TRI-TECH
PRECISION PRODUCTS, INC.

5-Axis Machining Alternatives

There are currently three alternatives to achieving full 5-axis machining capabilities:

1. **Dedicated 5-axis Machining Center**
2. **Tilting - Rotary Table**
3. **Spindle Head Attachment**

Dedicated 5-axis Machining Center

There are currently more than fifteen (15) original equipment manufacturers of 5-axis machining centers sold in the U.S. These manufacturers include all of the biggest names in manufacturing technology including: Cincinnati Machine, SNK, Makino, Haas Automation, Deckle-Maho, Nicholas-Correa, Okuma, Toshiba, Mitsubishi, Zimmerman, etc.

The majority of these machining centers are large, powerful, accurate and expensive with prices averaging well above $500,000. The least expensive 5-axis machining centers on the market today have a starting price of about $250,000. The chief draw-back of the dedicated 5-axis machines is their range of motion which is generally limited to about +/- 30°. Work pieces that require a steeper angle of cut or up to 90° drilling, etc. must be manually repositioned and restarted or in some cases just can't be done due to travel limits, fixturing, etc. These types of machines are also significantly less rigid than a 3-axis machine of the same size and class.

An alternative to this market are the dedicated 'trunnion style' 5-axis machining centers which allow the machine bed to tilt and rotate thereby providing access to all 5 sides of a part exactly as a performed by tilting-rotary tables (see below). Unfortunately, this design tends to limit both the size and weight of the parts that may be machined, reducing the accessible machine envelope by up to 60%.

Tilt - Rotary and Trunnion Tables

Several manufacturers now produce a tilting-rotary table that can be mounted to the bed of a (3-axis) CNC machine. Simple rotary tables have been available for many years and are used extensively by small and large machine shops around the world to index parts for various machining operations. A 'tilting' rotary table can rotate and tilt a part at various angles to provide machine access to five sides of the part, and some can accomplish true five axis machining with limitations.

The relatively small work surface of a tilting-rotary table places significant limits on the type of the

work piece that can be mounted to it including limits of length, width, height and weight. Additionally, tilting-rotary tables are themselves very large and use much of the host machine's working envelope. Even the largest tilt-rotary tables can reduce the working envelope of the host machine by 75% or more. Tilt-rotary tables are generally not suitable to holding parts during heavy cutting operations.

Spindle Head Attachments

The primary advantage of a spindle head attachment is that it can access all points of the machining center's work envelope. The head places no limit on the size of the work piece that can be machined.

One U.S. company and at least two European companies manufacture and sell a programmable spindle head for attachment to large 3-axis milling machines. When properly installed, these heads are fairly dependable, accurate and expensive. Because of their size and weight they cannot be mounted onto any of the small to mid-sized machining centers and are reserved for only the largest gantry type milling machines. Installation is permanent and requires custom fabrication and fitting. The price range for these head attachments is $150,000 to $250,000 plus the cost of custom fabrication and installation.

Tri-Tech - Model 5414-R3 spindle head attachment is fully programmable and can be used to convert nearly any 3-axis CNC machine to a true, simultaneous 5-axis machining center. The M5414-R3 has a wide range of motion including tilt capability of +/- 90° and continuous 360° rotary motion. Because the M5414 is a spindle attachment, it can access all points of the machining center's work envelope. The M5414 is portable and can be mounted, in less than thirty (30) minutes, with no modification to the host machine and easily moved to other CNC machines (call us for details). At 150 pounds, the M5414 is a heavy duty attachment and compact enough to attach to both smaller to mid-size machines as well and larger CNC machines!

While the "lower priced" 5-axis machining centers are fairly rigid, they cannot match the rigidity of their 3-axis counterparts for significant metal removal and larger part capacity. The M5414 allows the user to perform all significant metal removal using a heavy duty 3-axis machining center then mount the M5414 attachment to complete 5-axis profiling, holes, pockets, etc. using up to 3/4" shank cutting tools. **The Tri-Tech Model 5414-R3 is truly your 5-Axis Alternative Solution!**

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