

In Issue 3:

- Applications: • wafer sorting machine
- ultra-fast labeling • tracking athletes
- moving molten metal smoothly
- automating paper press loading
- CANopen for machine builders
- Intelligent 1-axis drive
- Linear motors extend range

machine intelligence

Advanced Motion Control for Machine Designers

True genius, or just another smart drive?

You have probably come across 'smart drives' before. Well, this one rates as the industry's first genius. It delivers a new level of flexibility by incorporating the high-level MINT motion programming language.

Called MintDrive, this innovation establishes a second generation of smart drive capability, allowing users to implement cost-effective standalone motion solutions capable of performing the most complex movement profiles, and controlling associated I/O. Dual CAN ports with full programming support for powerful peer-to-peer networking extend capabilities even further, allowing multi-axis machine builders to create more flexible motion architectures with distributed intelligence.

Integrated drives give automation designers the means of achieving major gains. Space and cost savings are possible because they eliminate the dual-box approach to motion control system building, with all the associated costs stemming from the greater real estate required, and the labour and parts needed to inter-

continued on back page

Molten metal moved more methodically



The spline and ramp functions of the MINT motion control language have helped Dangel Robots to build a highly efficient molten brass crucible handling system. The system automates movement from furnace area to a secondary workstation, removing the foundryman from the vicinity of molten metal, and increasing speed compared with the previous process - thereby maintaining heat and enhancing the quality of a consequent parts production process.

This project demanded as high a speed of travel as possible, while ensuring that the molten metal - which is half an inch from the top of the crucible - does not spill. It also involves navigating around a large I-beam pillar obstacle on the factory floor. Dangel Robots, and their consultant motion control specialist Craig Deady, provided a 2-axis servo motor-based solution. The first axis controls the X-axis carriage. A swing arm then repositions the crucible during its non-linear path.

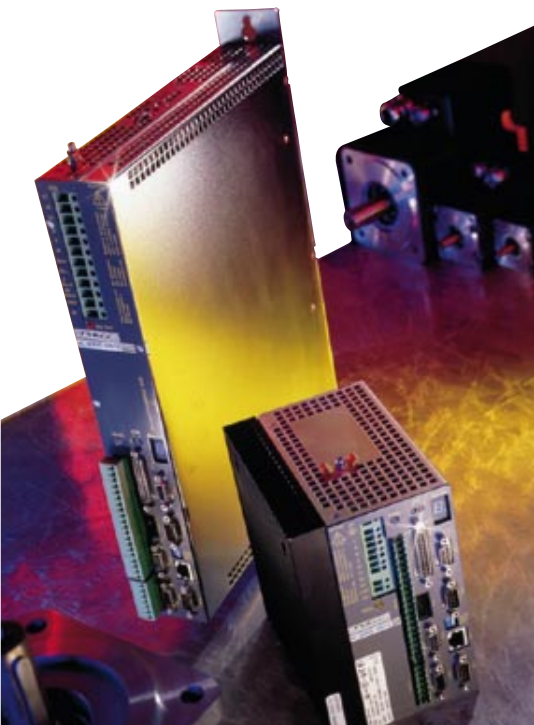
Deady chose to implement the system using Baldor's NextMove BX motion controller, primarily because of the flexibility of its MINT programming language.

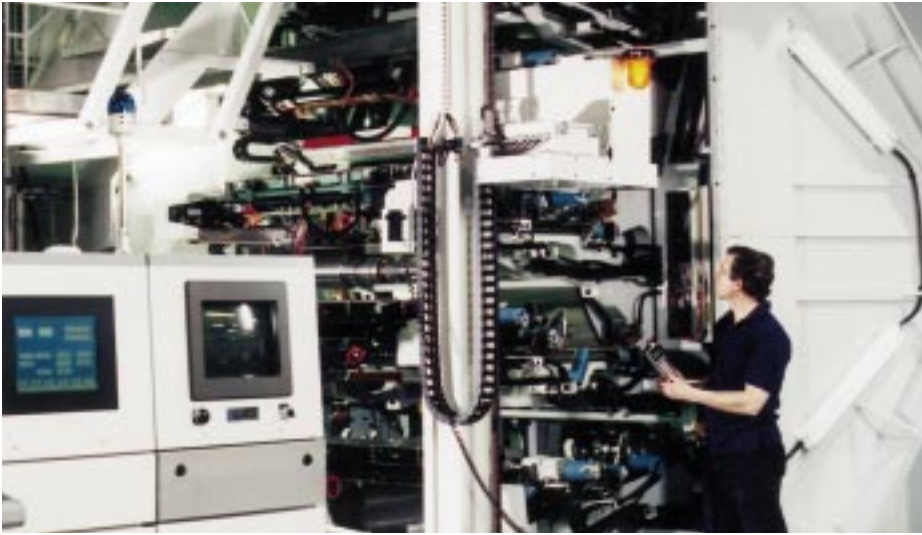
"MINT's spline commands allowed me to define a curved path which controls movement smoothly during transit to eliminate spillage" says Deady. "I also used ramp functions to build up speed as quickly as possible throughout the travel to minimize heat loss".

Deady considered other controllers, but rejected them because of limitations of control such as a lack of acceleration and deceleration commands - which would have resulted in jerky movement. Cost was another concern, with NextMove BX coming out top because it provided a standalone solution with case, PSU, and I/O. In addition to on-board I/O, Deady exploited NextMove BX's CAN interface to connect to the user interface mounted in a hand-held pendant.

Even though the Baldor controller offered all these features, it lacked one important facility for Deady: the ability to respond to a 'live man's handle' during the movement controlled by the spline function - a safety feature applied to many of Dangel Robots' systems. Baldor was quick to respond. "Most companies won't even talk to you about custom software" continues Deady. "Baldor's European R&D facility gave me some trial code to solve the problem in a couple of weeks, and final software a few weeks later - that's phenomenal service".

Enquiry card # 1





Robot loader upgrades printing press



The PC-compatible motion controller card, NextMove PC, proved the ideal tool for Dangel Robots' add-on loading system for one of the USA's highest-throughput printing presses. The 10-colour Flexo press from Kidder Inc (Agawam, MA) produces high-volume packaging and wrapping for consumer goods such as beverages, and operates from large cardboard rolls. The robot unloads, then reloads printing impression and ink rolls weighing up to 2000 pounds. Previously, each roll was exchanged manually using a block and tackle hoist, an operation taking two press operators 15-20 minutes. The Dangel robot automates the process, cutting it to around three minutes.

The NextMove PC is an upgrade to an existing machine control system based on programmable controllers. Dangel Robots decided to employ a PC platform to provide a graphical user interface for the motion control system. Consultant control systems designer Craig Deady chose Baldor's NextMove PC motion controller card for the motion and machine control because it provided an economic solution with all the necessary hardware, and because of previous experience with the MINT software development environment - which gave him confidence that the software could be developed rapidly to meet the project's tight timescales.

For this application, the motion system necessitated X and Z servo motor axes for each of two robot arms which grip the roll, plus a considerable amount of I/O, much of which Deady was able to locate remotely on the robot arms at low cost thanks the NextMove PC's CAN fieldbus interface.

The real-time motion part of the application is controlled by NextMove PC. The user interface is based on a touch screen, which allows the operator to program robot moves by touching the graphical image of the roll they want to exchange from the printing press deck, and the roll storage cart position.

These paths are taught using a 'teach pendant' peripheral and MINT's teach and replay commands, with NextMove PC then computing a smooth movement path using point-to-point motion functions and electronic gearing between the master and follower robot arms. During normal operation, the operator always has instant shut-down capability thanks to the incorporation of a 'live man's handle'.

As the motion system is only one element of a larger control system, Deady uses NextMove PC as an autonomous sub-system, exploiting MINT's interrupt handling to create an event-driven rather than polled system for software simplicity.

"The motion control program runs independently of the user interface and other host PC software, making the overall system modular and easier to develop," notes Deady. "This allowed me to adopt a 'divide and conquer' strategy to simplify debug and system integration, using the MINT software development workbench tools to test the program in isolation by reading and writing values via dual port RAM." Thanks to this approach he managed to develop the motion software in less than three weeks, and notes that the robot arms were also commissioned on site very quickly, in under a week.

Controller's CAN wafer handling

The combination of servo motor control axes and field-bus I/O interfaces on Baldor's NextMove PC motion controller is helping automation equipment manufacturer Sintech Automation (S) Pte Ltd to cut the cost and size of automation for semiconductor wafer handling. Custom-designed for one of the world's leading high-technology companies, its new PC-controlled machine sorts post-baked wafers by lot number and position, eliminating manual handling and slashing the valuable clean-room space typically required for this task. The system makes life very simple for operators thanks to a 'load and forget' principle of operation, which automatically orients, reads and sorts them as required.

Wafer handling is performed by two actuator arms driven by servo motors, which transfer the wafers from their handling 'boats', and place them into specified drawers in the machine, for subsequent removal and processing. There are 35 drawers in total, each of which is controlled and monitored by three digital input and three digital output lines.

At the outset of this design project, Sintech Automation thought that a separate PLC would be needed to provide and manage the I/O, but Baldor's Singapore distributor Servo Dynamics proposed a motion subsystem design based on a motion controller with integral CAN fieldbus ports. This approach allowed the I/O architecture of the machine to be implemented using a network, allowing an almost unlimited number of I/O channels connected directly to the motion controller. Just five of Baldor's 48-line I/O modules provide all the digital control inputs and output channels required, and these modules are also physically distributed around



Sintech's innovative wafer handling machine.

Enquiry card # 2

I/O simplifies



the machine - saving a considerable amount of cabling.

Servo Dynamics recommended Baldor's NextMove PC motion controller, as this module provided both a compact motion control solution - which plugs inside the host PC - and an easy means of interfacing to the machine's control software. The wafer sorting machine itself is controlled by a popular Windows SCADA software package.

This provides Sintech Automation with a platform to offer its customer a highly graphical user interface and control environment, with touch-screen interaction. The SCADA package, and other Windows software, orients the wafers, reads the ID numbers using OCR software, and then determines which locations in the machine they will be sent to - storing the information in a database for easy integration with the overall production process management computers. It provides high-level commands to the motion and I/O control subsystem via Windows' DDE mechanism. These are then converted into real-time control signals by the motion controller's onboard processor. The motion control and I/O processing routines were written in Visual BASIC, and simply call the specific Baldor MINT motion and I/O control commands as required - a simple approach which was achieved using Baldor's MINT Interface Library. Access www.sintech.com.sg for further information.

Enquiry card # 3

WINDOWS IN MOTION

The trend to embed PC-based control and user interfaces into industrial automation has become very pronounced following the wider availability of the 95 and NT versions of the operating system, and Baldor is pleased to announce v3.1 of its developer support: the MINT Interface Libraries. Designed to facilitate interfacing Baldor's NextMove family of motion controller with Windows - this version includes a pre-release version of the new 32-bit MINT Workbench 98. The toolkit package includes the latest version of the MINT language. This brings numerous enhancements including colour highlighting of motion keywords, a dual-port RAM watch window, a real-time software 'scope', and numerous upgrades for the NextMove BX.

Enquiry card # 4



Programming tips, from Prof. Mint

// Hi. I'm Professor Mint, head of the team that created and support the MINT language, and I have been asked to write a column providing tips for motion programmers. //

// For my first topic, I am going to look at a software technique which can yield spectacular results: replacing mechanical cams with software-generated profiles. //

// Known as 'cam profiling', a profile is generated by making a slave axis follow a master axis at a variable ratio. The slave covers a specified distance for any given distance traveled by the master. To produce a cam profile, consider the example shown in the diagram. The following MINT statements reproduce the same effect. //

```
DIM slave (10) = 150, 100, 150, 250, 300, 300, 250, 150, 100  
(this sets up the cam table with an array of positions which correspond to the height of the follower)
```

```
MASTERCHANNEL.0 = 2  
(designates that the slave axis is 0, and the master is 2)
```

```
MASTERSOURCE.0 = _msENCODER  
(defines that the master axis is sourced from an encoder on axis 2)
```

```
MASTERDISTANCE.0 = 40  
(makes the slave move to its new position after every 40 degrees of movement on the master)
```

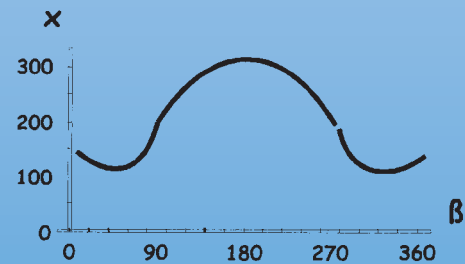
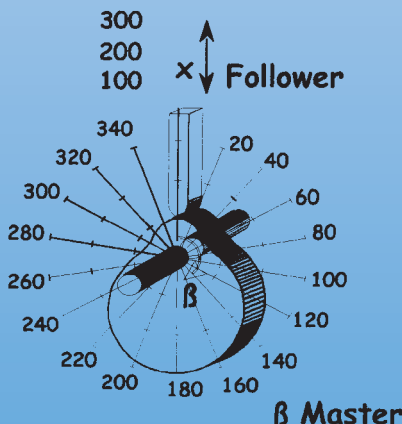
```
CAMTABLE (0,slave,null)  
(loads the cam table for slave axis, 0, and calls the slave array defined at the start of the program)
```

```
CAM = 5  
(simply denotes the type of cam we require, which could be absolute or relative, single-shot or continuous)
```



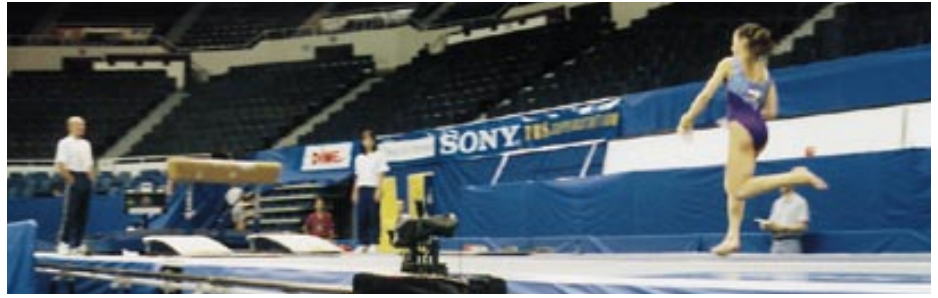
// As you can see, it takes just six statements to reproduce this complex shape! And the beauty of it is that I can change the profile at will, just by modifying a few values. More tips in the next newsletter. Ciao. //

Paolo Mint, PhD



A typical mechanical cam and its software equivalent.

A moving role in sports history



Using mobile cameras to track athletes has made a huge difference to the quality of TV coverage. We've all grown used to seeing the determination and effort of athletes as they race for the line, but for the companies that design the camera tracking systems that give us these exciting images, the technical demands are escalating rapidly.

Media companies want better and better views, with centimeter-perfect tracking, and they want to see the technology applied to more and more sports disciplines. For the UK-based pioneer, Camera Tracking Company (CTC) - who have been at the forefront of this field since their inception in 1991 - this meant a re-design to cope with the escalating application program sizes forced by spiraling I/O levels.

Originally based on a Baldor SmartMove - a standalone servo motion controller with a 16-bit processor and 64kbytes of battery-backed RAM

- the company recently upgraded its motion control systems to the NextMove BX. This boxed module comes with a 32-bit DSP and 0.5Mbyte of RAM for program storage, providing both the speed and memory for considerable expansion and growth.

The results could be viewed at the recent Commonwealth Games, which provided the venue to introduce new variations of CTC's technology including a system which tracks gymnasts on their run up to the vault, and one for tracking pole vaulters - a world first.

The motion part of CTC's system is based on a capstan-like drum driven by a brushless AC servo motor, to pull a gyro-stabilised camera payload along a carbon fibre track. Over the past few years, more and more digital I/O has been integrated into this system to allow the operators to program in specific positions, accelerations, decelerations etc, in order to

optimize the camera views and movement for specific events. In total, around 100 digital channels are currently utilized, which are interfaced economically using options from Baldor's CAN-based I/O expansion range. CTC's system also employs NextMove BX's built-in analog I/O to give the operators fine control over acceleration and deceleration to make real-time adjustments to tracking specific athletes' performances.

"The analog I/O handling built into MINT was one of the key features for us when we originally chose using the SmartMove system," notes Sam Heaphy, Director of the Camera Tracking Company. "The new NextMove controller has now provided us with much greater hardware capability, giving us the speed and the program space to add sophisticated new motion control features."

Enquiry card # 5

Macros boost labeling speed



around 20 conventional MINT instructions, allowing Baldor to slash the interrupt routine from around 80 to 24 msec. This provides enough time to detect a label, accelerate or decelerate as necessary,

and provide a real-time output to actuate a knife to cut the label from the web within the time-frame typically available between labels.

The controller also continuously polls a man-machine interface - implemented using Baldor's standard operator panel - which allows users to manually advance or retard the web at run time to cope with problems. The panel, and other digital I/O lines, are connected to the motion controller via the CAN bus, helping SASIB minimise cabling inside the machine.

Based in Mantova, Italy, SASIB is one of the world's leading suppliers of bottle labeling machines, and specialises in high speed applications. The company chose to base its

Custom motion control programming commands are helping SASIB to deliver machines capable of applying up to 60,000 labels/hour. Several dedicated keywords for Baldor's MINT motion programming language were created for this application, and provided as C code for the embedded controller, more than tripling the responsiveness of the single-axis servo motor in this bottle labeling machine.

The new keywords - such as LABELCORRECTION which provides a real-time phase shift position adjustment to accommodate stretching or other variations in web material - typically perform the functions of

motion control architecture on Baldor's products primarily because of the simple development and customisation possibilities offered by the high level programming language, MINT. This speeded development, and makes it simpler to set up machines at customer sites - as each application is almost invariably custom to some degree. This approach also helps the company to modify and adapt machines at a later date, a common requirement in the drinks industry as production processes evolve.

"The integrated motion control subsystem provided by Baldor is easy to use, and cuts the time and cost of setting up and tuning machines on the customer's site thanks to the high level MINT language" notes SASIB's Alberto Crescimbeni. "We have also standardised on Baldor motors and drives in this machine, which makes it easy to source spares anywhere in the world to support our international customer base."

"We customise software or hardware for a majority of our OEMs" noted Baldor's Technical Director Mark Crocker. "In this case we provided language extensions to optimize speed, and an embedded variant of one of our servo motor controllers to minimise costs."

Enquiry card # 6

It's networked. It's fast. It's...

...CANopen-based motion control. If you're looking to implement a networked motion system but with real-time performance, then you will find it hard to beat this protocol for the CAN fieldbus.

Now implemented on the multi-axis servo controller, NextMove BX, and the new single-axis MintDrive 'intelligent drive' (see page 1), it provides motion control systems designers with a fast and high-performance network which is ideal for real-time applications. It also opens up access to a very wide range of third-party CAN I/O modules including ranges from Weidmuller, Selectron and Beckhof.

Advanced motion system control strategies	Centralized multi-axis controller	Centralized multi-axis controller with distributed drives (& I/O)	Intelligent distributed multi-axis control (& I/O)
wiring and installation costs	high	low	low
system scalability for custom multi-axis applications	poor	good	excellent
Flexibility for making special application-specific machines	poor	average	good
Suitability for multi-axis systems:			
- loosely coupled axes	good	good	good
- tightly coupled fast systems	excellent	good	poor

Once a decision to network drives is taken, two architectures are possible. The first retains a central intelligence and sends fairly low level position and speed type commands over the network to the drives - implementing a 'master-slave' configuration. The second exploits the intelligence of networkable drives for performing complex motion control locally, allowing more autonomous 'peer to peer' architectures.

The key benefits of networkable servo drives are:

- reduced wiring and installation costs, higher reliability
- reductions in hardware because the central controller no longer needs an analog output and encoder input per axis
- a single man-machine interface as all drives are parameterized via the network
- availability of status/diagnostic information
- drift-free, repeatable performance, with no noise problems
- software-based performance and configuration simplifying the creation of 'specials', sophisticated MMIs and links to higher information network levels
- reduced costs resulting from use of multi-vendor supported standards

If an intelligent drives philosophy is chosen, these gains are complemented by:

- true 'scalability' of the system allowing costly drive hardware to be matched exactly to requirements
- highly modular architecture, allowing large machines to be divided into simpler design projects for simplicity, and speed to market

Baldor's implementation of CANOpen fully supports peer-to-peer architectures, allowing nodes to communicate with each other, from one MINT program to another, without intervention of a master. The table summarizes the benefits compared with traditional architectures.

Enquiry card # 7

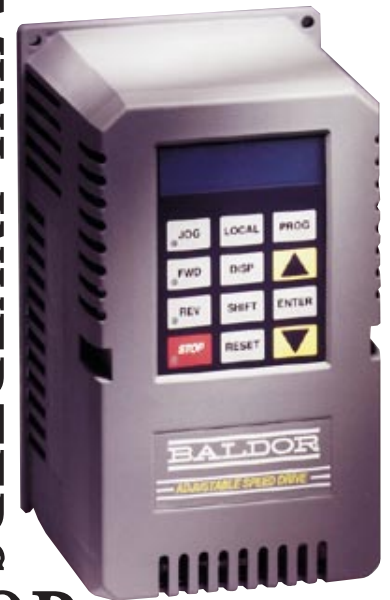


Web site moves on

Baldor UK has updated its web site with a new look and extra information including numerous new application case studies - check it out: www.baldor.co.uk

www.baldor.co.uk

MINI INVERTERS FOR CRAMPED LOCATIONS



All the advantages of Baldor's inverter technology - including the common keypad language - are now available in a small enclosure measuring just 7.6x4.8x4.4 inches (193x122x112mm). Available in nine choices of power ratings from 1 to 5HP, the new Series 15J is similar to the popular Series 15H with its block programming style, and thanks to its NEMA 1 style enclosure can be mounted directly on the outside of machinery with 230 or 460V wiring connected via a flexible or rigid conduit. We've also added new 1/2 and 1HP 'micro' open chassis inverters for OEM and repair applications, Series 5, which starts at <£100.

Enquiry card # 8

A preview of Baldor's new facility which is located across the street from the company's Fort Smith headquarters in Arkansas. The new building - scheduled to open at the turn of the year - will provide almost 60,000m² of space to consolidate all the company's USA-based drives, controls and other electronics-related design and manufacturing activities. It is designed to increase the efficiency of this rapidly growing sector of Baldor's business, and also provides enormous scope for future expansion - to take advantage of the many opportunities being opened up by developments such as the MINT motion controller and software development environment.

Space-saving INVERTER/ MOTOR COMBOS

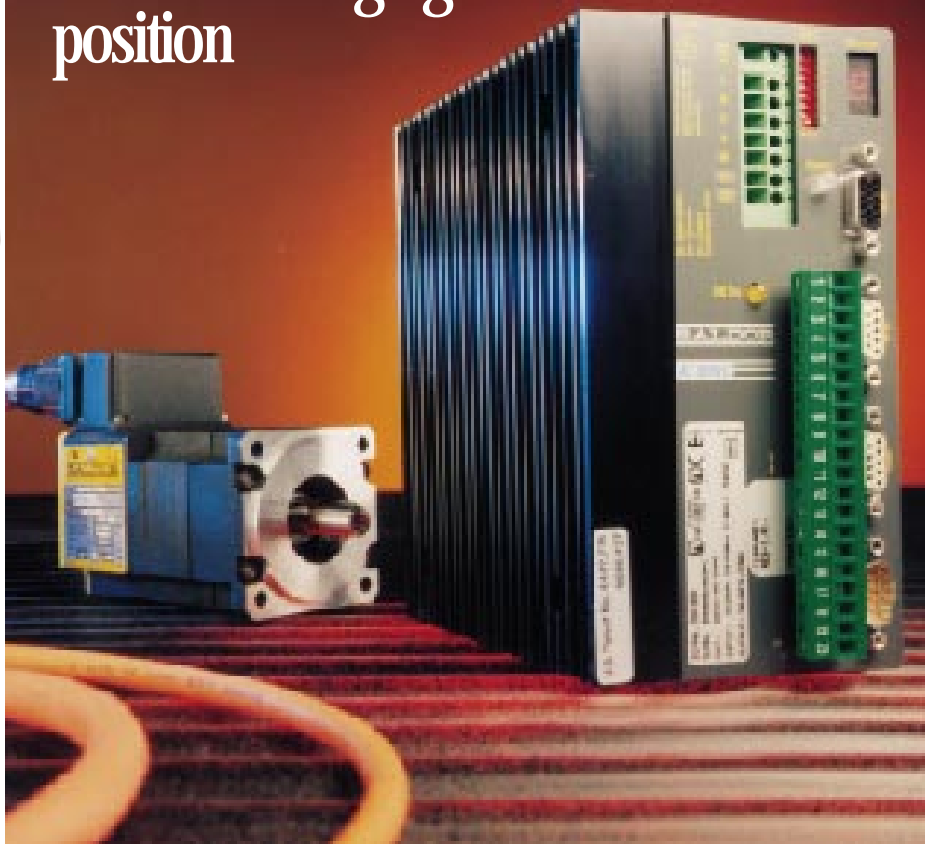


7 HP and 10HP options of the SmartMotor range of integrated inverters and three-phase AC motors are now available, providing low-cost and fast-to-install solutions for a much wider variety of variable speed industrial motion requirements. Six options are now offered in the complete range, spanning the output power range from 1 to 10HP for use with either 230 or 460V mains supplies, plus protected 'washdown-duty' versions to suit clean environments.

SmartMotors offer important advantages. The motor and control are completely compatible because the control has been designed and tuned to the performance of the motor. By eliminating cabling, the products completely side-step the interference problems which can commonly arise when long cables are routed around the factory environment, and reduce line voltage reflections - or 'ring up' - which contribute to premature motor failure in many adjustable speed applications. They also employ Baldor's 32-character plain language keypad, making them very easy to learn and operate. The new high power options are particularly suitable for fan and pump control.

Enquiry card # 9

Smart newcomer seeks challenging position



If you like the concept of an intelligent drive, but your motion application requires relatively simple movements, then try IndexDrive. This unit combines a single-axis brushless servo motor drive with built-in motion software, allowing many simple indexing or point-to-point moves - and even movements such as trapezoidal profiles - to be performed without the requirement for a separate controller. Adding less than £120 to the cost of a conventional drive, the smart drives make major savings compared with conventional motion control architectures. IndexDrive also offers a substantial advance in ease of configuration thanks to a free

Windows 95 or 3.1 set-up program incorporating powerful drive tuning software. Two versions are available initially, offering 2.5 or 5A continuous output power. These may be used with Baldor's BSM brushless AC servo motors. Each drive comes with built-in support for over 100 motion parameters, plus program storage memory for up to 15 moves. Loop closure time is typically 500 microseconds. Additionally, the drives offer limited PLC-style functionality, allowing users to construct If-Then-Else tables of events, using motion events and on-board inputs to trigger outputs.

Enquiry card # 10

tiny motor HUGE TORQUE

This brushless servo motor is only 53mm square yet delivers a peak torque of up to 5.4Nm - setting a new standard in power-to-size ratio. The new IEC size 50 frame motor is ideal for machine and automation builders seeking a versatile motion control component for restricted spaces, and offers much greater dynamic control and low-speed power than the stepper motors or pneumatic cylinders which are often employed for driving smaller loads. Typical applications

include robotics, semiconductor equipment, material handling, coil winding, packaging, and X-Y tables and slides.

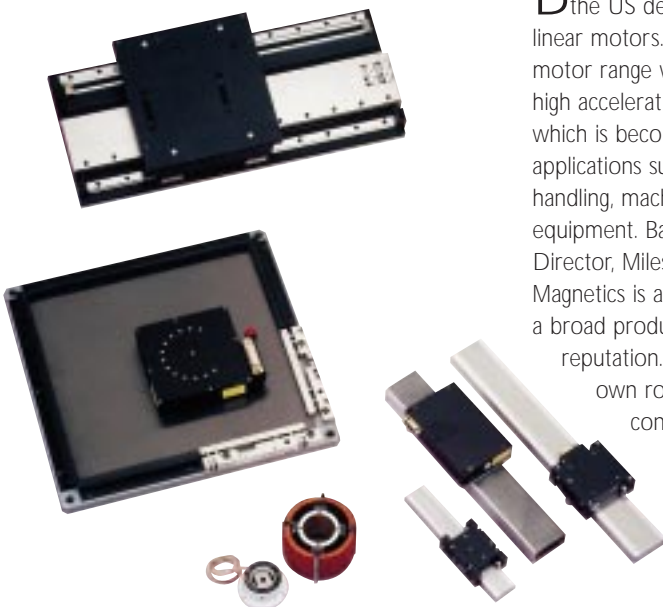
Designated BSM50A, the motor is the latest member in Baldor's BSM family, which offers a choice of frame sizes from 50-100 and torques as high as 162Nm. This provides users building larger multi-axis systems with a uniform range which simplifies system building and purchasing. Six versions are available, in three lengths with single, dual or triple stacks of rare-earth magnets. Two winding variants are also available, allowing users to tailor motor speed, continuous torque and other characteristics for a wide range of applications, up to a maximum motor speed of 12,000RPM. A rugged brushless resolver is integrated for simple system building. Baldor is also able to provide customized variants, with user-defined shaft, mounting or winding parameters, thanks to computer-controlled manufacturing.

Enquiry card # 11



Linear motors added

Baldor has acquired Northern Magnetics, the US designer and manufacturer of linear motors. The addition broadens Baldor's motor range with a technology combining high acceleration with precise positioning, and which is becoming popular in many motion applications such as packaging, materials handling, machine tools and semiconductor equipment. Baldor UK's Sales & Marketing Director, Miles Clee, noted "Northern Magnetics is a leader in linear motors, and has a broad product line with an excellent reputation. Its products complement our own rotary motors, drives and controls, allowing us to offer optimized motion control solutions - from a single cost-effective source."

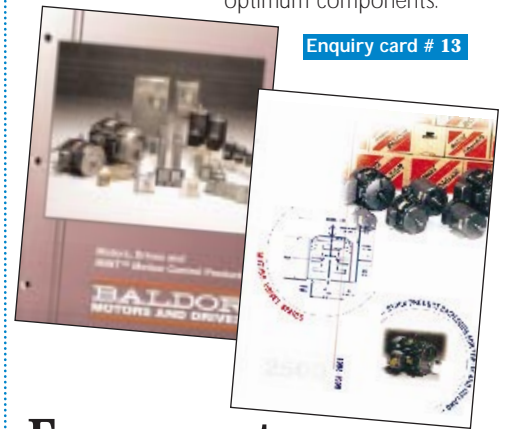


Enquiry card # 12

Refreshing motion control catalogue

Our new free catalogue combines information on motors, drives and MINT-compatible motion controller product ranges - providing engineers with a single source of supply for motion needs. It covers a wide range of technologies, from vector drives for high torque applications, through brushless servos for low inertias, to AC induction motors for higher speeds. System building is simplified thanks to lab-tested matched-performance curves, to helping pick optimum components.

Enquiry card # 13



Express motor and drive service

Baldor has released a new catalogue detailing its express-delivery motors and drives service - supported by the largest and most comprehensive stock of this equipment available anywhere in the UK and Ireland. Free on request, the catalogue details hundreds of DC and AC motors and spares, and SCR drives available for immediate delivery - providing a valuable resource for automation equipment builders and maintainers alike. Baldor's service is also geared to provide the stock levels required by OEMs too, and is now underpinned by an enterprise-resource planning network which automates stock control and allows Baldor to provide instant delivery quotes for volume orders across the company's entire product range. The selection of motors available via this new service is very wide, and includes permanent-magnet and shunt-wound DC motors in IEC and NEMA formats, and 50/60Hz AC motors - helping companies who build for international markets or maintain equipment manufactured overseas. It also includes right-angle and parallel gearmotors, tacho options, and washdown-duty motors for clean environments.

Enquiry card # 14

True genius, or just another smart drive?

The future at a glance:

Separate drive +
controller

MintDrive

Typical cost for 5A peak drive	£1800/\$2900	£1475/\$2360
Typical space needed	6800 cm ³ / 420 inch ³	2600cm ³ / 160 inch ³
Assembly required	2 hours	20 minutes
Controller/drive assembly parts cost	£20/\$35	£0/\$0

continued from front page

connect and install. Set-up and tuning time is drastically reduced thanks to all-digital operation. The integrated electronics also improves reliability and enhances performance compared with many of today's products thanks to the closely-coupled nature of the system elements.

MintDrive's intelligence stems from a unique new embedded motion controller implemented on a credit-card sized PCB, and known as MINT Motion Engine. The onboard MINT language means that application software can be written and commissioned within hours, saving days or even weeks compared with conventional motion control systems. Offering a rich development environment for motion-oriented control and automation applications, which has evolved over more than 10 years and has been used on well over 70,000 axes worldwide, the language provides dedicated high-level commands for sophisticated applications such as flying shears,

splines, axes synchronization, software cams and gearboxes. A library of MINT-compatible 'C' functions is available as an option for users seeking ultimate real-time performance, with 0.5Mbyte of flash memory and 128 kbytes of SRAM provided for application software.

MintDrive provides an amplifier for a single-axis brushless AC servo motor - initially in five output ratings from 2.5 to 15A continuous (with versions up to 35A following) - plus a comprehensive complement of onboard I/O to provide designers with a cost-effective standalone solution for most target applications. This includes 18 opto-isolated inputs, one of which can capture the position of an axis in 6 microseconds, nine opto-isolated outputs, four 8-bit analog outputs, four precision analog inputs (two 10-bit, two 12-bit differential), two serial channels, plus drive-enable and master encoder inputs. I/O is easily extended via CAN, choosing from Baldor's own range which incorporates specialist items such as a motion control operator panel, or from commercial modules compatible with the **CANopen** protocol. MintDrive will additionally function as a slave in DeviceNet-based systems.

For users building multi-axis systems, the CAN interfaces allow distribution of motor control nodes around a machine. Axes can operate as slaves under the control of a master PC or operator interface, or autonomously, communicating with other nodes over the network on a 'peer to peer' basis. The latter approach provides significant benefits in terms of machine modularity and reconfigurability.

MintDrive costs under £1,000 / \$2000 in small quantities for a 2.5A (5A peak) rated module - which can save around 30% compared with current separately packaged drive and motion controller solutions. The product complements a previous smart drive - IndexDrive (page 6) - which provides built-in software for indexing or point-to-point moves.

See us at these shows:

You can meet Baldor at any of the following exhibitions in coming months. If you would like tickets for any event, please phone your local office or use the reply card.

Design Engineering, Chicago, USA, 15-18 March

Drives & Controls 99, Telford, UK, 16-18 March

Westec, Los Angeles, USA, 22-25 March

CMMI, Chicago, USA, 12-15 April

Mesucora, Paris, France, 12-15 April

Hannover Messe, Germany, 19-25 April

Industrial Handling /Best 99, Zurich, Switzerland, 4-7 May

MotionExpo, Detroit, USA, 11-13 May

Semicon West, San Jose, USA, 14-16 July

BIMU 99, Milan, Italy, October

Jtelec, Strasbourg, France, 12-15 October

Packexpo, Las Vegas, USA, 18-20 October

PPMA, Birmingham, UK, 9-11 November

Automation, Paris, France, 5-7 December

Like more information?

Please complete the attached reply card, or if that has already been used, access our web site, or contact your nearest office, for further information on any product or service:

EUROPE

Baldor (UK)

Tel: +44 (0)117 987 3100

Fax: +44 (0)117 987 3101

email: sales@baldor.co.uk

Baldor Automation (France)

Tel: +33 4 7283 9654

Fax: +33 4 7283 9650

email: baldor_sg_lyon@compuserve.com

Baldor Italia (Italy)

Tel: +39 11 562 4440

Fax: +39 11 562 5660

email: sales@baldor.it

Baldor ASR (Germany)

Tel: +49 (0)89 90508-0

Fax: +49 (0)89 90508-491 or -492

email: sales@baldor.de

Baldor ASR (Switzerland)

Tel: +41 (0)52 647 4700

Fax: +41 (0)52 659 2394

email: sales@baldor.ch

USA

Baldor Electric Company (USA)

Tel: +1 501 646 4711

Fax: +1 501 648 5792

email: sales@baldor.com

Asia Pacific

Australian Baldor (Australia)

Tel: +61 2 9674 5455

Fax: +61 2 9674 2495

email: Ray.Harding@Baldor.com

Baldor Electric (Singapore)

Tel: +65 744 2572

Fax: +65 747 1708

email: baldorsg@singnet.com.sg

Baldor (New Zealand)

Tel: +64 9 426 6627

Fax: +64 9 426 6762

email: roger.scott@baldor.co.uk

Baldor Taiwan Electric Co

Tel: +886 2 2362 1929

Fax: +886 2 2362 1929

email: baldortw@ms23.hinet.net

Baldor Japan Corporation

Tel: +81 45 412 4506

Fax: +81 45 412 4507

email: toyoshige@mud.biglobe.ne.jp

BALDOR
MOTORS AND DRIVES

© Baldor1999. MINT is a registered trademark of Baldor. All trade names and marks are recognized and are the property of their respective owners. Technical specifications are subject to change.

Enquiry card # 15

NL1202

Reader Enquiry Card

Machine Intelligence #3

For further information on items in this issue please enter the numbers required in the boxes below, complete sections below, and post or photocopy and fax the card:

Name _____

Job title _____

Telephone _____

Fax _____

E-mail _____

Company _____

Address _____

Post/Zip code _____

Other Requests

(tick box or, complete/delete as appropriate):

Please send a FREE copy of Baldor's CD-ROM Catalogue

Please add my name to your database for future issues of Machine Intelligence and general information

I would like ___ tickets for _____ show

The following information will help us respond:
Details of application:

This information is for:
current projects/future project/information only

Please have a sales representative call

Please send me information on the following

Just post the card, or for an immediate response, photocopy and fax it to your nearest Baldor office:

UK: **+44 (0) 117 987 3101**

Germany: **+49 (0) 89 90508-491**

USA: **+1 501 648 5792**

UK: **+41 (0) 52 659 2394**

BALDOR
MOTORS AND DRIVES

Marketing Manager
Baldor Optimised Control
FREEPOST SWB 749

Clifton

Bristol

BS8 4ZZ

UK

Literature Fulfilment
Baldor Electric Company
P.O. Box 2400
Fort Smith
AR 72902
USA

Jan Coch

Baldor ASR GmbH
Dieselstrasse 22
D-85551 Kirchheim-München
Germany

Daniel Berg

Baldor ASR AG
Schutzenstrasse 59
CH-8245 Feuerthalen
Switzerland

