

STRAIN AND FORCE SENSORS WITH TECHNOLOGY SENSORMATE

THE SOLUTION FOR INJECTION MOLDING MACHINES



GEFRAN

GEFRAN. You know we are there

WE ARE THERE ... IN PLASTICS!

For Gefran, plastics is a passion. We were established as a producer of electronic devices to control industrial process variables, and entered the plastics processing market 40 years ago, developing and delivering technological solutions for related industrial processes. This experience has given Gefran comprehensive knowledge of the market's needs, making us a reliable and effective partner for plastics OEMs and end users.

WE ARE THERE ... IN PRODUCTS!

Every Gefran product is conceived and built in-house by our own technical personnel, who **design** and **produce the devices we ship all over the world every day**.

Total knowledge of our products and how they are made guarantees their reliability and, above all, ensures the flexibility with which we immediately respond to our customers' needs and to market demands.

WE ARE THERE ... CON SOLUZIONI PER LA MISURAZIONE E IL CONTROLLO!

Gefran **solutions range from systems for measuring of physical variables to products for machine, heat, and movement control**.

We make sensors for position, pressure, force, and temperature, hardware and software automation platforms, inverters, and drives - and they are all produced with passion.

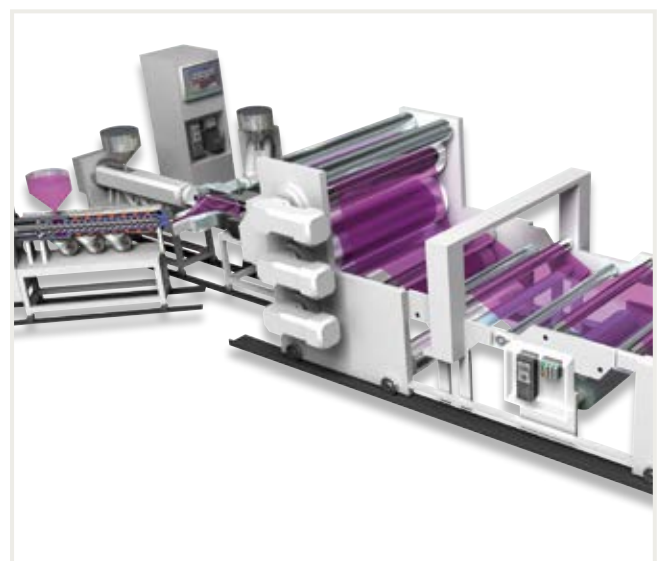
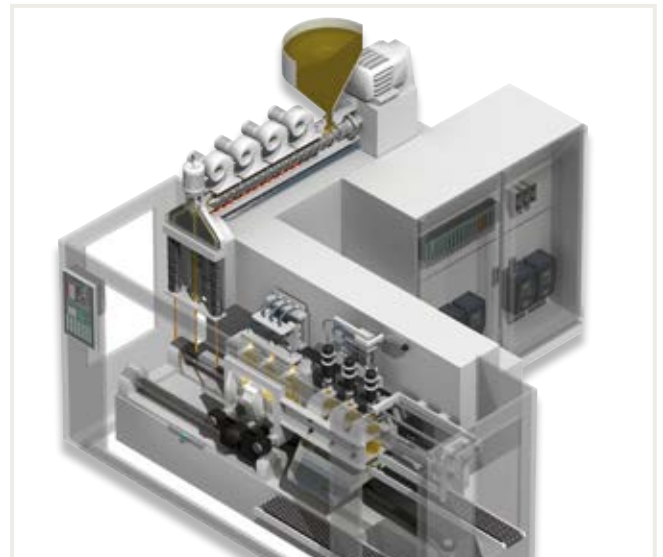
WE ARE THERE ... IN CUSTOMER RELATIONS!

Our customers are consistently supported by **highly qualified** staff in choosing the right product - each with special and unique features - for their application.

In addition, Gefran's after-sales support delivers reliable and dynamic service to resolve any issue with our products and their application.

WE ARE THERE ... ALL OVER THE WORLD!

Gefran has nine production plants (in Italy, Germany, Switzerland, United States, Brazil, China, and South Africa) and seventeen branches all over the world. A network of about 80 distributors completes a worldwide presence that guarantees truly global customer service.



SENSORS FOR MOLDERS

Injection molding machines are no longer manufactured without sensors. The reason is simple: ever increasing demands for improved performance and consistent product quality call for fast and reliable machines with sophisticated controls. Sensormate products provide this control and help to achieve continuously higher quality levels. Sensormate prides itself on delivering products which offer maximum ease-of-use, making the job for the molder as simple as possible.

ALL THE SENSORS YOU NEED FROM ONE MANUFACTURER

That's why over 80% of injection-molding machine manufacturers worldwide use our sensors for:

- Machine alignment
- Quality control
- R&D
- After-sales service
- Machine monitoring

Sensormate's focus on injection molding machines has led to the development of several patented products, including:

- Magnet tie bar sensors
- Wireless load cells
- Mold protection systems

And since Sensormate is now part of the Gefran Group, our customers benefit from decades of experience in sensors and controls.



APPLICATIONS

ALL-ELECTRIC INJECTION (and not only)

>Injection force:

- Wireless range of load cell for highly accurate monitoring of injection pressure, measuring axial force and torque (optional); optimum location behind the screw.
- Diaphragm load cell: the flat-body design allows for easy integration into the Injection unit.

>Mold protection (also in **Hydraulic/Hybrid Injection molding machine**):

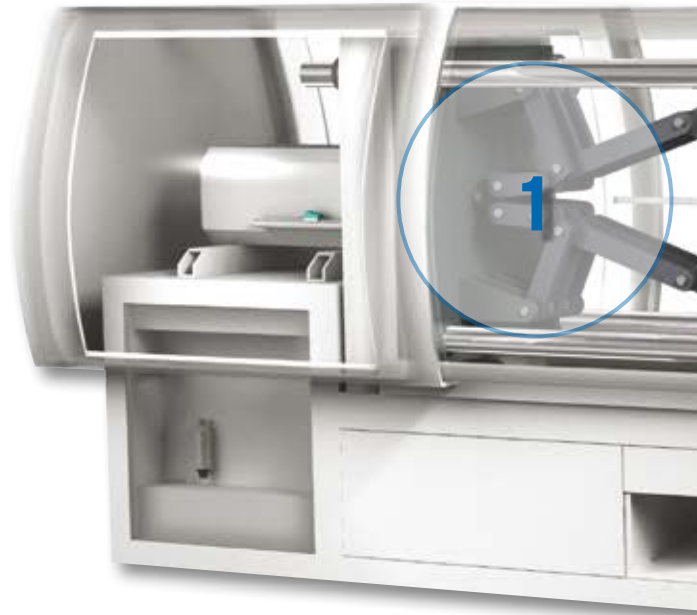
- Our strain sensors detect parts between mold halves instantly.

>Locking force (also in **Hydraulic/Hybrid Injection molding machine**):

- Strain sensors (SB,SL) measure the deformation on the fix platen and on the toggle which is proportional to the Clamping Force.
- Sensor ML inside tie bar, fast and easy mounting.
- Tie-bar GE strain sensors measure around the tie bar with 2 steel belts: flexible with diameter, fast and easy install, very high accuracy, for continuous online-control.

>Cavity pressure:

- Our Tie-bar GE strain sensors are able to reproduce the cavity pressure profile during injection.



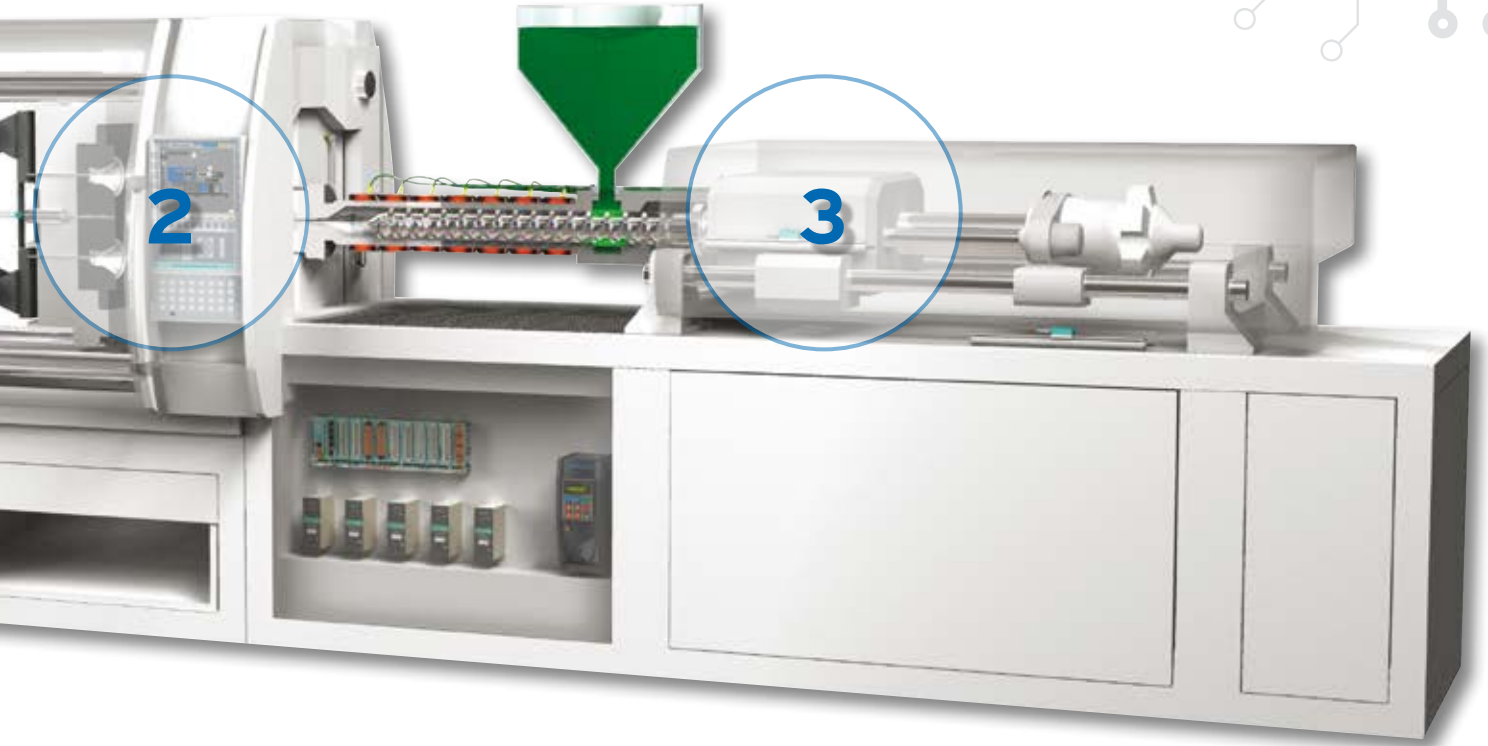
>Service (also in **Hydraulic/Hybrid Injection molding machine**):

- RQE1008 Magnet Tie Bar sensors for machine Setup Service, fast and accurate, used by most machine manufacturers worldwide.
- Nozzle Touch Force: magnet mountable, can be used to calibrate the load cells.

INJECTION MOLDING MACHINE

	ALL-ELECTRIC	HYBRID	HYDRAULIC
INJECTION FORCE	Wireless load cell Diaphragm load cell		
MOLD PROTECTION	Tie bar strain sensor GE Strain block SB	Tie bar strain sensor GE Strain block SB	Tie bar strain sensor GE Strain block SB
LOCKING FORCE	Strain block SB Strain link SL Strain probe ML Tie bar strain sensor GE Strain ring AN	Strain block SB Strain link SL Strain probe ML Tie bar strain sensor GE Strain ring AN	Strain block SB Strain link SL Strain probe ML Tie bar strain sensor GE Strain ring AN
CAVITY PRESSURE	Tie bar strain sensor GE Strain block SB	Tie bar strain sensor GE Strain block SB	
SERVICE	Nozzle touch force sensor DAK Magnet mount strain sensor QE1008	Nozzle touch force sensor DAK Magnet mount strain sensor QE1008	Nozzle touch force sensor DAK Magnet mount strain sensor QE1008

INDUSTRIAL STRAIN AND FORCE SENSORS



1 PLATEN AND TOGGLE TOGGLE

The structural integrity of the molding machine is determined by the platen, toggle and tie bars.

Monitoring the deformation of these three elements, along with that of the mold being used, is crucial.

Our strain sensors deliver signals to analyze deformation of the machine and mold, and control it on-line.

Sensormate sensors are ideal for R&D, final inspection, and after-sales support.

2 TOGGLE AND TIE BAR

Molding machine deformation is an indirect effect of the locking force, which can be very accurately measured on the tie bars. Our strain sensors can measure with high precision the strain in, on and around the tie bar.

The high resolution of our sensors even allows checks to be made indirectly of the cavity pressure on the tie bar.

We have solutions for final inspection, after-sales service and online control.

3 INJECTION FORCE

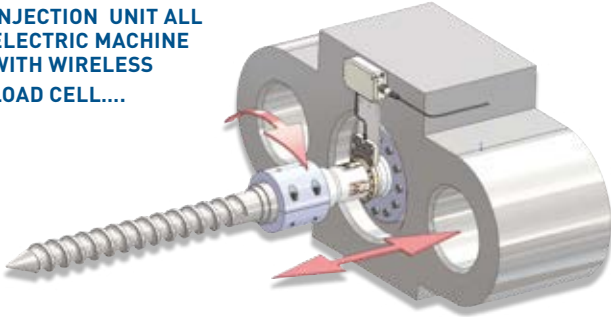
Injection pressure is the most important parameter in the molding process, so sensors to monitor this need to be at the heart of the all-electric injection molding machine.

For this reason, our newly developed wireless load cell has been designed for mounting directly behind the screw for maximum accuracy.

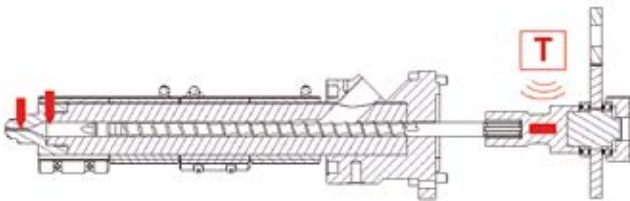
As an option, it can also deliver a torque signal at the same time, to improve the process quality of your machine.

1 WIRELESS LOAD CELL

INJECTION UNIT ALL ELECTRIC MACHINE WITH WIRELESS LOAD CELL....



Without doubt, as a process parameter the best signal can be found at the screw ante chamber (Nozzle). But this spot is very exposed and is only recommended to use for single use machines (nozzle change etc.). A telemetric solution at the nozzle is not available today and for the next future.



SOME FEATURE....

- Non-contact inductive power- and signal transmission
- Injection Force AND Torque (for perfect backpressure measurement)
- Digital amplifier VDA268 already integrated inside rotating part (load cell)
- Safe and reliable power and signal transmission
- Application for extruders, Injection Pressure Measurement in Injection Molding Machines and Measurements on shafts and spindels (long term).

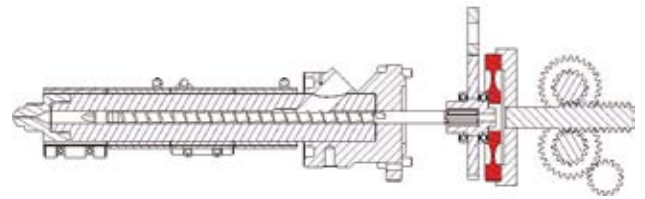
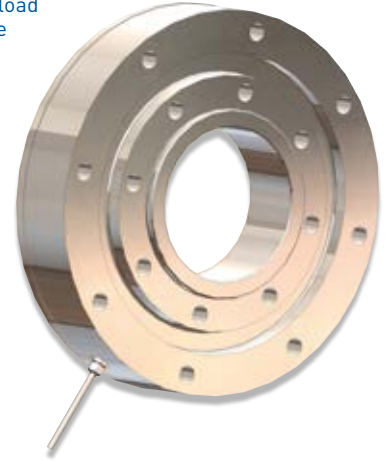
SAMPLE DIMENSIONS OF LOAD CELLS (@2mV/V)...

LOAD RANGE	LENGTH (mm)	DIAMETER	INNER-D
< 100 kN	75	35	25
≤ 100 kN	85	38	30
≤ 200 kN	90	41	30
≤ 300 kN	100	46	30
≤ 400 kN	110	50	30
≤ 500 kN	120	54	30
≤ 700 kN	120	60	30
≤ 1000 kN	150	70	30
≤ 1250 kN	160	75	30
≤ 1500 kN	170	83	30

2 DIAPHRAGM LOAD CELL

INJECTION UNIT ALL ELECTRIC MACHINE WITH DIAPHRAGM LOAD CELL

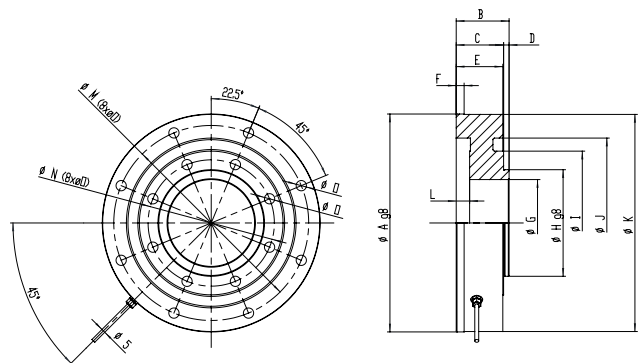
Pancake like diaphragm load cell designed for the case in Fully electric Injection Molding machines. The flatbody design allows for easy integration into the Injection unit without adding to the machine length. Available with standardized mV/V output or an EEPROMmodule to allow for higher mV/V-output for better signal/noise ratio.



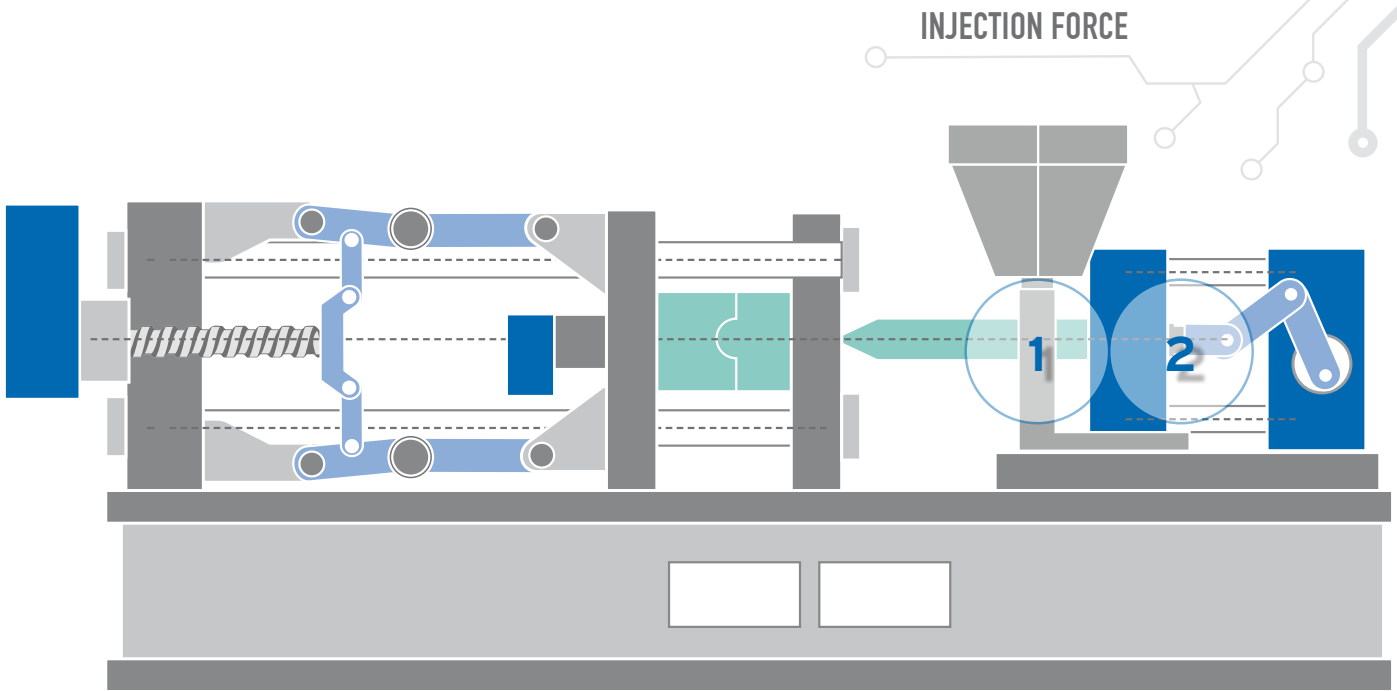
SOME FEATURE....

- Flat-body design
- Good linearity
- Designed integrate into machine
- With integrated amplifier
- With EEPROM for sensitivity detection

SAMPLE DIMENSIONS OF LOAD CELLS



Rated capacity	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
50kN	181	40	37	3	36	5	72	80	112	138	174	14	154	93	9
80kN	181	40	37	3	36	5	72	80	112	138	174	14	154	93	9
150kN	181	65	60	5	59	10	70	80	112	138	180	17	160	93	9
200kN	181	65	60	5	59	10	70	80	112	138	180	17	160	93	9
300kN	276	67	60	7	59	10	110	135	182	208	275	17	247	160	13
500kN	276	67	60	7	59	10	110	135	182	208	275	17	247	160	13
650kN	322	67	60	7	59	10	173	180	230	270	321	15	298	194	13



DIAPHRAGM VS COMPRESSION LOAD CELL

Most of today's all electric Injection Moulding machines use diaphragm load cells. But there are some drawbacks of this technology.

The following list shows the pros and cons of Diaphragm compared to Compression Load Cells.

The compression load cells – mostly used in wireless rotating load cells – have excellent technical data.

DIAPHRAGM-LOAD CELLS

Advantages

- Compact design (flat)
- Does not add much to Injection unit length

Disadvantages

- Heavy part (can be up to 100kg!)
- Expensive raw body (raw material, temperature treatment, machining)
- Difficult and expensive handling (shipping, installation)
- High grade steel necessary because of high strain in machined grooves
- Relative low signals (1,0...1,7mV/V), depending on design
- High strain peaks in the edges of the groove plastic deformation occurs locally
- Accuracy of strain gage location is very important for high signal
- High deflection of load cell, causing lower reaction time of injection process
- Linearity is typically 0,5%, depending on the design (because in the groove are compression and elongation necessary)



- Up to 2.0 mV/V signal are possible (depending on load introduction part 2 mV/V is ca. 1500 mε = 315 N/mm²), with narrow tolerances
- Only compression strain; fail safe designs possible
- 2.0 mV/V means better signal/noise ration (good for metering)
- Strain gage position is less critical
- Better temperature behavior because of body structure
- Low deflection even at 2.0 mV/V
- Very good linearity of load cell without any special measure or linearization: <0.25% FS is easy to achieve
- Very low hysteresis (because only compression mode)
- No cross talk

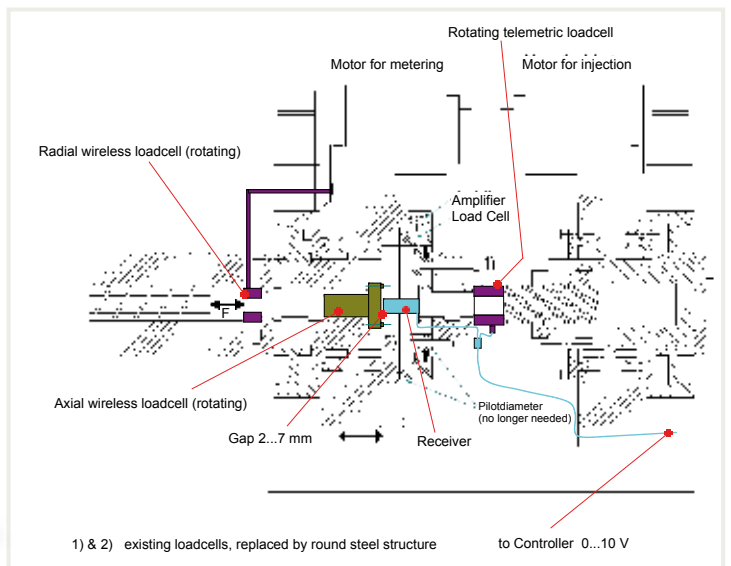
Disadvantages

- Long design (adding to Injection unit length)
- Sometimes difficult to install
- Load introduction into load cell body can be a problem

COMPRESSION LOAD CELLS

Advantages

- Light weight, low machining costs low price
- Simple body design, easy handling, low shipping costs
- Plated standard steel can be used (easy to machine)



3 STRAIN LINK



- Amplifies the strain between the 2 mounting areas mechanically
- Ideal for tension mode
- With analog amplifier (active)
- Dynamic applications
- Solid steel housing (IP54)



SL

4 STRAIN BLOCK

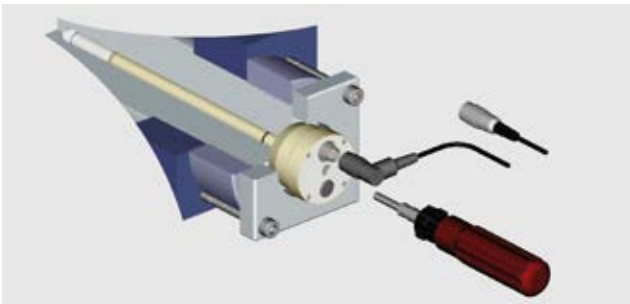


- Direct surface strain reading like bonded strain gauges, high linearity on tension and compression
- With integrated analogue amplifier (active)
- For dynamic applications
- Quick and easy mounting
- Very high accuracy (like bonded strain gauges)
- Protected against overload



SB

5 STRAIN PROBE



- Measure strain in deep holes
- With calibrated digital amplifier (active)
- Quick and easy mounting with torque-wrench
- High linearity on tension and compression
- For dynamic applications
- A Very high accuracy (like bonded strain gauges)
- Protected against overload



ML

6 STRAIN RING

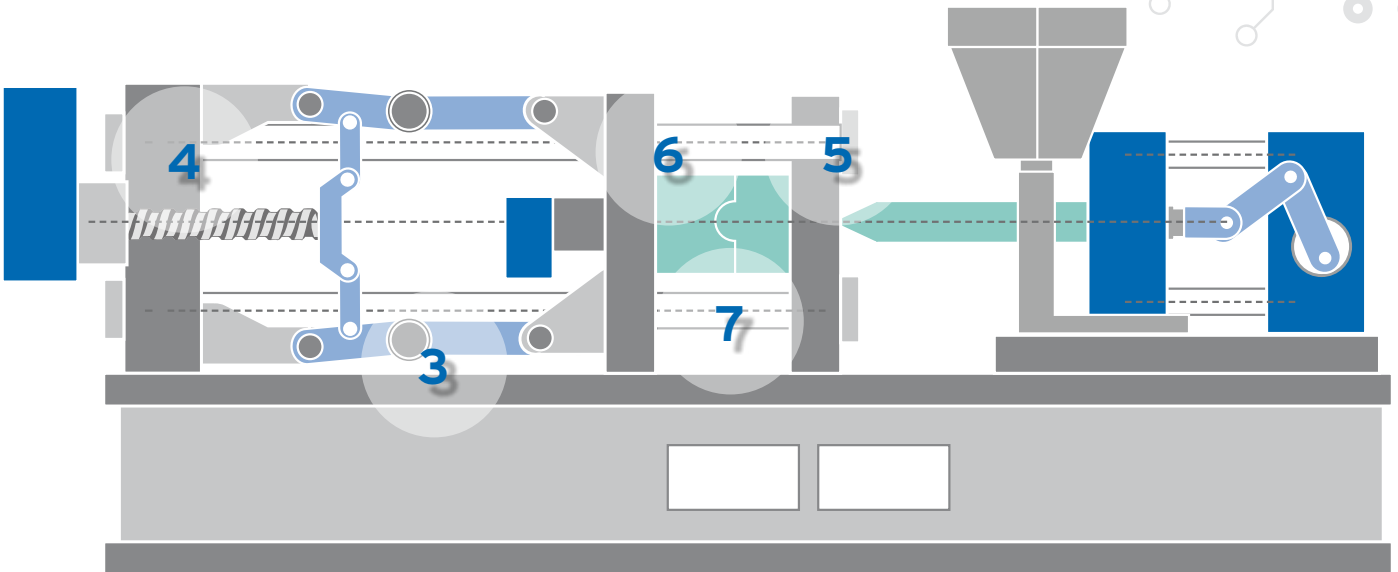


- Fast and easy strain measurement on cylinders (magnetic or not)
- Clamp the strain ring around the tie bar and measure
- 0,5% accuracy - without calibration
- Ideal for cyclical applications, e.g. clamping force measurements on presses

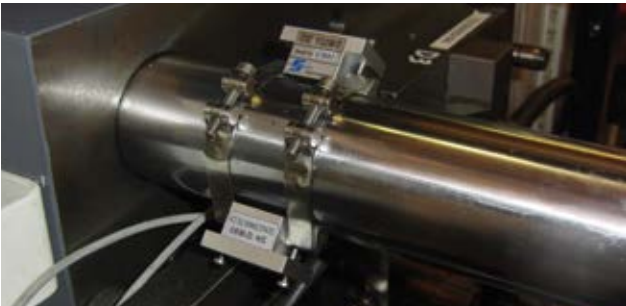


AN

CLAMPING FORCE AND MOLD PROTECTION



7 TIE BAR STRAIN SENSOR

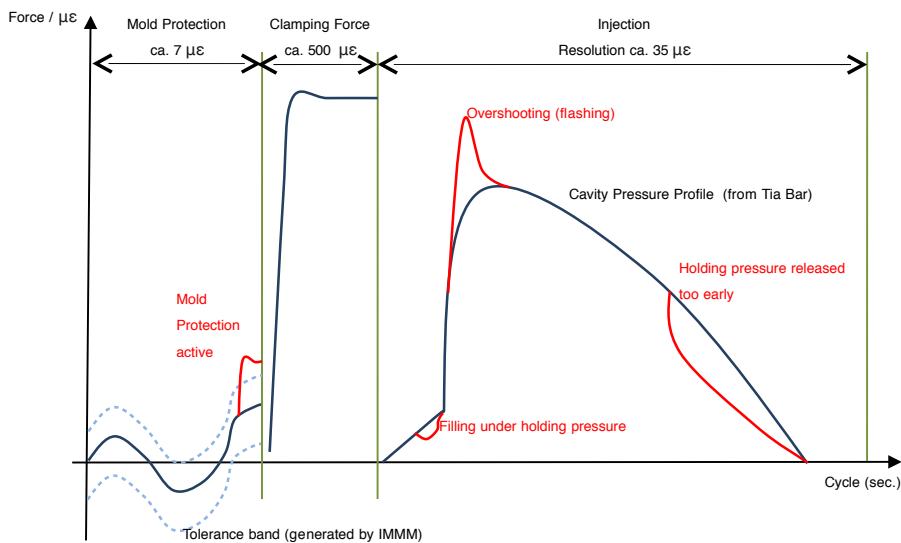


- Direct surface strain reading on
- High linearity on tension and compression
- Without amplifier (passive)
- For dynamic applications
- Fast and easy mounting
- Very high accuracy (like bonded strain gauges)
- Protected against overload
- One system for many tie bar diameters
- Ideal for on-line control of clamping force
- Make your own load cell



GE

TRIPLE MEASUREMENT SYSTEM



Triple Sensing System: Mold Protection, Clamping Force and cavity pressure profile in ONE system

(Pat. Pend.), only for toggle machines, based on GE1029 & VDA268sp

**MOLD PROTECTION,
LOCKING AND CAVITY
PRESSURE PROFILE
IN ONE SYSTEM**

NOZZLE TOUCH FORCE SENSOR DAK

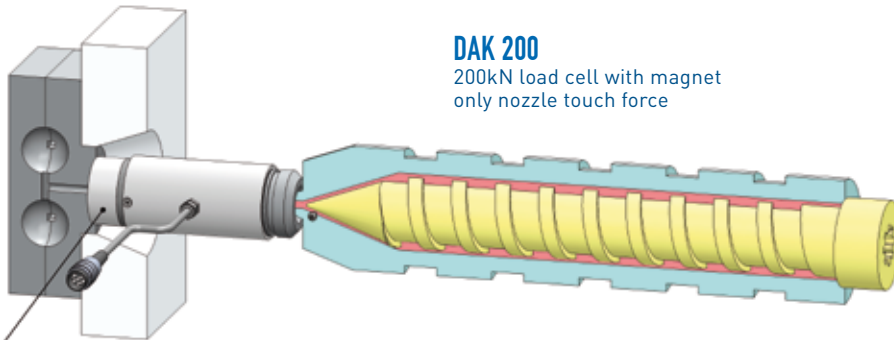
- Small and compact unit.
- Easy to use.
- Range of force measurement: 200/450 kN.
- To connect directly to our DU-4D / DU-1D monitors.
- No additional display unit necessary.
- Additional magnet holding plate available.
- Many optional nozzle adaptors can be retrofitted (e.g. in brass).
- Standard nozzle adaptor in ductible stainless steel.

Modern, all-electric injection molding machines have the need that the nozzle touch force (= nozzle contact force) needs to be checked every now and then.

The nozzle touch force sensor type DAK measures the nozzle touch or nozzle contact force reliable with high accuracy and repeatability.

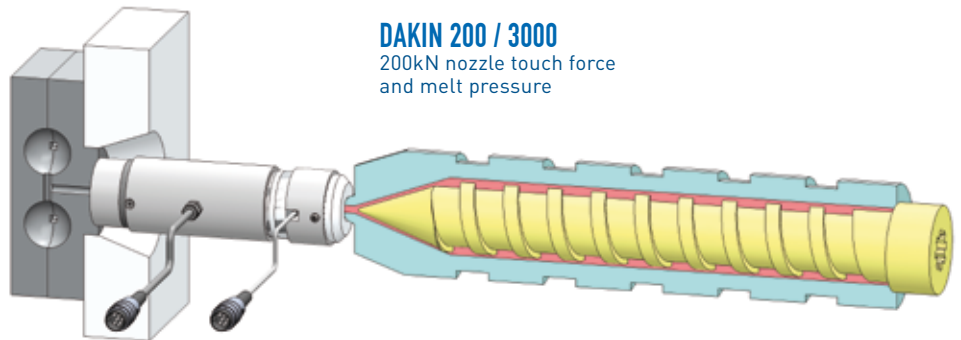
Simply place the DAK with the optional magnet base onto the mold, connect it to our existing monitor and move the nozzle onto the sensor and measure!

The high grade, plated steel makes this sensor a reliable tool which will fulfil its purpose for many years to come. Optional parts like magnet base for easy mounting and nozzle inserts complete the value of this tool for the molders.



DAK 200
200kN load cell with magnet
only nozzle touch force

Magnet type
MA-1



DAKIN 200 / 3000
200kN nozzle touch force
and melt pressure

MAGNET MOUNT STRAIN SENSOR QE1008

- Mounts strain gages in seconds on tie bars or cylinders with 2 magnets
- High accuracy and linearity on tension and compression
- Can be used on any diameter and even on flat surfaces
- For dynamic applications
- Can not be overloaded (offset may occur)
- Without integrated amplifier (passive)
- Also available in WIRELESS VERSION

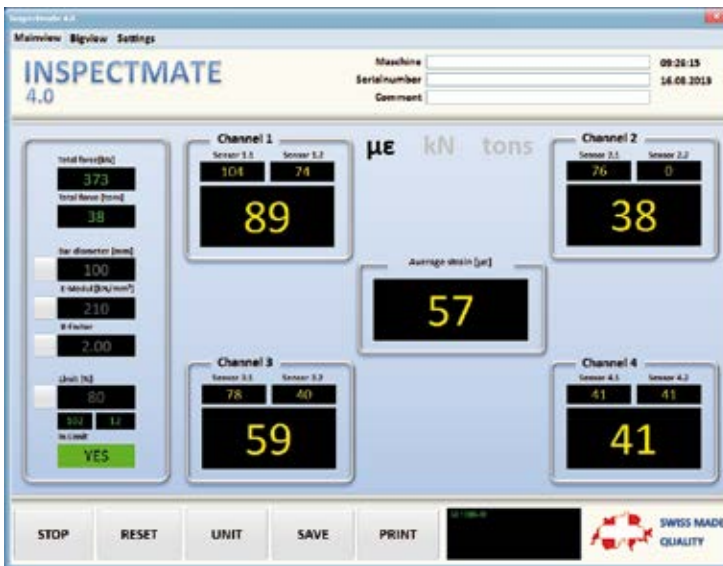
The magnet-press-on strain sensors QE1008 measure the surface-strain directly at the mounting location, similar to bonded strain

gages. The QE1008 is mounted in seconds and presses strain gages under the stainless protective foil that strongly onto the surface to be measured that friction replaces the bonding normally used to fix strain gages.

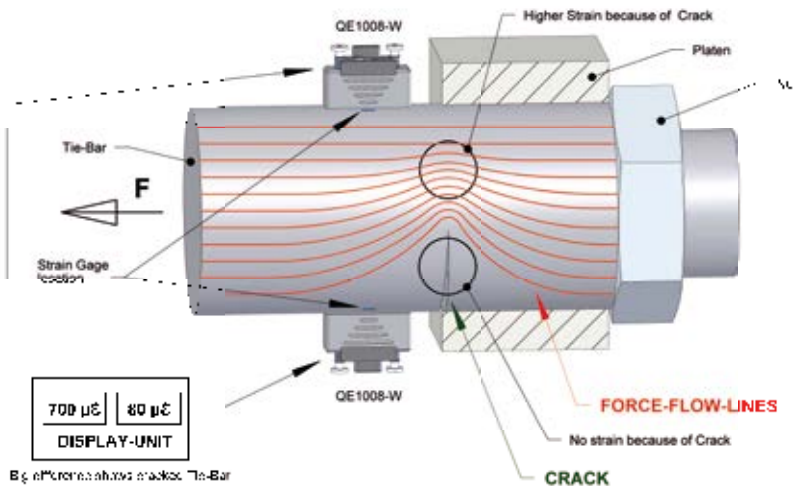
The mounting is very fast, and the strain gage is protected. The sensor can not be overloaded. The sensors do not need to be recalibrated once they have been replaced or remounted. They all have a standard sensitivity of 2.00. They need a cyclical reset (for cycles >1min.).

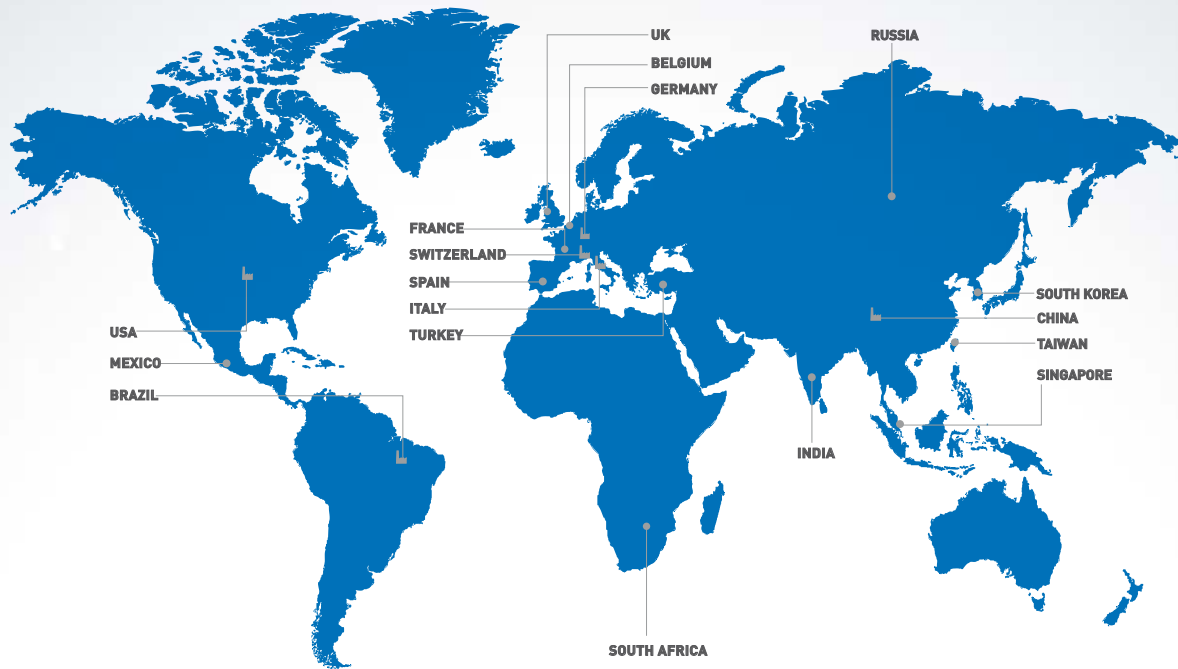
Our monitors can handle the occurring large offset range.

SOFTWARE DATA (also bending measurement with wireless model):



DETECTING CRACKS ON TIE-BARS:





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