

The background of the slide is a close-up, high-angle view of the front of a white car. A prominent feature is a glowing red light strip that curves along the bottom edge of the car's body. The text is centered over this image.

ATC FULDA

ACCREDITED TEST CENTER

1. Short introduction of the EDAG Group

Locations – Range of services

2. ATC Fulda

Accredited Test Competence at our location Fulda

3. Philosophy of Testing

Faster and Cheaper or Better to SOP.

**YOUR GLOBAL MOBILITY
ENGINEERING EXPERTS**

EDAG GROUP

COMPANY PRESENTATION



OUR FACTS & FIGURES



1969
FOUNDATION



~ 60
LOCATIONS
WORLDWIDE



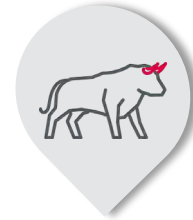
19
COUNTRIES



~ 8,000
EMPLOYEES



33
SHOW CARS



2015
IPO



~ 5 %
TRAINING
RATE



650
MILLION
REVENUE



~ 2-3%
CAPITAL
EXPENDITURE ON
REVENUE

EDAG WORLDWIDE

Europe:

- Germany
- United Kingdom
- Italy
- Netherlands
- Poland
- Sweden
- Switzerland
- Spain
- Czech Republic
- Turkey
- Hungary

Asia:

- China
- India
- Japan
- Malaysia
- Russia

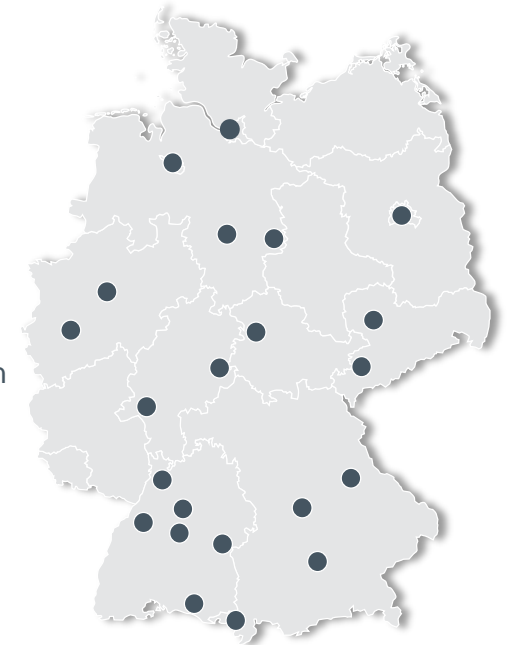
North & South America:

- Brazil
- Mexico
- USA



EDAG GERMANY

- Berlin
- Bremen
- Dortmund
- Eisenach
- Friedrichshafen
- Fulda
- Hamburg
- Hannover
- Ingolstadt
- Karlsruhe
- Köln
- Leipzig
- Lindau
- München
- Neckarsulm
- Recklinghausen
- Regensburg
- Stuttgart
- Ulm
- Weinheim
- Wiesbaden
- Wolfsburg
- Zwickau



OUR RANGE OF SERVICES

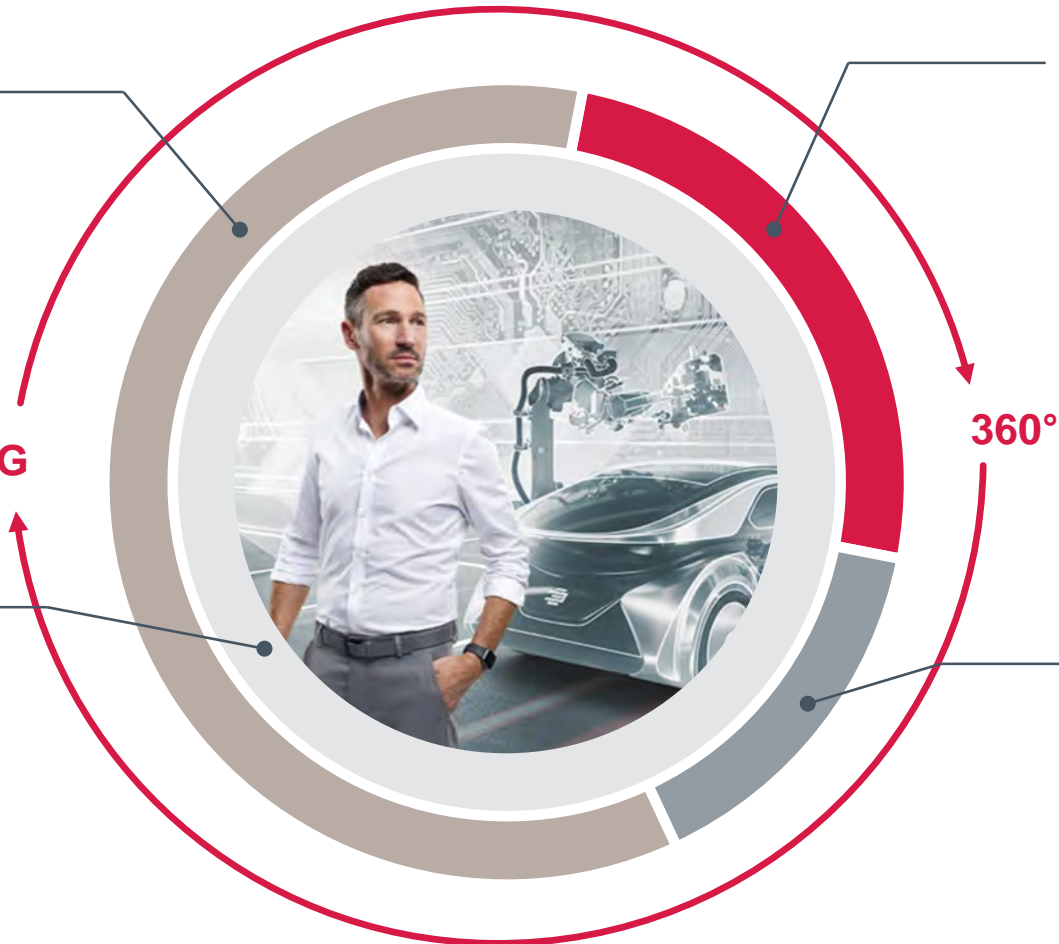
Vehicle Engineering

- Complete vehicle: development & management
- Vehicle integration
- Body in white
- Chassis
- Interior & Exterior
- Drive train
- Low-volume series & edition

360° VEHICLE ENGINEERING

Software & Digitalisation

- Mobility services
- Embedded systems
- CAx tools
- Testing & development tools
- Production IT



Electrics / Electronics

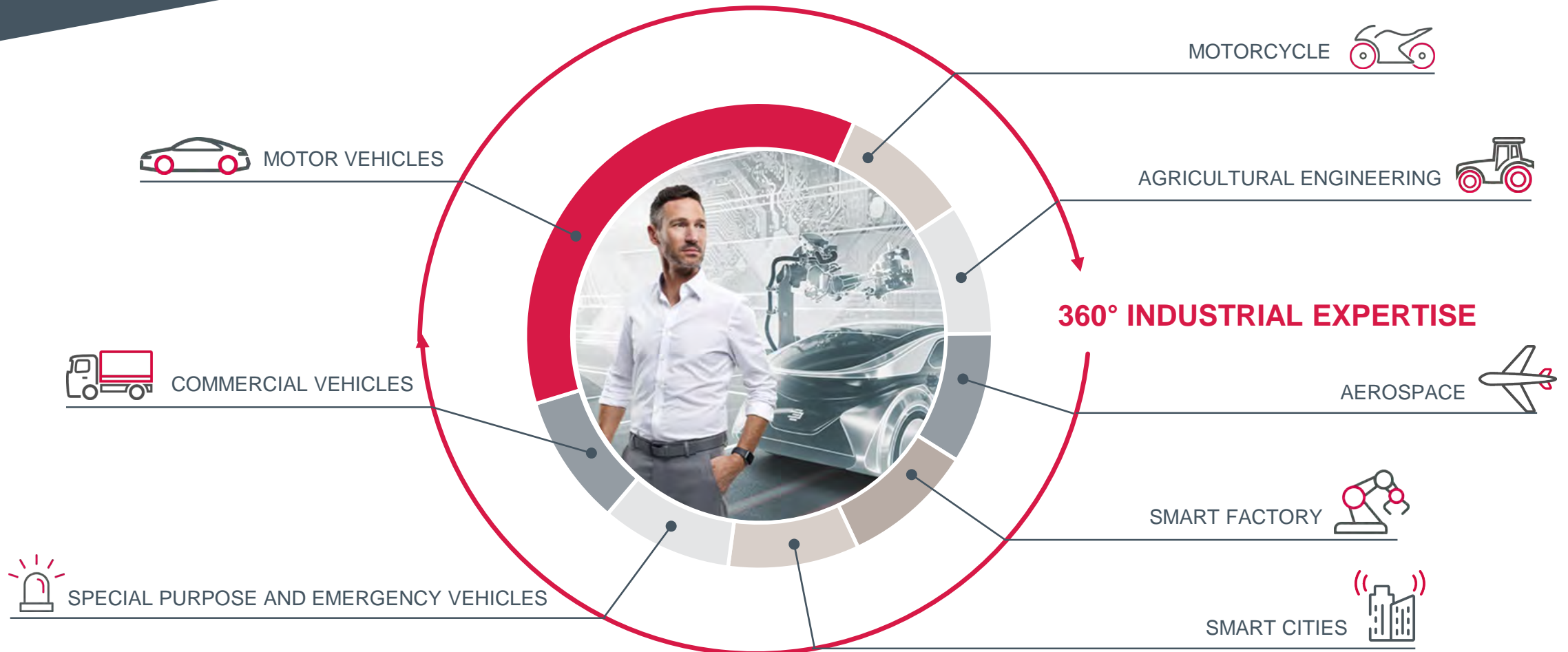
- Vehicle electrics & electronics
- eDrive & Battery
- Comfort & body systems
- Autonomous Drive & Safety
- Connectivity & user experience

360° PRODUCTION ENGINEERING

Production Solutions

- Feasibility analysis
- Production planning
- Systems engineering
- Fixture technology
- Plant automation
- Production optimisation
- Safety engineering services

OUR INDUSTRIAL EXPERTISE



OUR BUSINESS MODELS



COMPLEXITY ↑



**BUSINESS DEVELOPMENT
& CONSULTING**



**COMPLETE VEHICLE
DEVELOPMENT**



EDAG PRODUCTS



**ENGINEERING
SERVICES**



**MODULE & FUNCTION
DEVELOPMENT**

RESPONSIBILITY →

ATC FULDA

ACCREDITED TEST CENTER

Facts

- DIN EN ISO/IEC 17025 : 2018
- Founded 1991
- Laboratory area $\geq 4000 \text{ m}^2$
- Laboratory employees ≥ 85

Werkstoffe

- Plastics
- Elastomers
- Textile materials
- Laminations
- Metals
- Foams

Exterieur

- Coatings
- Bumpers
- Mirrors
- Wheel trims
- Radiator grille
- Trims, mouldings
- Wheel housing covers

Interieur

- Instrument panels and add-on parts
- Door side panels
- Centre consoles
- Hat shelves
- Vehicle headliner

Motorraum

- Tubes
- Protection systems
- Panels

Elektrik - Elektronik

- Components of the electro mobility
- Switches
- Plugs
- Contacts
- Wires and cables
- Fuse boxes
- Electric motors
- Actuators



Deutsche
Akkreditierungsstelle
D-PL-11061-02-00

ENVIRONMENTAL / WEATHERING SIMULATION

- Temperature change and Climate tests
- Vibration and Shock tests
- IP: Degree of protection
- Surge water and immersion tests

ELEKTRIC / ELECTRONIC TESTS LV / HV

- Modular test benches for component and function testing
- Electrical service life under environmental simulation
- Electrical system simulation / current and load profiles

PHYSICAL-CHEMICAL METHODS

- Emission determination
- Burning behaviour
- Chemical resistance

PHYSICAL-TECHNOLOGICAL METHODS

- Photogrammetry / Thermography
- Thermal Analysis (DSC / TGA)
- Tests on surfaces / Microscopy

COMPONENT TESTING

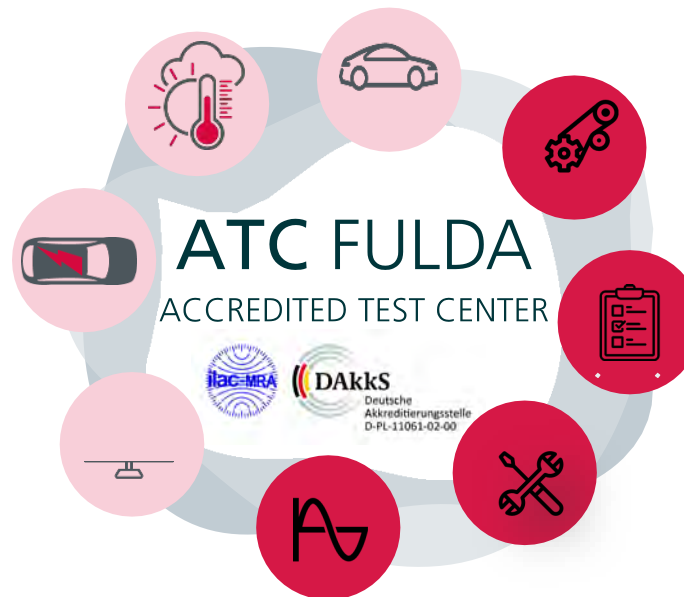
- Testing concept according to customer requirements
- Special testing machines
- Measurement and test automation
- Automated continuous operation, simulation of environmental influences

TEST ENGINEERING

- Validation planning
- Test execution and coordination
- Damage analyses

DEVELOPMENT AND CONSTRUCTION OF TEST BENCHES

- Development and construction of customized test benches
- Construction, delivery and commissioning of certified test benches
- Development and validation of new test methods



FATIGUE STRENGTH

- Material card generation
- Vibration analysis
- Tensile / compression tests
- Impact bending tests / hardness / puncture tests



Deutsche Akkreditierungsstelle GmbH

Beliehene gemäß § 8 Absatz 1 AkkStelleG i.V.m. § 1 Absatz 1 AkkStelleGBV
Unterzeichnerin der Multilateralen Abkommen
von EA, ILAC und IAF zur gegenseitigen Anerkennung

Akkreditierung



Die Deutsche Akkreditierungsstelle GmbH bestätigt hiermit, dass das Prüflaboratorium

EDAG Engineering GmbH
ATC Fulda
Steinauer Straße 20, 36100 Petersberg

die Kompetenz nach DIN EN ISO/IEC 17025:2018 besitzt, Prüfungen in folgenden Bereichen durchzuführen:

mechanisch-technologische, mechanisch-dynamische, mechanisch-thermische, physikalisch-chemische Prüfungen an Kunststoffen, Holz, Leder, Textilien, Metallen, Oberflächen und Beschichtungen von technischen Produkten; Prüfung elektrischer und elektronischer Baugruppen und Komponenten; Prüfung von Kabeln und Leitungen; Umweltsimulationsprüfungen an metallischen und nicht-metallischen Werkstoffen und Bauteilen

**! ::: Consulting ::: Testing :::
::: Analysis ::: Interpretation ::: !**

ACCREDITED

Flexible Accreditation acc. to DIN EN ISO/IEC 17025 : 2018-03

We have the competence not only to test according to defined standards and specifications, but also to modify them if necessary!

***Everything from one source:
What we do not offer, we will find for you on the testing services market.***

ATC FULDA

ACCREDITED TEST CENTER



***Our clients are the automotive industry,
Tier 1 and their suppliers!***

We always test according to the latest specifications!

Mercedes-Benz

- Approved as A-laboratory for various test methods.
- Approved as B-laboratory for all accredited test methods.

Volkswagen

- Approved for all emission tests.
- Approved for e.g. PV 1200, PV 2034, PV 2005, PV 3930, ...
- Approved for all accredited test methods.

BMW

- Approved for all accredited test methods.



[Current Certificates | EDAG Group](#)

Impact bending tests

IZOD – CHARPY – DYNSTAT

Impact energy: 0,5 J ... 15 J

Temperature range: -40 °C ... +120 °C



Tensile / Compression / Bending tests

Test load: 0,1 N ... 100 kN

Temperature range: -40 °C ... +130 °C

Puncture impact tests / Tensile tests

Test load: 100 N ... 50 kN

Speed of testing: < 20 m/s

Test temperatures: -40 °C ... +130 °C



Hardness tests

Ball indentation hardness

Compression hardness

Micro hardness IRHD

Shore hardness: Shore A / Shore D

Vibration tests

Frequency range: ≤ 5000 Hz

Acceleration: ≤ 300 g

Test temperatures: -50 °C ... +180 °C

Material card creation

Local stress and strain characteristics

Up to 120.000 frames/s

Material characterization

Photogrammetry

3D measurement of geometric changes during and after ageing simulations on components, modules and vehicles

Thermal Analysis

DSC -150 °C ... +600 °C

TGA ≤ 1000 °C



Microscopy / Microtomy

Magnification: up to 5000x

Damage analyses

Microstructure investigations

Burst pressure tests

Up to 200 bar (20 MPa)

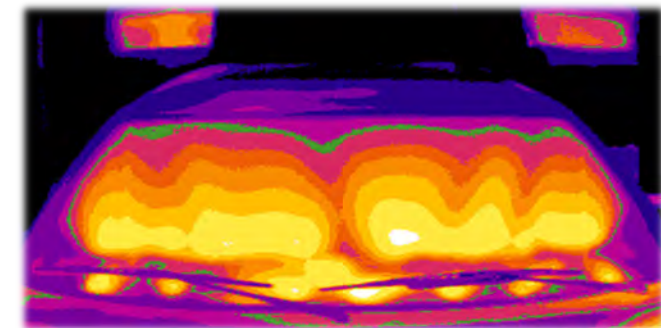
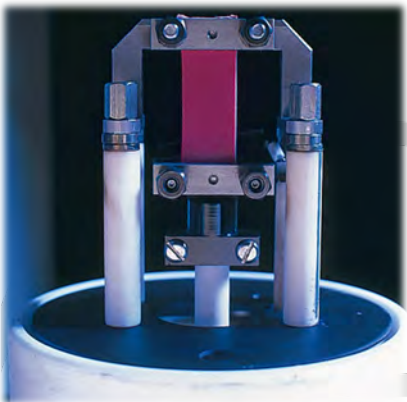
Also under temperature

Vicat / HDT

Temperature range: ≤ 190 °C

Thermography

Evaluation and documentation of thermal processes.





**Visual and metrological comparison of surfaces,
regarding color, gloss and surface structure.**

Color measurement

Color matching

Surface changes due to aging

Measuring geometries: $d/8^\circ$, $0^\circ/45^\circ$

Multi-angle color measurement BYK-Mac

Wave-scan

Reflectometer value

„Determination of gloss“

Measuring geometries:

20° , 60° , 85°



Laboratory car wash

“Simulation of car wash passages”



Emission determination

- Gas chromatograph (carbon emission)
- GC-MS for the determination of VOC/FOG
- SHED chamber (complete component test)
- Fogging (reflectometric / gravimetric)
- Odor behavior
- Formaldehyde

Surfaces / Coatings

- Resistance to media
- Abrasion, scratching, adhesion

Burning behavior

- FMVSS 302; GB 8410; VSTD 19;
- TRIAS 48; CMVSS 302

Viscosity number / Solution viscosity

- Temperature range: up to +50 °C
- Determination of the K-Value

MFI (MFR) / MVI (MVR)

- Temperature range: up to +400 °C
- Load: up to 21,6 kg



Temperature shock chambers

Temperature range: Hot chamber: +50 °C ... +200 °C
Cold chamber: -80 °C ... +100 °C
Chamber volume: 0,13 m³ ... 1 m³
Number of chambers: 6

Heat aging chambers

Temperature range: +40 °C ... +500 °C
Chamber volume: 0,05 m³ ... 180 m³
Number of chambers: > 120

Climate chambers

Temperature range: -70 °C ... +180 °C
Humidity range: up to 98 %r.h.
Temperature gradient: max. 15 K/min
Chamber volume: 0,2 m³ ... 180 m³
Number of chambers: > 50



Continuous monitoring and documentation of aging and weathering simulation!



UV-test

Suntest XXL+
Xenotest ALPHA
Xenotest BETA
Xenotest 440

irradiated area	3000 cm ² total
10 sample holder	480 cm ² total
54 sample holder	2600 cm ² total
38 Probenhalter	2310 cm ² total

Sun simulation

Irradiated areas:	5,3 m ² (2,3 m x 2,3 m)
	1 m ² (1 m x 1 m)
Irradiance:	1000 W/m ²
Temperature range:	-10 °C ... +100 °C
Humidity range:	10 %r.h. ... 85 %r.h.
without irradiation:	-40 °C ... +180 °C
	10 %r.h. ... 95 %r.h.



Corrosion cycling

Temperature range: +30 °C ... +60 °C
Humidity range: 20 %r.h. ... 98 %r.h.
Chamber volume: max. 1 m³
PV 1210, VDA 621 415, DIN 50958

Salt spray tests

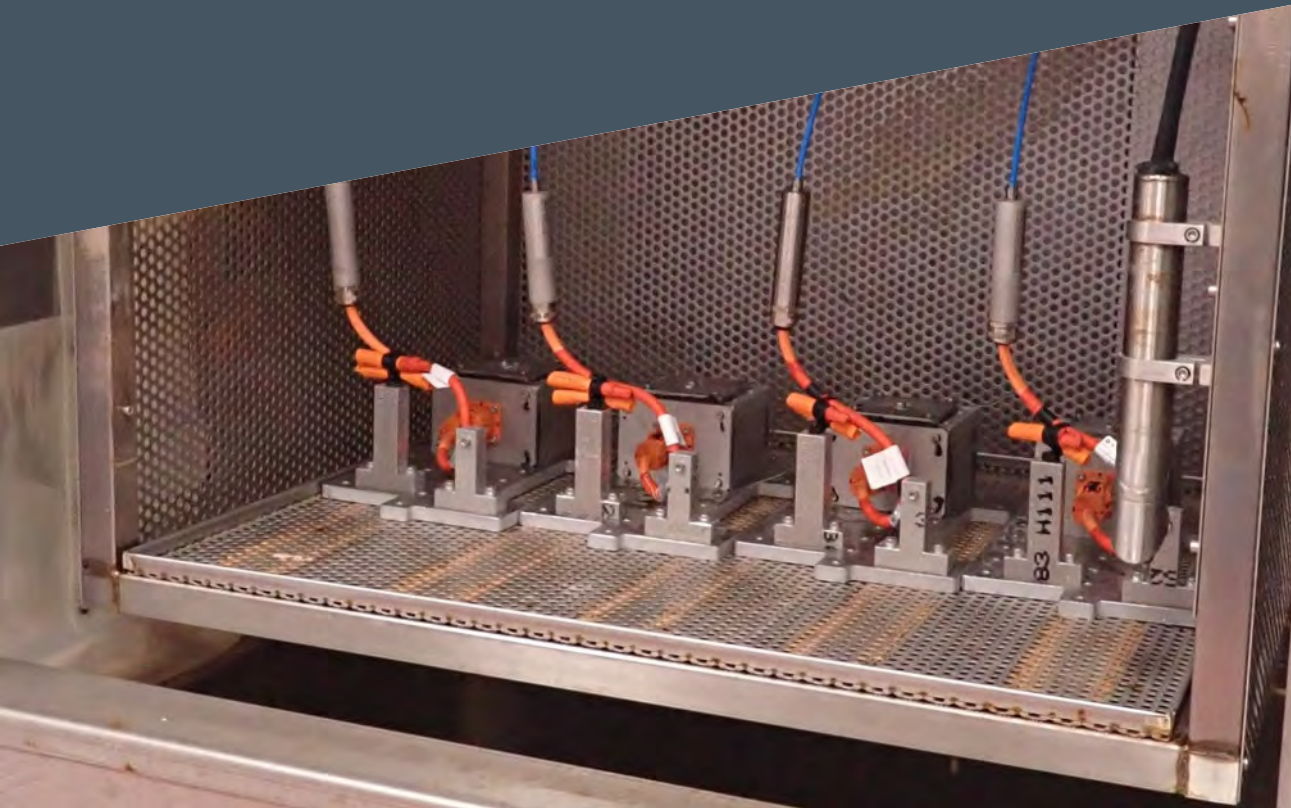
SS – ESS – CASS
Chamber volume: max. 1 m³
DIN 50021, DIN EN ISO 9227



Condensation water constant climate

Temperature range: +30 °C ... +60 °C
Chamber volume: max. 1 m³
DIN 50017, DIN EN ISO 6270-2

ACCREDITED



Condensation test

Chamber Volume: 0,6 m³
MBN LV124-2, VW 80000, GS 95024-3-1

Surge water test

Air temperature: +50 °C ... +160 °C
Water temperature: 0 °C ... +10 °C
Chamber Volume: 1,5 m³
Number of nozzles: 6



Temperature shock - Immersion

Air temperature: +50 °C ... +180 °C
Water temperature: 0 °C ... +10 °C
Capacity of the immersion basket: 0,8 m³



Degrees of protection : ISO 20653, DIN 40050-9, DIN EN 60529, ISO 16750-4

::: Water :::

IPX1, IPX2, IPX3, IPX4, IPX4K,
PX5, IPX6, IPX6K, IPX7, IPX8,
IPX9K Portal, X/Y 360°-Nozzle

::: Foreign objects and dust :::

IP1X, IP2X, IP3X, IP4X, IP5KX, IP6KX



Cables & Wires

Single core cables / twisted cables
Sheathed cables / special cables
Aluminum cables
HF cables
High voltage cables



Exemplary test specifications

LV 112-x, LV 122, LV 212-x, LV 213-x, LV 216-x
ISO 6722-x, ISO 14572, ISO 19642-x
VW 60306-x, VW 75205, VW 75206-x, VW 75209-x, VW 75210-x
GS 95007-1-x, GS 95007-3-x, GS 95007-5-x, GS 95007-6-x
GMW 15626, GMW 15839
ES 31834866, ES 31835546

Connectors & Contact Systems

Flat / Round contacts
Insulation displacement terminals
HV / HF contacts
Shield connections
Crimp connections



Exemplary test specifications

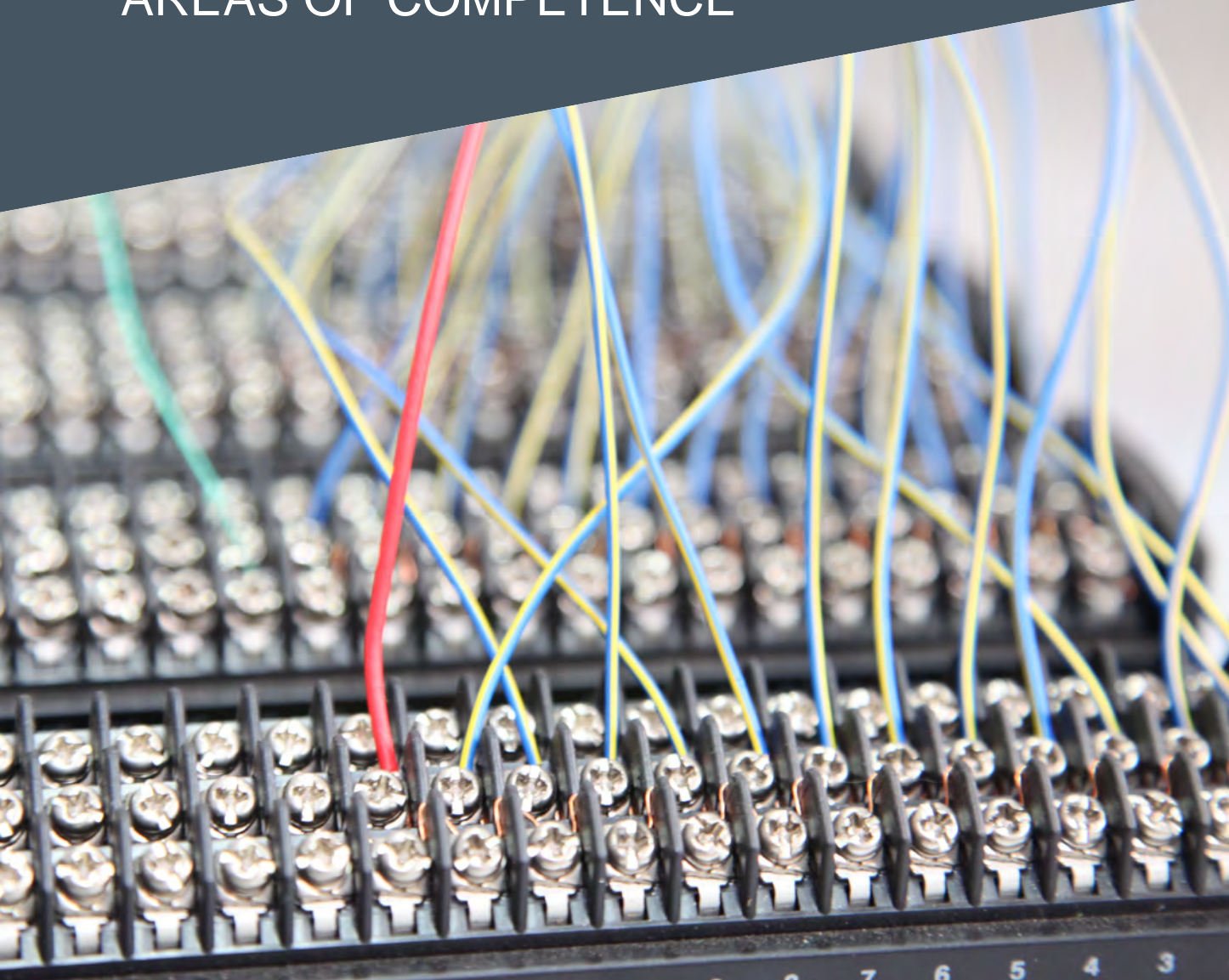
LV 214-x, LV 215-x
DIN 72585-x, DIN EN 60512-x, ISO 4091
MBN 10384, MBN 11215
GS 95006-7-1, GS 95031
VW 75174, VW 80332
GMW 3191, SAE/USCAR-2, PSA B21 7050

Cable protection systems

Wickelbänder, Schläuche, Wellrohre

Exemplary test specifications

VW 60360-1, VW 60360-2, VW 60360-3
MBN LV 312-1, MBN LV 312-2, MBN LV 312-3
GS 95008-3-1, GS 95008-3-2, GS 95008-3-3
LV 312-1, LV 312-2, LV 312-3



Electrical components

- Fuses / Fuse boxes
- Pyrotechnic battery disconnectors
- Switches / Pushbuttons
- Friction / ultrasonic welded joints
- Power distribution components

Exemplary test specifications

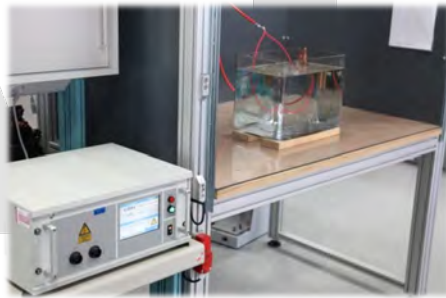
- LV 123, LV 124-x
- MBN 10615
- GS 95024
- VW 80000

Electronic components

- Control units
- Bus systems CAN / LIN
- Actuators
- Sensors
- Combi instruments

Dielectric strength

up to 12 kV AC
up to 9 kV DC



Insulation resistance

$\leq 10^{12} \Omega$ (Tera Ohm)

Surface- and Volume resistivity

up to 1,5 kV DC
 $\leq 10^{12} \Omega$ (Tera Ohm)

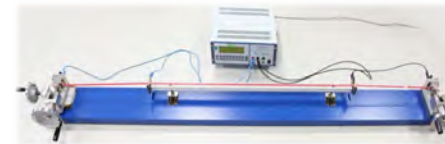


Data monitoring

Sample rate up to 5 GS/s
Short interruption (40 MS/s)

Electric resistance

$\geq 10^{-6} \Omega$ (Micro Ohm)
Measuring current 1 mA ... 10 A
Low voltage 20 mV



Power Supply DC

0,2 KW up to 15 KW
5 V – 3000 A ; 15 V – 440 A
30 V – 200 A ; 1000 V – 1,2 A

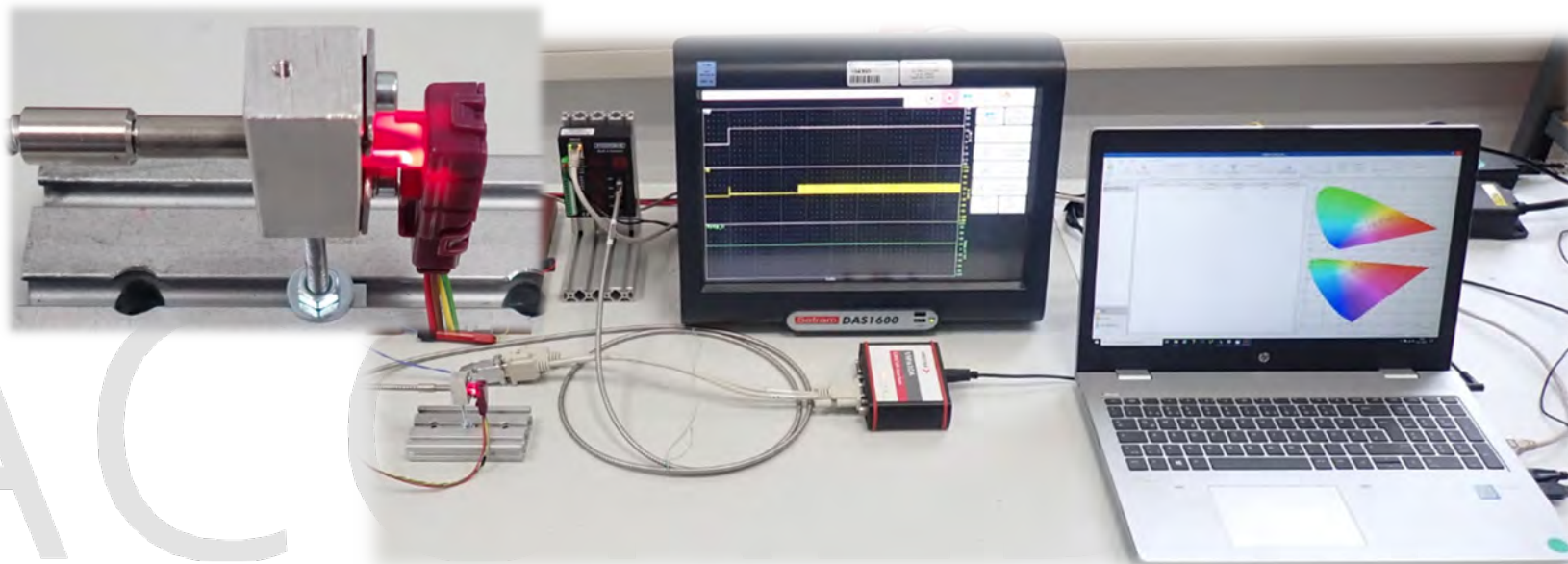
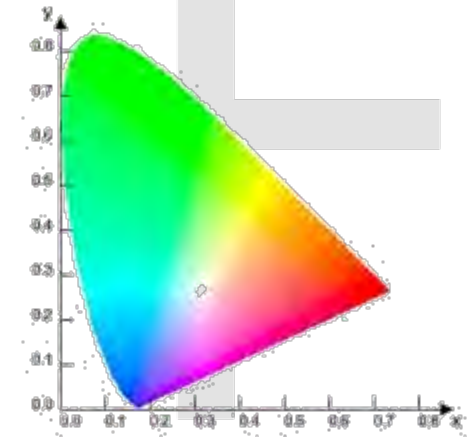
Electronic loads

768 channels – 5 A
260 channels – 25 A
9 channels – 340 A



Color analysis and intensity measurement of lighting components

LEDs,
Displays
Ambient lighting



Technical Data

4 channels for parallel measurement
Sensitivity 0,7 to 600.000 Lux
Spectral Auflösung down to 1 nm
Wavelength range 400 bis 700 nm

Measurement of all relevant HF-values

- Capacity
- Inductance
- Insertion Loss
- Return Loss
- Cross talk (NEXT and FEXT)
- Mode conversion
- Delay
- Propagation Velocity
- Impedance in Frequency and Time Domain



Network analyzer of the newest generation

- 9 kHz to 8,5 GHz / 4 Port / TDR Option
- 100 kHz to 40 GHz / 4 Port / TDR Option

Tri-axial measuring system

- Measuring head to 12 GHz / Measuring tube with a length until 3 m
- Tube in tube measurement
- Tri-axial cell in different sizes



Measurements in the field of EMC

- Screening attenuation
- Coupling (transfer) impedance
- Coupling attenuation



Line-Injection Measuring system

- Measurement of the transfer impedance

Impedance-controlled device for unshielded cables

ELECTRIC ::: ELECTRONIC VEHICLE POWER SIMULATION

Electrical requirements < 75 V

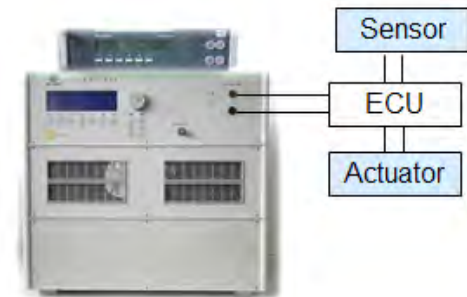
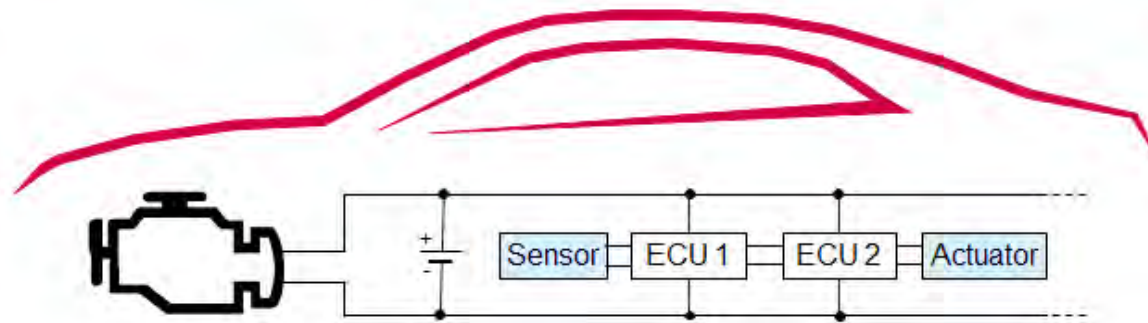
- LV 124
- LV 148
- ISO 16750-2
- ISO 7637-2 ...

Electronic control units

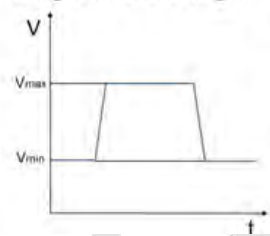
motors, gears, ABS ...
small control units, relays

4-quadrant amplifier

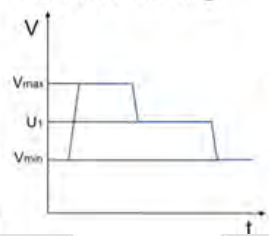
$\pm 75 \text{ V}$
 $\pm 11 \text{ A}$
DC till 1 MHz
 $100 \text{ V}/\mu\text{s}$



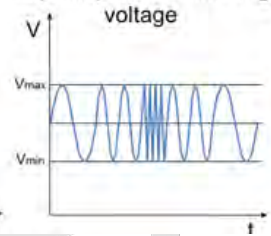
Long-term overvoltage



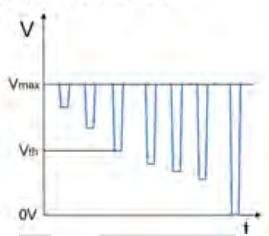
Transient overvoltage



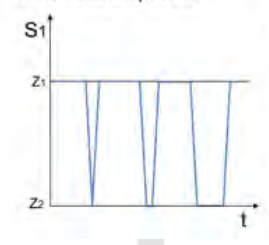
Superimposed alternating voltage



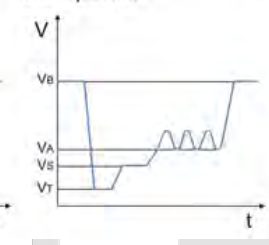
Reset behaviour



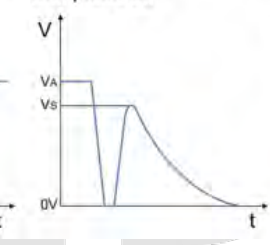
Short interruptions



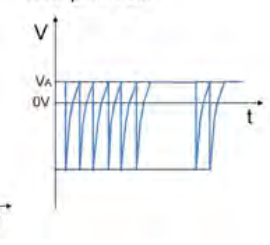
Start pulses



Test pulse 2b



Test pulse 3a





Test systems

Customer / sample specific
e.g. LabVIEW, NI, SPS, Arduino,
Device remote: USB, RS232
Bus simulation: e.g. CAN(FD), LIN
Relay matrix

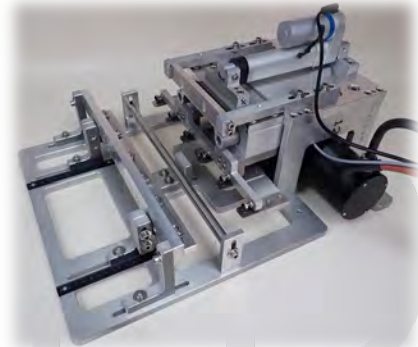


Electronic loads

128 channels - 5 A
20 channels - 25 A
1 channel - 340 A

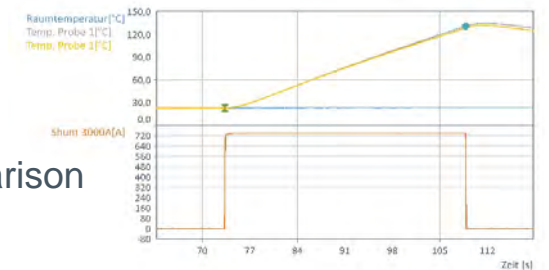
Actuation devices

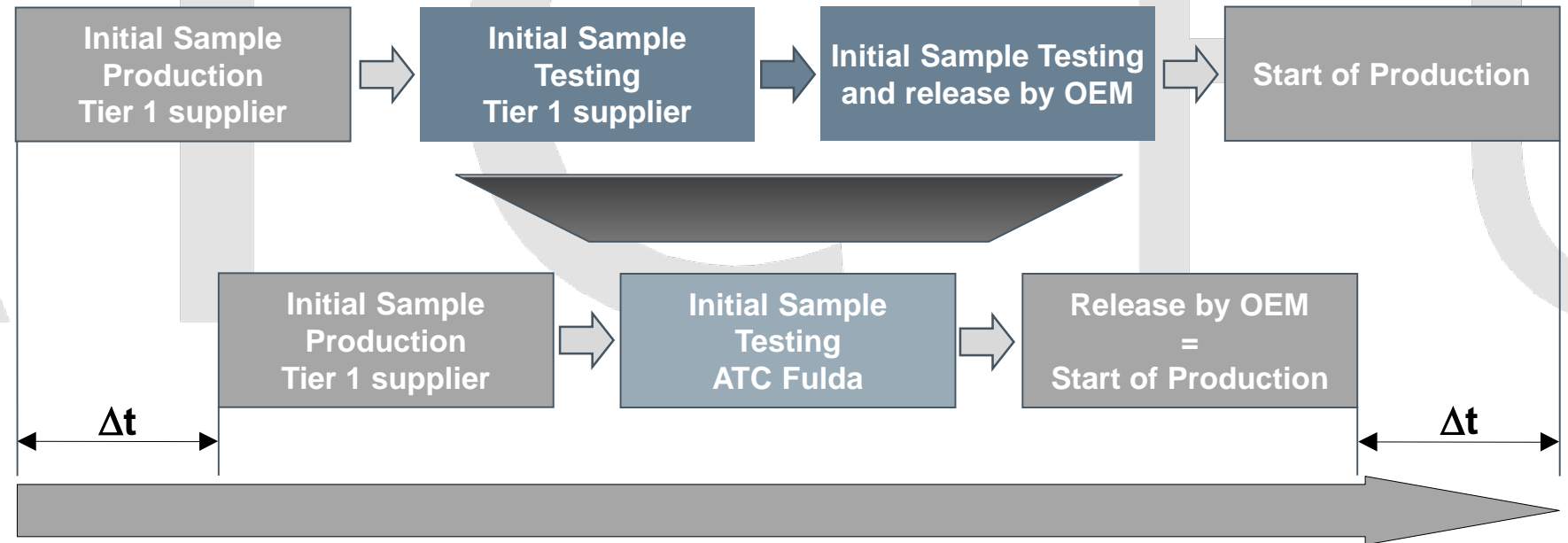
Step motors
Linear motors
Sample adaption
Actuation cycles
Lifetime durability tests



Analysis tools

Data analysis
Set / actual comparison
Data filters
Graphical analysis





ADVANTAGES

- Time saving
- Higher degree of maturity due to later initial sample production
- Cost reduction for OEM
- Independent review
- Avoidance of contradictory results/interpretation by different testing laboratories

Head of Accredited Test Center Fulda

Norbert Kamm
Norbert.Kamm@edag.com

phone +49 661 6000 802
mobile +49 171 602 4648

Kirsten Herrmann
phone +49 661 6000 9017
Kirsten.Herrmann@edag.com

Assistants

Karin Tissen
phone +49 661 6000 9017
Karin.Tissen@edag.com

Analytics & Surface **Michael Brehl**

phone +49 661 6000 895
mobile +49 171 195 7662
Michael.Brehl@edag.com

Electrical Components **Andreas Büchner**

phone +49 661 6000 9566
mobile +49 160 9292 4477
Andreas.Buechner@edag.com

Material & Components **Georg Käsmann**

phone +49 661 6000 9212
mobile +49 171 217 6052
Georg.Kaesmann@edag.com

Delivery address ::: EDAG Engineering GmbH - Steinauerstraße 20 - 36100 Petersberg
Global Mail Account ::: ATC-Fulda@edag.com