



## Name of the Technology: Development of strain gauged force proving instruments

**Summary:** CSIR – National Physical Laboratory, New Delhi is the custodian of national standards in India and has been mandated to maintain apex level standards and disseminate the same to the calibration laboratories, different industries and govt. organizations like Legal metrology etc. Force and Hardness metrology group maintains the national standards of force in order to fulfill the mandate of CSIR - NPL as mentioned above. CSIR - NPL calibrates about 350 force proving instruments per year and about 60 % of which are analogue type only. The quantum of the analogue force proving instruments may even be more in actual practice, especially where there is no need of interpolation and hysteresis related measurement. Such force proving instruments are mainly employed in verification of testing machines, and uncertainty of measurement of the force proving instruments of desired to be not better than 0.1 % in such cases. Hence, in order to focus over the mandate, CSIR - NPL hereby propose a technology to digitize the analogue force proving instruments especially analogue force proving instrument which dominates the mentioned category.



**Fig.1: A strain gauged force proving instrument**

Strain gauge has been used for precision measurement of strain over the years and precision force proving instruments are composed of strain gauges in order to measure the strain precisely and realizing force as a measure of electrical signal (voltage). The strain gauges are widely used for force proving instruments over many decades. The strain gauges consist of fine metallic wire and their resistance changes when they get elongated / contracted. This property is used for development of strain gauged force proving instruments. Before placing the strain gauges, the machined elements are normalized by applying maximum axial force so that the stress comes in the operational range. Strain gauges are placed and fixed using a hot curing adhesive from horizontal axis of the sensing element. After proper curing of the strain gauges, connections are made as per Wheatstone bridge configuration to nullify the temperature effect. The strain gauges are arranged in form of a Wheatstone bridge and the bridge is balanced, when there is no external force. As the external force is applied, the bridge gets unbalanced and the resultant output (in form of mV/V, an electrical form) represents the force applied.

### **Applications:**

1. Force transfer standard
2. Verification of material testing machines
3. Weighing scales
4. Precision metrological and industrial applications.



### Advantages:

1. The know-how presented is a way to improve the existing analogue force proving instruments and development of strain gauged force proving instruments.
2. The technology presented lies in between the analogue force proving instruments and the precision force proving instruments, available commercially.
3. The analogue force proving instruments have poor resolution and sensitivity in addition to lack of interpolation and hysteresis related measurement, leading to the poor metrological performance.
4. The analogue force proving instruments thus digitized would be offering comparable features as the commercial force proving instruments offer.
5. The digitized gauged force proving instruments will serve for metrological as well as industrial applications with capability of remote operation.
6. In the know-how, no design related issues have been discussed related to different shapes of force transducers and no sensing element fabricated or designed to be given to the licensee.

### Choose the Readiness level of the Technology

Idea	Concept Definition	Proof of Concept	Prototype	Lab Validation	Technology Development	Technology Demonstration	Technology Integrated	Market Launch

**Related Patents:** Patent No: **Know-how**, Country: **Not applicable**, Publication Date: **Not applicable**; Grant Date: **Nil**, Year of Introduction: **2016**

Broad Area/Category: **Electronics & Instrumentation**

### User Industries:

1. Calibration laboratories; 2. Industries; 3. Electronic weighing scale manufacturers