

Embedded PC as an open control platform for PLC, HMI, Motion Control and robotics

## Fully automatic welding robots ensure greater productivity and profitability

One of the major trends in automation is the increasing use of robots in order to increase production yields and to lower costs. In its fully automated welding machine, the Texas company ARC Specialties combines the use of robotics with an open PC- and EtherCAT-based control solution from Beckhoff to give its customers genuine competitive advantages.



The robot welds the end ring to the cylinder.



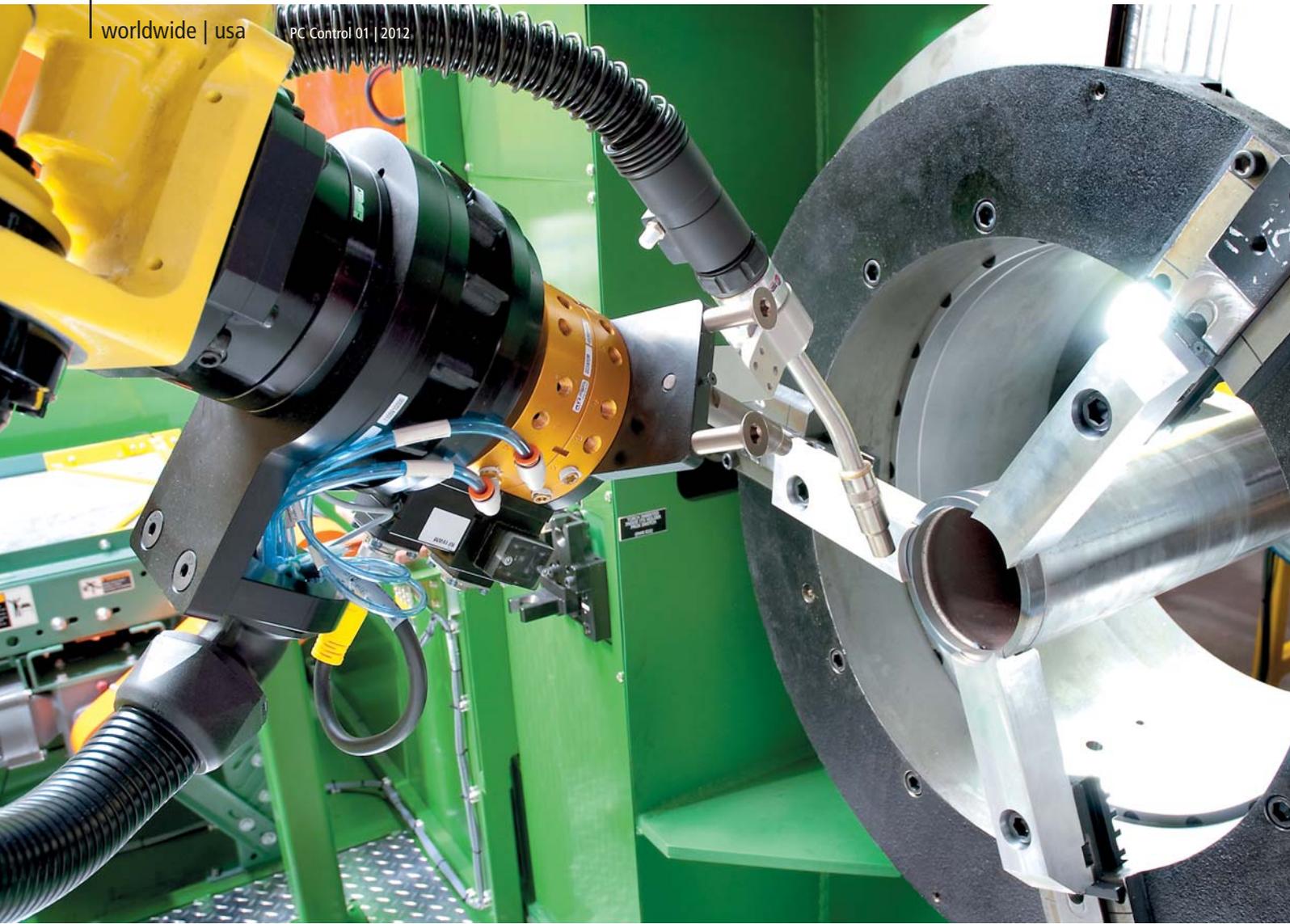
The Houston, Texas-based ARC Specialties specializes in welding and cutting machines, of which approximately 90 % are employed in the oil and gas industries. ARC Specialties can count several globally-active oil and gas OEMs headquartered in the Houston area as significant customers. "The ARC Specialties team strives to manufacture best in class custom automation equipment with standard, off-the-shelf technologies that ensure long-term availability", says John Martin, Sr. Project Manager, ARC Specialties. "Our company's control philosophy is centered on systems that are open by design," adds Gary Ewin, Chief Electrical Designer, ARC Specialties. "Many of our competitors manufacture their own proprietary controls, which can be a fine solution for a few years, but several years later this can be a major problem considering support and repairs needed to maintain the control system."

#### **Innovative plasma welding process meets automation technology from Beckhoff**

Many of ARC Specialties' customers have been long-time users of plasma arc welding solutions, which are considerably less expensive than laser welding systems, but cannot achieve their speed. "Of course, conventional plasma

welding systems are capable of very high quality work, but they are traditionally slower and require higher heat input," explains John Martin. In order to increase the performance of plasma welding systems, ARC has developed a new welding process in the company's own test laboratory – the TriPulse™ welding system, which is based on the tungsten inert gas (TIG) process. TriPulse™, in an ingenious approach, has three different pulse amperage levels, which allows for higher deposition rates with a minimal increase in heat input. "This allows us to achieve performance that is very similar to laser systems, but with much less expensive plasma welding equipment", says John Martin.

The new welding system was employed for the first time in the fully automated ARC-11RB robotic welding system for the assembly of fluid purification products, which ARC was commissioned to develop by a large Texas-based customer. In addition to boosting welding speed, all production processes were fully automated: An overhead gantry crane takes a cut-to-length cylinder and places it into a set of fixturing jaws. At the same time the robot picks up an end ring from an infeed conveyor and places it into a second set of fixturing jaws. The robot then changes from a gripping tool to a torch and welds the end ring to the cylinder; both fixtures are then opened and the overhead gantry



The robot changes from a gripping tool to a torch.

crane removes the assembly. Subsequently, the cylinder is flipped by 180° and the other end is inserted into the fixturing jaws, after which the process is repeated. The finished product is then placed on an out-feed rack by the overhead gantry crane. The entire process is completed within 1 - 2 minutes depending on the size of the product.

#### **Embedded PC as an integrated control platform**

The ARC-11RB robotic welding system is equipped with a Beckhoff CX1010 Embedded PC that features the Windows XP Embedded operating system and TwinCAT NC PTP software. The compact, DIN rail-mountable Embedded PC controls the entire application, including the overhead gantry crane, the robot functions, the HMI, the induction heater, the starting and stopping of the parts conveyor and all pneumatic processes.

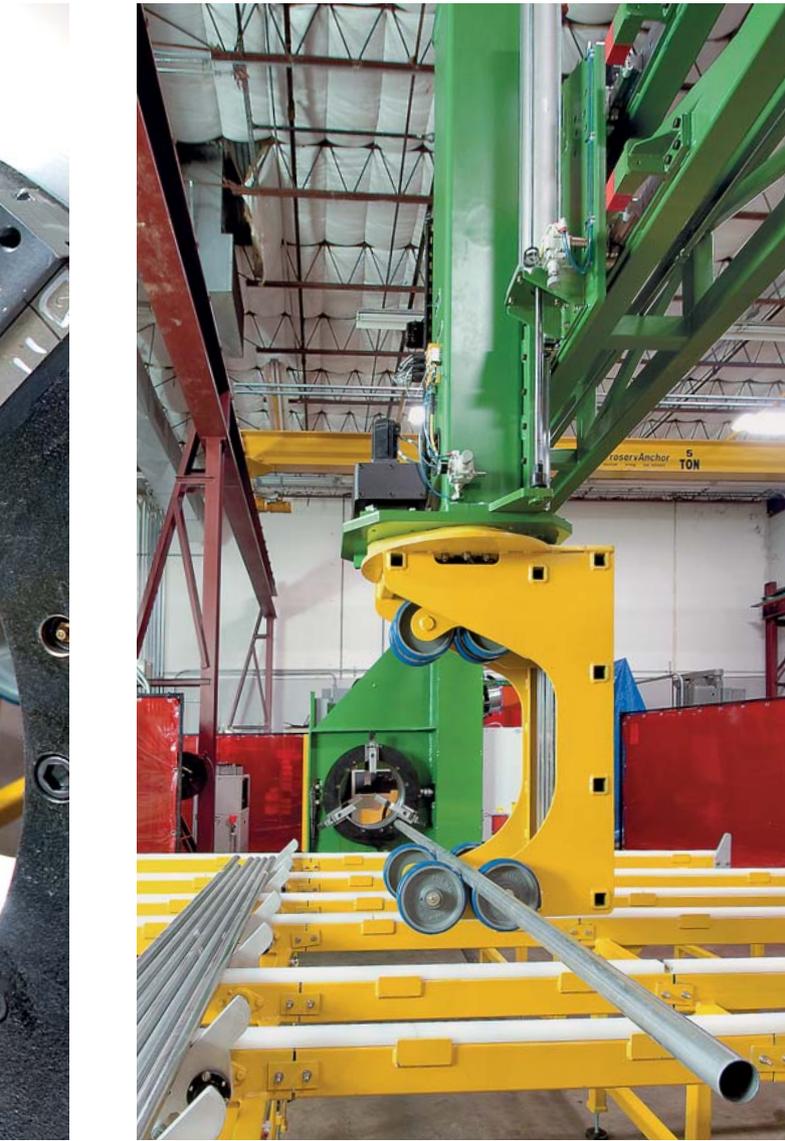
"We write all of our own software for operator interface visualizations in Microsoft Visual Studio® and C#," says John Martin. "This helps ARC Specialties give operators the familiarity and comfort of a Windows PC, but the specialization needed for custom equipment." The system's HMI elements communicate with the rest of the system using TwinCAT ADS.

The CX1010 controls a Fanuc ArcMate M710IC-50 robot and a Lincoln Powerwave R350 welding power supply, which are connected seamlessly to the Embedded PC via a DeviceNet master module. EtherCAT Terminals directly coupled to the CX1010 are used as the I/O system. ARC Specialties uses the EL403x analog EtherCAT output terminals for welding power supplies that have no DeviceNet interface or for applications requiring extremely short response times.

#### **EtherCAT ensures greater efficiency**

"With the high-performance of EtherCAT, we can monitor essentially any drive parameters we want on the ARC-11RB," says John Martin. "This decreased wiring and helped us more efficiently write our code to handle custom applications. This is very important for ARC Specialties as the majority of our business involves one of a kind, application-specific projects."

Despite the complexity of application, the control design for the new ARC11-RB welding robot took only four weeks. Construction and assembly were completed in just three weeks. ARC Specialties achieves



The cut-to-length cylinder (121 to 304 cm in length and 4 to 20 inches in diameter) is picked up by an overhead gantry crane and placed into the servo-actuated fixturing jaws.

a 30% increase in production throughput compared to manual assembly due to the fully automated fixturing. "Only the loading and unloading of the work pieces still takes place manually", John Martin stresses. "In addition, by using EtherCAT, we save approximately one hour per axis in wiring time on account of the simple topology. Fewer components and more compact designs also permit the use of smaller control cabinets."

John Martin sees a further advantage in the Windows-based PC controller: "Our customers can easily and securely connect Beckhoff controls to their local area network for remote access and using services like WebEx, for example. Remote control allows us to support machines anywhere in the world, to troubleshoot and to rectify faults by modifying the software. That saves both us and our customers considerable expense."

John Martin sees still further potential for the cooperation between ARC Specialties and Beckhoff with the release of TwinCAT 3: "We are excited about the integration of machine programming and HMI visualiza-



The robot picks up an end ring from an infeed conveyor.

tions into Visual Studio® as a single software environment. Considering the performance and price improvements we've already made, the majority of our machines and robots will be equipped with Beckhoff controls into the foreseeable future."

#### Further Information:

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