CO-ENGINEER SUPERIOR MEDICAL MOTION **IN 5 SIMPLE STEPS**

From general-purpose to specialized CT scanners, from fixed to mobile systems, from 64 to 640 slices—medical imaging equipment depends on super-precise motion, with the motion system perfectly fitted to the engineering parameters of the machine.

OEMs who seek to differentiate their imagers based on factors such as image resolution and clarity, procedural efficiency, radiation dose management and patient comfort often require motors that are collaboratively engineered specifically for their unique machine. The optimum motor and drive system must address issues of heavy gantry loads, high inertia ratios, resonance control, communications optimization, size requirements and more.

Kollmorgen co-engineering is a partnership for the success of your imager, from specifying the motion system requirements through meeting regional EMC compliance requirements and delivering the products and local engineering assistance and technical support you need, anywhere in the world.

Here's a simple, 5-step overview of how to co-engineer with Kollmorgen.

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STEP 1: DEFINE YOUR PERFORMANCE REQUIREMENTS

Motion systems for medical imaging equipment must move large masses—with inertia ratios far exceeding those found in typical industrial equipment—while maintaining extreme precision. The starting point, therefore, is to thoroughly understand the load, inertia and performance requirements of the gantry and the patient table.

Where to start:

- Determine the size of the load, the acceleration and speed required to meet your imaging performance goals, and the resulting rotational inertia.
- Choose the optimum mechanical transmission technology given your design goals and constraints.

How Kollmorgen co-engineering can help.

Inertia and speed specifications help define the power and torque requirements to move and precisely control the load. Kollmorgen can help determine the breakpoint at which direct drive delivers significant gains in control and precision over belt drive and gearbox technologies.

For example, in high-inertia systems operating at 300+ rpm, a belt drive can introduce excessive compliance and noise into the system. Motor speed is also a limiting factor due to belt reduction, and motors approaching 400 rpm require higher voltage and current to the point of diminishing returns.

For these reasons and more, we're increasingly seeing direct drive as the optimum solution, especially in 256-slice and above imagers. But whether the best solution for you requires direct drive, belt drive or a gearbox, Kollmorgen co-engineering provides self-serve Motioneering tools, engineer-to-engineer expert guidance and superior products to meet your exacting needs.

STEP 2: DEFINE YOUR COMMUNICATION PROTOCOL.

Once you have defined the inertia, speed and performance targets of the gantry or patient table, the next step is to specify a communication protocol that can reliably support these targets. The chosen protocol may be constrained by your familiarity with or preference for a particular control system.

Where to start:

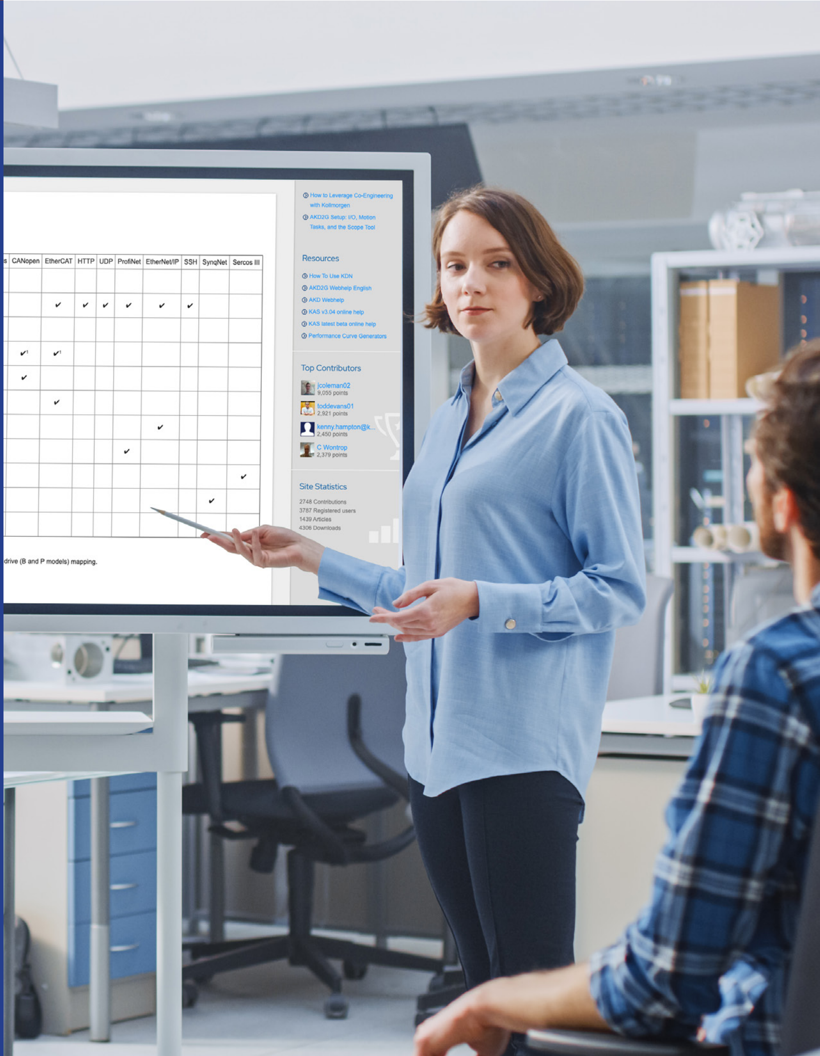
- » Based on your performance needs, determine the minimum rate at which information must be transferred between the host control system and the drive, and between the drive and motor.
- » If you have a preferred host control system, determine whether it will support these requirements. Determine the control loops or loop combinations that will achieve the necessary responsiveness and precision.

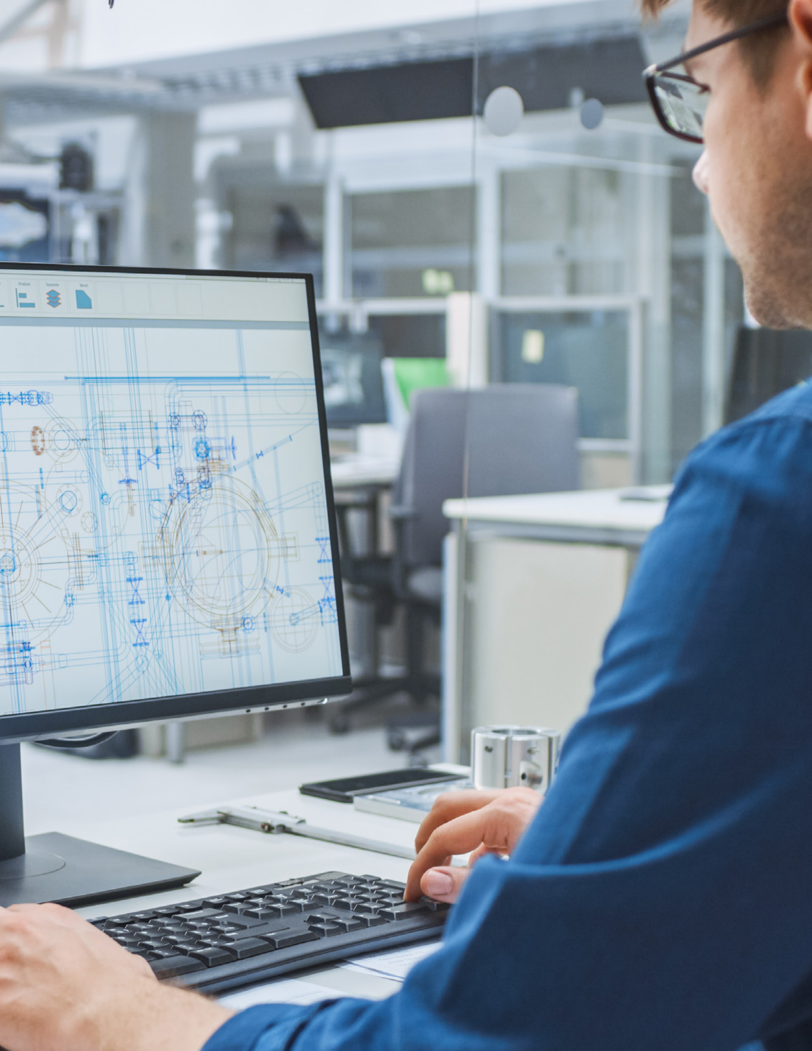
How Kollmorgen co-engineering can help.

Communication protocols vary in their capabilities, features and implementation. While some may be described as newer and more advanced than others, the truth is there's no one-size-fits-all optimum protocol.

Kollmorgen understands this. For example, if your choice is based on a control system and protocol that you already use and are familiar with, we can help configure the motion system to work optimally with that choice. We can help you choose the most appropriate control mode, whether based on velocity or position loops or even a combination of position, velocity and time (PVT).

And we provide the exceptional product range and expert support you need to implement the solution with confidence.





STEP 3: ESTABLISH EMPIRICAL TESTING PROCEDURES.

Drawing-board solutions rarely pan out exactly as envisioned in real life. In particular, actual system inertia will almost certainly vary from your calculations. That's why it's critically important to develop testing and data acquisition procedures prior to system modeling.

Where to start:

- Provide your engineering drawings and specifications to Kollmorgen. These will be used to develop a mechanical representation of the end application for testing purposes.
- Through an iterative process, we'll test motor and drive configurations, modifying the motion model as needed to approach and ultimately achieve the desired real-world execution.

How Kollmorgen co-engineering can help.

Problems arise not because the original design is inaccurate, but because system requirements evolve from the original prototype. For example, variations in actual mass or changing acceleration and speed requirements call for modifications to the motion solutions.

Iterating and testing these design changes can be burdensome for OEMs and can slow down the development process significantly. Kollmorgen helps remove that burden to speed development of a perfectly tuned system. Through expert motion modeling, we can help you get closer to the final specifications from the start, mitigating the need for alpha/beta testing cycles and accelerating your time to market.

STEP 4: CONDUCT MATHEMATICAL MODELING.

Once we have established empirical testing procedures, we'll work with you to conduct mathematical modeling in order to virtually test the system prior to producing prototypes for physical breadboard simulations.

Where to start:

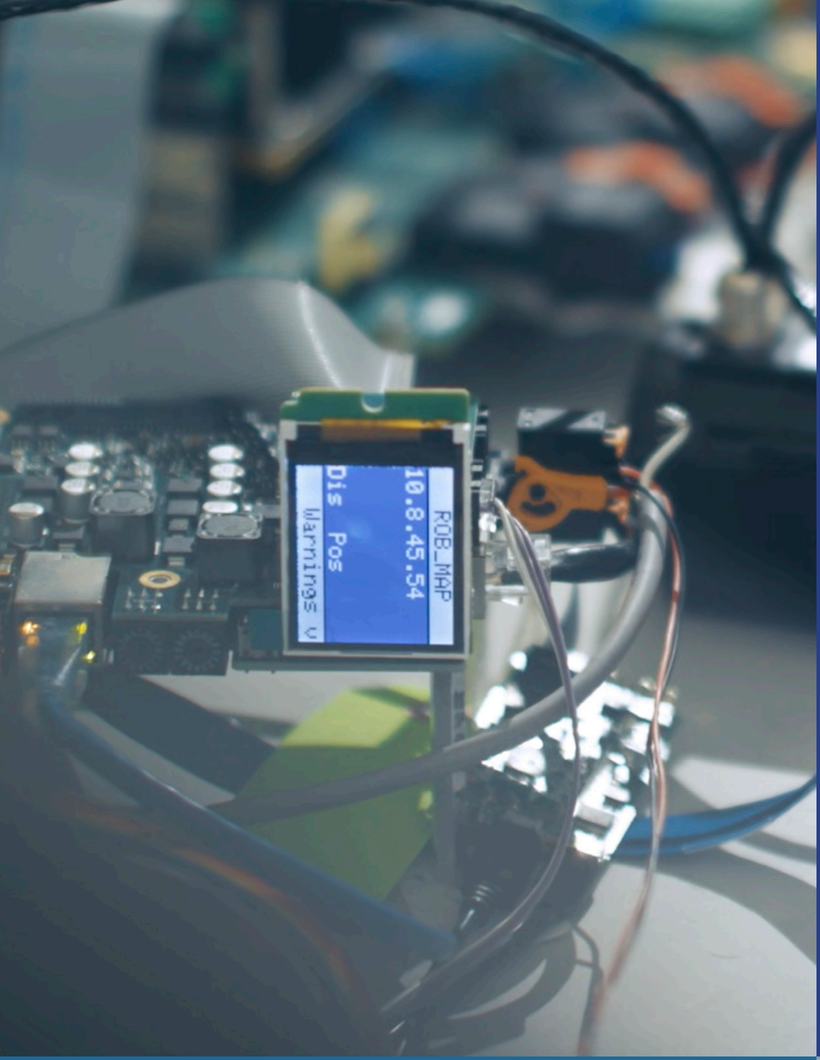
» Start by modeling elements such as maximum acceptable compliance, friction, acceleration and speed.

» Your models should be designed to ensure that you can test for unforeseen factors such as low or high power. All of this is done first through modeling because these variables are more difficult to test with a physical system.

How Kollmorgen co-engineering can help.

This step is crucial for maximizing the likelihood that your motion performance specifications will be met when the actual physical specifications are met. For example, mathematical modeling can provide information such as what conditions are likely to result in drive foldback and what duty cycles the drive can maintain.

If you choose, Kollmorgen can team directly with your engineering staff to conduct this highly collaborative step.



STEP 5: CONDUCT PERFORMANCE AND COMPLIANCE TESTING ON ALPHA/BETA BUILDS.

Alpha and beta testing of physical systems ensures that all performance targets are met. At the beta build stage, the equipment is also submitted for compliance testing according to applicable regulations, which vary by region. EMC testing is of particular importance to ensure that electromagnetic interference won't cause a drive fault, corrupt imaging data, or affect external equipment.

Where to start:

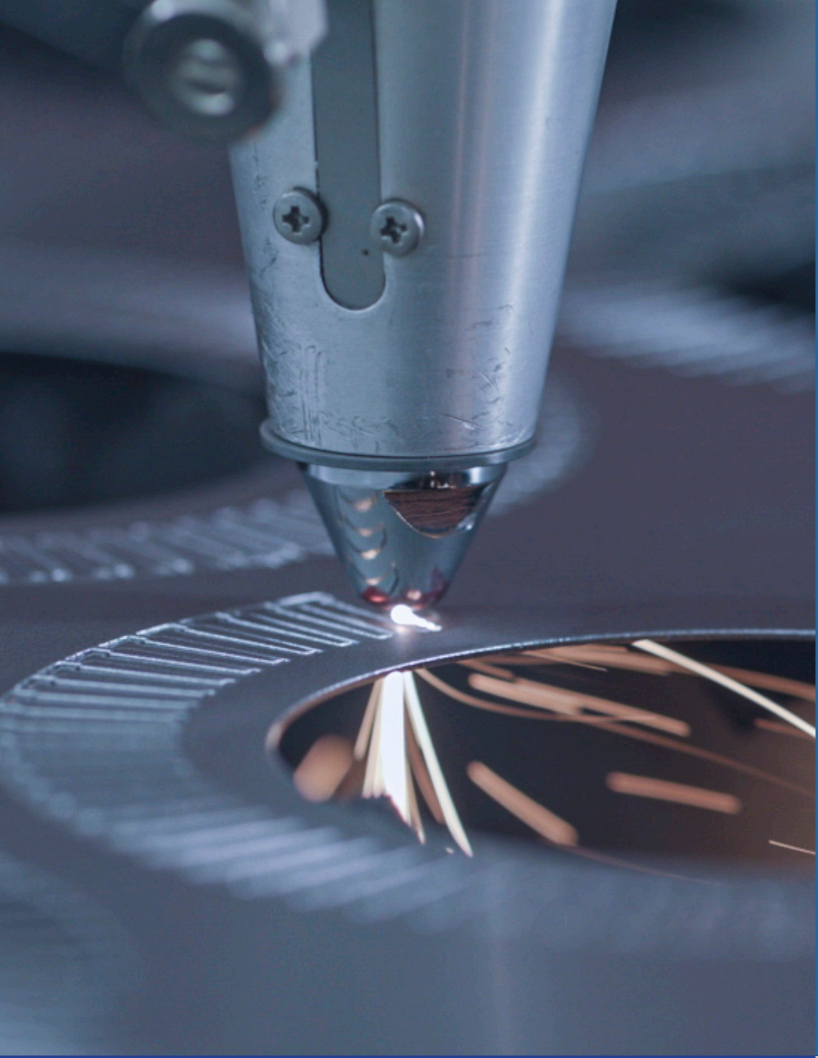
» All vendors should be present during testing to ensure that each system component is achieving the desired results. With motion systems, this includes verifying acceleration, speed, positioning accuracy and system stability, as well as compliance with installation characteristics, design standards and manufacturing processes.

Where to start (continued)

» EMC testing for medical applications is significantly more stringent than for typical industrial applications. Important considerations include dielectric strength, creepage and clearance distances, and compliance with appropriate thermal standards.

How Kollmorgen co-engineering can help.

Kollmorgen's experts have over 30 years of experience in medical device requirements. All of our products can easily be modified through extra filtering, extra shielding and other measures as needed to meet specific medical imaging standards. And we can help you complete the EMC and other motion system compliance phases of your project quickly and successfully to achieve the certifications you need, in any market.



LET'S GET STARTED.

Once definition, design, modeling and testing procedures are complete, you're ready for full production. Read our Guide to "Proven Processes, Reliable Delivery" to learn how Kollmorgen helps ensure successful design, production, delivery and support as you serve your healthcare customers around the world.

So let's get started. Explore all of Kollmorgen's capabilities for medical applications, and begin specifying the ideal motors and drives for your imaging system today.

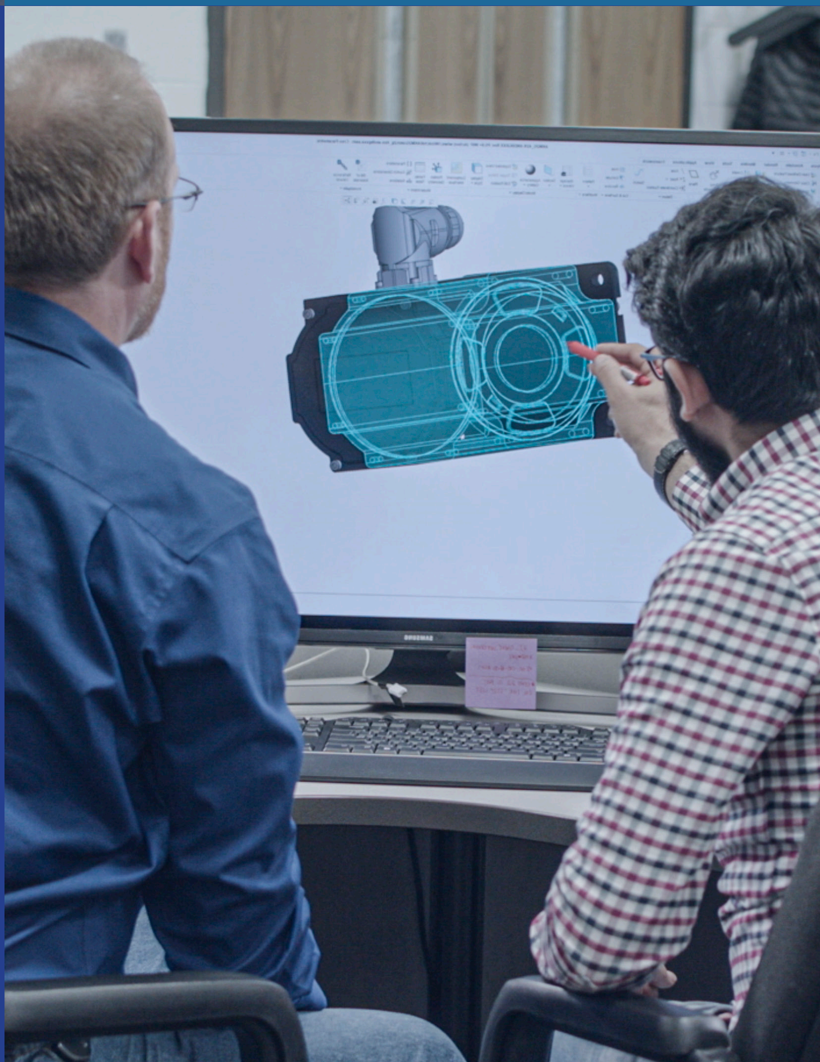
» **Learn more:** kollmorgen.com/medical

» **Start designing:** kollmorgen.com/designtools

» **Talk to a Kollmorgen engineer:** 540-633-4152

FOR ANSWERS, PARTNER WITH KOLLMORGEN

Kollmorgen is more than a supplier. We're a partner, dedicated to your success. We give you direct engineer-to-engineer access to the designers who create our motion systems and who understand how to address specialized medical requirements. Our self-guided design tools help you model, choose and optimize products online. And with our global footprint of manufacturing, design, application and service centers, you always have access to dependable supply, co-engineering expertise, and personalized support that no other partner can provide. For superior motion performance in CT and hybrid imaging systems, patient tables, digital mammography, mobile imaging systems and more, we can help you engineer the exceptional.



Ready to discover all your medical imaging system is capable of?

Learn more at www.kollmorgen.com/medical.
Or talk to a Kollmorgen engineer today at 540.633.4152

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