Technical data

	Measuring range	Spring constant	Height (mm)
CBSF-10	20 ... 300 N	10 N/mm	107
CBSF-25	20 ... 500 N	25 N/mm	89
CBSF-30	20 ... 400 N	30 N/mm	75,5
CBSF-35	20 ... 500 N	35 N/mm	76
CBSF-40	20 ... 500 N	40 N/mm	73,5
CBSF-50	20 ... 500 N	50 N/mm	65
CBSF-60	20 ... 500 N	60 N/mm	64
CBSF-75	20 ... 500 N	75 N/mm	62
CBSF-150	20 ... 500 N	150 N/mm	60

Measuring surface:	80 mm Ø
Maximum measurement error:	± 3 % of reading
Measurement inaccuracy:	typ. ± 1 % of reading
Rise / Fall time:	≤ 1 ms
Capacity of internal memory:	100 single measurements
Voltage supply:	integrated NiMH rechargeable batteries
Power consumption:	20 mA
Interface:	USB/Wireless
Temperature range:	-10 … +50 °C
Relative humidity:	20 … 90 % r. h. (non-condensing)
Protection class:	IP 20
Weight:	~ 790 g

Pressure measurement via scan (Set CoboSafe-Scan)

Measurement inaccuracy:	typ. ± 10 % or less (measured at 23 °C, 65 % r.h.)
Temperature range:	+20 … +35 °C
Relative humidity:	35 … ~80 % r. h.
Measuring range film LLW:	50-250 N / cm²
Measuring range film LW:	250-1000 N / cm²

Pressure measurement using film sensors (Set CoboSafe-Tek)

Pressure sensor types:	9500	5051	5151	5101	5027
Pressure range:	827 N/cm²	242 N/cm²	242 N/cm²	242 N/cm²	345 N/cm²
Measuring surface:	70 x 70 mm	56 x 56 mm	165 x 165 mm	112 x 12 mm	28 x 28mm
Sensors:	3.9/cm²	62.0/cm²	7.1/cm²	15.5/cm²	248.0/cm²
Measurement inaccuracy:	< 10 %	< 10 %	< 10 %	< 10 %	< 10 %

Optionally available:
- CBSF-75-Gripper as an additional force transducer for measurements on grippers
- CBSF-75-Basic: force transducer with handle and display
- Mounting bracket

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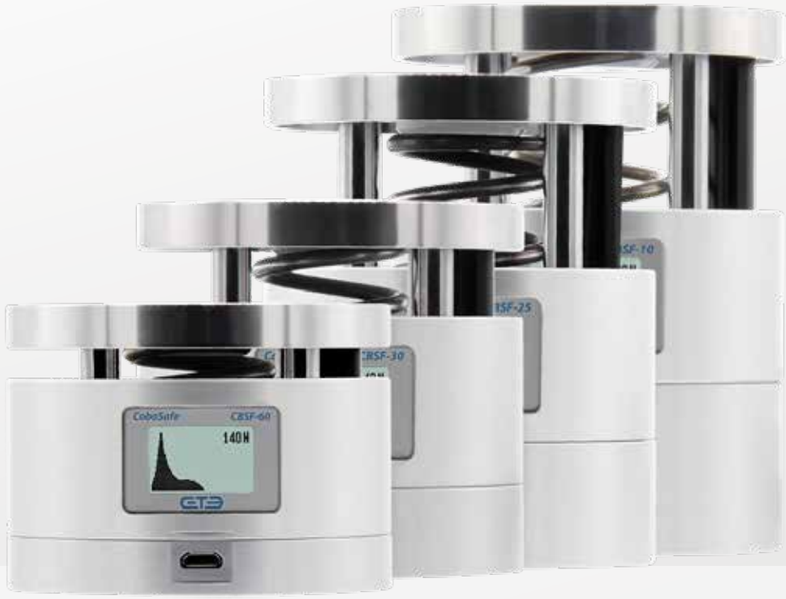
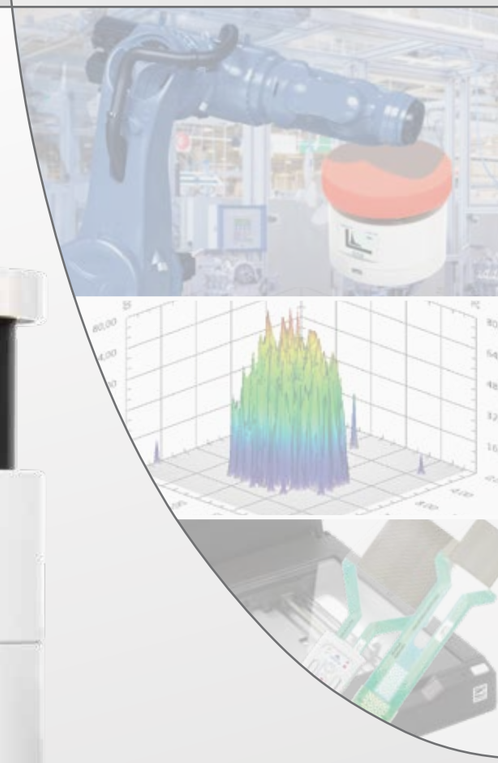
Product division measurement and sensor technology

CoboSafe





Measuring system for the testing of transient and quasi-static **forces** and **pressure** on collaborative robots

In conformance with ISO/TS 15066, ISO 10218-1 and ISO 10218-2

Developed in conjunction with: DGUV

Force and Pressure Measurement System CoboSafe

Demand-based measuring technology in HRC working areas: the modular system permits the customized and extendible assembly of measuring sets.

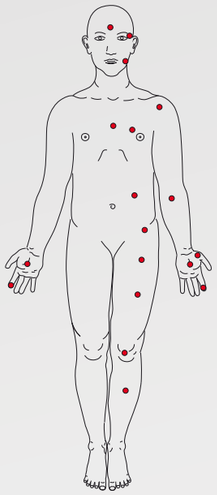
In any human-robot collaboration (HRC) without separating protective equipment, collisions between humans and robots cannot be completely ruled out. The permissible limit values for force and pressure in accordance with ISO/TS 15066 must be observed as they ensure the safe operation of HRC work areas. Regarding occupational safety arise different requirements on work spaces of collaborative robots. Collision prevention and detection, torque monitoring and force limitation have to achieve a similar level of protection like separating protective fences.

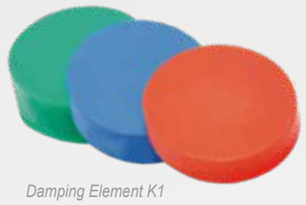
The force and pressure measurement system CoboSafe meets all the requirements that are necessary to verify the adherence of limit values and is tailored for every application area. Depending on the requirement and objective, a set with up to nine force transducers with different spring constants can be set up. The combination of the spring constants (K2) with one of the additional damping elements (K1) allows the biomechanical properties to be configured according to ISO/TS 15066, DGUV (German Social Accident Insurance) information „FB HM-080“ and „RIA TR R15.806-2018“ specified by the Robotic Industries Association of the American National Standards Institute.

As a component for pressure measurement are either a simple scan pressure measurement method or a more demanding pressure measurement method based on electronic film sensors available.

CoboSafe Components:

1. PC-Software **CoboSafe-Vision**
2. Force transducer **CoboSafe-CBSF** (composition of 9 variants with different spring constants)
3. Set **CoboSafe-Scan**: Pressure measurement via scanner or
   Set **CoboSafe-Tek**: Pressure measurement using film sensors

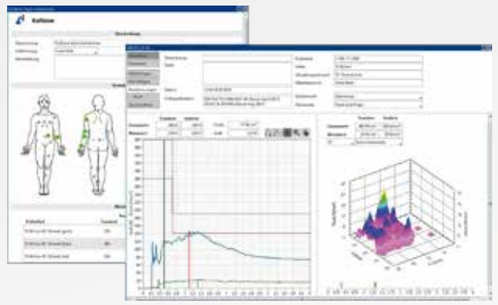




Damping Element K1

1. Software CoboSafe-Vision

The software CoboSafe-Vision visualizes the force curves measured and the pressure images. It calculates and determines the values for the transient and quasi-static forces. An assessment of the pressure image is possible by means of the two and three-dimensional representation as well as by using the filters. Individual reporting is also possible, such as csv-export.



2. Force Measurement: CoboSafe-CBSF

For each of the nine spring constants according to ISO/TS 15066, one aluminum made calibrated force transducer is immediately available and ready for measuring without any further preparation. The heart of the force transducer is the Piezo force sensor with linear-guided measuring mechanism which guarantees optimum measuring accuracy and reproducibility. The force gauge is equipped with integrated electronics for the evaluation and storage of the values measured. The storage capacity is up to 100 single measurements. The transient and quasi-static values are represented via the display. Data are transferred wireless, or alternatively by USB interface. In this way, the force transducers are very easy to position and the data is immediately visible on the PC or another external display screen.

3. Sets Pressure Measurement: CoboSafe-Scan and CoboSafe-Tek

The set CoboSafe-Scan is based on Fujifilm Prescale measurement films. It records the pressure distribution and the maximum pressure.

The films react to the pressure and display the pressure distribution. The pressure force is determined by the intensity of the discoloration of the pressure measuring films. Using a scanner and a calibration-sheet, the pressure image is imported into the Software CoboSafe-Vision and evaluated automatically. The imported pressure film is converted into pressure values and the pressure image and maximum pressure are displayed as a result. The set includes a scanner, a calibration-sheet and films.

Scanner ,calibration-sheet and films

The set CoboSafe-Tek supplies via electronic film sensors next to maximum pressure and pressure distribution also a pressure curve measurement.

The system is particularly suitable for applications which require very detailed results. The collision pressure is recorded as a "film". By means of synchronization on the force curve, the pressure values and the pressure distribution can be determined and visualized for the required transient and static pressure. The system will show all four measured values according to ISO/TS 15066. It comprises various film sensors, a handle for picking up the films and a hub (interface). The film sensors can be reused several times and consist of ultra-thin circuit boards with circuits and pressure sensitive cells.

Versatek™ Hub

Film and Versatek™ handle