

# SmartCrash Lightweight Element

Type 9357B1

## With digital data output

The piezoelectric SmartCrash force measuring element with integrated electronics measures 3 orthogonal components  $F_x$ ,  $F_y$  and  $F_z$  of dynamic forces in any direction. It is predestinated for measuring high dynamic impact forces during crash test procedures. The force measuring elements with integrated data acquisition and storage are supplied with the preloaded piezoelectric force sensors 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
- D-Sub 9 pin connector
- TEDS functionality (calibration data and automatic sensor identification)

### Description

The SmartCrash lightweight element consists of a cover plate and a base body. The piezoelectric quartz sensors (4 units) are preloaded by an expansion screw between base plate and top plate and electronics for data preprocessing and digitization are integrated in the base body. Each individual SmartCrash force measuring element measures the 3 orthogonal forces  $F_x$ ,  $F_y$  and  $F_z$  of the forces affecting during the crash. The piezoelectric sensors in the lightweight element generate a proportional charge on the force, which is summed, amplified and processed.

A summation print and a charge amplifier with a unit for digitization of analog signals (DiMod module) 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 in a central data recorder which simultaneously executes the parametrization and control. Before the actual measurement is performed, an automatic system check is carried out to check that the entire measuring chain is operating properly. Each individual force measuring element is connected by a corresponding connection cable to the data recorder via an RS-485 interface.



The SmartCrash force measuring element is supplied calibrated ready to be used for taking measurements immediately after being mounted. The power supply for a SmartCrash force measuring element is provided via the data recorder by means of an external power supply.

### Application

The SmartCrash lightweight element is mainly used in vehicle development for instrumentation of the full-scale **Mobile Progressiv Deformable Barrier (MPDB)** test with a 1 400 kg trolley where high dynamic forces have to be detected quickly, easily and precisely.

In the full-scale MPDB test, the test car is driven at 50 km/h and with 50 percent overlap into the **MPDB** mounted on an oncoming trolley, also travelling at 50 km/h. The mobile progressive deformable barrier represents the front end of another vehicle, getting progressively stiffer the more it is deformed. The test replicates a crash between the test vehicle and a typical mid-size family car.

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## Technical data

Measuring range	F <sub>x</sub>	kN	0 ... 300
Measuring ranges relate to the nominal sensor sensitivity	F <sub>y</sub>	kN	–100 ... 100
	F <sub>z</sub>	kN	–100 ... 100
Calibrated range	F <sub>x</sub>	kN	0 ... 300
	F <sub>y</sub>	kN	0 ... –50 <sup>1)</sup>
	F <sub>z</sub>	kN	0 ... 50 <sup>1)</sup>
Calibrated partial range	F <sub>x</sub>	kN	0 ... 200 <sup>1)</sup>
Bending moments	M <sub>y</sub>	kN·m	on request
	M <sub>z</sub>	kN·m	on request
Linearity (FSO)		%	≤±1,0
Crosstalk (FSO) – [typical values]	x → y, z	%	≤±2,0 [≤±1,0]
	z ↔ y	%	≤±3,5 [≤±1,0]
	y,z → x	%	≤±3,5 [≤±1,0]
Operating temperature range		°C	0 ... 40
Natural frequency of the crash force element alone	F <sub>x</sub>	Hz	>7 000 <sup>2)</sup>
	F <sub>y</sub> , F <sub>z</sub>	Hz	>4 000 <sup>2)</sup>
Mass/element	m	kg	3.8
Material lightweight element – top plate/base body			3.7165/3.4345
Protection (IEC)			IP65

<sup>1)</sup> Measuring ranges for determining the correction factors for crosstalk

<sup>2)</sup> Free air resonance

## Electronics

Selectable measuring ranges	F <sub>x</sub>	kN	20 ... 500
	F <sub>y</sub>	kN	4 ... 100
	F <sub>z</sub>	kN	4 ... 100
Self test signal		%FS	2 ... 50
Frequency range of charge amplifier (–3 dB)		kHz	>10
ADC resolution		Bit	16
Sampling rate (synchronous per channel)		kHz	20
Flash memory, per channel (150 s @20 kHz rate)		Samples	1 306 624
Data processing	RS-485 bus		
Data processing (external: host controller, TCP/IP)	Ethernet	100 BaseT	
Power supply (per element)		VDC	5.2 ... 6.0
		mA	≈50

## Functions

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

## Application Software (on Request)

- Preparation and execution software CrashDesigner
- Others on request

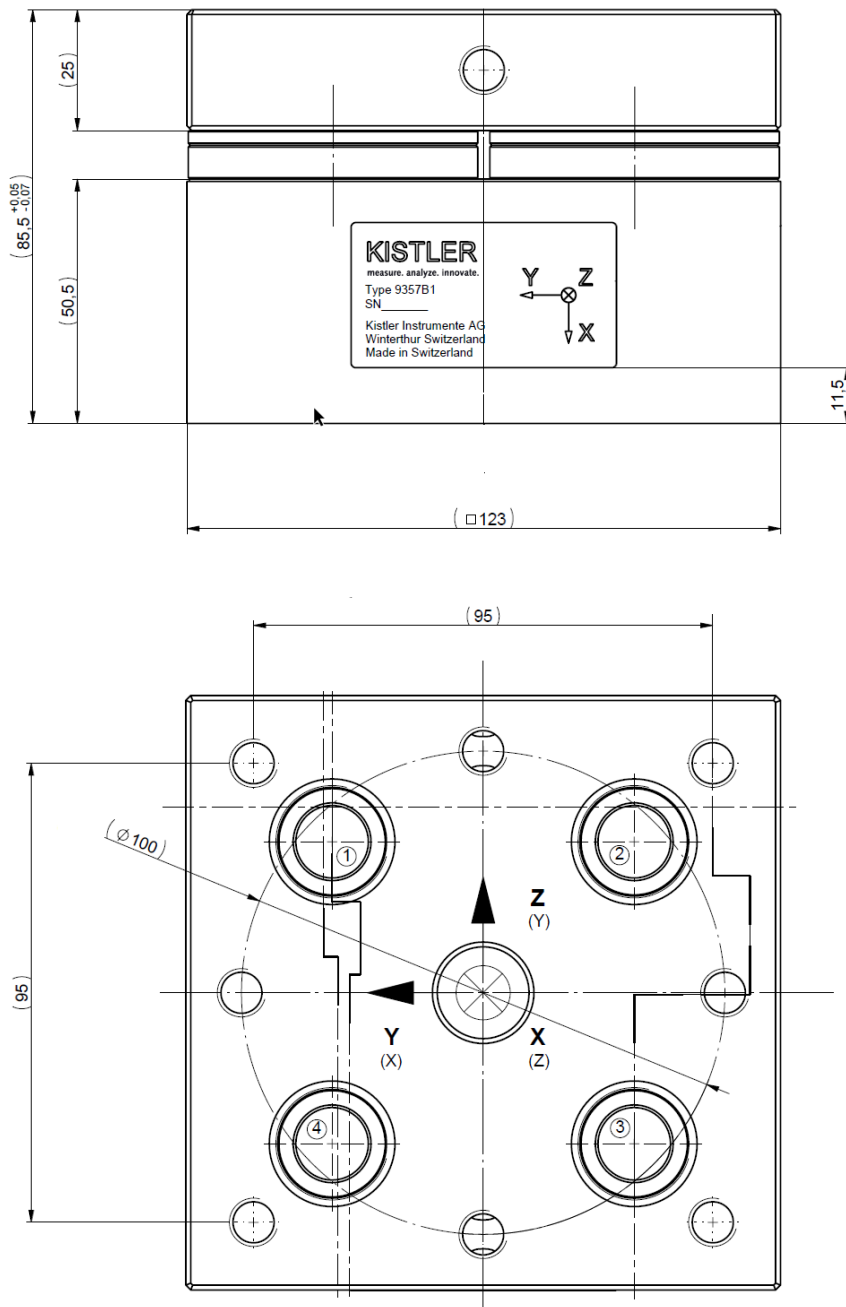


Fig. 1: SmartCrash Lightweight Element

### Ordering code

- SmartCrash Lightweight Element  
with Digital Data Output

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