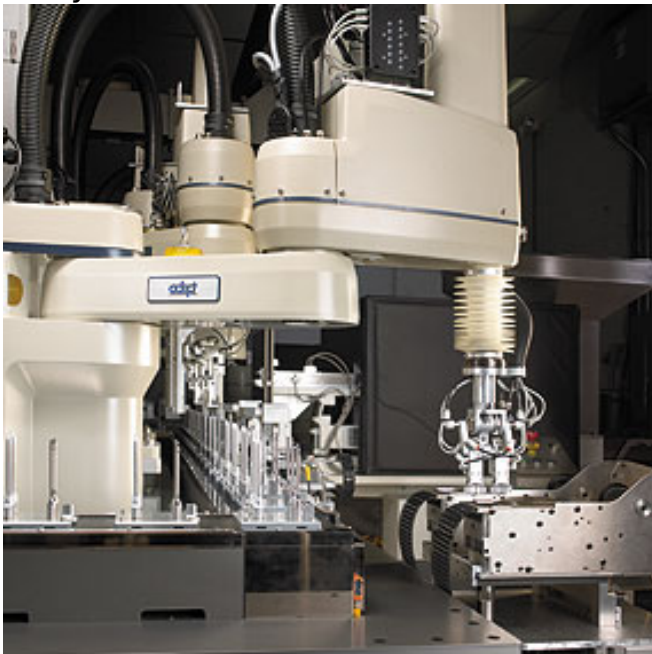


Small Footprint, Big Impact

By adding robotics to the production line, a company can turbocharge its product quality, reliability, and speed to market. This article will focus on what characteristics should be examined when considering a robotic solution for various tasks. In addition, a success story illustrates the advantages that can be realized from this automation purchase.

By Keith Bocchicchio

Smart choices can make all the difference in a product's success or failure. Should product manufacturing be outsourced so a company can instead concentrate on developing new intellectual property? Should product be manufactured overseas? Which processes should be automated? The answers to these questions aren't always clear-cut.



Close-up of needle overmold load station

For years, Integrated BioSciences Inc. has manufactured Class I and Class II medical devices for OEMs and helped numerous customers determine the best paths to pursue to achieve a competitive advantage. Recently, IBS found that one intelligent solution—robotics—could help address many OEM concerns.

Trends in Robotics

Today's robots, although they appear similar, bear little resemblance to their counterparts of 10 years ago. They are now smarter, faster, and far less expensive, allowing for a significantly reduced initial return on investment and enabling U.S. manufacturers to regain the cost advantage offered by overseas manufacturing. Robots provide higher precision, repeatability, process control, and productivity while reducing waste and performing sometimes dangerous duties formerly handled

by humans.

Choosing the Right Robot

for the Job

From manufacturing to assembly, handling, and packaging, robotic systems can speed the process.

By Craig Tomita

Whatever the medical manufacturing task, chances are a robot can perform it more quickly, precisely, and cost-efficiently than a human can. To choose the ideal robot for a particular process, consider the characteristics of the three main categories of these machines.

SCARA (Selective Compliance Articulated Robot Arm), or four-axis, robots excel in small part assembly and pick-and-place applications (moving small, delicate parts from one location to another quickly, precisely, and fluidly). Among the fastest robots on the market today, SCARA units offer the most favorable price-performance ratio for high-speed assembly. For applications that require great dexterity—for instance, applying adhesive to a particular spot on packaging—six-axis robots are most popular.

Cartesian coordinate (XY or XYZ) robots often are used in high-accuracy parts placement since they can provide repeatable, precise positioning over a work area ranging from 100-mm square to 2-m square or larger.

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Previously used primarily for pick-and-place (moving parts from one location to another), material handling, packaging, and assembly operations, robots' newer capabilities now allow for new functions, including inspection. Advanced technologies such as integrated vision, dexterity, and force sensing enable robots to distinguish very subtle differences in colors and geometries. Robots can also be

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programmed to follow logic so they can automatically adapt to product and environmental changes. Traditionally a mainstay in automotive manufacturing, robotics increasingly are employed in the life sciences/pharmaceuticals/biomedical sector. According to the Robotic Industries Association's latest data, orders for robotic systems for use in the medical sector increased by 48% in the first quarter of 2007, compared with the same period in 2006.

An Intelligent Solution

IBS continually reviews available technologies to find solutions that will help its customers gain or maintain a competitive edge in the market. Our company manufactures medium- to high-volume products that can have many pieces, and accuracy and repeatability of assembly are essential. Many of the products incorporate small, hazardous components, such as sharps, and the company needs to protect its workers as well as minimize potential defects and contamination that can be introduced by human handlers.

Lean cells, semi-automated processes, and human operators can successfully manage some of the work, but IBS chose to pursue robotics to achieve reduced variability, higher-scale, lower-cost manufacturing. Too often, companies implementing new, highly technical custom solutions encounter difficulties. To avert potential disaster, manufacturers should first develop a strategy that offers scalability and applicability over a large range of applications. Decide which processes will be automated and the goals to be accomplished. IBS's in-house automation design and build group wanted to create a more standardized, rapid-development platform that could handle a wide variety of products. The target manufacturing rate was 35 million to 50 million pieces per unit per year. By further automating the assembly process, products would be completed 10 to 15 times faster than they were previously. There are many robotics products on the market, and choosing the right solution can be a challenge. IBS spent one year developing detailed requirements for a robotics system, writing specifications for the system, performing comparison analysis of many of the offerings on the market, and completing initial engineering and the installation, which went online last September. For the most successful robotic system implementation, project managers should consider a robot's features.

Capabilities

Speed, flexibility, precision, and intelligence are among the leading reasons why any manufacturer will choose a particular robot to automate a formerly manual process. Different products have different capabilities in these areas, so be certain to thoroughly investigate and verify a product's capabilities before making a purchase.

The Cobra Robots





The iSeries

Cobra robots from Adept Technology Inc. are the only SCARA robots on the market with amplifiers and a motion controller that are built into the base of the robot, making it one of the easiest robots to design into work cells where space is critical.

Key features:

- No external electronics. Because the amplifiers and motion controller are part of the robot itself, this significantly reduces the size and number of cables required which dramatically simplifies system installation.
- Absolute encoders allow for easy robot calibration.
- High-resolution encoders provide high-precision.
- High-efficiency motors deliver high performance with high torque-to-amp ratio.
- Low-inertia harmonic drives provide maximum acceleration.
- Temperature sensors on motors and amplifiers maximize performance and reliability.
- 8 kHz servo update rate offers superior path motion and control.
- Error code display on robot allows for faster troubleshooting.
- Easy replacement of electronic sub-assembly

reduces MTTR.

IBS's most sensitive operation occurs in the initial cell. The robot must pick up and place very small, delicate parts, including a sharp. Obviously, this operation should not be performed by humans since it could be dangerous for them, and they could potentially contaminate the product. Robots, on the other hand, can perform the task quickly and efficiently without incurring such risks. In the specific IBS case, the sharp component was delivered in pocketed tape, and it was crucial that the selected robots be able to compensate for non-precise location of objects. Each manufacturer will have its own sensitive operations and vital must-haves to consider.

Flexibility

IBS, like most manufacturers, produces an array of products, generally in the same size range and form factor, but with many potential variations. For instance, syringes are available in many sizes, including 1.0-, 5.0-, and 10-ml variations, with a large assortment of feature options. Therefore, the company wanted a system that allowed for changing process flow and fast changeovers to keep production lines moving.

The robot selected has a robot signature card embedded in its arm. All of the critical information related to the arm stays with that portion of the robot instead of residing in the controller. Changeovers simply involve a quick swapping-out of arms and take mere minutes. No reprogramming is necessary. In IBS's case, the arms are not changed out. The robot can be programmed to provide any number of unique sequences and can change operation or perform a totally different function with simple end-effector change and command-to-change operations.

Scalability

Some new robotic systems do not work well with a company's legacy software and hardware platform, or they don't easily allow for future upgrades. More than 20 years ago, Adept Technology Inc. developed V+ scalable software for robots, which has become the industry standard. The V+ language enables the robotics system to easily integrate with other software solutions, even versions that are more than a decade old.

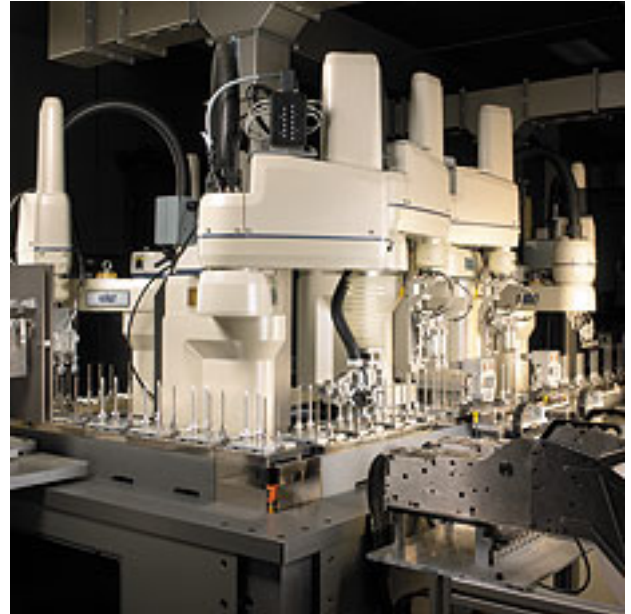
IBS's integration of Adept Cobra i600 SCARA robots with IBS's modular systems took just days. In addition, the robots accommodate vision capabilities when required for the application, and a conveyor tracking option is slated to be introduced later this year. Finally, there is no need to return the robot to the factory for upgrades; all changes and upgrades can be easily made on-site.

Footprint

Manufacturing floor space is precious; the more efficiently machinery is placed, the better for both manufacturer and customer. Cleanroom space is a whole other world. Floor space here is extremely expensive. The overhead-associated costs of monitoring, air handling, and cleaning systems is much pricier than those incurred on the typical factory floor. Large equipment can disrupt air flow, making it difficult to maintain cleanliness. As a result, medical device manufacturers want systems with as small a machine footprint as possible.

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Automated syringe assembly system

The Adept iCobra is the only robot on the market that has a controller embedded in the base of the machine. This design reduces controller cabinet floor space needs and dramatically reduces the size and number of cables required, which simplifies system installation. Another cleanroom concern is that some machines generate particulate. Robots are clean, and some versions are made specifically for use in cleanrooms. The IBS-designed modular robotic manufacturing cell measures just 4 x 10 ft. It can provide up to eight robots per cell and perform as many as 20 unique manufacturing and assembly operations while consuming a minimal amount of space.

Recapitalization

The ability to quickly replicate robotic systems as product volumes increase and the corresponding ability to be able to quickly recapitalize the equipment if product volume falls off is another essential criterion for most manufacturers. To save time, money, and aggravation in the long run, choose a robot (and controls) that can produce myriad parts with the simple addition of new tooling rather than the need for reengineering and reprogramming.

Traceability

While product traceability may not be as large of a concern in the consumer manufacturing markets, it is paramount for medical device companies. Any robotic system employed must provide for documentation and traceability that will withstand any FDA scrutiny.

Global Support

Today, it is common for many manufacturers to have multiple facilities around the world. IBS wanted the ability to deploy its robotic manufacturing system in different locations and to make complete transfers of manufacturing lines to factories in South America, Europe, and Asia so that its customers can more easily distribute their products in these markets. It is critical to select a robot supplier that has superior support globally; if challenges arise, help is available.

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Conclusion

Medical device manufacturers have unassailable requirements for product quality and timeliness, and thus, the paramount need for improved accuracy, reliability, and consistency of the manufacturing process. By enabling faster time to market and consistent top-notch quality, robotic systems are providing more OEMs and their contract manufacturers with a smart solution to their top manufacturing challenges. OnlineFor additional information on the technologies and products discussed in this article, see *Medical Design Technology* online at www.mdtmag.com and the following websites:

www.ibiosci.com [2]

www.adept.com [3]

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