Precision Digital Level Accuracy and Reliability - Digi-Pas® 2-Axis Technology

In any measurement instruments and tools, **accuracy** and **reliability** are very important aspects to users. Readings from an inaccurate measuring instrument/tool would result in making a faulty decision and in many cases could have unintended consequences.

Digi-Pas® Digital Levels are built with advanced digital **MEMS** Technology Sensor and precisely calibrated for non-linearity for entire measurement range using high precision computer numerical controlled machines with resolution of 0.0001° (< 1 arcsecond). The accuracy and repeatability conformance of these highly specialized machines are tested and verified by ultra-high precision Moore Nanotechnology Systems (<0.03 arcsecond) – NanoTech 350FG (USA) and also calibrated by world-leading accredited certification bodies. This has demonstrated **Digi-Pas®** technology and capability to develop world-first dual-axis high precision machinist level having wide-angle planar measuring range for leading-edge applications in precision CNC machining, medical, metrology & aerospace industries.

The digital technology adopted has enabled **Digi-Pas®** Digital Level to be compensated for wide operating temperature variation utilizing **Digi-Pas®** patented advanced calibration processes (US Patent Pending). Programmable precision temperature and humidity chambers are also utilized to calibrate various **Digi-Pas®** product lines for a range of -20°C to +60°C. This has enabled these products to reliably withstand stringent operating environment in many harsh terrains ranging from building skyscrapers in the desert of Middle-East to the constructing of oil pipes, tunnels and bridges in the freezing cold countries such as Canada, the Nordic and Russia.

1. Characterizing Digi-Pas® 2-Axis High Precision Digital Level

It is well known that a typical characteristic of MEMS sensor inherently contents nonlinearity characteristic of angular range at fixed operating temperature and also when temperature changes. The effect of nonlinearity to instrument accuracy becomes even more significant when dealing with ultra-precision angular measuring system. **Digi-Pas®** employs our proprietary calibration processes utilizing advanced calibration technologies to stabilize the variables contributed by material properties, components and electronic system. Hysteretic nonlinearity and cross-axis error have been controlled and managed to a level negligible or within product's specification.

2. Calibration and Testing of 2-Axis Precision Digital Level – Digi-Pas® U.S. Patented

Calibration and testing of precision angular measuring instrument becomes very challenging at higher precision, wider measuring range and multi-axis. Test equipment's linearity compounding error within entire measuring range and testing processes such as Swash errors become major impediments for establishing a responsible budget on measuring system uncertainties of no less than 95% confidence level at a coverage factory of k=2.

Over the years, **Digi-Pas®** has closely collaborated with global-leading accredited 3rd party calibration laboratories in USA, Japan, UK & Germany and world-leading National Metrology Institutes under Bureau International des Poids et Mesures (**CIPM MRA**) to successfully test and verify with rigor our

products performances traceable to **NIST, JIS, UKAS & DIN** for international conformity assessments. These collaboration and cooperation have benefited many of our users in USA, EU and Asia to conveniently sending their instruments for annual calibration and test at a nearby laboratory for shorter lead-time and lower cost as these labs are in a close proximity to their respective geographical location.

Digi-Pas® patent (**U.S. Patent Pending**) on methods and apparatus for calibrating ultra-precision 2-axis **simultaneous** angular instrument (i.e. of 1.0 arcsecond accuracy) utilizing nano-technology equipment addresses and resolves critical limitations and shortcomings inherent when using conventional **single-axis** rotary table or laser interferometer to calibrate and test **dual-axis** precision digital angle instrument for **one axis at a time**.

3. Utilizing the "Absolute Level Setting" to Set Reference Level Point to Earth Datum

In leveling applications, the primary aim is to align the surface of a physical object such as a machine, equipment or engineering structure to a **reference leveling point**, commonly known by tradesmen as '**zero level'**. This 'reference level point' is a planar position tangent to the center gravity of earth i.e. refers as **Earth Datum**. This 'reference level point' can then be transferred into a leveling instrument. Subsequently, this leveling instrument is used by industrial engineers to set a particular machine/object surface to a required leveling position. The process of transferring Earth Datum to a Digi-Pas® digital leveling instrument is referred as performing "**Absolute Leveling Setting**". By performing Absolute Level Setting on Digi-Pas® digital levels, it also effectively remove any offset resides in the instrument and thus resetting the instrument's reference leveling point to coincide with earth datum.

Similarly, "**User Self-Calibration**" is another alternative process to transfer Earth Datum and automatically store the reference leveling point into a Digi-Pas® digital leveling instrument.

For further information on earth datum, please also refer to web-link: **Geodetic Datum**.
http://en.wikipedia.org/wiki/World_Geodetic_System

4. What happen to the accuracy of Digi-Pas® leveling instrument/tool if it drops?

Likewise to any precision measurement instrument/tool, mishandling such as dropping a digital level to the floor or storing it outside the specified temperature range, could affect its accuracy. This is due to structural deformation resulted from mechanical shock on impact when dropped and physical micro-dimensional changes (e.g. non-linearity) resulted from thermal expansion or contractions when storage temperature exceeded maximum specified range.

However, unlike traditional 'bubble' spirit levels and many other digital levels in the market, all Digi-Pas® digital level is built with **User's Self-Calibration feature**. This feature empowers users to perform their own calibration without the need to sending to 3rd party testing laboratory for inspection when minor mishandling the device. At user's convenient work site or field work, User's Self-Calibration can reliably reset the **Digi-Pas®** digital level back to factory preset accuracy whenever in doubt with the accuracy.

For further information on **Digi-Pas® digital level**, please refer to **FAQ** at the following web-link**:** http://www.digipas.com/faq.php.