

## DATA SHEET

# Three-Component Dynamometer for Cutting Force Measurement

### Introduction

Three-Axis Force Sensor measures forces  $F_x$ ,  $F_y$ ,  $F_z$  in all three independent loading directions. It is able to measure force in both tension and compression direction

Strain gauge-based force sensors are accurate and reliable devices for measuring orthogonal cutting forces and moments. They are also inexpensive and easy to use.

The force sensors designed with a monolithic measuring body on which three independent strain gauge bridges are attached. They have good rigidity and high natural frequency, making them inherently suitable for universal application in cutting force measurement and also withstand high bending moments for eccentric force applications. Low profile design makes it suitable for 3-axis force measurement where mounting space is limited.

### Typical applications

- General 3-component force measurement (dynamic and quasistatic)
- Cutting force measurements for optimization of the manufacturing process (temporary measurement)
- force exertion control in automotive crash testing, industrial test benches, grinding force control, actuator operating force measurement, etc.

### Description

The sensor element is fitted between a Cover Plate and a Base Plate on which a terminal box is mounted with connector plugs for the bridge power supply and output signals.

Both plates have provision for mounting other attachments and have been electroplated thus making it useful even for external applications.

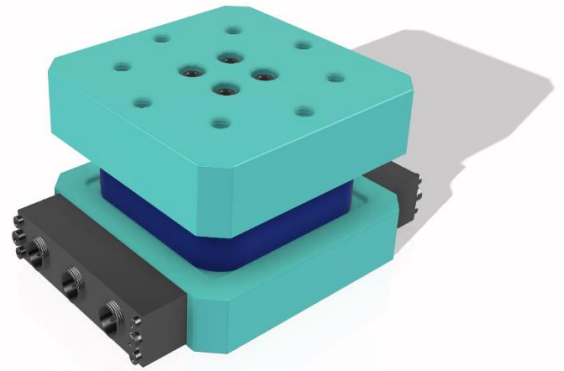
### Applications

**Machine tool design:** The sensor measures the cutting forces in machining operations. This information can be utilized to design machine tools that are better able to withstand the stresses and strains imposed by these forces.

**Tool geometry optimization:** The dynamometers can be used to optimize the geometry of cutting tools. By measuring the cutting forces under different conditions, it is possible to identify the optimal tool geometry for a given material and cutting condition.

**Machinability testing:** The force sensor can be used to test the machinability of new materials. By measuring the cutting forces, it is possible to assess the difficulty of machining a particular material and to identify the optimal cutting conditions.

**Tool condition monitoring:** Our force sensor can be used to monitor the condition of cutting tools. Measuring the cutting forces and moments makes it possible to detect tool wear and breakage before they cause problems.



Model Type: NK23-TFS10K

### Technical Specifications of NK23-TFS100K

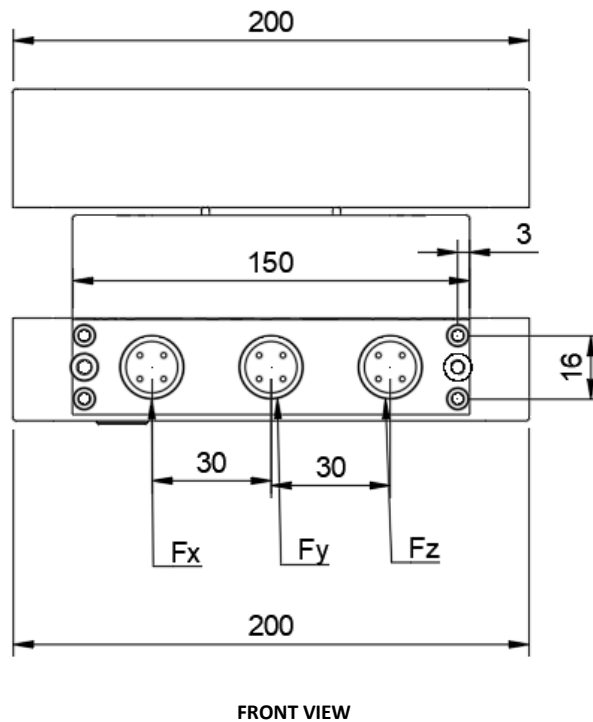
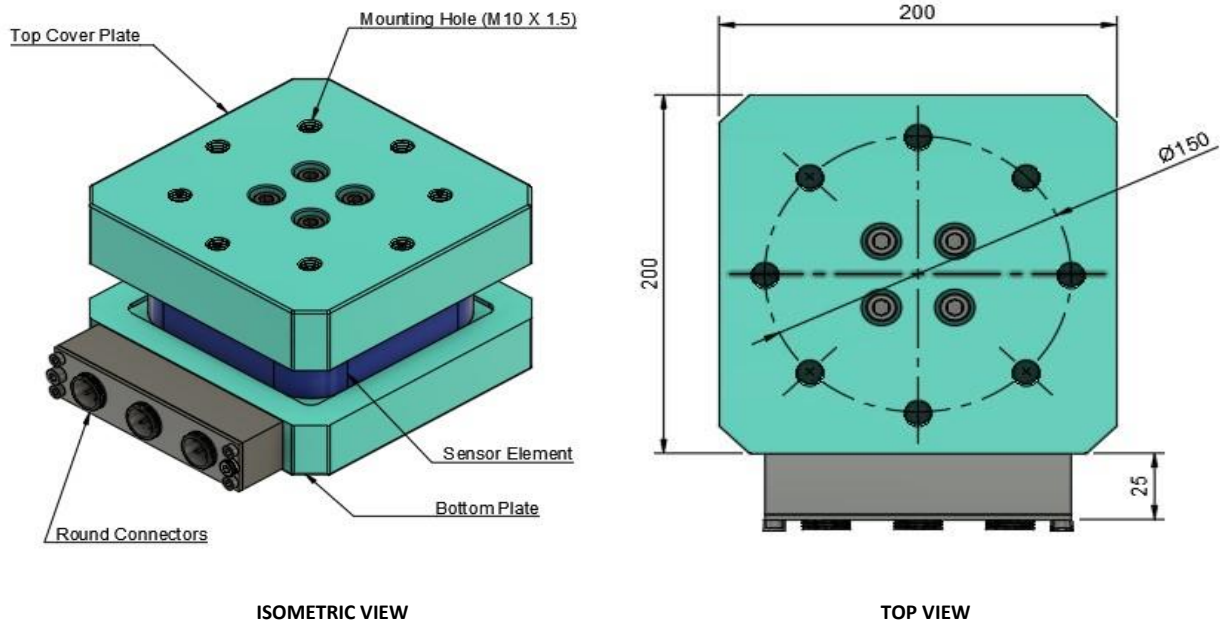
|                                       |                     |                 |
|---------------------------------------|---------------------|-----------------|
| Force Range ( $F_x$ , $F_y$ , $F_z$ ) | 10000               | N               |
| Over Load ( $F_x$ , $F_y$ , $F_z$ )   | 150                 | % FSO           |
| Sensitivity $F_x$                     | 1.00                | mV/V            |
| Sensitivity $F_y$                     | 1.00                | mV/V            |
| Sensitivity $F_z$                     | 2.00                | mV/V            |
| Excitation                            | 5-10                | VDC             |
| Linearity, all axes                   | $< \pm 1.5$         | % FSO           |
| Hysteresis, all axes                  | $< \pm 0.5$         | % FSO           |
| Cross talk, all axes                  | $< \pm 2$           | % FSO           |
| Natural Frequency                     | 2000                | Hz              |
| Operating Temperature                 | -10...+60           | °C              |
| Input Resistance                      | 700                 | $\Omega$ , ohms |
| Output Resistance                     | 700                 | $\Omega$ , ohms |
| Material                              | Stainless Steel     |                 |
| Electrical Connector Type             | Circular Connectors |                 |

### Electrical Connections

**Red Wire:** Excitation Positive  
**Black Wire:** Excitation Negative  
**Green Wire:** Output Positive  
**Yellow Wire:** Output Negative

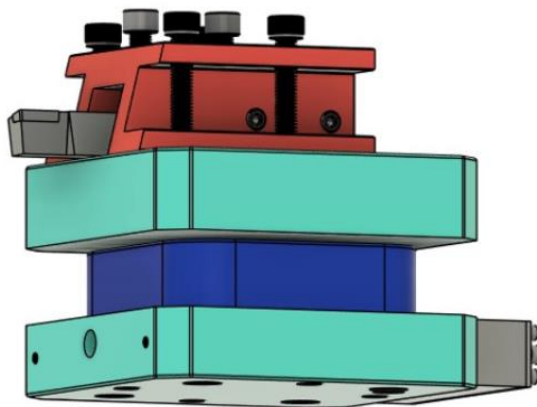
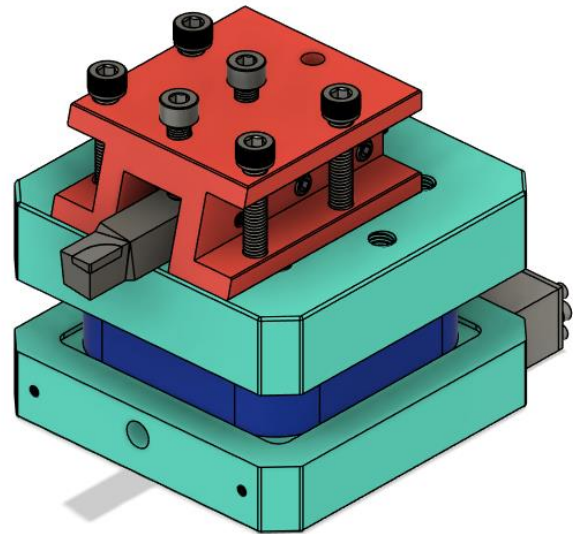
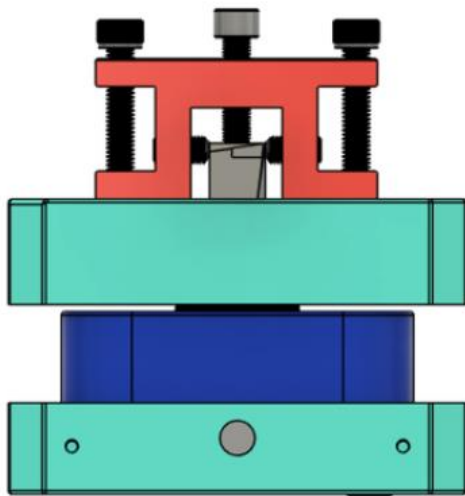
## DATA SHEET

### Technical Drawing details:



Drawing of Type NK23-TFS10K

## DATA SHEET



*Schematics of the Turning application of Type NK23-TFS10K*