SCHNEEBERGER
LINEAR TECHNOLOGY

TECHNICAL BRIEF

OEMs: Six Tips For Bringing Your Compact Distance Measurements Up to the Mark

INTRODUCTION

In recent years, more compact linear distance measuring systems have been designed to fit the tight spaces inside devices built for life sciences / medical, semiconductor, and other key applications. The best models give machine makers — and their users — the precision, quality, and repeatability they demand. But how does an OEM designer, engineer, or purchaser know the system they specify is really up to the mark?

When evaluating a compact distance measuring system buy, here are six tips for knowing where you're at.

1. Fit Your Footprint

Look for distance measuring systems specifically designed for devices like yours, which feature comparatively smaller operating parameters plus relatively "clean" environments. Obviously, saving precious space inside the machine is a key consideration. (This is opposed to heavier-duty measuring systems intended for use in applications such as machine tools and industrial automation, which present larger operating dimensions, longer stroke lengths, and more potential exposure to corrosion and contaminants.)

Pick a slide based on your required load and stroke length. For these applications, many users today are finding that their best options are **optical scale distance measuring systems**. They offer a range of truly compact yet high-performance solutions.

Make sure the scale is integrated with the rail, to maximize those critical space savings. Here, a high-precision dimensional scale is part of a hardened miniature guideway's surface, in a simplified design with minimal components. Its sensor records the optical signals and supplies them for processing in the interface module, in either analog or digital format.

Among these compact products, an advanced **ball recirculation** model allows for relatively longer stroke lengths. A good one can measure dimensions from a few millimeters to basically 1 meter. If you need a shorter stroke, even more accuracy, and exceptional rigidity, look for a ball **cage non-recirculating** model.

Finally, some components have additional features and options that allow you to run the cabling away from the carriage, tucking it in for even greater compactness.

2. Insist on Integrated

Some OEMs take a component approach, sourcing different parts of their distance measuring system from different manufacturers: a linear scale from one maker, a miniature guideway (rail and bearings) from another, and carriage attachments from a third.

But that means you must assemble the system yourself. You undertake extra labor, and lose precious time. You also risk ending up with an inaccurate alignment.

Take an integrated approach instead. Buy an engineered solution from a high-quality manufacturer: one integrated assembly — rail, carriage, and measurement system encoder.

Why? Because integrating measurement and guidance into one system helps preserve that precious machine real estate. It avoids the need for differing thermal expansions compensation. And it saves time and effort all along the line: from supply chain and purchasing to receiving, handling within your operation, and installation.

With a relatively larger ball recirculation model, you simply lay the rail down, then put the carriage on. With some smaller non-recirculating models, you receive a finished assembly, ready for mounting.

3. Go Directly To Measurement

A number of distance measurement systems, such as glass scales and rotary encoders, utilize indirect measurement. But the most advanced, compact systems use direct measurement, in a setup using a sensor, an optical read head, and LED light sources.

You're not measuring when the ball screw or the linear motor moves. You're measuring exactly where the movement takes place — as the entire assembly with payload moves — to ensure the smallest possible error. You avoid loss due to wind-up in the ball screw, coupling, or motor, or errors due to ball screw temperature variations.

Some system makers have only tried direct measurement fairly recently. Their designs may not yet be perfected. And their systems tend to be proprietary, locking you into one controller type. Instead, look for a product from a linear motion specialist manufacturer that demonstrates long experience in direct-system design, and whose system can work with any controller you choose.

4. Pick Precision

Obviously the demands of your machine design will determine the level of precision you need. Today, your choice includes systems with resolution down to well below a human hair, which has a diameter of 75 micrometers (µm).

For example, an advanced ball recirculation model could have:

- Maximum digital resolution: 0.1 µm
- Accuracy over 1000 meters down to +/- 10 µm
- Repeatability: ± 0.1 µm (unidirectional), ± 0.2 µm (bidirectional)

For even greater precision on even more compact dimensions, a non-recirculating model like the one mentioned earlier offers extreme rigidity. Its ball cage design maximizes load capacity in all directions, eliminating the cage creep normally associated with high-speed movement. No reset strokes are needed during production, for instance. The results are exceptional stiffness, high load capacity, and very smooth running performance.

Plus outstanding precision. A system like this can achieve:

- Maximum digital resolution: 0.1 µm
- Accuracy: ± 3 µm
- Repeatability: ± 0.1 µm (unidirectional), ± 0.2 µm (bidirectional)

Note: in the near future, look for some advanced systems like these to add absolute positioning capability. So even if your system loses power, the last position is safely maintained.

5. Select for the Speed You Need

The best modern distance measuring systems can achieve impressive velocities, to match your applications needs such as high productivity.

- A superior ball recirculation model can attain metrics like these:
- Maximum speed: 1 meter per second (m/s)
- Maximum acceleration: 50 m/s^2 (about 5 g's)

When even greater velocities are called for, a top-flight system with a non-recirculating ball cage could reach:

- Maximum speed: 3 m/s
- Maximum acceleration: 300 m/s^2 (about 30 g's)

Naturally, especially in the second example, very high speeds bring somewhat lower levels of resolution.

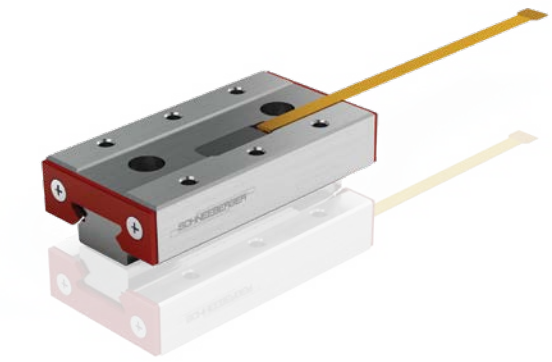
6. Trust Experience

The linear motion field offers a large number of suppliers. However, their product quality varies; some are startups — and even established suppliers may be late entrants in the distance measurement system segment.

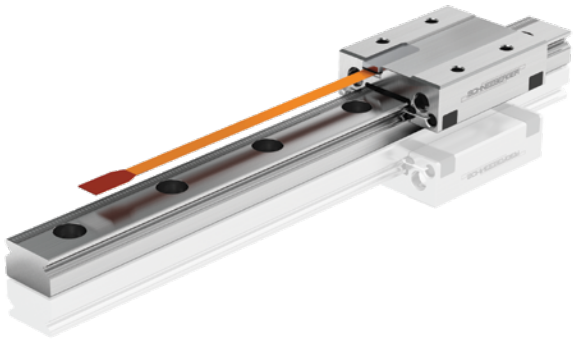
The more important your measurement is to your product, the more important that you pick a truly experienced supplier. So look for a maker with a proven record for technological excellence, as well as thousands of successful installations of high-performance linear motion components and systems.

Consider the factors above and you'll find a linear distance measuring system that can go the distance for your device.

The ultra-compact SCHNEEBERGER MSQscale integrated encoder system, with exceptional rigidity in a ball cage non-recirculating design and resolution as low as 0.1 micron, offers the highest speed and acceleration for stroke lengths from 0.33 mm to 130 mm.



The compact SCHNEEBERGER MINISCALE PLUS integrated encoder system, with ball recirculation and 0.1 micron resolution, provides high rigidity and precision for carriage lengths and rails from 7 mm to 42 mm in width and up to 1 meter in length.



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