



Custom Sensor Assemblies for Innovative Products

Design, rapid prototyping and scalable production
of custom sensor assemblies for OEMs

The Search for Custom Sensors

DESIGN FOR MANUFACTURABILITY SHOULD BE EASY

Original Equipment Manufacturers (OEMs) are constantly working on ways to create innovative products. Sensors that deliver data to feedback loops have already appeared in a wide variety of industry sectors. They have transformed product performance in many challenging applications. Engineers want sensors that can be easily built into a specific product, to perform a specific function. They want sensors that are manufactured according to stringent industry quality standards and can be delivered across the globe in high volumes.

Reality is different

But standard products will never fit the engineer's expectations for dimensions, performance, quality or price. The alternative? Create a custom sensor. To do this, you need to consider the sensor as a complete system: one that integrates strain gage, sensor body, cables and electronics into an assembly. You could take a Do-It-Yourself approach, and co-ordinate the work of multiple vendors yourself. But do you have the knowledge - of sensor design, prototype development and validation, of production and quality control - to act quick and lean, to avoid delays in Time-to-Market?

The HBK impact is tangible

A faster, more effective approach is to partner with HBK. Tap into our extensive experience of building sensor solutions. As a manufacturer of custom strain gages, we have the expertise to guarantee that your sensor assemblies will deliver the accurate data you need.

The best news? You can clarify the key issues online, in just a half-hour meeting with the HBK OEM engineers at our global competency center.

Looking for a custom sensor assembly?

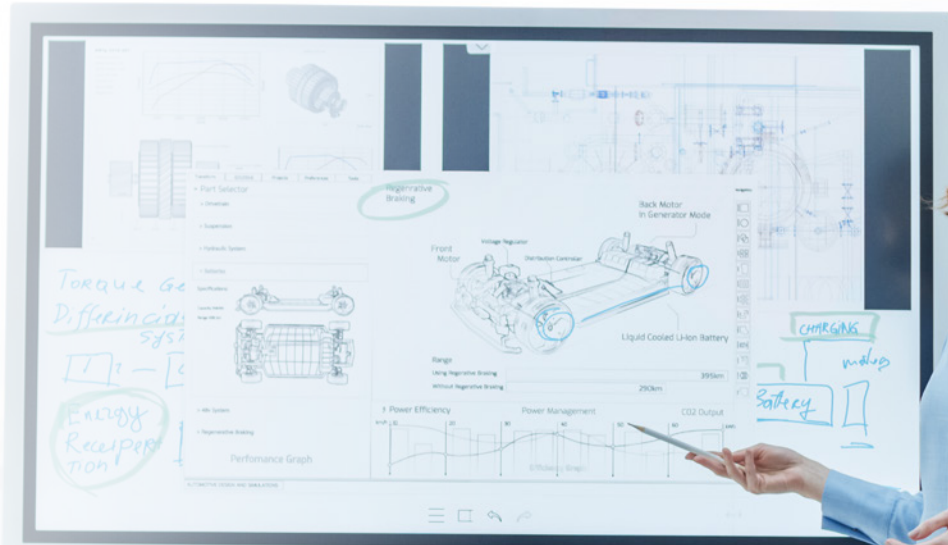
You've come to the right place. OEMs from almost every market choose HBK because it's not just about the sensor. You need a partner with a deep understanding of your application, and HBK experts can actively contribute and advise on fundamental sensor system design. By listening to our customers, we have learned how to optimize the process of designing, developing and manufacturing custom sensing solutions.

A leader in sensor technology for decades

Combine your product knowledge with our product knowledge. We apply design competence with manufacturability in mind. Thanks to our lean processes, global manufacturing and an experienced logistics team, the best possible customized sensor assembly will be ready for your series production, on time and within budget.



JOIN US FOR A WALK THROUGH THE PROCESS ...



Requirements gathered in the Engineer-to-Engineer Conference form the basis of Prototype designs.

Design Phase



Lean engineering means a smooth and effective development process that can achieve DFMA objectives within as little as six months.

Prototype Phase



Quality component manufacture, in scalable volumes ensures that you get your product innovations to market faster.

Production Phase

HBK Experts can guide you smoothly through the three, well-defined Phases of Custom Sensor development.

The Design Phase

KEY ELEMENT OF THE DESIGN PHASE IS AN ENGINEERING DISCUSSION.

A dedicated group of engineers will work with you to clarify your needs and the desired function of the sensor, including which components should be considered for measurements. Here HBK reviews the possibility of turning existing components into active sensors.

1 Enquiry

Your enquiry for a customized sensor is our starting signal. Our dedicated OEM engineering team is standing by in Marlborough, Massachusetts, ready to deliver professional support. In an email or quick conversation, we can learn about your objectives and set a date for the engineering discussion.

2 The Engineer-to-Engineer discussion

At this meeting we learn about your requirements in detail and what you want us to deliver. We'll listen to your needs, discuss the design options and brainstorm suitable sensing solutions. At the HBK competency center we prepare the solution that will deliver the quality of data that you need. The complete assembly can include: a strain gage, the sensor body (an existing part, or a new part), the cabling, electronics and mounting components.

3 Exchange of drawings

After an exchange of technical drawings, we perform finite-element analysis (FEA) to determine whether

we can turn your part into an active sensor or whether we have enough space to add a sensor. The combination of FEA, together with our extensive experience of manufacturing in volume, will provide you with the best solution.

4 Review

In this discussion, we review our findings and the design, to uncover any additional requirements or issues. This alignment is very important to ensure that we achieve your Design for Manufacture and Assembly (DFMA) objectives.

5 Product Requirements defined

With the preliminary design accepted, HBK proposes a solution that includes: product and performance requirements; an initial risk analysis; the development plan for your sensor; test plan and protocols. As we move into the prototype phase, we have a joint vision of how the solution will look and perform.

✓ CUSTOMER APPROVES PRODUCT REQUIREMENTS DOCUMENT

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FINITE ELEMENT
ANALYSIS (FEA)
IDENTIFIES THE
EFFECTIVENESS OF
PROPOSED DESIGN
SOLUTIONS.”



HBK's expertise in strain gauges, empowers innovative OEMs to create the intelligent products that benefit society.



The Prototype Phase

ONCE THE PRODUCT REQUIREMENTS ARE DEFINED, WE CREATE SENSOR CONCEPTS AND TEST PROTOTYPES.

Rapid prototyping techniques enable the HBK team to build functional test samples within a few weeks. Before we ship them, it's imperative to talk about how to mount the samples and test them. After this discussion, we can provide test protocols, fixtures and test amplifiers to ensure the best test results. We will provide control drawings, a partner-pricing cost for prototypes, and a price estimate for series production.

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RAPID PROTOTYPING
ENABLES THE TEAM TO
TEST IDEAS QUICKLY
AND EFFECTIVELY.”

1 Requirements

The product requirements, discussed in the Engineer-to-Engineer Conference form the foundations of the Prototype phase.

2 Virtual model – First Prototype

The HBK design team uses techniques such as rough CAD, rapid prototyping, FEA and 3D modelling to develop samples. In partnership with you, we identify other components of the bill of materials (BOM) that can include cables, or a sub-assembly that contains our HBK electronics. The milestones in this stage are: the engineering confidence test; test reviews; actual testing; and proof-of-concept (POC) approval.

3 Physical samples phase

The key issues to discuss and resolve in this phase include the successful testing of the sensor assembly and finalization of drawings. We also finalize: validation and testing; whether tests under any specific environmental or operating conditions or loads are appropriate; which 'special' aspects to test (such as ingress protection, material coatings, sealing issues, etc.). We also identify the steps in the manufacturing process and finalize DFMA issues. The milestones for this stage are Design Validation (DV) and customer approval.

4 Results of first Prototype Tests – test protocols established

Defining the test protocols allows us to focus on the implications of the data, rather than how the data is collected. Jointly agreeing to test fixtures and data acquisition equipment ensures that both our companies have consistent methodologies that deliver accurate readings.

By aligning the test parameters upfront, we create Quality-by-Design. At this point, the sensor assembly starts to become a key part of our customer's 'smart product'.

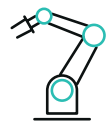
5 Production intent audit

All HBK factories have ISO accreditation and our experts are comfortable with audits. The production intent audit is particularly important, as it enables auditors to see where and how their product will be built in volume. As your strategic partner, HBK welcomes this kind of cross-department effort.

✓ WE HAVE EXTENSIVE PPAP EXPERIENCE
LOCAL APPROVING AUTHORITIES, AND
OTHERS AVAILABLE UPON REQUEST.



When standard sensors don't meet the requirements, we create custom sensor solutions to give OEMs the data that is essential for real-time feedback and control.



The Series Production Phase

WHEN WE DEVELOP A CUSTOM SENSOR, WE WORK TO ENSURE EASY INTEGRATION WITH CLIENT SYSTEMS AND ACCURATE MEASUREMENT THROUGHOUT THE LIFE OF THE PRODUCT.

In our experience, OEM sensor assemblies often go into volume production within six months of the initial Engineer-to-Engineer discussion. In HBK factories, lean manufacturing techniques and automation combine to ensure smooth production processes with high quality standards. HBK's focus on its own manufacturing facilities and processes ensures that OEMs get quality manufacturing plus scalable volumes. As your new 'intelligent' product gains traction in the market, you can scale sensor assembly orders to match the growth in demand. HBK will ramp-up production to keep pace as needed.

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SCALABLE PRODUCTION
CAPABILITY MEANS WE
CAN KEEP PACE WITH
YOUR MARKET SUCCESS.

1 Quality – A step ahead

Throughout the development process we have been designing for quality. In this stage, we formalize the data collection, inspection points and analytics to ensure the highest quality possible. We provide detailed control plans and capabilities studies. We have extensive experience with Production Part Approval Process (PPAP) - as do our suppliers. We provide samples with supporting data showing design, specifications and our process control for volume production. HBK is proud of its history leading quality standards. In August 1986, HBM was the first German company to be certified to ISO 9001 and is an accredited Calibration Laboratory, ISO 17025: D-K-12029. We also maintain compliance on numerous items such as RoHs 3 and more.

2 Test processes – How you test is how we test

In addition to producing high volume sensors assemblies with fewest rejects, we work closely with our clients to develop application test protocols. When producing an assembly that will be integrated into complex customer parts, it is best to clearly understand how the assembly is integrated, mounted, and tested to uncover any errors that may occur in the handling and testing of the parts. HBK manufactures high-quality laboratory equipment and software to assist this process, and has specialized equipment in-house (such as autoclave machines) that can be included for in-line testing.

3 Lean Manufacturing

All of our facilities are fully committed to lean manufacturing to minimize waste and continually improve operational efficiencies. Kaizen events are held often and Gemba walks are numerous - both are constants in our calendars. We are committed to produce to the highest standards and our ambition and goal is always "Zero Defects".

4 Automation

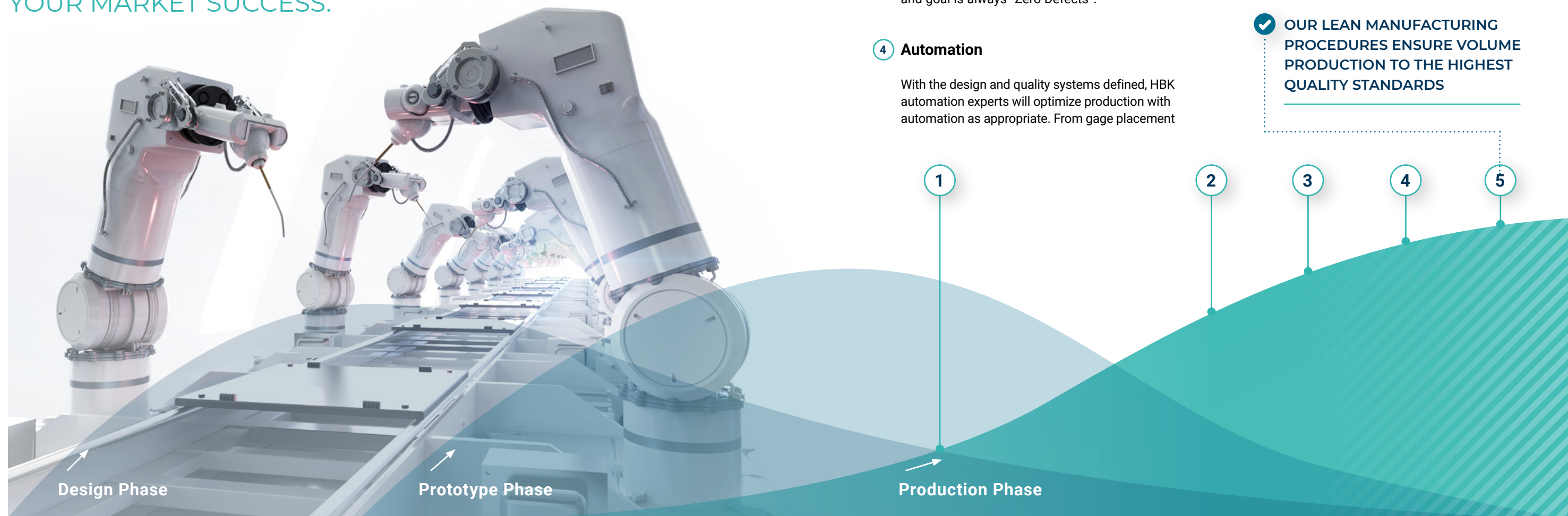
With the design and quality systems defined, HBK automation experts will optimize production with automation as appropriate. From gage placement

to printed circuit board (PCB) assembly, automation allows for consistent quality and optimized value. Having the best technology available, HBK has all types of modern equipment including automation, wire bonding, CNC, 3D printing, autoclave testing and much more. Since we own the largest strain gage production facility in the world, we have both the ability and the experience necessary to meet demand.

5 Logistics and Agile Supply Chain Management

Complex supply chains require detailed attention to packaging and logistics to ensure timely deliveries. Using our SAP enterprise resource planning system, the logistics group work closely with freight forwarders to ensure around-the-clock visibility of materials. Our three production facilities, strategically located in Europe, Asia and the United States, minimise logistics disruption and risk for our customers. Direct access to our logistics team means we can respond quickly to any changes in your forecasts or needs.

✓ OUR LEAN MANUFACTURING PROCEDURES ENSURE VOLUME PRODUCTION TO THE HIGHEST QUALITY STANDARDS



When you choose HBK as your Partner you gain access to Experts who can Guide You through new Challenges and on to Success.

Two Great Companies Working in Partnership

MANY SKILLS AND DISCIPLINES, ONE TEAM. EFFECTIVE COMMUNICATION AND COLLABORATION IS THE KEY TO SUCCESSFUL PRODUCT DEVELOPMENT.

HBK

We make sure your primary contact is an engineer who is familiar with your industry and who owns the project from design and prototyping, through to production.

Working alongside this engineer are very capable and experienced HBK engineering, commercial and administrative staff who work seamlessly together to ensure your custom sensor assembly meets your specification and is delivered on time and on budget.

Your Company

Your project manager is probably an engineer with an overview of the technical and business objectives that you want to achieve.

You will also have experts in a wide range of departments with specialised knowledge about your requirements, such as product management, engineering, production, quality and purchasing. Each will want to interface directly to their counterpart at HBK to get the answers you need, promptly.

✓ **YOUR ADVANTAGE – A UNIQUE COMBINATION OF SKILLS, TALENTS AND EXPERTISE TO CREATE THE BEST POSSIBLE CUSTOM SENSOR SOLUTION FOR YOUR APPLICATION**



Book a Meeting with the Experts Today

HBK UNITES EXPERTISE AND EXPERIENCE

Based on decades of experience, HBK is the worldwide leading supplier of strain gages. We have developed thousands of designs to match every application across many industries. Our competence center in Marlborough, MA, USA has worked with OEM customers worldwide for 40 years to realize customer-specific sensor solutions.

World leading production facilities

ISO-certified production plants in Marlborough, MA, USA, in Darmstadt, Germany, and in Suzhou, China, ensure seamless transition from the design and prototyping phases of custom sensor development, through to volume production of sensor assemblies.

Widen your professional network

When you choose HBK as your partner for custom sensors development, you gain access to experts who can guide you through new challenges and help you achieve your project goals.



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