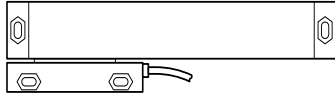


Encoders

Linear Encoders

Linear encoders can be added to all linear Precision Tables to improve positioning performance.

Repeatabilities up to one encoder count may be possible depending on application conditions.



Because the linear encoder read head is directly attached to the carriage, a motion controller can benefit from directly measuring the carriage position. Directly measuring the carriage position can improve positioning results by compensating for the positional errors caused by thermal expansion of the drive screw, lost rotary encoder counts, mechanical backlash and other system hysteresis (e.g. coupling wind up). Please note that most positioning systems using both rotary and linear encoders typically need at least 4 times more rotary encoder pulses than linear encoder pulses to avoid linear encoder dither. This 4:1 rule of thumb also applies when comparing step motor and linear encoder resolutions.

Standard Options

All IDC linear positioning tables have the option of adding a 1 micron resolution (EM1) or 2 micron resolution (EM2) linear encoder. Each linear encoder contains a precision etched glass scale packaged within a protective aluminum housing with a photoelectric read head. The glass scale has protective seals over the length of travel (IP53). All linear encoders are precisely attached to the Positioning Tables to minimize misalignment. Encoders are supplied with a 3 meter high flex cable that terminates in a 12 pin DIN connector. The mating connector is also supplied. The reference pulse is nominally located at the center of table travel.

Precision Positioning Tables

Linear Encoder Wiring – 12 Pin DIN Connector

Pin No.	Wire Color	Signal
A	Shield	Earth GND
B	White	GND (OV)
C	Green	CH A+ (TI+)
D	Yellow	CH A- (TI-)
E	Pink	CH B+ (T2+)
F	White (opt.)	GND (OV)
G	Brown	RI+
H	Grey	RI-
J	White (opt.)	GND (OV)
K	Black	+5V
L	Red	CH B- (T2-)
M	Black (opt.)	+5V

All linear encoders provide a differential square wave output with a reference pulse (RS-422) that is compatible with most motion controllers. A + 5VDC ($\pm 5\%$), 150 ma power supply is required. The environmental capabilities of the linear encoders exceed the capabilities of the Precision Tables that they are attached to. A calibration certificate is shipped with all standard linear encoders. All linear encoders, when ordered as part of an IDEal system, will arrive prewired and tested.



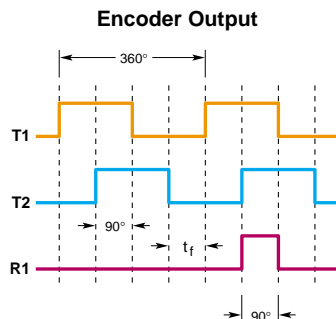
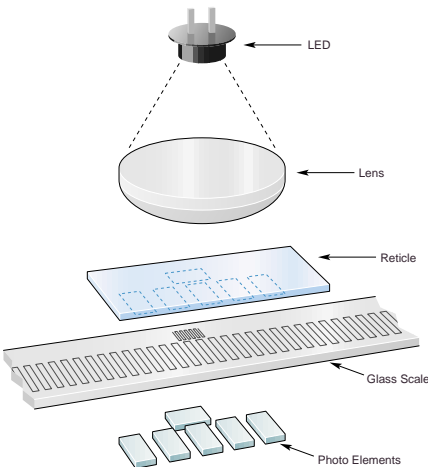
Encoder Specifications

	EM1	EM2
Resolution (microns)	1	2
Scale Accuracy (microns per meter)	± 5	± 5
Grating Pitch (microns)	20	40
Output Frequency (kHz)	100	100
Peak Speed (meters/sec)	1	2
Continuous Speed (meters/sec)	1	1
Operating Temperature Range (Storage 70°C)	0°C to 50°C	32°F to 122°F

Please contact IDC if a non-standard linear encoder is required for your application.

Application Notes

It is important to note that a linear encoder does not have the ability to correct all the positioning errors of a motion system. First, adding a linear encoder to a positioning system does not ensure that a positioning system will actually be able to make incremental movements equal to the resolution of the encoder (e.g. adding a 1 micron (EM1) linear encoder to an RB6 Table does not mean that the RB6 can now make 1 micron incremental movements). The positioning system resolution is determined by the system static friction (stiction), the load inertia, the mechanical compliance and the torque of the rotary motor. The smallest incremental movement

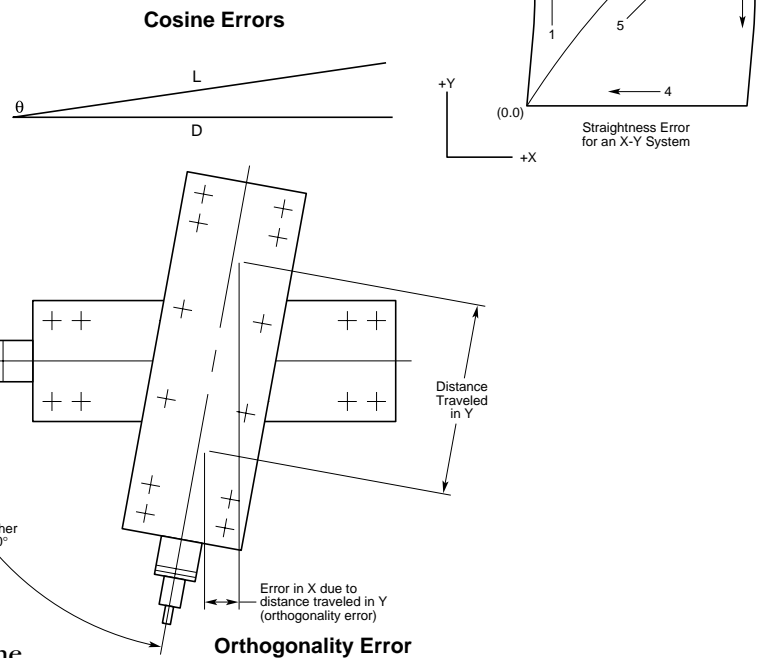
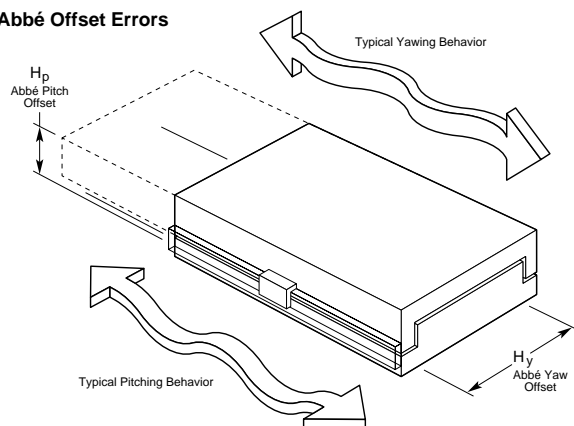


(system resolution) must be measured for each specific positioning system based on application conditions. The resolution of the linear encoder only provides the smallest incremental movement that can be detected (electrical resolution). For more information on measuring the smallest incremental movement of a positioning system, please refer to the Performance Verification and Testing section.

In addition to system resolution, it must also be noted that adding a linear encoder to a positioning system does not increase the accuracy of the system to the resolution of the linear encoder (e.g. adding a 1 micron (EM1) linear encoder to a CP8 Table does not mean that the CP8 now has an accuracy of 1 micron). To understand why this is true, it is important to remember that a linear encoder measures the position of the read head relative to the glass scale. A linear encoder cannot compensate for the following types of errors:

- **Cosine Errors** caused by misalignment between the linear encoder and the direction of travel
- **Angular Errors** in roll, pitch and yaw caused by the structure and bearings
- **Straightness and Flatness Errors** caused by the structure and bearings
- **Abbe Errors** caused by the offset distance between the point of measurement (read head) and the carriage top
- **Orthogonality Errors** caused by imperfect perpendicularity between 2 axes
- **Stack Up Errors** caused by the transmission of angular errors from a supporting axis to the supported axis
- **Contouring Errors** in material removal or marking applications. Permanent errors will occur before the linear encoder can compensate for them.

Abbe Offset Errors



To better understand the true positioning performance limitations of a motion system, actual performance testing is necessary. Please refer to the Performance Verification section for further details. Most motion controllers (with or without linear encoders) can compensate for most positioning errors provided that the error data is known.

Please note that high resolution encoders may not be well suited for high speed applications depending on the bandwidth limitations of the encoder or the motion controller. The top speeds for each linear encoder are listed on the previous page. Improperly shielded or grounded encoders can cause serious controller problems.

Rotary Encoders for Motors

All IDC servos (BN and B series) have integral rotary encoders. IDC Steppers do not have rotary encoders as part of their standard configuration; however, a rotary encoder can be added to a Stepper with the -EM or -EMK option. Please refer to the Stepper section for further details.

Rotary Encoders for RG Rotary Positioning Tables

For applications requiring rotary positioning performance beyond the standard specifications of an RGC or RGP Rotary Precision Table, a high resolution rotary encoder can be mounted directly to the base of the RG Table. This option requires a substantially taller base. Please contact IDC to discuss your application.