The powertrain of the KTM Freeride BEMC

>> ...from the motorcycle garage to a group of companies...

History #1

1953	Start of industrial production of motorcycles: Company name KTM „Kronreif, Trunkenpolz, Mattighofen“
1955	First engagement in road racing
1964	KTM factory team participate in the Int. Six Days Enduro for the first time
	Start of the bicycle production
1970	Start of the in-hous production of engines
1974	Gennadij Moiseev wins first MX World Championship
	KTM produces 42 different models
1984	Heinz Kinigadner wins 250-MX Word Championship
	Foundation of KTM-Kühler (radiator)
1991	Bankruptcy – the lines of business motorcycles, bicycles, radiator and tool manufacturing are split up into independent companies

>> ...after bankruptcy strong development up to a worldwide operating group...

History #2

1992	Restart as KTM-Motorradholding GmbH
1994	First Word Championship title of the new era: Shane King, MX
2000	KTM dominates off-road racing with 6 of 8 possible World Championship titles
2001	Rally Dakar, first of nine victories in a row
2003	Re-start of the road racing activities in the GP 125 class Launch of the 950 Adventure – KTM´s first twin cylinder bike
2004	First victory in the road racing GP: Casey Stoner, GP 125, Sepang/Malaysia Launch of the 990 Super Duke, the first KTM street motorcycle with a V2 engine
2008	Launch of KTM´s first Superbike - 1190 RC8 Serial production of KTM´s supersports car X-Bow
2009	Presentation of the new 125 cc street models in cooperation with Bajaj Auto Ltd.

Philosophy

ZEMC – ZeroEmissionMotorCycle

» Projectstart in November 2007 in course of A3 programm
(Austrian Advanced Automotive Technology)

» Projectpartner

KTM

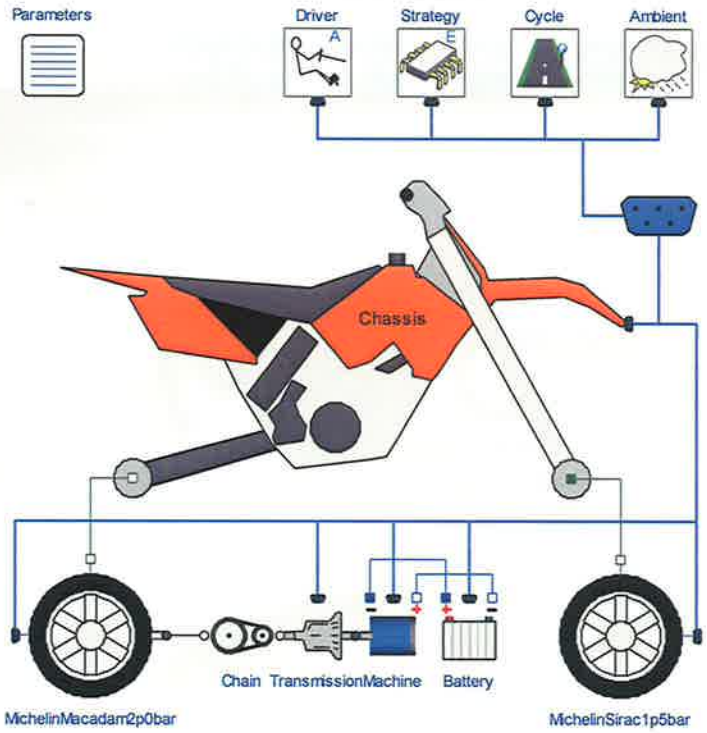
KISKA.

arsenal research
A Company of Austrian Research Centers

KTM

FREERIDEEDRIVETRAIN

- High performing and intelligent E-drive
  - Energy storage with low weight
  - Intelligent closed loop control
  - Smart energy management
  - **Powersport without Emissions**



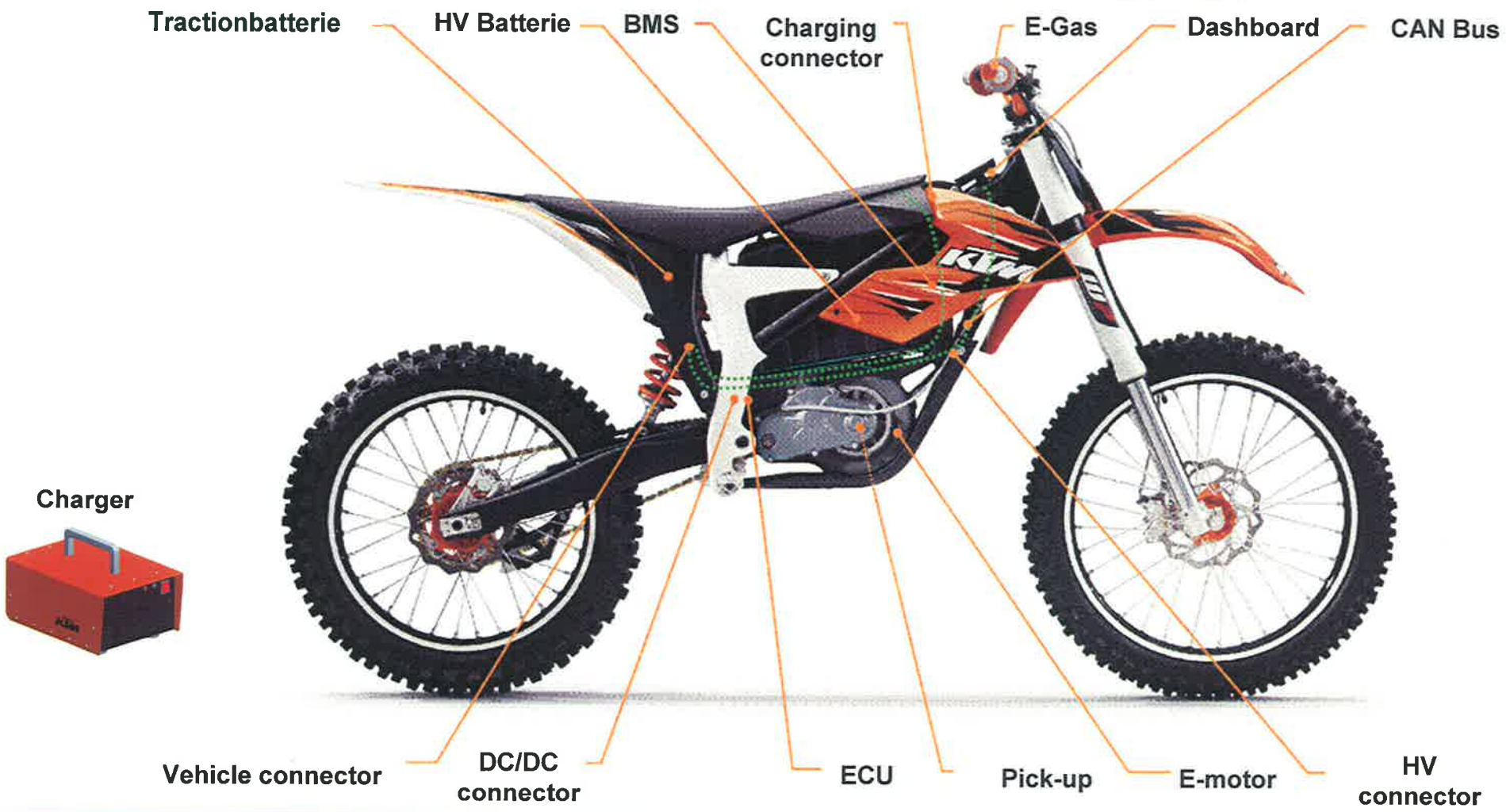
FREERIDE EXPECTATIONS

- Reaching of new target groups
  - Indoor events
  - Easy handling for beginners
  - Urban mobility
- Reduction of emissions
- New oportunities to perform endurosport

FREERIDECHALLANGE

- Development of weight and power optimized powertrain
- Design of an intelligent controll tequnique
- Sustain real characteristics of motorcycle
- Establish a userfriendly motorcycle for capturing a new market
- Clever matched measures of safety - ISO DIS 26262 respected
- Homologation
- Commercial relevance

» E/E COMPONENTS

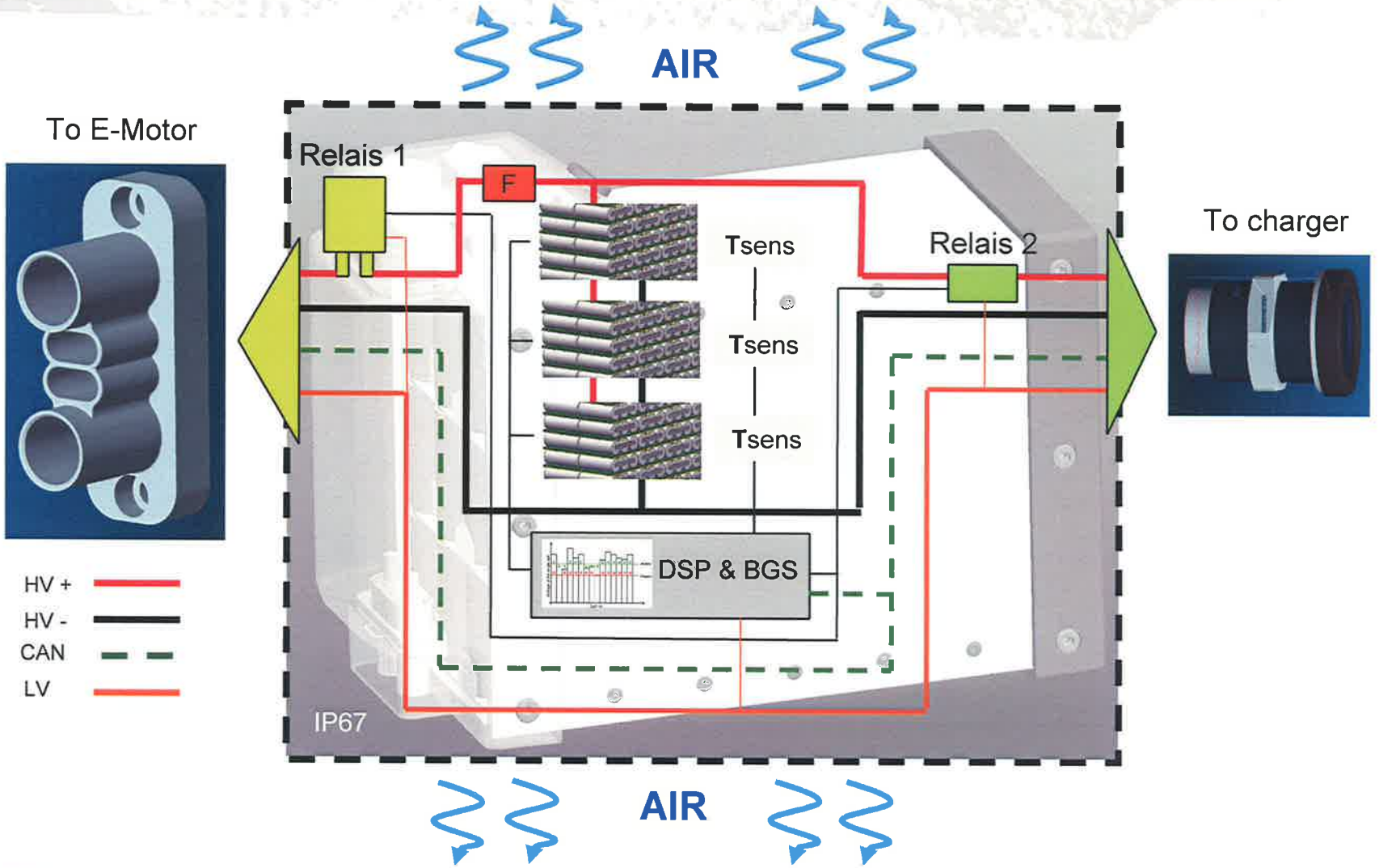


- E/E COMPONENTS in detail
  - ECU
  - E-MOTOR
  - TRACTION BATTERY
  - CONNECTORS
  - OPTIMISATION OF THERMAL BEHAVIOUR

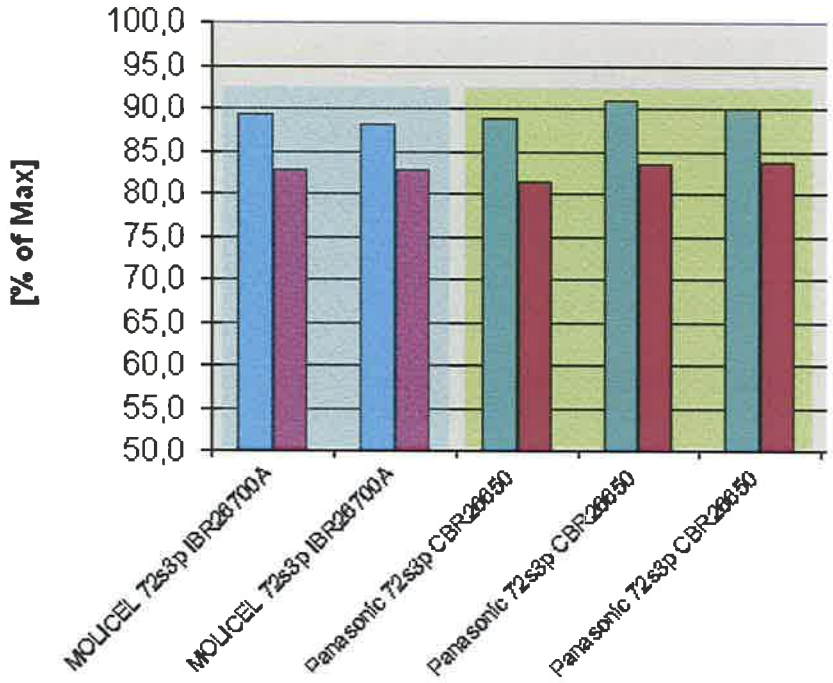
Synchronous motor:

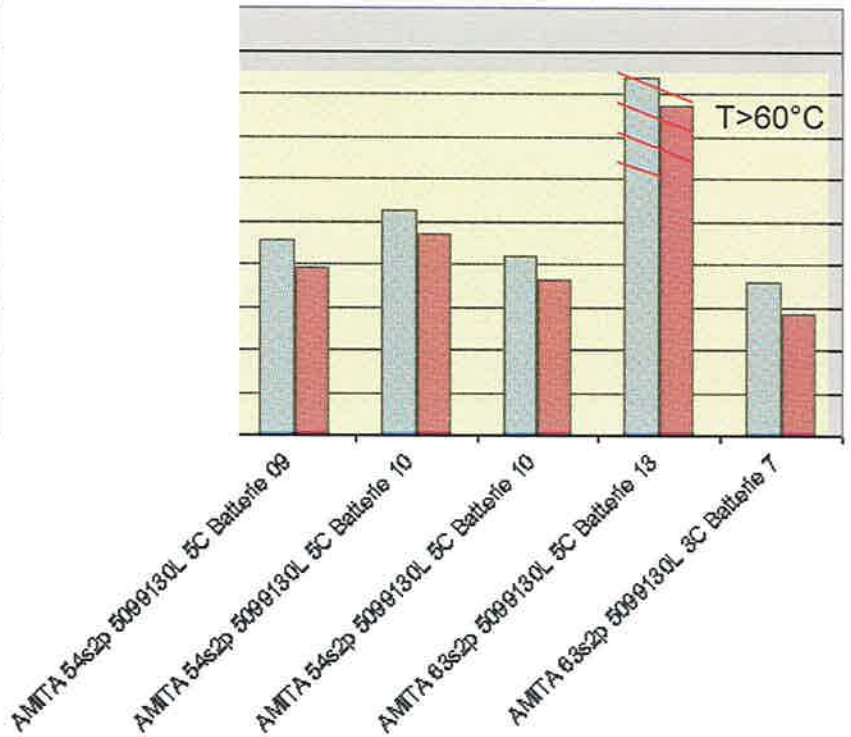
- Rated power: 7,4 kW
- Range of voltage: 200 – 300 VDC
- Optimized efficiency
  - Reduction of losses in the overload range due to increased amount of copper

» DESIGN


AIR
To E-Motor
Relais 1
F
Tsens
Tsens
Tsens
Relais 2
To charger
DSP & BGS
IP67
HV +
HV -
CAN
LV
AIR

» ENERGY ANALYSIS





converted CAPACITY [% of max]

converted ENERGY [% of max]

Molicel	Molicel	Panasonic	AMITA	Lishen	BYD	PHET	TD HiTech	ITRI taiwanese Source	A123	Kokam / CBS
Kanada/Taiwan	Kanada/Taiwan	Japan	Taiwan	China	China	Taiwan	Taiwan, Japan, Korea	Taiwan	USA	Korea, USA

FREERIDE CONNECTORS

Charging Connector

High Voltage Connector

Vehicle Power Connector

FREERIDECONNECTORS

- Special seal level requirements to Connectors:
  - Tightness if IP67 when unplugged
    - Tightness of the single pins
    - Sealing flange between the motor and connector housing
- Reliable combined power and signal transmission, despite
  - Frequent mating cycles
  - Moisture / Contamination
  - Vibrations / mechanical stress
  - Interference of the power transmission to the signal line
  - Hot-plug capability (disconnect under load)
- Compact design
- Conform to relevant standards

FREERIDE OPTIMIZATION OF THERMAL BEHAVIOR

Motivation:

- Avoid high temperatures in the engine BAY
  - Possible permanent damage to the magnets
  - Temporary loss of torque
  - Temporary worsening of efficiency
  - Damage to the insulation on the winding

- Avoid high temperatures at the power electronics
  - Destruction of electronic components
  - Temporary worsening of efficiency
  - Drift of measurante influences control

Solutions:

- Improve heat dissipation in the housing
- Reduction of temperature losses

THANK YOU FOR YOUR ATTENTION