Coordinate Measuring Machine for Large Structures

Laser Tracking System

SpaceTrac Series
High-accuracy and reliability with a wide variety of applications, a new standard for multi-functional coordinate measuring machines.

The SpaceTrac Series, which is active in a wide variety of measuring situations, for example, measurement of large structures such as aircraft, positioning of conveyor lines and machines, measurement of medical instrument movements, emits a laser beam from a measuring head to a Spherically Mounted Retroreflector (SMR) to accurately determine the workpiece coordinates (X, Y, Z) from the reflected beam. This is a multi-functional coordinate measuring machine representing a new standard, demonstrating high accuracy and reliability in a portable compact package.
Principle of measurement

The SpaceTrac Series determines the 3D coordinates of the center of a Spherically Mounted Retroreflector (SMR) that is moved around in contact with the critical surfaces of the object to be measured by emitting a laser beam from a measuring head towards the SMR and receiving the reflected laser beam passing back along the same path. From this data the surface coordinates of the object are computed. A fast feedback loop operating at 3,000 times/second enables the measuring head to automatically track the SMR wherever it is moved within its line of sight.
Straightness measurement of double-column machine tools

Measuring straightness inside the vertical surface of large and long structural workpieces can be done without using a straightness gage (master gage) for reference. Also, an error map of a machine can be accurately created, making it possible to check for distortion or deformation in assemblies and double-column structures.
Three-dimensional measurement to check whether movements are as programmed

Checking multi-axis robotic behavior

The three-dimensional behavior of a robot arm can be tracked by mounting the SMR at the tip of the arm. Checking the robot’s spatial conformance to programming in this way enables positioning accuracy to be tested with a view to improving reliability on the production line.
Improvement of work efficiency through rapid measurement of large construction machines

Checking power-shovel arm bearings

Fine and precise motion is required in power shovel arms. SpaceTrac enables easy and accurate measurement of the shaft bearing position on the joint that supports arm motion. Since travel time can be reduced without depending on a fixed measuring instrument, work efficiency is also improved.
CASE 04 Energy

Measuring thermal power generation casings

Accuracy to 0.1 mm is required for the inner diameter measurements of vapor turbine casings to obtain optimum efficiency of power generated by pressurization. SpaceTrac is compact and easy to set anywhere, thereby making rapid measurement possible. In addition to casing inner diameter, it is highly effective for measuring diameter and shaft direction distance.

CASE 05 Advanced medical

Critical alignment of advanced medical apparatus

For corpuscular ray therapy apparatus, since millimeter accuracy is required for irradiating therapy zones, high accuracy is needed when setting the bed position and direction. SpaceTrac measures the real-time bed position precisely by attaching the SMR directly to the critical bed elements.
Automatic capture of the SMR delivers high-stability and accuracy

The measuring head with its unique combination of He-Ne laser interferometer (IFM) and Absolute Distance Meter (ADM) eliminates the errors inherent in conventional systems due to limitations of mirrors and thermal effects. Additionally, the head automatically recaptures the SMR as soon as the laser beam from the SMR is interrupted, thereby realizing superior stability and accuracy.
**High accuracy**

The SMR is practically unbreakable, and maintains its accuracy even if dropped onto a hard floor. The center accuracy is ±12.7 µm or less in the standard type, ±2.5 µm or less in the high-accuracy type. Three sizes are available: 1.5 inches, 0.875 inches, and 0.5 inches.

**Ultralight**

The body of the high-accuracy tracker weighs only 8.2 kg, while the integrated type is 9.8 kg, which is light enough to carry with one hand. This makes for easy transfer and installation.

**Mobility**

Wide measurement range is provided: 640° in the horizontal direction and 138° in the vertical direction.
LINE-UP

— High accuracy or integrated

Integrating the latest laser tracking technologies

In addition to performing measurements, SpaceTrac-AI can easily perform analyses, inspections, assembly, etc. There is also a integrated type SpaceTrac-AP/A, which entirely eliminates external controller. The SpaceTrac Series integrates the features of advanced laser tracking technologies.

<table>
<thead>
<tr>
<th></th>
<th>High-accuracy type</th>
<th>Integrated type</th>
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<tbody>
<tr>
<td></td>
<td>SpaceTrac-AI</td>
<td>SpaceTrac-AP</td>
</tr>
<tr>
<td>Laser technology</td>
<td>IFM/ADM</td>
<td>ADM</td>
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<tr>
<td>Measuring range</td>
<td>Azimuth range</td>
<td>640° (±320°)</td>
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<tr>
<td></td>
<td>Elevation range</td>
<td>-59° to +79°</td>
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<tr>
<td></td>
<td>Distance range (diameter)</td>
<td>40 m/100 m/160 m</td>
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<tr>
<td>Accuracy of a 3D coordinate**</td>
<td>±10 µm±5 µm/m</td>
<td>±15 µm±5 µm/m</td>
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<tr>
<td>Angular accuracy</td>
<td>3.5 µm/m</td>
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<tr>
<td>Distance accuracy**</td>
<td>IFM</td>
<td>±0.5 µm/m</td>
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<tr>
<td></td>
<td>ADM</td>
<td>±10 µm or ±0.7 µm/m (whichever is greater)</td>
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<tr>
<td></td>
<td>±15 µm or 0.7 µm/m (whichever is greater)</td>
<td></td>
</tr>
<tr>
<td>Mass</td>
<td>8.2 kg</td>
<td>9.8 kg</td>
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</tbody>
</table>

*1: A ScaleBar measurement in accordance with ASME B89.4.19-2006 *2: Accuracy in MPE

** Laser safety

Mitutoyo SpaceTrac Series use a low-power visible laser for measurement. The laser is a CLASS 2 EN/IEC60825-1 device. Warning and explanation labels, as shown right, are attached to the SpaceTrac Series as is appropriate.
Enhanced usability, functionality, and measuring accuracy

Mitutoyo offers a hard probe that enables a workpiece to be measured easily without having to reposition the tracker or jig, a dedicated tripod for stable measurements, and various types of mount for the SMR.

PolyWorks|Inspector™ is software which directly captures measurement data from 3D measurement devices and calculates workpiece dimensions, evaluates complex surfaces and generates inspection reports. This powerful 3D measurement software solution manages the whole process from product engineering through manufacturing to provide high operability and performance that improves productivity in measurement and inspection.
Whatever your challenges are, Mitutoyo supports you from start to finish.

Mitutoyo is not only a manufacturer of top quality measuring products but one that also offers qualified support for the lifetime of the equipment, backed up by comprehensive services that ensure your staff can make the very best use of the investment.

Apart from the basics of calibration and repair, Mitutoyo offers product and metrology training, as well as IT support for the sophisticated software used in modern measuring technology. We can also design, build, test and deliver bespoke measuring solutions and even, if deemed cost-effective, take your critical measurement challenges in-house on a sub-contract basis.