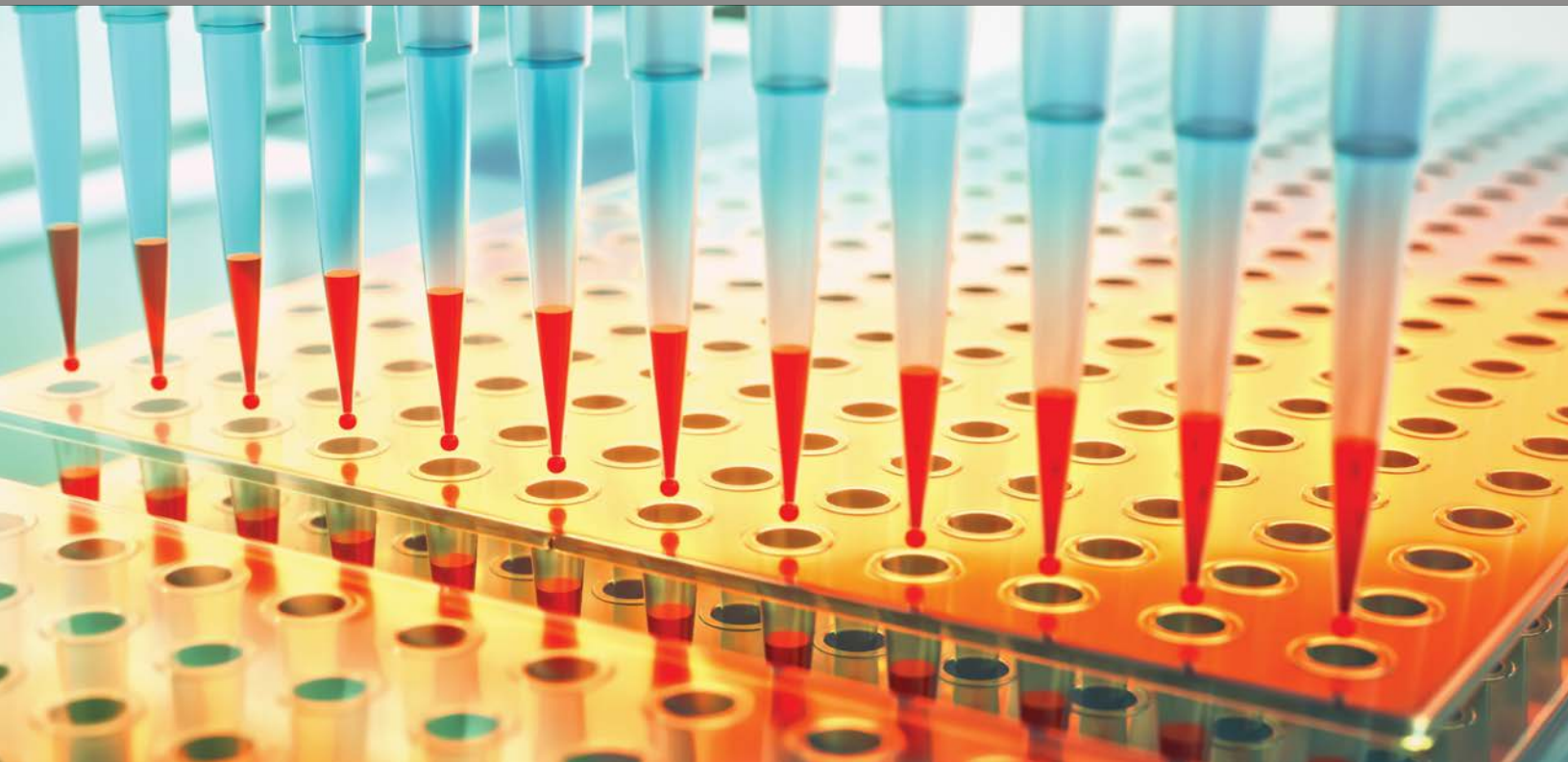


WHITE PAPER

The Medical Equipment
Manufacturer's Guide to

Customizing Linear Motion

SCHNEEBERGER Inc., U.S.A.



The Medical Equipment Manufacturer's Guide to Customizing Linear Motion

Introduction

Designing and manufacturing medical and life sciences equipment is always a challenge. Linear motion components with the required form, fit, and function are often vital parts of advanced medical equipment. Most such components are bought off the shelf. But what if standard linear motion products don't work, or don't fit, or can't deliver quite the right performance?

As a manufacturer of medical / life sciences equipment, you should keep your options open. Look for linear motion suppliers that can tailor solutions to fit your unique needs.

This report examines linear motion customization issues, how to work with a supplier that's willing to customize — and what advantages customization can bring. Properly specified, customizing your linear motion components and systems can improve the design process, the performance, and the total cost of ownership of your medical or life sciences equipment.

The Customization Fear Factor

For quite a few original equipment manufacturers (OEMs) of medical equipment and life sciences technology, implementing the linear motion aspects of their design takes a tried and true approach. They develop specs for that portion of their product's new design or upgrade; consult linear motion representatives for the standard or catalog components or systems that come closest; buy them; and do their best to make them fit their purposes.

They don't really consider customizing their order. They're afraid it might cost too much, or add too much to their lead times. Some OEMs could worry that customization takes

some control — particularly control over the level of designed-in quality — out of their hands.

Others may consider customization for more elaborate linear motion systems, but never just for components. Or they may fear getting locked into a single source for a custom stage or guideway.

There's one final reason why many original medical equipment manufacturers haven't tried linear motion customization: Because relatively few suppliers are able — or willing — to offer it. Perhaps only 25% of linear motion product manufacturers provide truly "spec-sheet-to-prototype-build" capabilities.

Other suppliers may be too small, and thus lack the necessary resources. Or too large: a number of the industry's biggest players prefer the high-volume commodity production model. They just don't want to risk the investment of time and resources that a custom project demands.

However, where a qualified customization need can be met by the right supplier, the above concerns will prove unfounded. And while some suppliers don't want the extra time or trouble, a few welcome customization's challenges and rewards.

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Why Customization Works

Medical equipment demands exacting characteristics. When you try to integrate linear motion components into your medical / life sciences equipment, general requirements might include factors such as high rigidity, maximum precision and positioning accuracy, smooth movement, very low displacement forces, and resistance to corrosion.

Fit for your purpose

However, fairly frequently you need more. Sometimes a lot more.

The unique equipment you're designing or updating may demand a different size, a new shape, a special coating, or a nonstandard material. OEMs seeking customization often ask for products or systems that hit specific targets for accuracy, speed, flatness, preloading (to increase stiffness by eliminating internal clearances), service life, maintenance levels, or price.

If you use off-the-shelf linear motion components, you must design around them. This can often unduly limit your choices in other aspects as well. For instance, settling on a particular stock rail or carriage may in turn force you to use a certain type of motor or controller, or a particular encoder feedback.

You end up with a non-optimized linear motion solution. Unfortunately, that in turn means that your product may possess too much functionality — so you pay extra for

performance you don't actually need. Or you may have to sacrifice results, because the off-the-shelf component or system in your brand-new product just can't meet all your performance metrics. Too often, the result is that you can't offer a hoped-for competitive benefit, or take advantage of a key market trend.

By contrast, customization means designing to accommodate your preferred process and tool architecture — not the other way around. It can make all the difference between meeting or missing your targets for quality, performance, and profitability.

Expert design

Another reason to customize: because "do it yourself" doesn't always yield the best results.

Your designers are experts in medical equipment — not in linear motion technology. Suppliers called in after customers' own designs provided unacceptable performance report a host of problems: including excessive vibration, insufficient straightness, undue noise, improper sizing of bearings (leading to rail yaw and roll), improperly located lubrication ports, failures caused by dirt resulting from lack of carriage wipers or scrapers, and more.

By contrast, a specialist supplier can bring all the advantages of expert linear motion technology know-how — together with hands-on experience customizing the right solution for challenging medical equipment applications.

Reasonable lead times

Customized jobs don't have to mean excessive delays.

Simple adjustments to stock components can take surprisingly little time. Of course, as complexity increases, lead times can lengthen. A complicated custom project may require 12 to 16 weeks from initiation to prototype.

But here's a paradox: customization may actually shorten your entire project timeline.

First, it's key to involve your linear motion supplier as early as possible during your design process. Once fully informed of your specifications, the supplier's planners can work to avoid delays. For instance, they might examine the list of suitable components for a particular spec, and choose the one that takes the shortest time for design/material/manufacturing/shipping. The company can strive to ensure rapid completion of your prototypes and adherence to delivery deadlines.

Also, remember that a little time spent on design can often prevent a lot of time lost to later delays. Intelligent customization anticipates and eliminates product shortcomings, and avoids potential roadblocks. That can significantly assist your equipment in meeting rigorous requirements — whether they arise from market conditions in your specific region, or from regulatory constraints such as those demanded for U.S. Food and Drug Administration (FDA) approval.

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Surprisingly low costs

Customization may not be as costly as you think. In fact, in many cases it adds little or no extra expense ... or actually saves money.

Certainly, compared to buying a could-be-good-enough component off the shelf, purchasing the perfect customized linear motion solution may require an average 15% premium.

But again, consider the whole picture. With the right supplier, that customized component or system will be designed to your specific cost and performance targets. In many cases, it can avoid expensive pitfalls during your design phase; suffer fewer failures; and deliver superior performance over a longer, more trouble-free service life.

Result: a total cost of ownership that's actually lower — and superior medical equipment with competitive differences you can offer your customers.

Ensured quality control

It's true that when you engineer your own linear motion solution using a stock component, you can perform your own checks to guarantee the level of quality you want.

Conversely, in a customization project, you must trust your linear motion supplier to build assured quality into your custom product, and to perform rigorous testing to validate its quality and performance.

Solution: chose with care. A vendor that embraces the commodity / low-cost business model might not be the best choice. Again, look for an experienced customization specialist with a recognized focus on quality and true customer partnership.

Rewarding partnership

Rather than avoiding single-source linear system customization, many OEMs welcome this type of partnership.

Medical equipment OEMs interested in custom stage solutions may want to dedicate their research and development, design, and engineering resources to their own core competencies. In true partnership with a good linear motion supplier, they can work together to realize manufacturing and performance improvements and cost reduction measures, collaborating on long-term business/technological roadmaps for mutual benefit.

For this and many of the other reasons above, more and more major medical equipment manufacturers are sharing these functions. Outsourcing designs of linear motion and similar technologies may now account for more than 50% of development efforts at large companies in this segment.

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Customization Success Stories

SCHNEEBERGER, a long-established global supplier based in Switzerland, has made a specialty of custom designs. Its stages and systems are always customized. And even components and parts — drawn from a wide array of standard offerings — can be extensively customized for use in prototypes and production models of qualified OEM products. The company has applied customization to solve an array of issues for a number of medical equipment manufacturers.

Example 1: DNA sequencing.

The manufacturers of a DNA sequencer consulted the company early when selecting a profiled guideway. During initial discussions, the OEM's engineers mentioned that their machine's interior was likely to experience a high humidity level, with potential for solvent spills. SCHNEEBERGER linear motion experts realized this could eventually lead to corrosion of standard parts, so that stock items would be unsuitable. Providing a MONORAIL guideway with a customized anticorrosion coating eliminated that risk, even in the enclosure's challenging environment.

Example 2: Microtomy.

A leading manufacturer of microtomes needed linear bearings to provide precise movement for their latest design. However, their linear motion supplier's standard product allowed an unacceptable degree of deformation, and less than ideal acceleration. So the OEM searched for a supplier willing to tailor a unique component. SCHNEEBERGER was able to customize roller bearings featuring a special cage creep solution. The resulting assembly proved to provide the required stiffness versus deformation, as well as on-spec acceleration. (SCHNEEBERGER now furnishes linear motion components for more microtomes than any other supplier worldwide.)

Example 3: Automated diagnosis.

The manufacturer of a benchtop automated blood diagnostic system had trouble making the unit's ejector unit function as planned. During test runs using different profiled guideways from a variety of suppliers, about half the time movement would occur as desired. But half the time, it wouldn't: probably because the ejector's unique design represented an atypical application for any standard guideway. However, the ejector system design was already well advanced. Changing it would require an unmanageable amount of effort to re-validate and redesign. Solution: SCHNEEBERGER is supplying a customized rail with increased push force, to ensure the ejector carriage can fall freely over the rail when held vertically.



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How to Work With Your Linear Motion Customization Supplier

Many medical equipment OEMs have limited resources. Partnering with an experienced linear motion supplier can in effect extend your engineering team. Shape your working relationship with the supplier to build the best basis for a successful customization project:

1. Start early. Linear motion components or systems often play a fundamental role in your equipment's design and functionality. Call your supplier in early, arrange a nondisclosure agreement (NDA), and get your linear motion requirements quantified and understood as quickly as possible. That gives the supplier maximum time and scope to come up with just the right customized solution, from initial planning to final design freeze.

2. Design to performance. The supplier should work to quickly pinpoint any motion issues and opportunities that a given medical

equipment design may present. They can identify trade-offs and suggest alternatives. The goal: help you avoid any pitfalls now — to prevent performance shortcomings later, when they're harder to correct.

3. Design to cost. Costs are always a prime concern. Give your supplier your intended market price or target. They'll strive to meet it, without sacrificing quality or long service life. The ultimate goal: optimal performance with the lowest total cost of ownership over the lifetime of your equipment.

The Future of Linear Motion Customization for Medical Equipment

As medical technology progresses, high-precision control of component movement is always at a premium. Demands for miniaturization are increasing. And budget pressures remain ubiquitous. It seems likely that key medical equipment manufacturers

will increasingly turn to customized solutions with specialized designs, optimized costs of ownership, and ever-higher performance indices for key linear motion components.

Successful customization projects that might be applied to future medical equipment prototypes include use of unique stage base shapes; combinations of different drives for different axes (such as ball screws in one axis, linear motor in another); customized flex cabling; and manufacture of an integrated stage on top of a granite or mineral cast base.

Cutting-edge medical equipment applications that may need the precise match of form, fit, and function that linear motion customization can provide include robotic surgery equipment, CRISPR gene-editing technology, 3-D printers for prosthetic appliances, virtual reality-controlled equipment, and many more.

Conclusion

An increasing number of medical / life sciences OEMs are exploring the benefits of customized linear motion solutions for their unique products. The right supplier can overcome concerns and obstacles to help deliver advantages such as purposeful performance, expert design, acceptable lead times, reduced cost of ownership, reliable quality, and rewarding partnership.

SCHNEEBERGER COMPANIES

SWITZERLAND

SCHNEEBERGER AG
Lineartechnik
St. Urbanstrasse 12
4914 Roggwil/BE

+41 62 918 41 11
+41 62 918 41 00
info-ch@schneeberger.com

JAPAN

Nippon SCHNEEBERGER K.K.
Crane Toranomon Bldg 7F
3-20-5 Toranomom, Minato-ku
Tokyo 105-0001

日本シュネーベルガー株式会社
〒105-0001
東京都港区虎ノ門3-20-5
クレイン虎ノ門ビル7階

+81 3 6435 7474
+81 3 6435 7475
info-j@schneeberger.com

GERMANY

SCHNEEBERGER GmbH
Gräfenau
75339 Höfen/Enz

+49 7081 782 0
+49 7081 782 124
info-d@schneeberger.com

CHINA

SCHNEEBERGER
(Shanghai) Co., Ltd.
Rm 606, Shang Gao International
Building
No. 137 XianXia Road
200051 Shanghai

施耐博格 (上海) 传动技术有限公司
上海市长宁区
仙霞路137号盛高国
际大厦606室, 上海 200051

+86 21 6209 0027
+86 21 6209 0102
info-cn@schneeberger.com

ITALY

SCHNEEBERGER S.r.l.
Via Soldani 10
21021 Angera (VA)

+39 0331 93 20 10
+39 0331 93 16 55
info-i@schneeberger.com

KOREA

SCHNEEBERGER Korea Ltd.
Garden5 Tool
10, Chungmin-ro,
Songpa-gu, Seoul,
Korea 05840

슈니베르코리아 유한회사
05840 서울시 송파구 중민로 10
가든파이프 툴관 10층

+82 2 554 2971
+82 2 554 3971
info-kr@schneeberger.com

USA

SCHNEEBERGER Inc.
44 Sixth Road,
Woburn, MA 01801-1759

+1 781 271 0140
+1 781 932 4127
info-usa@schneeberger.com

SINGAPORE

SCHNEEBERGER Linear
Technology Pte. Ltd.
38 Ang Mo Kio Industrial Park 2
#01-04, Singapur 569511

+65 6841 2385
+65 6841 3408
info-sg@schneeberger.com

INDIA

SCHNEEBERGER India Pvt. Ltd.
406, Satra Plaza,
Palm Beach Road, Sector 19D
Vashi,
400 703 New Mumbai

+91 73 0454 0119
info-in@schneeberger.com



www.schneeberger.com