

MOTION CONTROL FORUM 02

\$50 U.S.

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Tell us what differentiates your company from other motion control vendors?

BRIAN CASEY: Rockwell Automation is entering its 100th year as an automation company, serving customers of all industries around the world. Our background as an automation company and leadership position in motion gives Rockwell a unique perspective on the motion control market and the broader expectations of end-users and OEMs. The automation and motion control markets have traditionally been separated by their roots - electrical engineering and control theory for automation and mechanical engineering and dynamics for motion control. However, at the point-of-use, machines and the factory floor, these two disciplines are always brought together, whether loosely coupled or tightly integrated. In all cases, the user, OEM, or system integrator faced the sometimes-daunting task to integrate systems with different tools, languages, and practices into a cohesive whole to achieve the required functionality and performance. This created many one-off systems that were difficult to replicate and maintain or to evolve as new requirements emerged.

Recognizing the inevitable merger of these two disciplines, Rockwell Automation has developed an integrated solution to meet the current and future needs of the market. This new

solution, Kinetix(tm) Integrated Motion, builds on Rockwell's approach to Complete Automation and the Integrated Architecture. Kinetix adds motion control to the core competencies of the Integrated Architecture - control, communication, and visualization - as delivered by a world leader in automation. The result is a complete machine control solution, pre-integrated to minimize sizing, configuration, and development time. Featuring a single IEC61131 programming package, Kinetix makes it easier for designers, fabricators, and maintenance personnel to deliver functionality, productivity, and reliability than ever before. More than just the advantages of architecture, Kinetix offers world-class drive, motor, and actuator products, backed by industry-trained application experts.

Rockwell's global presence and support is helping machine builders provide greater value to their customers. Kinetix Integrated Motion makes their jobs easier and more productive, while creating functionality and options not possible with non-integrated products.

JANYCE FADDEN: Danaher Motion is the result of successfully incorporating several acquisitions into a full line motion control company- our brands include Kollmorgen, Pacific Scientific, Thomson, Portescap, NEAT, and Harowe. We approach the markets through the brands.

We've organized Danaher Motion into platforms that are similar to how our customer buys- Linear Products; Motors and Drives; Specialty Components; and Linear tables.

Danaher's strength is in improving results in quality and delivery by implementing DBS tools and this is one of our differentiators. The tools are based on Toyota Production Methodology and are used at all facilities. All the tools start with Voice of the Customer (VOC) which allows us to focus on the issues of interest to our customers

By using Danaher Motion our customers can get the choice they need for the best technology, best cost and best ease-of-use from one company. The customer can simplify their job and focus themselves on machine flexibility and productivity. Our key differentiators are listed below:

- Breadth of Motion System Solutions.
 - Standard drives & motors.
 - Expertise in motor and electromagnetic design.
 - Mechatronic combinations.
 - Offer the ideal technology for the application.
 - Custom Engineering & Services.
 - Customer Support & Services.
 - Operational Excellence.
 - Financial Stability.

RICHARD HUSS: Bosch Rexroth Electric Drives and Controls, as you probably know, was formerly Indramat. Bosch Purchased Rexroth about a year and a half ago then merged their Automation Technologies division into Rexroth. There are two main groups, Factory Automation and Mobile Hydraulics. Factory Automation consists of industrial hydraulics, pneumatics, mechanical assembly and linear technologies and electric drives and controls. As factory automation we are focused on best in class components, industry expertise and applications excellence. We design & manufacture the most comprehensive range of innovative motion products in the industry. CNC's, PLC's, HMI's and several types of motion controls along with Servo, Vector and VF drives from 100W to 600KW. Linear motors, high pole count ring motors, PM servo both rare earth and ceramic, high speed frameless motors both PM and induction and traditional low inertia induction. All are available air, fan or water-cooled. All our drive products have the same easy to use set up tools regardless of size and motor type. All product interfaces with the open standards of SERCOS, DeviceNet, ProfiBus and Interbus S. Secondly, we are focused on specific market segments and provide comprehensive control solutions for those segments. Our engineering staff and controls development staff focus on their specific market segment making

them not only experts in applying and developing our controls but also in those markets, understanding the needs of the user of the machines. We are committed to providing solutions for all applications in those markets. Next our applications expertise is second to none. We have some of the best known and most knowledgeable applications engineers in the industry, probably more than any other company. Our support and service assistance is Worldwide so we are wherever you ship your machines or have a plant we are there. Finally as part of Bosch Rexroth, the drive and control company, however you control motion, you can get it from one source with integrated multidiscipline technologies with a unified approach controlling all actuators whether they are hydraulic, pneumatic or electric creating better and more productive machines.

GREG JOHNSTON: Oriental Motor USA Corporation is headquartered in Torrance, California and distinguishes itself in the marketplace in a number of ways. For one, we manufacture all of our products, including gearheads, motors, controllers and drivers. Because of this, all components of our motion control systems are designed to work together and are factory-matched for guaranteed performance. Our factories incorporate a unique u-line manufacturing process, providing high quality products and just-in-time delivery. This

also allows us to provide our customers with excellent delivery with almost 1,500 part numbers available for same day shipping and more than 3,500 available for 7-day shipping.

Oriental Motor was founded in Japan over 100 years ago. For over a century we have concentrated on technological advancement and product design improvement. This has allowed us to develop a wide breadth of products. We develop, manufacture and market AC gearmotors, AC and DC brushless speed control systems, 2-phase and 5-phase stepping motor and driver systems, controllers, linear motion systems, as well as a full line of fans and blowers. In addition to continually improving our standard product line, we also concentrate on developing specialty motion control products, such as wash down motors used in the food industry.

With facilities around the world, Oriental Motor provides sales and service to customers in North America, Europe and Asia. With R&D on a global scale, Oriental Motor gains different perspectives into market expansion and customer requirements, resulting in the development of state-of-the-art technology to meet a wide range of needs. For example, products are available with electrical and safety standards to meet international requirements.

Perhaps what differentiates Oriental Motor the most from

other motion control vendors is our philosophy on bringing our products to the marketplace: we adhere to the principle of selling one motor to one thousand customers rather than selling 1000 motors to one customer. In doing so, we cover many different markets, including factory automation, large OEM, and the general market, and we believe in a balance between direct and distributor sales channels. This means that we have over 15,000 product solutions available worldwide, and we believe that with our philosophy, our market share and global influence in the motion control market will continue to grow.

GEORGE KAUFMAN:

Automation Intelligence or AI started in 1983 and we have specialized in the application of PC-based motion controllers and servo systems on industrial machinery. Introduced in 1992, our flagship product is AML[®]. AML is a high-performance machine controller accomplished with software running on a PC hardware-platform. We use the SERCOS interface[™] standard as the method for connecting the AML controller to as many as 36 servo drives and I/O stations.

Our customers have found AML to be a very effective product because it comes from a company that is heavily involved in the hands-on application of control products on machines. There is a real-world and practical feel to AML because it is developed by

people that have worked as control engineers at sometime in their careers.

Following a private-label agreement for AML, AI joined Sanyo Denki in 1997. Sanyo Denki is one of the top five Japanese suppliers of motion control products. Since joining Sanyo Denki, AI has formed the *Partner in Motion* distribution program for North America and Europe. Using the Sanyo Denki brand name, AI sells AML and a wide range of ac servo systems through the *Partner in Motion* channel. In addition to products with advanced technology, AI and the *Partners in Motion* provide outstanding technical support for builders and users of industrial machinery.

GREG WOODS:

1. Complete Machine Automation Solutions
2. Fully Integrated Software for both Control Logic & Manufacturing Intelligence
3. Web Enabled Automation

At Control Technology Corporation (CTC), we have been supplying innovative hardware and software solutions for factory and process automation applications for over 25 years. As our name indicates, we are a controls company. We focus on hardware and software control solutions including motion control, BUT we do not manufacture motors or drives.

WE see motion control as not necessarily an end in itself, but rather as one important component of a more comprehensive machine automation solution.

CTC's automation controllers and software are used in thousands of machines in a wide range of industrial and commercial applications that incorporate not only motion control, but also analog and digital I/O control, and remote data acquisition. Over the years we have continued to refine our products making them smaller, more powerful, and easier to use.

As a leading innovator in the machine control arena in the 1980's we were one of the first companies to offer a truly state based control logic language that greatly simplifies complex machine automation programming and allowed motion, I/O, and communications to be done through a common interface.

In the mid-90's we took this a step further as the first company to integrate web based technology into automation controllers providing our customers with the ability to remotely monitor and control their machines and to even have the controller act as a web server.

Today CTC is focused on designing, manufacturing and marketing products that enable electronic automation devices to

be monitored, controlled, configured or reprogrammed over the Internet and/or intranets.

SCOTT EVANS: Advanced Digital is a member of the Lenze Servo and Automation Group. Lenze is a worldwide manufacturer of motion control components, including drive-based motion controllers, servo amplifiers, servomotors and gearboxes.

Advanced Digital is the California-based designer and manufacturer of the famous SimpleServo[®], a *simple* servo amplifier (used in concert with PC-based Motion Controllers) to control brushless servomotors. Advanced Digital was founded because of a gaping hole in the servo market: Many high-performance drives are too feature-rich and too expensive for volume OEMs; while the low-cost servo amplifiers' performance is unsatisfactory for these same OEMs.

Our flagship SimpleServo[®] offers outstanding 32-bit-DSP performance for the price of analog drives.

PHILIP STRONG: Motion Engineering, Inc (MEI) delivers embedded high performance motion control solutions to OEM machine builders. MEI develops core technologies, provides customized products, and offers a high level of integration and application support directly to OEM customers.

MEI's mission is to "help customers build a better machine, and get it to market faster." These days 'better' usually means lower cost, higher performance, more modular and more easily integrated into a networked system architecture. Getting to market faster increasingly means 'from concept to production in nine months or less!'

In response to such demands, MEI has focused its R&D dollars on developing a high performance high reliability simple to use, network connection between the motion controller and servo drive. SynqNet is the result.

SynqNet replaces conventional analog wiring, improves performance, and offers the additional benefits of fault tolerance, and real-time data collection from the drive and motor. SynqNet is built upon the IEEE802.3 industry standard, and offers all the electrical isolation and noise immunity benefits inherent in the 100baseT copper and optical fiber physical media.

Since its market introduction in summer 2002, OEM acceptance of SynqNet has been strong. In response to growing customer demand, SynqNet is now supported by leading drive vendors including Panasonic, Yaskawa, AMC, Danaher Motion, Tamagawa Seiki, Sanyo Denki and Glentek. All vendors offer SynqNet embedded into their drives (not an option card). This integrated design enables a cost

effective solution and ensures a clean and simple integration of motor, drive and controller.

Today, SynqNet is the only high performance (48 KHz torque update rates, 32 axes per network ring) synchronous motion network that offers multi-vendor support, and a common software interface. It's much faster than SERCOS, and easier to integrate in a multi-vendor environment. It also addresses the weaknesses inherent in Firewire, namely; the lack of node-to-node electrical isolation, the lack of a suitable synchronous operating mode, and the lack of a common software interface across multiple drive platforms.

SynqNet is supported by a range of motion processors from MEI, software programming and tuning tools. You can expect to see more SynqNet compatible products coming available from other vendors through 2003.

In summary, MEI is a technology rich company, serving the growing needs of machine builders with embedded networked motion components that can be easily integrated and configured.

The present recession has been described as mild, yet it has been painful for motion control. What happened?

SCOTT EVANS: It's the longest one since the great depression. Maybe not as deep, but certainly

as long. In my mind, it was really this unbridled enthusiasm for the dot.com industry inasmuch as a tremendous amount of pressure was put on capacity by the electronic manufacturers: They produced computers for the server farms, as well as home computers and modems, and the telephone industry. A significant portion of motion control is fed into automated assembly equipment, pick-and-place machines, and semi-conductor equipment. The result was this mad rush, kind of like the gold rush of 150 years ago, to get designed into those machines. For instance, everybody was tripping over each other to get into companies like Applied Materials... Suddenly, the dot.com industry goes belly up and the money evaporates. Now we have excess capacity everywhere. Today, the demand for machines to expand production capacity is more in line with where it was 5 or 6 years ago.

GREG WOODS: I agree with Scott's comments on the current excess capacity in the manufacturing sector, especially in the semiconductor marketplace. When you combine this with the decreased demand in these sectors it's easy to see why capital equipment purchases have decreased dramatically recently. The effects have not been as severe in the overall market due to the continued strength of the retail and housing sectors. Hopefully that continues, but that's really what has made things

more mild than you might otherwise expect. In the capital equipment business, especially in the automation area many of our customers still have excess capacity. Therefore most companies are not freeing up large amounts of capital to invest in major plant expansions. They are instead focusing on better utilization of existing assets. Another thing you see at the same time is the gold rush phenomenon that Scott mentioned. This has had the effect in the motion control arena of driving down the average sales price per axis, whether that be for the motor, drive, or controller. So motion control revenue is getting hit from both sides: fewer machine purchases mean fewer axes of motion are required, and the excess capacity in the industry means that those axes are selling at lower prices.

RICHARD HUSS: We do quite a bit of work in the automotive industry and I think we have a new average number of vehicles. Previously, to say 1999-1998, a normal good year for the automotive company was considered about 14-1/2 million vehicles and that has gone up to almost 16-1/2 now. So you had a tremendous amount of spending to get the capacity in the automotive, both in assembly and engine power train side, increased. There was also a lot of Y2K spending during that time. A lot of factory systems, a lot of machine control systems, a lot of

MRP systems needed to be upgraded. Capital spending is simple. When you have enough capacity, and there's no more demand, you don't buy any equipment. In 2001-2002, capacity was where it needed to be or there was excess. Factory output went down and nobody bought capital equipment.

PHILIP STRONG: I think there is a positive side to this too. During such down turns every OEM works harder to develop their next generation of machines. We have seen this generally over the last 18 months, and increasingly over the last six. Although revenues may be down, motion control companies should continue to innovate and develop new products, and get those products designed into OEM machines. We know our customers are going to be looking for better, faster, cheaper, high performance machines, so there's an opportunity for us all if we choose to innovate and stay ahead of the competition.

THOMAS BULLOCK: Unfortunately when this happens, a lot of companies cut their R&D budgets and that's the thing that we need to make change.

PHILIP STRONG: I think that's one of the challenges inherent in managing any high tech business. Cutting R&D to pump up short-term profitability is usually a long term disaster, particularly in a fast moving industry. Ultimately it doesn't

deliver the products that customers want and need and deserve. I agree it's a challenge but I think it's a basic issue of business philosophy, and having the backing of your shareholders to take a long term perspective.

JANYCE FADDEN: The other thing that is happening as a result of this ongoing recession is that further consolidation maybe faster than normal would happen to the capital goods market, and the customers we're serving, so before we might have had two competitors in a market. The market went down so deeply that they have to merge to stay alive and so when we come out of this we're going to find that there are fewer customers for us to call on and that's going to make it more competitive for all of us sitting at this table to try to figure out how to call on those customers. So it is conceivable in the next generation is they come to bring it out that there will be more price pressures on all vendors because there will be more of us calling on fewer customers.

RICHARD HUSS: I think Danaher has done more than their fair share of consolidating the supplier base.

THOMAS BULLOCK: Nobody has mentioned the glut of products. How much of this glut has been caused by foreign competition? They have a lot of capacity too.

RICHARD HUSS: We probably started our recession a year earlier than Europe did and Japan has been there for a while, but I think the weak euro caused a lot of capital investment that did occur late in 2000-2001 to go to European machinery builders. At least I noticed that in the machine tool market and the automotive assembly market. We need to realize that about 40% of our manufacturing in the United States goes somehow into the automotive and vehicle production area. So you saw a lot of machine tools from Thyssen Production systems, Grob, Liebherr coming in, presses from Schuler etc. I think that made an already weak capital equipment supply base in the US even weaker than it needed to be causing many companies to consolidate dramatically or go out of business altogether during the past year or so.

GREG JOHNSTON: I think Tom bought up a really good point. A lot of the industrial sectors are closely tied to Semiconductor, Telecom and fiber-optics. When they all stopped buying in the beginning of 2001 in the USA, we also saw the same kind of problems worldwide, resulting in worldwide markets dropping, which brought an influx of a lot of competition, for example competitors from China or Korea, with the price substantially lower, the market price in the USA. This is a big challenge. One of the long-term challenges is this influx

of new competition because their market has dried up and now they will be trying to penetrate the USA market. Our challenge is to change the perception that our products are commodity products. The total value we provide is what is important – not just the product. Customers want to know “What's the difference?”. It's our job to prove to the customer that the service and support that we provide here locally is much better than what they can receive from China.

September 11 has had a major impact on our nation. How is it impacting our motion control industry?

PHILIP STRONG: I'd like to make a few comments on that. I took over as President of Motion Engineering on September 10th so I was there. It was a sad day for this nation, it has reset our view of the world and our expectations in many ways; from both a business perspective and from a very personal perspective. First, I don't think we can blame the economic situation on Sept 11th, we were already on the way down before then. Second, at a simple business level, the events of Sept 11th have generated sales growth for MEI in areas relating to security. Third, at the human level we saw our people really pull together. After the dot com party, we saw a new level of realism about the basics of business; I mean working hard, getting products out the door, and earning

customer business. I think that is just one of the positives that came directly out of this tragic event.

BRIAN CASEY: Just to play on a number of things Philip has mentioned, I don't think that September 11th has any specific impact on motion control per se. I think we're riding the same wave as a lot of the industrial segments we're seeing. There is some, perhaps, level of conservatism or temperance that has curbed things a little bit, so I tend to agree that most of the recession, down turn, depression, whatever terminology you want to use right now, is probably due to the bubble bursting and a few other things. There is also a certain amount of temperance, some holding back by folks, but likewise I think it's helped people with a little of perspective and so as we start to come out of this, we'll probably have a better vision of what we want to do and how we want to do it going forward, and I don't think that's just the motion control industry phenomenon, I think that's kind of across the board for industrial companies and manufacturers overall.

THOMAS BULLOCK: What are the chances that this will result in a double dip recession do you think?

BRIAN CASEY: Marketing is hard enough, I don't want to start getting into the economic forecast business!

RICHARD HUSS: I was at an AMT machine tool forecasting seminar and the majority of them did not believe that it would be a double dip recession, but they were concerned about the consumer confidence level. If the consumer confidence level drops significantly then they said it could be a problem. They still think that cars, and housing will continue strong as long as the interest rates remain where they are and GM continues to try to buy it's market share back with incentives and the others follow.

The Internet continues to gain in popularity. What are its primary benefits and how will it affect your company?

GREG WOODS: As I mentioned before, one of the key features of the Control Technology product line is that it's web enabled. What that means from a simplistic point of view is a person can interact with one or our controllers from virtually anywhere with any browser based device. That device could be a desktop, laptop or even a cell phone! That interaction is bi-directional so that the machine could notify a technician 10,000 miles away of a fault condition, and the technician could take remedial action – adjust a set-point or PID parameter for example -- from that remote site. Additionally the controllers can be simultaneously accessed by many browsers from many different locations. So the

technician's manager in a different country could assist in the troubleshooting operation in real-time. Similarly the internet technology that we use provides bidirectional access to other computers as well. This is now allowing manufacturers and their supply chain partners to affordably gain access to reliable and accurate real-time information from the plant floor without expensive middleware. For example the controllers can be set-up to automatically write a quality record into an ORACLE database at the plant and the order fulfillment system at corporate. By supporting this type of communication using existing IT standards like XML, and SOAP the internet is rapidly linking the real world conditions sensed or controlled by the controller to the enterprise.

GREG JOHNSTON: I think the Internet has changed the way we look at the market for example, from our experience at least, our customers want information much faster, they want their product faster, they want answers to their questions faster, they want everything faster. Because of this we see the Internet providing a great opportunity to provide fast and quick information channel for our customer base. The Internet will provide our customers a 24 hour, seven day a week access to our knowledge data base, being able to access anytime, product information, assisting them to speed the design process. We also see this as a secondary sales

channel. We see this as a very important channel to the small user market and design engineers in larger OEM customers. We also see as an avenue to sell samples for prototypes and in the future. In fact, we just introduced our e-commerce site last week. It has been very successful, especially for design engineers downloading CAD files. Everyone can access our web site at Orientalmotor.com.

GEORGE KAUFMAN: As I mentioned before, all of our controllers are PC based and they have IP addresses. While I won't repeat all the benefits that Greg mentioned, I think another benefit of the Internet for our company, being a smaller company, is on the marketing side. We use the Internet to create awareness for our company, awareness for our products, and all of our literature such as catalogs and instruction manuals are only available on the Internet. We don't print any catalogs or instruction manuals which obviously saves us a lot of money but it also allows us to put that kind of information into the hands of our customers more quickly and allows us to keep the literature up to date. The soft format allows us to make changes more frequently and at our convenience.

BRIAN CASEY: I think we've talked about a lot of things the Internet has improved: the level of performance, the ability to communicate, or substantially change the cost associated with

those communications whether it be time or other resources. I would also suggest that we've seen the first wave and there's another wave to come which will be a result of the level of performance that's available as the network speeds increase and the transaction cost, the cost of that communication continues to drop down. We all know what's coming yet, but there will be new ways of doing things as a result of being able to do it for much lower cost than ever imaginable before. Some people are on the edge of that right now, and I don't want to open up a big debate or conversation right here, because I think in this forum we'll probably get into some of that, but I believe we've only seen the first wave of the changes on our industry as a result in the Internet and the next wave will probably be coming as the network speeds increase and the costs continue to drop.

PHILIP STRONG: We're very much an engineering company. That means we really depend heavily on having the right people with the right skills in our organization. We have a saying in MEI "that it's better to have the right person in the wrong place than the wrong person in the right place". We have a lot of specialized people. The Internet allows them to get access to our customers much more quickly and efficiently. I think in this global economy the important thing for a company like ours to do is continue to differentiate ourselves by sharing our expertise and

making that expertise accessible through the Internet. As we have heard from other panel members, the Internet is also a pipeline into the customers' machine. MEI's contribution to this is to deliver tools that take advantage of this pipeline, providing remote configuration, analysis and diagnosis capabilities.

AUDIENCE: I have a couple of questions concerning the Internet. One of them is security. In term of being able to access machinery on the factory floor by the Internet. Would anyone care to comment?

GREG WOODS: Our software incorporates the latest web technologies to insure security. For example we use Secure Sockets Layer (SSL) technology with 128-bit encryption – same as used by secure web banking sites. Forgetting the jargon, what that means is you can reliably transfer information over the Internet without having it be intercepted by a third party. While in theory you could use several supercomputers to try and break the code, it would take so many years that its not a threat any time in the next several decades. In addition to incorporating web based security techniques, we also have other levels of security within our controllers such as multi level password protection and program encryption. We also recommend that customers isolate their manufacturing web based controllers from the rest of their network using switches and

firewalls to keep most of the outside traffic out anyway. So there are a variety of levels of security that can be used to make your machines more secure than Amazon.com or even a financial web site.

BRIAN CASEY: I think Greg mentioned a number of the security mechanisms that have been developed recently. I'd push it back a little bit and say if September 11th taught us anything, it is that if someone has really malicious intent and they're a little bit clever, they'll find some way to try and cause some havoc or otherwise cause some destruction. But at the same time I think a lot of the technologies are developing to address that and that it will get to the point where it will fall into somewhat of the classic cost benefit, or risk assessment type of situation where there is a risk, there is a very small risk and getting even smaller as the technology to secure Internet communications improve. I think what we'll find typically is the benefits substantially outweigh the risks not unlike the other risk assessment we do on other assets or activities within the business, so it's a concern right now because it's somewhat new and there's a little bit of fear of the unknown. As we get a little more familiar with this and some industries have already experienced this, it moves into a much more of a classic trade off situation and everyone makes their choice base on that.

RICHARD HUSS: I wasn't going to say much different than that but if the disgruntled employee on the factory floor wants to do something to mess up production, they have a better chance of doing that than through the Internet. The other thing is you still have OSHA and safety work rules, so you can't start machines and make machines run remotely.

AUDIENCE: I'm not questioning the context of shutting down production, the question is the technology put into the machine itself, what kinds of safety precautions are being considered in terms of access by terrorists because that is a real threat at this point at a power plant or even a waste water treatment plant. There is a possibility to wreak havoc.

GREG WOODS: The answer to that is to have the proper network and device security. I already mentioned a number of steps that we have taken to prevent unauthorized access to our controllers via a network attack. The other thing that customers need to take into consideration is: will this controller be physically accessible? And if so, could this be a security risk? My point here is you can have the best web based security in the world, but if an unauthorized person can walk up to the controller and override its security via a switch or serial port connection for example, you need to protect yourself from this as well. Again the CTC

controllers are fully password protected, so that even local access requires a password. Another simple step that should be considered though is placing the controllers into some type of locked control box. This has the added benefit of giving it some protection against tampering or destruction.

What do you see as the most effective sales channels in the years ahead?

GEORGE KAUFMAN: It's always going to change but the most effective sales channel will depend upon the supplier business model and the types of product they have. In our case, we are dealing with PC based control. These are programmable products with various interfaces to the outside world. Even today, these are relatively sophisticated and technical products. We feel we can be most effective with this type of product selling through a distribution channel. This allows the customers to have local sales and technical support. With a different type of product then a different type of sales channel might be more effective. So for us, high-tech distribution is the most effective sales channel today and will continue to be the most effective sales channel into the future because our product will continue to be an applied product. The sales channel needs to provide significant added value on a local level. For example, with the current economy, a significant amount of our present

business activity is machine modernization. For many customers, the retrofit or updating of existing machinery, rather than going out and buying a brand new piece of machinery, is very attractive. Much of this value add can occur on a local level and the distributor is an integral part of the value chain.

JANYCE FADDEN: I think we have to stay focused and understand how the customer wants to buy because that changes over time. Today what we have are many different customers coming into Danaher Motion wanting to buy in different ways. Distribution clearly is one way we need to support in North America through the AHTD, high tech type distributors, but similar to the types George was talking about where it's concentrated selling and really paying the distributor to apply our product. Not paying them to stock anything. What we're really paying them for is to hire engineers who can put a system together for that customer and use our product within that system. We also have some product lines that are ideally suited for power transmission distribution. So we focus our brands through whichever channel is best. Then we have a number of customers who expect to be called on directly. They expect someone to come in the door with your company name on their business card and be able to put together the services of your company for the customer. The customer expects to know more

people than the sales person. They expect to know the inside sales person, the production person on the floor, manufacturing engineer on the floor, the design engineer on the floor, maybe on a weekly phone conversation with that customer. For us because we're, Danaher, and have put together such a diverse product line, we have to have all these variety of ways for the customer to be served. It's really up to them to tell us what they want. Then we have to accept whether we want to put that system in place or not. So the customer expects to be served on that basis and so we have assurance that all our sales offices around the world are going to treat that customer the way we've decided to accept their orders. At this point, there are enough customers that have that value.

BRIAN CASEY: I'm obligated by law to say that the most effective sales channel will be Allen-Bradley authorized distributors. Having said that, I think to play on what Janyce was saying that there's a lot of difference depending on the customer as what value they're looking for out of the channel, what additional services they need. Someone who is designing a new machine, obviously needs something very different than someone who's had a breakdown and less than 24 hour delivery on a repair part and yet frequently those two very different demands are served through the same channel, so my expectation is that

we either going to see companies bring their products to market through a number of different channels which may be distribution plus complementary on the web type of services or it may be the channels themselves become more dynamic in their ability to adapt specifically what they're doing to added value to the actual transaction. We've seen some people start to go down that path. Some of our distributors are starting to work on some things where they, when the call comes in, they're adapting if you will, the value they add, and the business and to the needs of that specific transaction as compared to always working against a fixed business model. So I think that's going to be a part of the future is to have channels that are dynamic and adapt to the requirements sort of on the fly as compared to the current mode which is a sort of mixture of channels to serve different needs.

RICHARD HUSS: I pretty much agree with what everyone said about the channel but somebody mentioned the global channel and that's where I think the difficulties are going to lie because the culture and the requirements of a German customer, or an Italian customer, or an English customer, or a Japanese customer, or a North American customer of the same company are significantly different and the terms are different. But they're going to try to drive the pricing down and some of the services down to the

2002 MOTION CONTROL FORUM PARTICIPANTS:



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Brian Casey is the Global Marketing Director for the Industrial Motion Control division

of Rockwell Automation. IMC develops, markets, and supports completed Integrated Motion solutions around the world through Rockwell's extensive sales and distribution network. Mr. Casey has an extensive background in technology and industrial markets, working with market leaders Rockwell Automation, Schneider Electric, and Eaton. He has worked with industrial OEMs and customers on every continent and lived in France for four years. Casey is a member of IEEE, ISA and Tau Beta Pi, and is a registered PE in Wisconsin. He currently

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Scott Evans is president of Advanced Digital, Inc., a member of the

Lenze GmbH Servo and Automation Group. He has been in the controls business nearly 20 years. After graduating with a BSEE degree from Lawrence Technological University, he started as a controls engineer at General Motors in Ypsilanti, MI.; then as a Motion Control Specialist for a national distributor; then as an Engineering Manager (and later General Manager) for a drives company. He founded Advanced Digital nearly 3 years ago. The company was founded on the principal that one should not have to pay a lot of money for exceptional servo performance. Advanced Digital succeeded in developing the SimpleServo[®], an affordable and approachable (i.e. *simple*) DSP-based brushless servo amplifier. Lenze GmbH, an internationally respected name in motion control (and long an advocate of drive-based motion), saw the need to invest in PC-based motion-control technology. One of their first acquisitions was Advanced Digital.



Janyce Fadden is the General Manager for Motor Products at Danaher Motion.

She leads development and implementation of motors for our diverse customer base. She joined Danaher Motion in 1998 from the Pacific Scientific brand.

She was educated in Engineering and Management for her undergraduate BS at Clarkson University, Potsdam, NY and received her MBA from Northern Illinois University, DeKalb, IL. She has spent her career in executive positions for Marketing, Sales and General Management at Honeywell, General Signal, and Applied Power prior to joining Danaher.



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Born in New York City in 1954, Rich graduated with a BS in Engineering from the University of New Hampshire in 1976 and did post graduate work in Business Administration. Joining Indramat in 1985, he has served as Regional Sales Manager, National Sales Manager, and VP

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Philip Strong

has been President and CEO of Motion Engineering

since Sept 2001. He has over 15 years experience in the motion control industry, starting as a design engineer, and developing his career through system design, product marketing, and business development positions. Phil has extensive experience of international business, including Japan, Europe and US, and has lived in various countries before joining MEI's California based management team in Sept 2000. His formal education includes a Masters in Industrial Robotics and Automation from Imperial College, London, and a Masters in International Business from ENPC, Paris. When not at work, Phil enjoys family time with his three young sons, hiking and photography.



Greg

Johnston is Executive Vice President of Oriental Motor

USA Corp., overseeing all North American operations. Oriental Motor USA Corp., a wholly owned subsidiary of Oriental Motor Co. Ltd. of Tokyo, Japan, is a manufacturer of a wide range of motion control products, providing solutions to the factory

automation and OEM markets. Greg has over 22 years of experience in the Motion Control industry, with 19 of them being with Oriental Motor. He earned a BS in Business Administration from Arizona State University. Over the past 19 years with Oriental Motor he has held numerous positions including Sales Engineer, Regional Sales Manager, National Distributor and Marketing Manager, Vice President of Sales and Executive Vice President.



George

Kaufman is President & CEO, Automation Intelligence (A

Sanyo Denki Company). George is an Electrical Engineer with an undergraduate degree from Carnegie-Mellon University and a graduate degree from Rensselaer Polytechnic Institute. George began his 25-year career in the motion control industry with General Electric and was involved in the early days of brushless servo systems as a research and design engineer. George helped to bring brushless servo products to the marketplace with Electro-Craft as the Director of Engineering & Marketing. Today, as President & CEO of Automation Intelligence, George continues his passion with motion control and industrial automation



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lowest common denominator, so I think when we're going through the sales channels being able to adapt our company to those different needs and those different cultures convincing the customer that there should be different levels of services and pricing for the same product within the global arena is going to be a real challenge. In Germany they have a lot of engineers that stay with the company and in the same job for a long time. In the U.S. there is a lot more turnover especially in the end user with the unions bidding on and off jobs, they need a lot more support here just because of the nature of the way they work. In Germany much of the support labor cost is at the end user facility, here it is through the manufacturer or third parties, either way it costs, it just is paid for differently. But when the cost is in the supply chain it is hard to obtain it from the customer.

SCOTT EVANS: I'd like to share maybe a broader point of view: One could argue that all products and technologies go through a "life cycle": They all start out as somewhat esoteric ("black magic" if you will), and they work their way towards commodity. Each of the prior points of view I agree with 100% in as much as they are snapshots in time. I think one of the greatest challenges the channel itself faces is to recognize where a product is in its life cycle and what type of support it requires. For instance, the way the channel introduced value to an AC

inverter 10 years ago is dramatically different to the way they introduce value now-a-days. The product is the same, inasmuch as it is an AC inverter; but now it's much easier to use, and more people understand it. The result is AC inverters are quickly approaching commodity status. People like Digikey, Newark and Grainger recognize when a product becomes a commodity and pounce on it immediately. Everything we sell here today will someday be a commodity. Of course, we'll continue to introduce many new products, which will demand similar support and value the channel adds. But today's products won't require the same support 10 years from now that they require today. In summary, the channel has to change *with* the product as it goes through the cycle as well.

PHILIP STRONG: I think the term 'sales channel' is becoming outmoded by the Internet. It connotes a physical channel through which vendors ship their products to the customer. At MEI we prefer to think in different terms. Getting delivery of a product is easy these days, with the help of the Internet, supply chain management and overnight courier services. What our customers really need most is technical support. So we believe it's more important to think in terms of a 'support channel', or more precisely a 'support network'. A network of people who are technically capable and

interested in adding value to our products in the form of design and integration services. As more OEMs shift towards outsourcing their engineering projects, we must respond with a network of motion experts available around the world. The challenge for our industry is that many OEM's have traditionally not been prepared to pay for such engineering support. They expect to get it for free. But that attitude is changing and they see value in engaging external expertise to build better machines and bring them to market faster.

GREG JOHNSTON: We feel both distributor and direct sales are important now and in the future. Because we have a wide range of product, some very technical, some not, we need direct sales personnel and a wide variety of different types of distributors. We base our new products and how we go to market based on information we get from the market place and our customers. We mainly get this valuable market information from our direct sales force. One thing that Phil bought up that I thought was very interesting is the real strong trend of outsourcing. More and more our customers no longer want to take on the responsibility of manufacturing, they want to concentrate on the design and engineering of their products. The manufacturing is outsourced. This poses a challenge because we must deal with basically a middleman instead of the end customer. Our unique production system is based on a very accurate

forecast which is difficult to get except from the end user. In addition, with the economic downturns, who is responsible for the product that's been ordered or is in inventory? So it's a challenge for sales channels but it's a trend that we're all going to have to face.

As one who sets the course for your company, what challenges are you dealing with now? What new challenges are on the horizon?

GREG JOHNSTON: Currently and the last two years it's been cost control verses keeping an infrastructure in place that provides excellent customer service and support. I know a lot of motion control companies that have cut so deep that once the market comes back they will not be able to provide the needed support their customers will need. We have decided to keep the major support infrastructure in place- such as applications engineers and inside support so when the economy comes back we will be ready to support our customers. I think it's going to come back very strong and they're going to need product quickly and product support very strongly. So the challenge is to control the costs while maintaining customer support, while trying to make profits in the process, which is the real challenge. So hopefully the economy will be coming back

real soon.

SCOTT EVANS: Greg made an allusion to what I think is absolutely the core of our challenge: Talent. "Out-sourcing" is spreading like wildfire... Even into engineering departments. A lot more people at our customers are applying pressure "up stream" (as was pointed out by Phil). *Our* engineers are becoming *their* engineers; and *our channels'* engineers are becoming *their customers'* engineers. So we need more talented (and polished) engineers to help our customers. Also, we must continually develop products which are better, stronger, faster, easier-to-use and less expensive. We're not going to accomplish that by staring at the ceiling. We'll do it by hiring talented engineers, and have them work hand-and-glove with our customers and suppliers. We face an enormous challenge in recruiting top-notch engineers out of college... Factory automation is not the most glamorous business to young engineers.

GREG WOODS: The biggest challenge that we're facing, and actually its not new, is how do we improve the speed at which we develop and deploy our new technology to the marketplace. Because of the sophistication of some of the products that we are developing, we are often looking at a multi-year product roadmap. In my case, I'm looking at the products that are one to three years away and looking for ways

to get those products to market sooner. We're always looking at ways to do it better, whether it be by talent or by different development techniques or maybe even some collaboration with third party providers to try and compress that schedule.

RICHARD HUSS: Well I agree from looking at new products with pretty much what everyone else said, talent and trying to figure out where the next innovations are so you could make your motion control product better with them. One of the more difficult things that we're finding even now is support of legacy products in the plant. Try and get a 486 processor, or a 16 digit display or something that you might have used in a product 10-11 years ago when you get called by the end users, and this guy has got a factory full of them. It's been very difficult keeping people supported on those products. Now we make our products faster, better, less expensive using innovations in the consumer electronics industry, they come out with a new product every 18 months and just tell you to throw away the old one. Try and do that to someone who just made an investment of 100 plus million dollars of capital equipment to manufacture some product that they have to keep making for 10 or 12 years. Being able to keep those people trained, keep that product supported, keep the spare parts available is a huge challenge for all of us.

PHILIP STRONG: The panel has made some good comments about talent and R&D investment. I agree with all of those. Another specific challenge we and other software based companies face is that we pretty much live in a hardware world. Even though we ship hardware to our customers who end up embedding them into hardware machines, much of our value is tied up in our software. So the general challenge is how you charge for that value. Educating the customers' purchasing agents on the true value of control software is a good starting point. The enlightened ones are receptive, but there's still a big hardware mentality in the industry. In the case of MEI software our real value is better machine performance, greater design and manufacturing flexibility and faster to market.

JANYCE FADDEN: I'd like to comment on that added challenge to what we've been looking at. A lot of our components, like a linear product, use metal parts and we're finding that the China market is one of the places to be to get the lowest cost of the product. Our challenge is how do we set up the right flow of that component to us so we can incorporate it into our product and keep the price points that other companies are also achieving in the market place. So for those of us who are in hardware sales, where should that hardware be sourced and then where should that be built. As we find

ourselves going to these low cost regions, we're finding our customers are going there. Not only are they going there themselves, they're going there to sell their product and many of them are beginning to say, "Hey, we're going to set up our facility here, in this country and if you want to be on our platform, you need to have support structure" in places we might not have had on our list of the next place to open our office. So that's a challenge that's going to be coming to all of us as we watch the emergence, especially in the hardware areas, of low cost regions like China and the former Eastern bloc countries as they become more and more competent at making components that we may have made just here in North America over a year ago.

BRIAN CASEY: One other challenge that I think is certainly facing us and probably everyone at the table here, how do we have the talent to touch the customer, how do we get our product to market faster and the other factor that's becoming more and more a reality for all of us is how do we get our product to the dump slower? Or looking at it another way, the environmental issue, you were talking about the legacy products we still need to support, I think we're all facing that issue, but at some point they're done. There's a lot of legislation that's in process right now in Europe and has found it's way to North America already for some debate and we're all going to be facing some pretty serious challenge,

including the folks sitting here in the room who are OEM's, end users and manufacturers in terms of looking at the disposal of these kinds of products. There's a lot of chemical compounds and materials that are used frequently today that pose some pretty interesting risks to the environment and we're all going to be challenged to eliminate those from our products while providing the same service, the same fire resistance, the same characteristics that we've seen developed over the years in various technologies. I think it's an emerging challenge and it will become a major challenge for almost every electrical company within the next couple years.

Open architecture as portrayed by OMAC is developing slowly. Why?

GEORGE KAUFMAN: Our product and our product strategy for ten years has been based on open architecture. While open architecture can mean a lot of different things to a lot of different people, for us, it's really what we've always done and I'm not sure I would agree that it is developing slowly. However, we do make our software based controller available as an open controller and as an embedded controller. Because our controller is software it is easy for us to offer the two solution formats. The sales strategy of being able to offer the controller either way ensures that the customer doesn't feel like we're pushing one type

of solution over another. It gives us a more objective approach. The funny thing is if you look just at unit volume, it's pretty much split 50-50. About half the controls we sell are open and the other half are imbedded. I think there are a lot of different reasons for that. When you decide to use an open controller, you do need to accept that there will be a certain level of risk. You're going to be putting together a variety of third party products to control your machine and for certain types of situations or applications that risk may not be necessary. For example, let's say you're building only one machine and you're a system integrator. You're on a budget and you're on a schedule so you might benefit more from the imbedded controller. You're going to take it out of the box and it's going to work and there's not going to be any question about that. On the other hand, maybe you're an OEM making the same machine over and over. You could invest the effort up front of putting the components together and verifying that everything works. After that initial investment, you can just repeat the open control solution without fear of unexpected problems. If you want to say it's developing slowly, I would just say it's for that reason. Open architecture isn't necessarily the best solution for every situation and if that's the way we view it, then maybe we would say it's just developing as it should.

THOMAS BULLOCK: The

reason I say it's developing slowly is if you look at OMAC, it's huge. You literally have hundreds of people on the committees. Proctor and Gamble and General Motors and all those big names are all participating in OMAC, yet few are actually putting it to use.

RICHARD HUSS: They should put their money where their mouths are and buy products that are open. Then we can ask our friend here (Brian) and Fanuc and Siemens as well if they will still remain closed. As long as the end users keep specifying the closed products, they stay closed. I see some companies like Proctor and Gamble promoting open and getting better, certainly but when they buy machines today, they still specify a certain control and they're not buying open, not pushing the OEM's. Actually it's quite the contrary, a lot of them are pushing the OEM's not to supply open by continuing to specify a particular brand. In fairness, if a plant is loaded with a certain type of control and buying one additional machine, they want one that is the same. Open is better and will come along as time goes on. It's still moving forward

PHILIP STRONG: A general comment about open standards. We have an open market out there and that creates open competition. Generally I think all of us and our customers agree this is good for the industry. Competition drives innovation. Regarding the process of standardization, if you have too

many cooks in the kitchen what happens is every party wants to contribute their opinion. We all have our own business agendas, and the more of these you bring to the table the more difficult it is to get rational agreement. You end up with a compromise and things move too slowly. Executed poorly, the result can easily be a consensus specification that doesn't necessarily deliver the best product to the customer. It's too easy to end up with a standard that's overburdened with diverse features yet missing some of the key differentiating features. So while I am not opposed to open standards – they serve a good place in our industry – such standards are unlikely to deliver leading edge technology in a timely fashion. I hope it's going to be a world where everyone is out their developing new and appropriate technology in a timely fashion. That's what keeps us competitive as a nation and any compromise of this principal means we will be losing business to someone else.

BRIAN CASEY: I can play off of that and say that basically what we're doing is helping to keep the United States competitive. The whole reason to get a group together like OMAC is to put together an open standard, sometimes you wonder if the thinking behind that is a little bit misplaced from the standpoint that the whole purpose of getting a group together like that is to create options so they've got different value propositions to

look at, different options to look at from what might be coming out of the major vendors. Frequently the options that are really out there are the ones that come from the major vendors, or the ones that come from the smaller companies that are doing developments along a particular line or with a particular technology. There may be a bit of a fallacy in thinking that any organization, and this is not to point a negative finger at OMAC, but we look at the number of standard activities that probably a number of us have been involved with over the years, myself and several, and some of them have taken off because they were close enough to, I was thinking of IEEE standards for Ethernet for example. If you're old enough, you remember the Ethernet - Token Ring wars, if not, good for you! At one point technology ultimately won the war there. In most cases, and in the industrial space particularly, we don't see that. There were eons of effort and person-hours put into developing the field bus standard which in it's current incarnation of S-50 and the fieldbus foundation or whatever the current thing is, that's only a small segment of the total right now. There are a number of other technologies that are in play, in fact I think we get into that question here in a minute. I don't know that any organization can come up with a single standard and achieve it's objective of being open, because the whole point of being open is to have multiple

choices and not be locked into just one single solution. Either OMAC would be so broad as to allow pretty much everything, in which case it doesn't really help set any choices or determine direction, or it would become so closed that it really just becomes a different variation of a proprietary solution.

GREG WOODS: The inefficiencies of large standard setting bodies in both government and industry are well documented. However, if you ignore that for a moment, I think the reason that OMAC hasn't really taken off is that the world has changed dramatically since OMAC was started by the auto companies around ten years ago. Back in the early 90's there were nearly as many control standards as there were controls suppliers. So OMAC was kicked off to try and legislate some order in the world – or at least in the factory. The basic concept was to be able to buy off the shelf control products from multiple vendors and have them work together as easily as a plug-and-play printer works with your PC. In theory this sounds great, but the practical implementation in the factory is much more complicated. In the factory, you have significantly lower unit volumes of the various automation components, combined with much higher variety and specialization of the components. Unfortunately the market for automation controllers has not yet crossed the 100 million units / year mark. So you

have this economic impediment out there. The other big influence is the emergence of market driven open standards based on Internet and IT technology. As far as I know OMAC is based only on Microsoft software which as the courts have recently pointed out, is not exactly open. On the other hand web and IT technologies like Java, XML, and HTTP are open and platform independent. As the first company to incorporate web technology, like a web server, into an automation controller, CTC believes that the web and IT standards will also end up as the de facto standards in the factory as well. The reason that these standards will win out is that they are already in use by millions of people and nearly all systems “above” the plant floor are already compatible with them. By using the same standards on the factory floor, manufacturers can achieve low cost plant-floor to top-floor integration of their enterprise.

A motion forum wouldn't be complete without bringing up fieldbuses. Which ones are you supporting and why? Do you see any up-and-comers on the horizon?

JANYCE FADDEN: Danaher supports SERCOS, through the companies we've bought we have SERCOS product available. We have our sales people trained to talk about it, and promote that product but we also support SynqNet, Devicenet, Ethernet,

and Modbus. It's really up to the customer to decide what they want to do in their facility. We are primarily a linear, actuator, motor, and drive company and do not make the control choices, so the customer is going to make the control choice and we have to have part of the connection. I don't think this mix of products and mix of different types of buses is going to end soon. I think customers are going to continue to pick and choose and a lot of it has to do with regional influences or the influences of these very large automation companies that we're seeing at this table. However they influence the market is how we would have to follow. It's ok to go back to those end users and the choices they're making and right now they're continuing to make a variety of choices.

SCOTT EVANS: It really boils down to the application and/or economy-of-scale: Almost any of these buses are OK for most applications because we don't require real-time control over the fieldbus: The torque and velocity loop and often even the position loop are closed at the drive. Said a different way, it would be ludicrous to think you can control torque, real time, over DeviceNet, for instance. Regarding "economy-of-scale", which buses will become ubiquitous? I don't think you're going to see one bus ever win completely, but (long term) you can't fight the momentum generated by high-volume industries... If the PC

industry is heading to Ethernet, you're not going to be able to fight Ethernet.

RICHARD HUSS: Well I was just thinking about it. We're pretty committed to multi axis complex motion control, we're certainly committed to SERCOS, and what you said was correct, we do a lot of control in the drive itself. We have DeviceNet, Profibus, Interbus, Ethernet drives that perform simple coordinated one or two axis applications including cam functions without a control. The reason why we stick with SERCOS and continue to do so is because it is multi vendor supported, proven, there's compliance testing, it continues to evolve, it continues to get faster. And there is no better open standard for high-speed multiaxis coordinated control. There's a lot of things that can happen but if the Ethernet proves to be a better medium or Firewire, and we can get an agreed upon standard application layer, there's no reason why we wouldn't move on to that either. You have to be deterministic to do motion control and you can probably do it in one or two ways, either SERCOS, which is very synchronistic and is very deterministic in the way it's protocol is set up or I suppose you could do it by shoving as much data as you can through something with a huge amount of bandwidth so you make sure it gets there, but I think in the future SERCOS will evolve. There is a big investment in it already so it might even become the

application layer for a different physical layer.

PHILIP STRONG: MEI's 'bus' strategy is very clear, we are supporting SynqNet. SynqNet is a synchronous network developed by MEI for high performance, high reliability motion control applications. SynqNet replaces the $\pm 10V$ connection between motor and drive, so in a way it's a very specialized kind of 'fieldbus'. Its unique features have attracted a lot of attention, and SynqNet is now supported by a growing number of servo drive vendors, including Yaskawa, Panasonic, Danaher Motion, AMC, Glentek, Sanyo Denki, Tamagawa. The machine architectures we tend to get involved with usually require a centralized control model, because there's a lot of real-time interaction between each axis. Before we developed SynqNet we looked very hard to use an existing standard. We looked at a number of networks including Firewire, SERCOS and Ethernet. None of them delivered on what we consider the basic features of a high end motion bus. For example, number 1 basic feature is that it's got to work reliably, in all electrical environments, including the factory floor and the belly of a machine that's generating a plasma arc. So preferably it's built upon technologies that have a proven track record in the industrial environment. Firewire does not yet have such a track record, and it unlikely to have one for reasons

I cited in my opening statement. Second, it needs to be available for the long term, which means it shouldn't be built on proprietary consumer silicon which goes out of fashion quickly. Again Firewire fails in this area too. Third, the technology needs to have a clear roadmap of performance upgrades. The performance you will need in three to five years is likely to be ten times faster than what you're using now. So think ahead. On that note, this is where SERCOS is weak. We have supported it for many years and have OEM customers using it today in mid-performance applications. For high performance applications however SERCOS cannot deliver the horsepower. So, from our point of view, SynqNet is where we are putting our money. It's built upon an open, industry proven physical layer (100baseT), it's reliable, and delivers high performance today, with a clear upgrade path through gigabit Ethernet. These are a few of the reasons why it's been quickly adopted by customers in Europe, US and Japan, and is well supported by industry leaders. We've spent the last eighteen months embedding SynqNet products to the machines of large OEM customers. Now we're at the stage where we're ready to take it to a broader market in a number of ways. We'll be marketing to a wider audience, and in Q2 we will be open to licensing the technology. So expect to hear more about SynqNet in 2003.

BRIAN CASEY: I think there were a number of things that were brought up by the various folks who are talking about this particular question, clearly the environment that you're trying to play in is going to have an impact, the architecture, whether you're running a very centralized architecture, which is what led to some of the development of SyncNet, or if you go back to some of the roots of SERCOS, it was intended to be a little bit more of a centralized architecture where more things would actually be happening and in the intelligent drives as compared to the straight torque block, if you will. To the extent that different customers have different opinions as to which is the right way to go, there are probably going to be multiple standards because it's not today, one size fits all networking technology that meets everybody's requirements for both environment, which gets in the noise susceptibility emissions and all the rest of that architecture and those sorts of things. I can tell you that right now, Rockwell, we're using SERCOS as our primary motion network, we're using it as an enabling technology to create the complete integrated solutions. We're also very active, as is Rexroth in terms of driving SERCOS forward, and one of the things we're working on right now is defining what the future strategy is for SERCOS, how we can take that standard beyond its current state, and I'm speaking now with my SERCOS board member hat on as compared to

Rockwell, where we're going with that technology so that users and vendors will understand here's where we are with SERCOS today, here's where it's going forward. One of the key elements within that is recognizing that motion control, and we talked about this earlier a little bit, was largely an independent discipline for a long period of time. It's becoming less and less so. Almost everybody here is doing both motion control as well as sequential control, they're trying to do whole machine control. Things like Profibus, things like DeviceNet, things like commercial technologies which have strongly infiltrated the more core factory automation market will get to a time period where it gets a little fuzzy between what is motion control and what is sequential control or classic factory automation, and that will drive out some changes and that may mean that commercial technology such as Ethernet becomes more prevalent even in motion control applications or it may mean there still is, we find through the various architecture developments, that some sort of dedicated technology is still required to get the job done, to meet all the requirements or there may be some mix because of a variety of motion control requirements that are out there. What it takes to run a machine tool versus what it takes to do a wafer handling system versus what it takes to do a packaging machine, some similarities and

lots of differences and that may not converge all to the single technology.

What new features, such as embedded web servers and servo tuning, are critical to maintaining the technology?

SCOTT EVANS: Although we all have differences of opinion about what type of communication is “best”, we all agree communication in some form is part of our future. There is also some great new technology coming from the hardware people... Most of it is not quite affordable for the broad market yet. You see things like linear motors and encoders with extremely high-resolution feedback... Technology that helps all of our products perform faster and, ultimately, more accurately; They help our customers create machines which produce less scrap and have a shorter changeover time. When I see all of this great technology coming down the pike, I always think to myself, “I hope the motor guys keep up!” Next thing you know, here comes Danaher with 20% lower cost on a motor...

JANYCE FADDEN: Many times when we talk about the motion control industry, we think about the industrial factory floor and I think we need to continue to seek application areas that can drive the kinds of volumes that Greg alluded to in order to get the

price quotes down and that way the motion technology can be used more in the plant than it is today. For example we need inventions like the self-balancing scooter called Segway to be very successful because that creates a new price point on motors and on feed back devices. When the leader of Segway first came to us with that concept as an industrial company, we had no idea how to make it, but our engineers, like many engineers, when given an interesting challenge come up with new ways to do it. I think the industry needs more of those challenges that allow engineers to link their thinking about how a motor really works and is put together, how an encoder works, what its role is, feedback and what it needs to be doing, so dimensions like that. We're working with the fitness industry in much higher volume applications than we would normally see to apply servo technology using some of the things that we've learned. That's going to allow us to bring those solutions into the industrial market so that we can continue to lower the price point for an axis of control.

BRIAN CASEY: One of the key things that is going to be necessary for the continued success of the motion control industry really comes down to the people aspect of it. In terms of developments that are going to be important to us going forward are going to be things, frankly that will allow George to ultimately

retire one day and his services no longer be needed because there's enough people out there who are familiar with technology, and if it's easy enough and accessible enough, not that we're going to gum it down to the level of Joe consumer, but it's still going to require talented engineers but right now we're in a state where you need to be a really good mechanical engineer, you need to be a really good electrical or controls engineer and also have some business savvy in terms of what the business problem is you're trying to solve through the application of the technology. There's a lot of technology, technological developments and innovations going on which is allowing motion or closed loop servos to be applied in a much broader number of applications or pieces of machinery, things that were done mechanically before, etc. or into new applications like the Segway. Most important is keeping it simple, or natural or intuitive so that enough people understand it to properly apply it, support it, maintain it, and continue to develop it and find those new applications for the technology. I think that's probably going to be the most important thing that we're going to need to do to sustain the continued development and proliferation of the motion.

PHILIP STRONG: From a technology point of view, we see a lot of cost reduction programs that are upping the demands on the control system. Let me

explain. What we see is design teams build lower cost machines by using lower cost components including lower cost mechanics. They're looking for ways to compensate for those mechanical deficiencies by using a more powerful control system. With modern control techniques and real time control models you can do an awful lot of compensation in software. I see going forward a closer marriage between real time software control models and the mechanics. MEI has started to address these trends with its Enhanced Control Architect tool. We have already demonstrated earlier success, so we know it can be done. It's just a question of more tightly integrating the software control technology, the mechanics and drives, and making the whole process more efficient for the systems engineer. This is one area that we expect to deliver a lot of value to our customers over the coming years.

GREG WOODS: We have put a lot of investment in the whole web services area. I think you'll see many innovations in that area across the factory landscape. We touched on several concepts this morning but just to amplify what Brian said earlier, we're already seeing motion control being wrapped into machine control. I think you'll next see those machine automation solutions more fully integrated into the overall factory IT structure. This will facilitate enhanced quality, uptime, and asset utilization in the factory. If you can get more

reliable data out of that machine in real time, you can optimize your whole process. Then you can take it to the next level by integrating your process with your supply chain partners. It's like that commercial I saw the other day where the customer first orders a red car, so he clicks the red box in the showroom, then the machine in the factory starts with the red paint then he changes his mind to black, and it starts painting black. You are starting to see those types of collaborative manufacturing models starting to emerge out there.

The key is having open and compatible standards from the motion control right through machine control, and complete factory management and it's the Internet technology as well as the IT technology that are the enablers. The other technology to keep an eye on out there is the use of wireless technology on the factory floor. While we don't recommend using this for motion control, it works great for asset monitoring applications, especially where it's difficult or expensive to run network cabling.

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