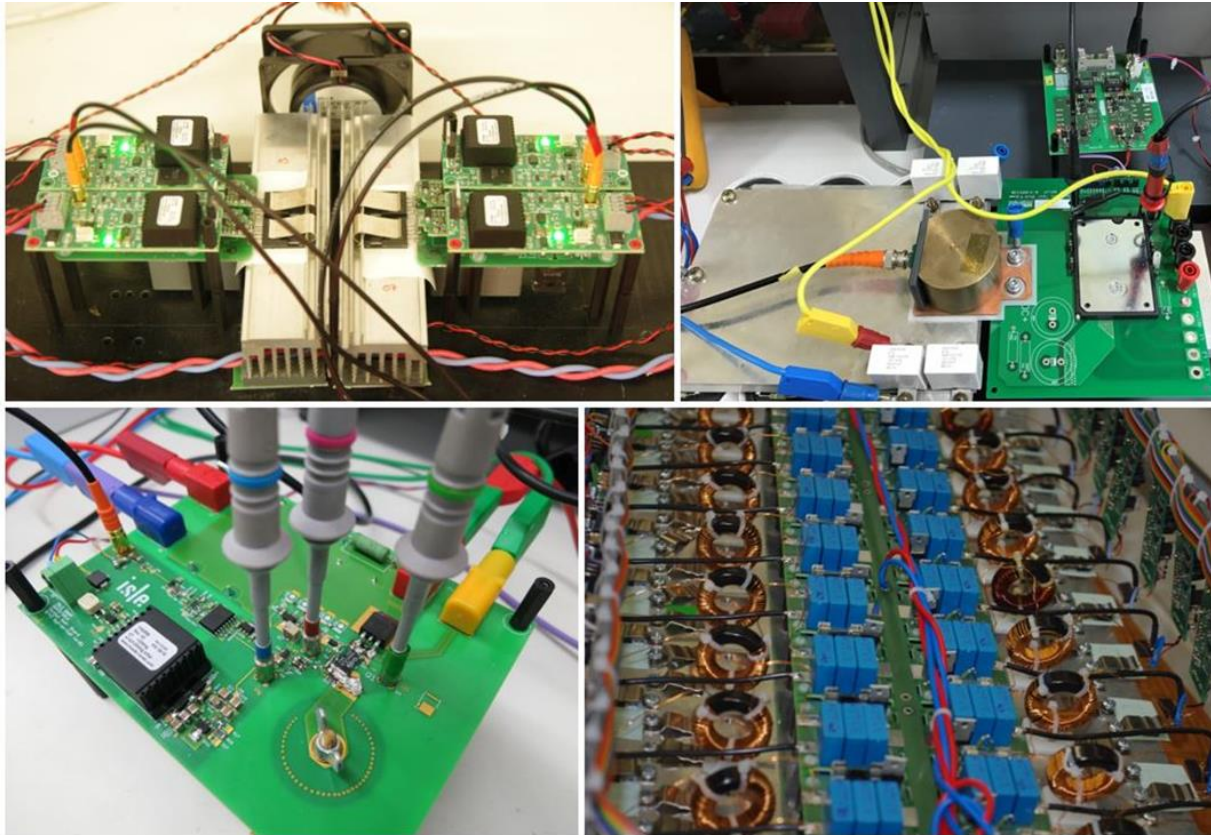
#### Specifications:

- Compliant with IEC 61326-1 / EN 1326-1 and IEC61010-1 / EN 61010-1
- CE certified
- Power range: 500A/3kV
- Measurement of on-state, forward and transfer characteristics of power semiconductor devices
- Measurement of forward and reverse blocking characteristics of power semiconductor devices
- Measurement of input, output, reverse and transfer capacitances of power semiconductor devices biased up to 3kV
- Measurement of gate-charge-characteristics of e.g. Power MOSFET, IGBT for devices rated up to 500A/3kV
- Measurement of parasitics of packages and circuit carriers (PCB, ceramics)
- Integrated main processor based on Windows 7, HD drive and GUI





## Test benches for dynamic characterization of power semiconductor devices



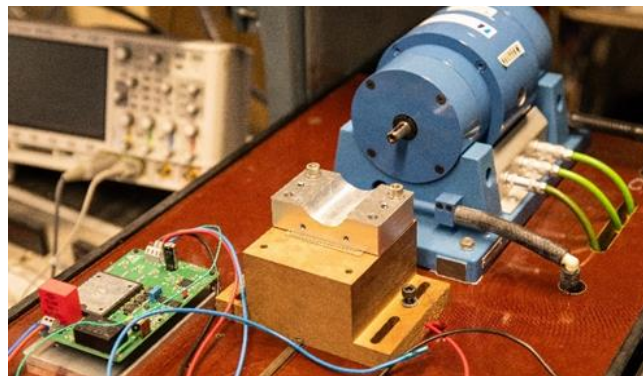
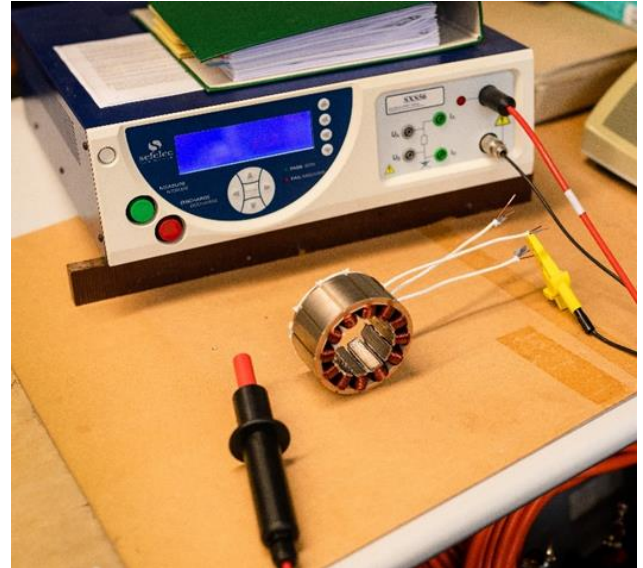
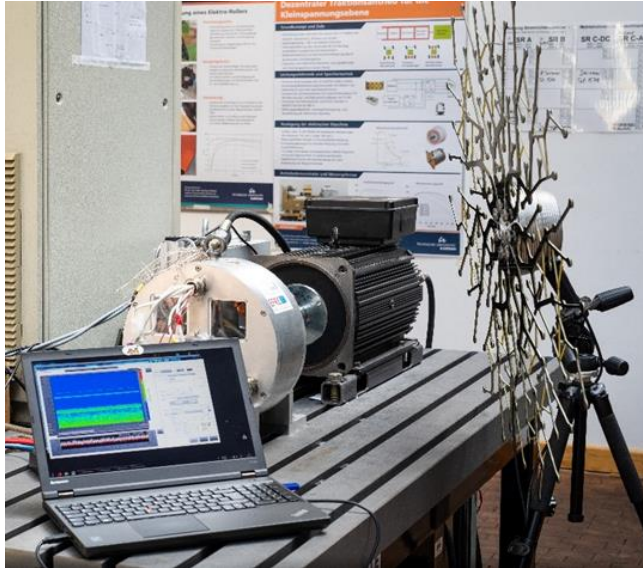
### Types of dynamic characterization:

- Devices: IGBT, MOSFET, diode, JFET, SIT, HEMT, thyristor; (Si, SiC, GaN)
- Dynamic standard characterization (switching waveforms, switching times, switching losses, double-pulse-test)
- Short circuit behaviour (SC1, SC2)
- Dynamic latch-up-test
- Dynamic  $R_{DSon}$
- Dynamic repetitive reverse bias test (DRB)
- H3TRB (high temperature, high humidity)
- Very high  $dv/dt$  and  $di/dt$  stress test
- SOA-tests
- Avalanche test (UIS, single-pulse, repetitive)
- Application-oriented repetitive switching test (hard and soft switching / commutation)
- Temperature cycle test
- Gate-driver optimization
- Series and parallel connection of power semiconductor devices





## Test benches and laboratory equipment for electrical machines



### Equipment and research possibilities:

- Test benches and loading equipment for rotating machines up to 50 kW
- Torque measuring shafts from 0.2 to 200 Nm and speeds up to 50,000 rpm
- Laboratory inverter, AC and DC sources for operating electrical machines
- Determination of machine characteristics and power measurement
- Recording of temperature curves on electrical machines
- Magnetic field measurement with probes or measuring coils
- Investigation of machine vibrations
- Acoustic camera / microphone array for analysis of airborne sound
- High-voltage tester for checking windings up to 10 kV
- Balancing station for rotors up to 5 kg and concentricity measuring device for commutators