






# Precision Tables Selection Checklist

The following steps describe the process of selecting a Precision Positioning Table to match your application requirements.

## 1) Simple Applications with Standard IDC Products (Simple Checklist)

For relatively simple single axis, X-Y, or X-Y-Theta applications that can be solved with Standard IDC Precision Tables, please refer to the General Selection Guidelines (E-3). For custom systems, please proceed to Step 2. Please remember to add up the Weights and Error Bands of each Precision Table for Multi-Axis Configurations. Please refer to the Technology section and the individual product sections for further details. Completing the Product Selection Worksheet (E-11 to E-14) is also strongly recommended.

- A) If you are able to decisively select standard IDC Precision Tables based on the selection flow chart, then proceed to the *How to Order* pages for each chosen Precision Table. Otherwise, proceed to step 2. 
- B) Each *How to Order Section* has a Basic Stepper and a Basic Servo Configuration. These Basic Configurations provide a Precision Table solution that has been optimized for the majority of applications. Choosing a Basic Configuration also provides the best deliveries and pricing. Standard catalog options (Drive Screws, Couplings, Motors, Limit Switches, Encoders and Covers) can typically be substituted within the Basic Configuration with minimal impact on delivery. Pricing will vary according to the components chosen. Please refer to the *How to Order* section or contact IDC for further details. 
- C) Each *How to Order* section also has information on how to add several standard Precision Table options. Please refer to the *How to Order* section and order appropriately. Please note that certain Environmental Preparations, such as Vacuum Preparation, may require additional lead-time. 
- Standard IDC Drive and Control Integration (IDeal System).
  - Standard Multi-Axis Configurations.
  - Standard Clean Room and Vacuum Environmental Preparations.
  - Standard Performance Verification Tests.

Please refer to the Technology section or contact IDC for further details.

*Please contact IDC to review your choices if you are unsure in any way.*

## 2) Complete the Product Selection Worksheet (Full Checklist) — Loading Considerations

Specifying a Precision Positioning System starts by evaluating the forces and moments that act on each axis. It is important to remember that 5 out of the 6 degrees of freedom for each axis will be static (not moving). The direction of travel is the dynamic (moving) degree of freedom. For Multi-Axis systems, please remember to include the static (weights and cantilevered loads), dynamic (forces and moments generated by system motion) and transient (externally applied) forces and moments generated by the other axes and machine operations. Please note that Multi-Axis systems require a detailed drawing to properly evaluate the loading conditions.

The calculations that follow are straightforward Newtonian Physics. Please refer to page E-10 and IDC's Engineering section for further details on how to perform these calculations. Certain bearing designs, such as recirculating bearings, are better suited for handling moment or impact loads. Please refer to the Structure and Bearings Section for further details. It is important to note that any structure will deflect when subjected to a force or moment. Ultimately, the amount of deflection that is acceptable must be determined based on the application requirements. Complete stiffness and compliance data is provided in each individual product section.

- A) Evaluate the forces (normal, side and axial) that act on each individual axis. Include static forces, dynamic forces, frictional forces and transient forces. Assume a coefficient of friction of 0.01 for initial friction calculations.
- B) Evaluate the moments (roll, pitch and yaw) that act on each individual axis. Include static moments, dynamic moments and transient moments. Applications with significant moment loading requirements typically utilize Precision Tables with recirculating bearings.
- C) If your application requires impact or moment loading, recirculating bearings will be necessary.





- D) Evaluate the type of application (linear, rotary, open frame or miniature), the travel (or diameter for rotary applications), and the loading requirements, and consult the General Selection Guidelines (E-3). A specific Precision Table (or at least a range of Precision Tables) should be fairly obvious. If this is not the case, please complete as much of the Product Selection Worksheet as possible, and fax it and the supporting documentation to IDC. Please remember that IDC defines travel as the distance between the end of travel limit switches.
- E) Compare the coefficient of friction of the selected Precision Table against the initial calculation assumptions. Recalculate if necessary.
- F) To further determine the initial suitability, consult the individual product section of a selected Precision Table. Review the compliance and stiffness data to determine if the specific Precision Table is still appropriate based on predicted deflection.
- G) Review the bearing life calculations to determine if the specific Precision Table is still appropriate based on product life cycle considerations.
- H) If this analysis does not provide a conclusive result, please complete as much of the Product Selection Worksheet as possible, and fax it and the supporting documentation to IDC.

**3) Complete the Product Selection Worksheet (Full Checklist) — Dynamic Considerations**

In reality, the dynamic considerations are also considered during the loading analysis. For example, the axial load of a Linear Precision Table is affected by the acceleration ( $F = ma$ ). To determine the velocity and acceleration based on the distance to move and time to move please refer to IDC's Engineering section.

- A) Calculate the required velocity and acceleration. Based on the velocity requirements, a specific drive screw should be obvious. Please consult the Drive Screw section for further details. Compare the calculated velocity and acceleration to the limits for your chosen Precision Table. If these values exceed the Precision Table limits, consider using a different Drive Screw, a different Precision Table or altering your move profile. If this is not possible, please consult IDC to discuss your application requirements.
- B) After selecting a specific drive screw, review the drive screw life calculations to determine if the specific Precision Table is still appropriate based on product life cycle considerations.
- C) For rotary and leadscrew driven applications, calculate the Duty Cycle. Please refer to IDC's Engineering section for details on how to calculate Duty Cycle. If the Duty Cycle exceeds the limits for your chosen Precision Table, consider using a ballscrew (for linear axes) or contact IDC to discuss your application requirements.
- D) Steppers are typically well suited for lower speed, higher torque applications without feedback. In contrast, Servos typically have a much flatter speed torque curve and rotary encoder feedback. Each IDC Precision Table has a Basic Stepper and Basic Servo Configuration. These Basic Configurations provide a Precision Table solution that has been optimized for the majority of applications. To verify that the motor for each axis is appropriate, it is necessary to perform the motor sizing calculations (E-10), and verify resolution requirements. Each Precision Table provides the necessary efficiency and inertia data for each drive screw and travel choice. Complete motor sizing calculation information is available in IDC's Engineering section. Please refer to the Motor section for further details on the consequences involved with different motor and gearmotor choices. If the Basic Configuration Motor does not have sufficient torque, considering using a different IDC motor from the *How to Order* page. Please remember not to exceed the maximum input torque limits for your chosen Precision Table. Please contact IDC if you are having motor sizing difficulties, or if you want to use a non-IDC motor. See step 6.
- E) After selecting a motor, it is necessary to select the correct coupling. Typically, Servos use Bellows couplings and Steppers use Oldham couplings. Selecting a coupling that has poor torsional stiffness could cause positioning and resonance problems. Please refer to the Coupling section for further details on coupling selection.





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- F) Determining the minimum incremental movement that is possible for a Positioning System can be somewhat complicated. Typically, System Resolution can be increased by using high torque, high resolution motors with low inertia, using rigid mechanical components (couplings, drive screws, etc.), minimizing system friction, and minimizing load inertia. Because System Resolution is significantly dependent on load inertia, it must be simulated and verified for a given payload and orientation. Please refer to the Performance Verification section for further details.
- G) If this analysis does not provide a conclusive result, please complete as much of the Product Selection Worksheet as possible, and fax it and the supporting documentation to IDC.

4) **Complete the Product Selection Worksheet (Full Checklist) — Movement Considerations**

Ultimately, the major reason for selecting a Precision Table, instead of an actuator, is the quality of movement that can be achieved. It is first necessary to evaluate the movement requirements of your application. For a better understanding of these concepts and terminology, please refer to the Performance Verification and Terminology sections.

- A) Determine the type of movement (unidirectional or bi-directional) and the accuracy and repeatability requirements.
- B) Compare these requirements to limitations of your selected Precision Table. If your requirements are less stringent than the Precision Table limits, then an encoder is not necessary. Encoders can be used to improve the on-axis positioning results, but they also have significant limitations. Specifically, they are blind to off-axis errors. It is also important to note that having a 1 micron encoder does not guarantee that a Positioning System will be able to make 1 micron incremental movements. Please refer to the Encoder and Performance Verification sections for further details to determine if an encoder is necessary.
- C) For contouring applications, please refer to the maximum thrust load values for each specific ballscrew. Contouring applications, specifically circular interpolation applications, may have additional backlash deviations if these thrust load limits are exceeded. It is also necessary to consider encoder limitations in contouring applications. Please refer to the Encoder and Performance Verification sections for further details.
- D) It is also necessary to evaluate the off-axis errors to determine if their deviations are acceptable, especially scanning applications. This should have already been considered for heavy load applications in step 2. For lighter load applications where the inherent off-axis errors of the Precision Table dominate, compare the Precision Table limits to your application requirements. For applications that require lower off-axis errors, most Precision Tables offer a Precision Assembly option. Please refer to the individual product sections and the Performance Verification section for further details.
- E) Certain high performance applications that utilize error compensation require Performance Verification Testing. Other customers require this type of quality assurance as part of their overall quality certification program. Please refer to the Performance Verification section for more information on standard IDC testing programs to learn how to maximize the performance of your system.
- F) If this analysis does not provide a conclusive result, please complete as much of the Product Selection Worksheet as possible, and fax it and the supporting documentation to IDC.

5) **Complete the Product Selection Worksheet (Full Checklist) — Environmental Considerations**

In reality, environmental considerations are also considered during the initial evaluation of the Positioning System. Certain geometric and physical limitations are obvious from the start and directly influence the initial selection. All standard Multi-Axis configurations are detailed in the *How to Order* section of each individual product section. Please refer to the Multi-Axis section for further details and options. The remaining discussion is concerned with Environmental considerations.





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- A) Protective covers are part of the Basic Configuration for every Precision Table that can accommodate them. Covers should also be omitted for vacuum applications or especially clean environments. Please contact IDC if special environmental protection is required.
- B) IDC provides standard preparations for clean room and vacuum environments. Special environmental conditions can also be accommodated. Please refer to the Environmental section and the individual product sections for further details. Please contact IDC if your application has requirements that exceed the catalog specifications.
- C) Please provide a detailed drawing showing the physical layout of your application. IDC Precision Tables have standard orthogonality tolerances. Please include any special requirements if they exceed standard specifications.
- D) If this analysis does not provide a conclusive result, please complete as much of the Product Selection Worksheet as possible, and fax it and the supporting documentation to IDC.

## 6) Complete the Product Selection Worksheet (Full Checklist) — Control Considerations

Although certain control considerations have already been evaluated (motors, encoders, etc.), others have not. IDC drives and controls can be integrated into your Positioning System as part of an IDEal System solution.

- A) If IDC drives and controls will be used, remember to choose the IDEal System option to have the drives and controls integrated into your positioning system. Please refer to the IDEal System section for further details.
- B) Limit switches are included in the Basic Configuration for each Precision Table. They may be eliminated, or special limit switches may be required. Please refer to the Limit Switch section for further details. Please contact IDC if non-standard limit switches are required.
- C) Please provide any relevant information regarding any non-IDC drives or controls that are required by your application.
- D) Please provide complete motor information and a dimensional drawing for all non-IDC motors.
- E) If this analysis does not provide a conclusive result, please complete as much of the Product Selection Worksheet as possible, and fax it and the supporting documentation to IDC.



## 7) Complete the Product Selection Worksheet (Full Checklist) — Special Considerations

At this point, a standard IDC solution has been chosen and confirmed or the requirements for a custom system have been specified. Please refer to the *How to Order* sections to verify that your Positioning System has been ordered correctly. If a custom system is required, please record any special system requirements (e.g. special cable lengths, custom limit switch position, etc.) in this space on the Product Selection Worksheet.



## 8) Fax the Product Selection Worksheet (Full Checklist) and the Supporting Documentation to IDC.

IDC will review the information that has been sent. Standard product selections will be verified and quoted based on the information that has been provided. Custom system requests will be evaluated and quoted based on the information that has been provided. You will be contacted if additional information is required. A local IDC distributor can also be sent to your facility to directly evaluate your application requirements.