

Consulting services are available for optimizing implementation of **Len Graham Consulting's ADP-MI** Precision Gage Balls as well as any other aspect of machining automation. Although this methodology is ideal for automated, untended machining, it is important to note that non-robotic application of the **ADP-MI** Precision Gage Ball in **system 3R**® palletized equipment will reap great financial benefits as well. Our consulting services are available to cover design, programming, machining and inspection enhancement, as well as robotics and selection of specialized tooling/fixturing....all to help your shop facilitate the untended automation process.

Perhaps most importantly, we offer help with the people side of adopting automation processes. Enhancing the skills and value of people in a new automation environment is paramount for success.

Information relating to **Len Graham Consulting's** speaking engagement at



entitled

"People: The Most Challenging Component in Automating a Mold Shop"

can be accessed at

www.moldmakingexpo2005.com or www.lengrahamconsulting.com



*Len Graham Consulting's New **ADP-MI** Precision gage Balls are also applicable to **system 3R**®'s Dyna-fix system when utilizing fixture 3R-90356.21 as pictured.*



email: len@lengrahamconsulting.com or call **Len at 602-284-3114**



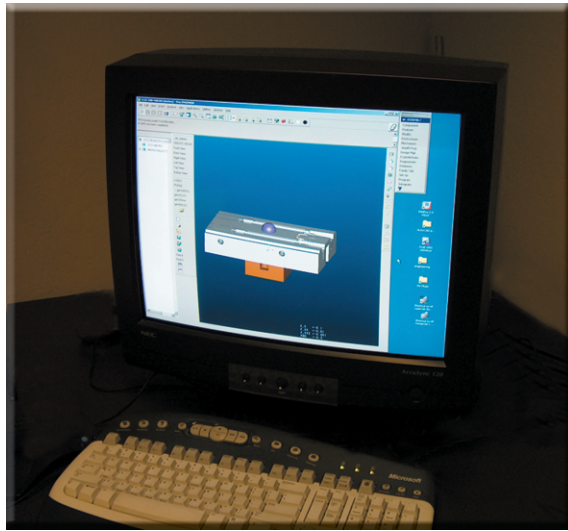
Model ADP-MI™ **Adapt Me™** **Precision Gage Balls**

Len Graham Consulting's new hardened Stainless Steel **system 3R**® Macro-pallet-mounted gage balls are the ideal way to drastically reduce overall costs in the machining/manufacturing process of electrodes and components and eliminate dimensional inconsistency, especially on angles (including compound angles) and radial forms. Consistently measuring dimensions with tight tolerance windows is no problem with this methodology.

"Adapt Me" - Model **ADP-MI** - Precision Gage Balls are manufactured and individually certified to repeat to within $\pm .0001$ of center and are also within $.0001$ of a certified height from the resting pad of the **system 3R**® Macro pallet they are mounted on to the top of the ball. They will easily afford your shop the ability to adapt to a system of manufacture that will allow you to...

Associate your Design, Programming - Machining and Inspection...

to one common reference datum for all these machining/manufacturing-related disciplines. The customary method of engineering tooling ball dimensions either from multiple sides of a component, or from a tooling ball referenced somewhere off center of a component and perhaps even requiring machining/mounting the tooling ball into the component is now outdated for palletized electrodes and components. Relying on subjective microscopes/optical comparators for high-tolerance measurements is now also a thing of the past. **Len Graham Consulting's** Precision Macro pallet-mounted Gage Balls are set dead center of the pallet and at a repeatable height to within $\pm .0001$, making both symmetrical and non-symmetrical dimensions on palletized work-pieces very easy to measure/achieve and consistent for both CMM and surface plate manual methods of checking the dimensions.



The **ADP-MI** acronym:

Associating: When designing, programming, machining and inspection personnel are all using the same common reference datum point working in their disciplines, the entire manufacturing process will be more consistent and can be greatly streamlined.

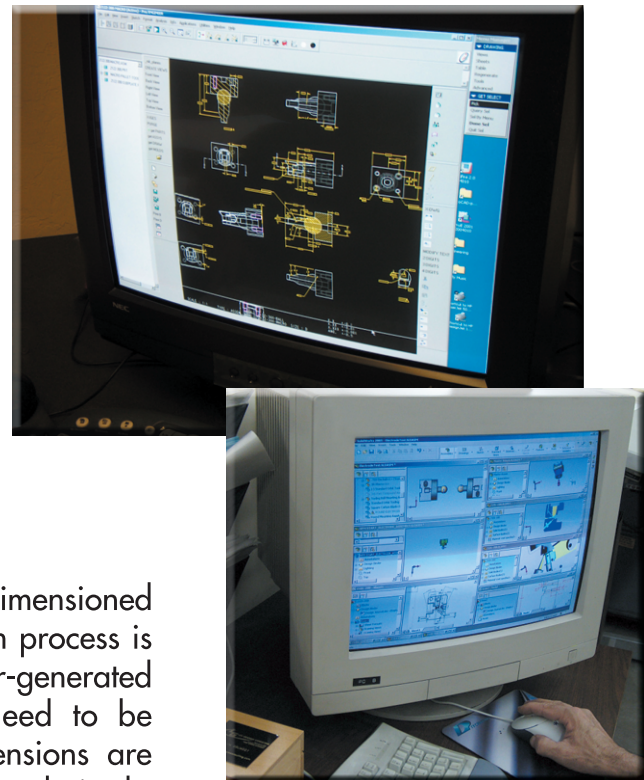
It is generally best, though not completely necessary, to generate a 3-dimensional model of the part being machined on the **system 3R**® Macro pallet with the **ADP-MI** Precision Gage Ball superimposed within that unit. The advantage, if this is done, would be that dimensions generated on the electrode/component design can be automatically related to programming, machining, and

inspection throughout the process of its manufacture. When design models are associated to our Precision Gage Ball, dimensions required from the ball surface to any surface being machined can be easily and accurately acquired simply by interrogating the associated model. Further, programming and inspection can also be associated to the same model in the same fashion.

Designing: Beginning with Design, as mentioned, palletized components to be machined utilizing **Len Graham Consulting's** model **ADP-MI** Precision Gage Balls would ideally be designed with it superimposed and associated to the pallet-mounted component. Any required dimensions would be listed from the surface to be cut on the component to the radial surface of the Precision Gage Ball, regardless of whether that surface to be machined is planar, angular, or 3-dimensionally-radial in nature.

Take the irregular radial surface, for instance. There is always one point on any radial surface being machined, that when taken perpendicular to the centerline of our Precision Gage Ball, will register a hard number at its low (concave) or high (convex) point and be easily checked with a CMM, or on a surface plate with a compound sine, to the surface of the Precision Gage Ball ball. Remember, since the model controls the shape, that one point is all that is needed to accurately set and check its position in most cases.

Both electrodes and components to be machined can be dimensioned to our **ADP-MI** Precision Gage Ball. If an associated design process is used, the Shape of all detail is determined by the computer-generated model, the machining technician would really only need to be responsible for size and position. Thus, far fewer dimensions are required. Of course, any critical areas can be focused on, as desired.

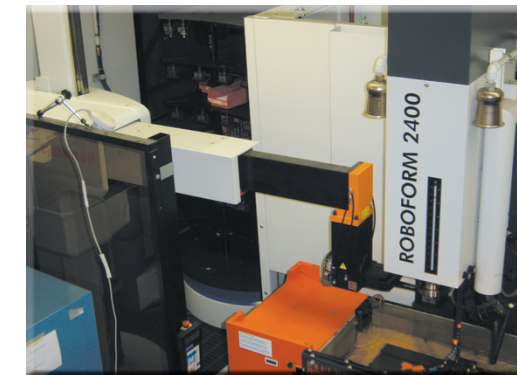


Programming: Once the customer's part model is generated, and the components/inserts are defined, electrodes can be immediately and concurrently designed/programmed with the components on their pallets and generated, with machine programming referenced to **Len Graham Consulting's ADP-MI** Precision Gage Balls.

Cutter paths are generated from the surface of the Precision Gage Ball for a machining center cutting electrodes and components/inserts alike on their pallets. Machining in both cases is referenced to the **ADP-MI** Precision Gage Ball.

Manufacturing: All components to be machined that are mounted on pallets and programmed to the **ADP-MI** Precision Gage Ball, can be machined in a variety of CNC machines, as long as they are **system 3R**® Macro pallet receiver-equipped. After machining, they can be verified to file dimensions generated in reference to the gage ball.

Whether manual or robotic CNC EDM'ing, set heights and offset amounts are easily programmed and machined for one or multiple electrodes. Electrodes are cut and components are EDM'ed, both referencing **ADP-MI** Precision Gage Ball dimensions.



Programming for this **system 3R**® Workmaster robotic-equipped CNC EDM machine is very easy, can be automatic, and results are predictable.

Inspection: So far everyone involved in the design, programming, and machining disciplines will have used the same **ADP-MI** referenced dimensions in their processes. It is no time to change now. Inspection will follow suit in the final inspection/certification process using the same dimensions in the same fashion as designers set up for programmers and machining disciplines. If any discrepancies occur, it is far easier to trace the cause of the issue using this method, than it has been historically, when disciplines may choose to use different, personally preferred methods along the way.

All dimensions will concur whether taken manually against gage block standards or on a certified CMM as long as all are done referenced to **ADP-MI** Precision Gage Balls.

