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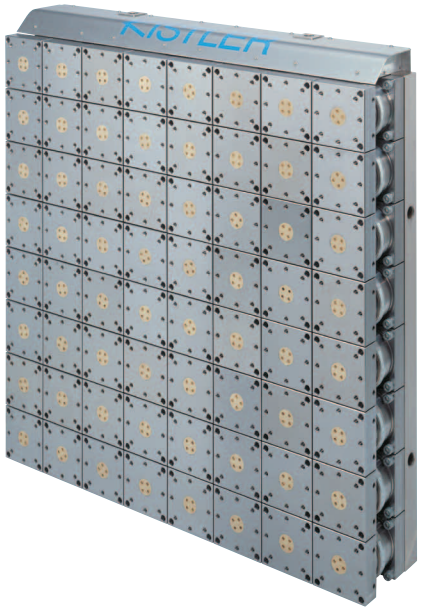
SmartCrash® Segment

Type 9655A...

With Digital Data Output

SmartCrash segments with piezoelectric SmartCrash force measuring elements and integrated electronics are able to measure 3 orthogonal components F_x, F_y and F_z of dynamic forces in any direction. They are predestinated for measuring high dynamic impact forces e.g. during crash test procedures for automotive R&D. Each single SmartCrash quartz force measuring element with integrated data acquisition and data storage is factory calibrated.



- Wide measuring range
- High sensitivity
- Excellent linearity over total measuring range
- High rigidity/ natural frequency
- Easily mounted and removed from front
- Integrated data preprocessing and data storage
- Digital data output
- Single connecting cable per segment
- TEDS functionality (calibration data and automatic sensor identification)

Description

A standard SmartCrash segment consists of 64 3-component SmartCrash force measuring elements. Its dimensions and the number of force measuring elements can be tailored to customer's technical requirements. The piezoelectric sensor, integrated in the force measuring element, generates a force-proportional charge, which is amplified and processed. A complete data acquisition and storage module (MICRODAU®) is incorporated in each individual SmartCrash force measuring element. The charge signals are converted into a voltage signal, digitized by an A/D converter and stored. Each MICRODAU® module has a 16 MB flash memory for the acquired data. Before the actual measurement is performed, an automatic system check is carried out to check that the entire measuring chain is operating properly. The individual force measuring element is connected by a corresponding connection cable to the power supply and USB interface.

The single SmartCrash force measuring elements of each SmartCrash segment are factory calibrated. The elaborate design allows to realize SmartCrash segments with up to 100 crash force elements and 300 channels. The SmartCrash segment is ready to be used for taking measurements immediately after being mounted on the crash barrier or the offset block.

The power supply for a SmartCrash segment (USB-hubs, force measuring elements with integrated electronics) is provided by the power unit/controller (industrial PC) through a single connecting cable. The industrial PC controls one entire SmartCrash segment and preprocessing of measurement results. Communication with the host computer relies on an Ethernet, using the TCP/IP protocol. This combination includes device drivers and configuration/control software for the electronics of the SmartCrash force measuring elements. The acquired data is then processed with standard DAQ software CrashDesigner.

Front mounting of the entire SmartCrash segment, which is prepared to mount different cover plates and other accessories allows quick conversion for various crash standards. Optional corner elements, front plates and plywood protection plates can be adapted for these special applications. Suitable mounting material is included.

The simple calibration concept allows recalibration with low expenditure of time on customer's site for minimum downtime.

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Application

The standard SmartCrash segment is used vertically in the automotive industry and in vehicle crash test centers, and horizontally in towers for component drop tests, where impact and shear forces have to be measured quickly, easily and very precisely.

Typical configurations of SmartCrash barrier:

RCAR/AZT

Research Council for Automobile Repairs/Allianz Zentrum für Technologie, (v = 15 km/h ±1 km/h), determination of repair costs after an accident, Kasko classification test, 40 % offset crash.

EuroNCAP

European New Car Assessment Program, (v = 64 km/h ±1 km/h), 40 % offset crash with deformable element honeycomb.

TRL/US NCAP

Transport Research Laboratory, (v = 56 km/h ±1 km/h), full frontal accident with/without deformable element honeycomb.

The system can be adapted to meet other crash standards.

Technical Data

Sensor System

Measuring range	F_x	kN	0 … 500
	F_y	kN	–100 … 100
	F_z	kN	–100 … 100
Bending moments	M_y	kN·m	on request
	M_z	kN·m	on request
Linearity (FSO)		%	≤±0,5
Crosstalk (FSO) – [typical values]	x → y,z	%	≤±2 [≤±0,5]
	z ↔ y	%	≤±3 [≤±1,0]
	y,z → x	%	≤±3 [≤±2,0]
Operating temperature		°C	0 … 50
Natural frequency of the crash force element alone	F_x	Hz	≈4 000[1)]
	F_y, F_z	Hz	≈1 700
Weight of segment (with 64 crash force elements)		kg	≈1 250
Material	crash force element 1.2316+S segment base plate Ck45 chemically nickel-plated		
Protection (IEC)			IP65

[1)] mounted on foundation plate

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Electronics

Selectable measuring ranges	F_x	kN	20 … 500
Measuring ranges specified for nominal sensor sensitivity	F_y	kN	4 … 100
F_x ≈–0,65 pC/N, F_y, F_z ≈–1,33 pC/N	F_z	kN	4 … 100
Selftest signal		%FS	2 … 50
Drift at 25 °C (lowest measuring range = FS_{low})		%FS_{low}/s	<0,004
Repeatability		%FS	<0,1 (typical 0,04)
Frequency range of charge amplifier (–3 dB)		kHz	≈0 ... >10
ADC resolution		Bit	16
Sampling rate (synchronous, per channel)		kHz	8 … 20
Flash memory (per channel)		Samples	3 000 000 (150 s @ 20 kHz sampling rate)
Trigger		V(mA)	18 … 30 (≈2)
Auxiliary voltage		VDC	≈26
Data processing (internal: controller segment sensor)	USB-Bus	1.1 full speed (12 MBaud)	
Data processing (external: host controller, TCP/IP)	Ethernet	100 BaseT	
Power supply (per segment)		VAC	85 … 132/184 … 264
		Hz	47 … 63
		VA (W)	130 (80)

Functions

Reset/Operate		all channels simultaneously
Test signal ON/OFF		all channels simultaneously
Measuring range setting		individually selectable ranges

Software interface for computer

- API DACORE®, DLL, CrashDesigner Plus

Application software (not included in scope of delivery)

- CrashDesigner Plus
- Others on request

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SmartCrash Barrier, Consisting of 2 Standard SmartCrash Segments

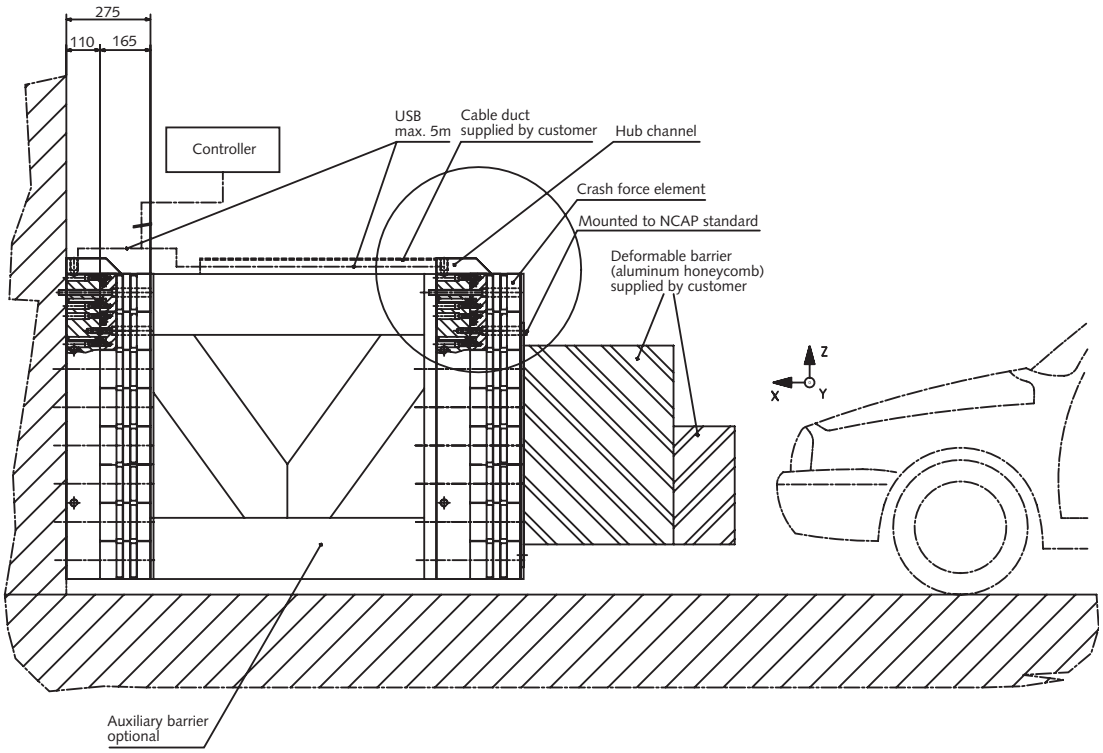
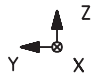


Fig. 1: SmartCrash Barrier



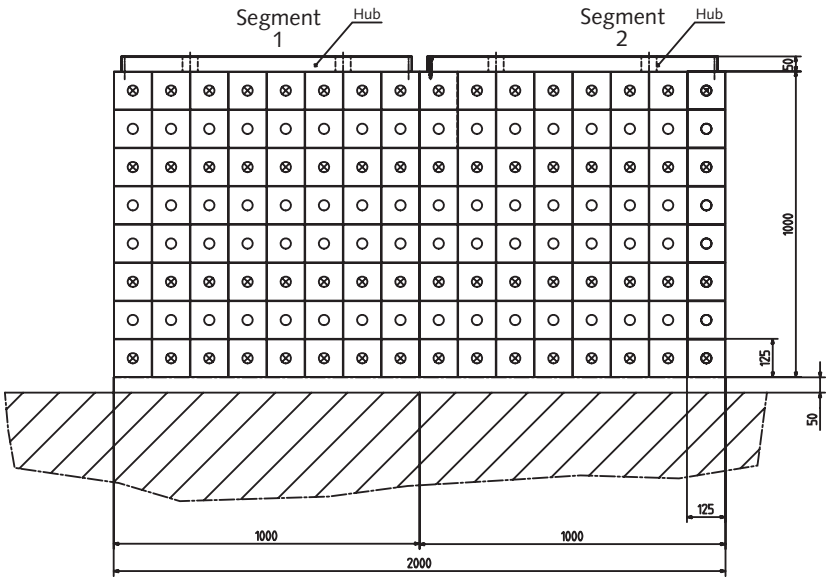


Fig. 2: Standard SmartCrash Segments

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3-Component Standard SmartCrash Segment

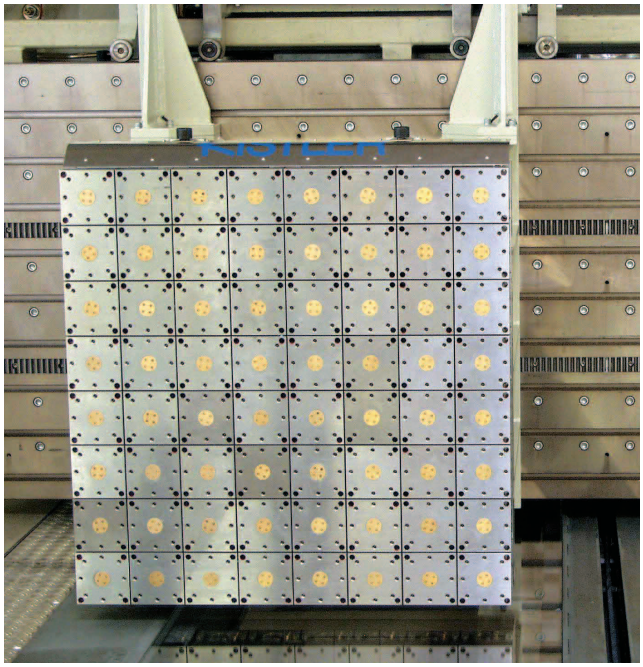

Fig. 3: Standard SmartCrash segment 1 000x1 000 mm with 64 force measuring elements, mounted on optional offset-block

Fig. 4: Standard SmartCrash segment, prepared for EuroNCAP with plywood protection plates, without deformable element (honeycomb)

Fig. 5: Standard SmartCrash segment, prepared for RCAR/AZT with profiled aluminium corner elements R = 150 mm and aluminium front protection plates 250x250 mm

Fig. 6: SmartCrash segments with up to 100 SmartCrash force measuring elements need only one single connecting cable to the controller (industrial PC)

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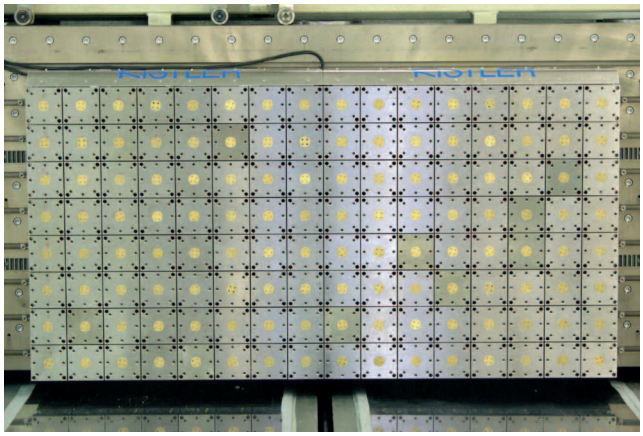


Fig. 7: Two standard SmartCrash segments, prepared for TRL/US NCAP, without plywood protection plates, without deformable element (honeycomb)

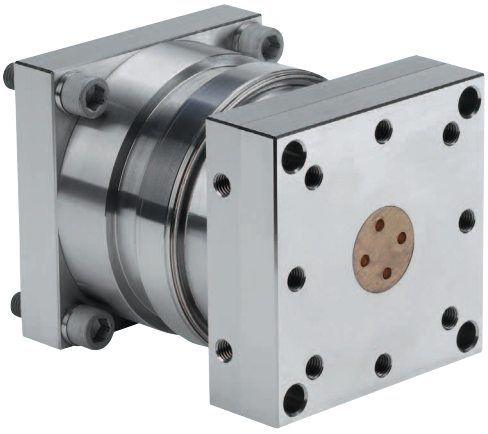


Fig. 8: Front view standard SmartCrash force measuring element 125x125 mm

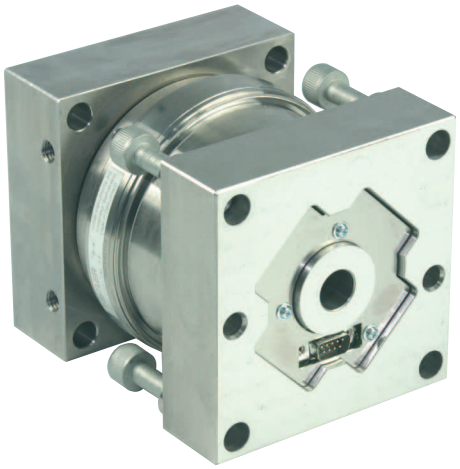


Fig. 9: Back view standard SmartCrash force measuring element 125x125 mm

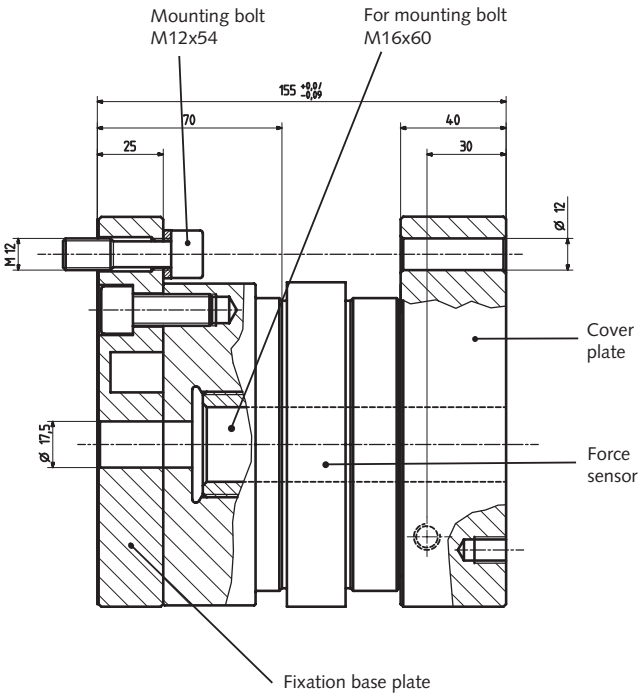


Fig. 10: Standard SmartCrash force measuring element 125x125 mm

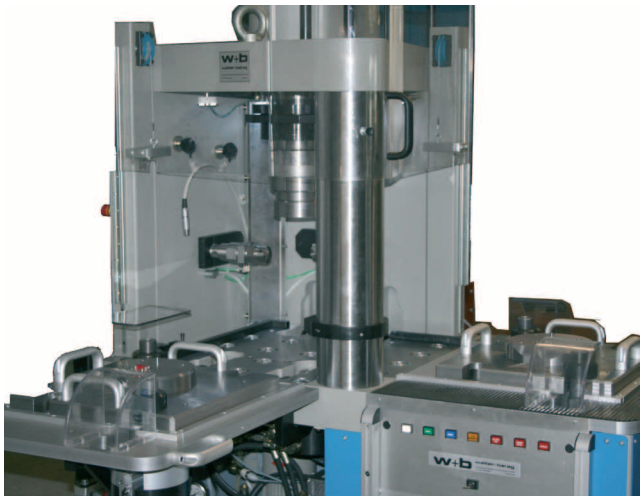


Fig. 11: Movable 3-component calibration unit for full scale re-calibration (100 % FSO) of SmartCrash force measuring elements on customers site

Block Circuit Diagram of Electronics

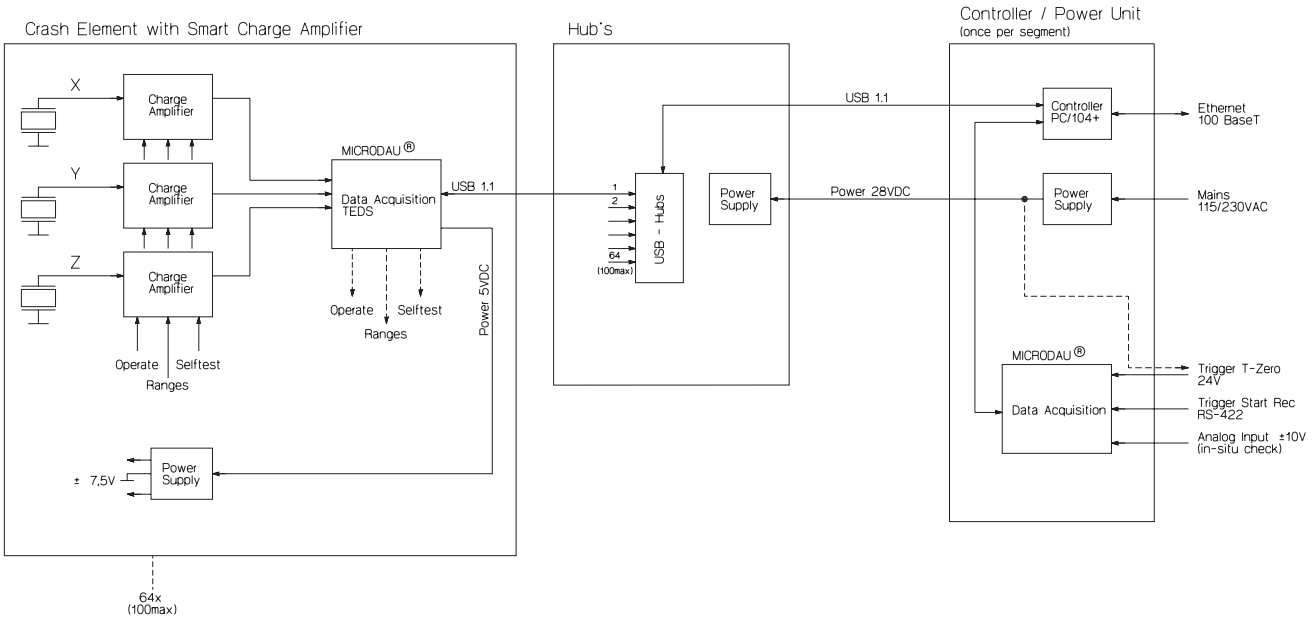


Fig. 12: Electric block circuit diagram with sensor electronics, hub and controller

System Configuration

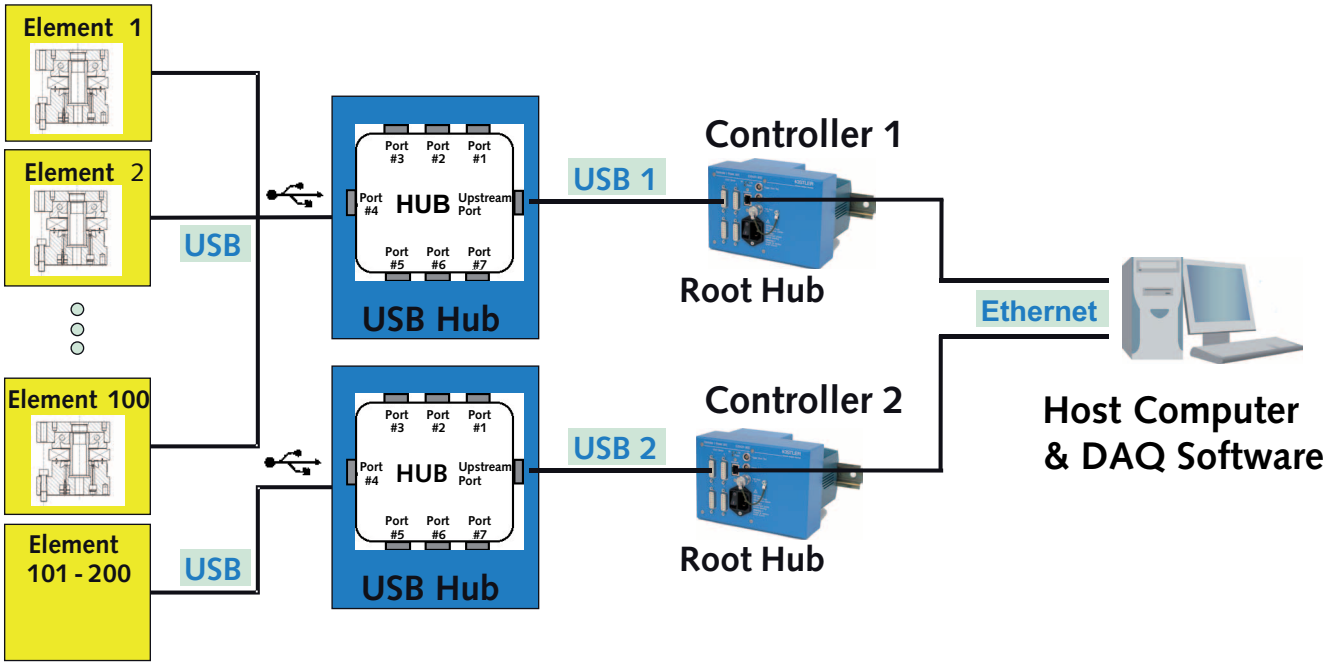
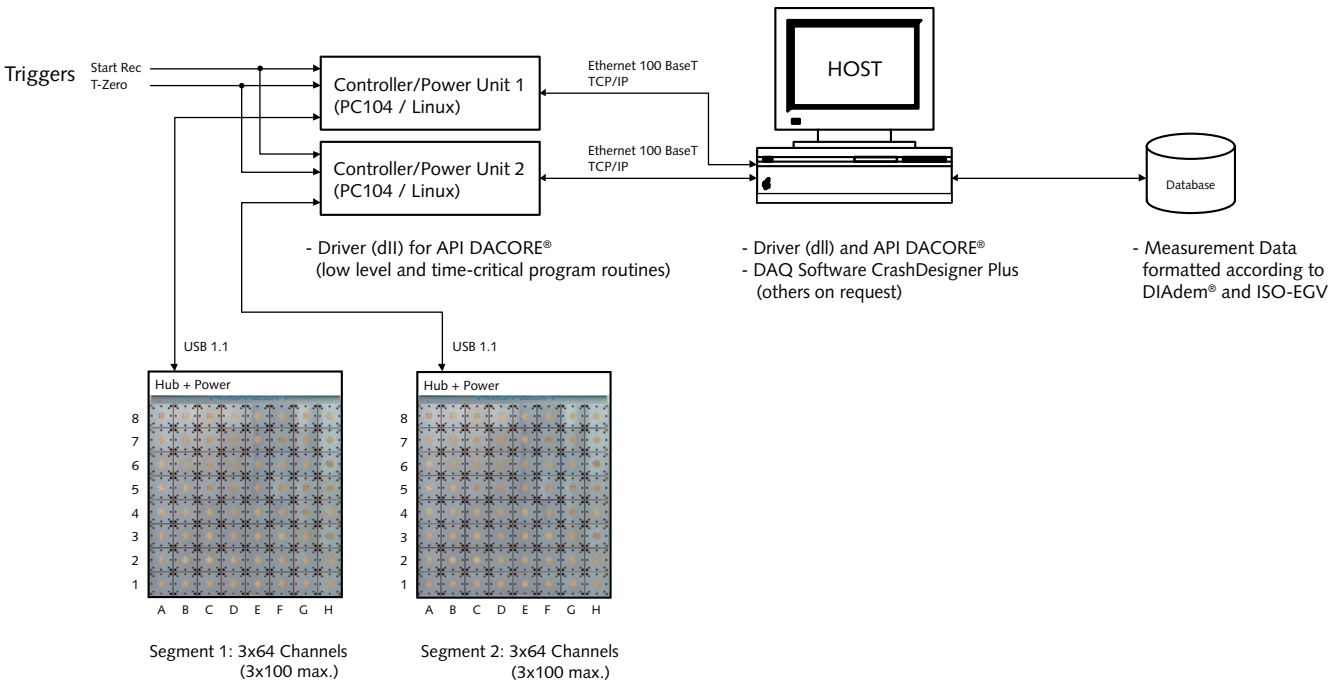


Fig. 13: General configuration of crash barrier

Data Acquisition Concept



TEDS:
- Calibration Data
- Position of Crash Element
- Serial Number of Sensor and MICRODAU® Module

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DIAdem® is a product of National Instruments.

Fig. 14: General concept for data acquisition

Fig. 15: Controller/power unit for one segment

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Included Accessories	Type/Art. No.
• Special tool assembly	Z20695-790

Optional Accessories	Type/Art. No.
Protection plates for standard SmartCrash segment	
• Plywood protection plates 123x123x21 mm, incl. mounting hardware	Z18722-180
Offset block for RCAR/AZT/EuroNCAP	
• Offset block incl. mounting hardware	on request
AZT 0 ° and 10 °	
• Al-front plates 248x248x60 mm, incl. mounting hardware	Z18722-181
• Corner elements, r = 150 mm incl. mounting hardware	Z18722-182
• AZT 10 ° front-/corner elements	on request
TRL-Test-Set	on request
• Plywood protection plate 123x123x21 mm	
• Plywood protection plate 123x164x21 mm	
• Clamping bars, 998x36x8 mm (4 units needed) incl. mounting hardware	
EuroNCAP-Test-Set	on request
• Fixation bar, top, 998x123x21 mm	
• Fixation bar, bottom, 998x123x21 mm	
• Clamping bars, 998x60x8 mm (2 units needed) incl. mounting hardware	
Storage and transportation of SmartCrash segment	
• Rack or transportation trolley	on request
Other spare parts	
• Adaptations and accessories to customer specification on request	
Service	
• Re-calibration on-site	9951-STDC-F-12

Ordering Key

Type 9655AQ ☐

SmartCrash Barrier with Digital Output

Version (internal)	...

Type 9655A ☐ Q ☐

SmartCrash Segment with Digital Output

Number of force measuring elements	...
Version (internal)	...

Type 9350A33Q ☐

SmartCrash Force Measuring Element with Digital Output

Version (internal)	...

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