

BALDOR



Mint[®]

Automation Software and Applications



Mint® – Machine Intelligent Programming Language

- › One programming language for Baldor's motion controller and intelligent servo drives reduces the learning curve
- › Compiled BASIC programming language
- › Multitasking allows complex applications to be broken down into simpler, more manageable sub-tasks
- › Modular programming capability, including functions and subroutines, allows for code re-use and ease of debugging
- › Comprehensive library of motion types including interpolated moves, CAM profiling, flying shears, gearing and more
- › Intuitive Windows® tools including advanced editing tools, software oscilloscope, online help, drive configuration wizards and auto-tuning system
- › ActiveX® components (supplied free of charge) simplify the development of Microsoft Windows host applications

Mint - Simply Advanced

With more than two decades of development, Mint® fully embraces advanced programming functionality, including multitasking, functions, procedures, structure data types, scoped variables, bit fields and events. This functionality is presented in BASIC programming form, which makes it easy to write and develop modular programs that are understood by others, maintainable and reusable across different applications and hardware platforms.

Mint - More than just Motion Control

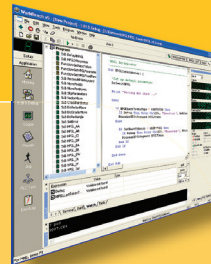
Mint excels in motion control applications, but is equally accomplished at:

- › HMI interaction
- › Serial and fieldbus communications
- › I/O processing
- › Complex mathematical functions
- › Recipe data management

Realizing that today's applications are more demanding, more precise, more dynamic and more complex, Mint focuses on providing creative features, advanced motion capabilities and features for the user to innovate the application solution.



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Mint Overview
Mint's advanced features



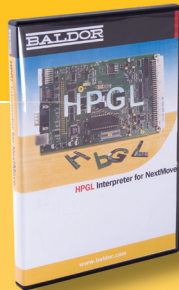
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Mint® – the single solution for machine control

“Powerlink hardware reduces the system building complexity, and the software support on Baldor’s controller made it particularly easy to develop. For this machine I managed to program the first iteration produced in just two weeks - which speaks volumes about the simplicity of the control system and the development tools” - Lead Engineer, UK Manufacturer

High Level Modern Language

Mint is a BASIC programming language and offers all of the high level programming features associated with a modern programming language such as modular programming, named variables and high level keywords. This makes it easily understood, and with only one programming language to learn, reduces time to market for machine developers.

Motion and I/O Handling

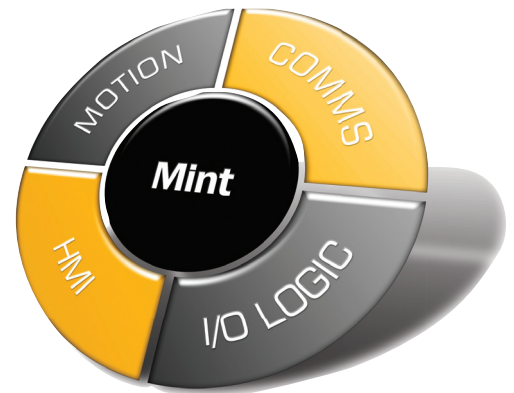
Multi-axis motion control and I/O requirements of machine automation can be handled within a Mint application. Mint supports many motion types including positional moves, coordinated moves, gearing, flying shears and cam profiles. Full control of the onboard and remote I/O is possible for complete machine control, removing the need for a PLC in many applications. The sample Mint code below demonstrates a simple indexing application - move an axis 10 units, fire a digital output for 100ms and repeat 10 times.

```
Dim i      'Initialize variable
For i = 1 To 10
    MoveR(0) = 10 : GO(0)
    PAUSE IDLE(0)
    OUT(1) = _on
    WAIT 100
    OUT(1) = _off
Next
```

Versatile Multi-Tasking Capabilities

Mint’s multi-tasking features allow for logical parts of machines can be broken down into discrete tasks and handled individually. Each task holds its own data and subroutines. They can also perform as self contained programs, useful for handling different machine configurations within one single project.

Full control of tasks can be performed within the application. Tasks can be started, stopped, paused and their priorities changed.

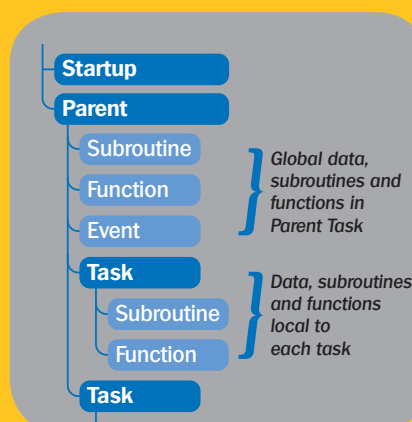


Simple to Complex

Mint handles simple to complex applications with ease, whether this is a simple indexing application or a more complex multi-axis synchronization application over an Ethernet network.

Modular Programming

Mint is a modern programming language with subroutines, functions and tasks, allowing modular programming techniques to be employed. Each subroutine, function and task can contain their own data making code portable and re-usable across multiple projects. Code segments can be packaged up and saved within the Mint Library for use in later projects.



Flexible Data Handling

Meaningful names can be given to any data, making programs self documenting. Data can be viewed in real-time from the Mint WorkBench programming environment. Mint also supports data types, as well as multi-dimensional arrays, constants and strings.

Event Based Programming

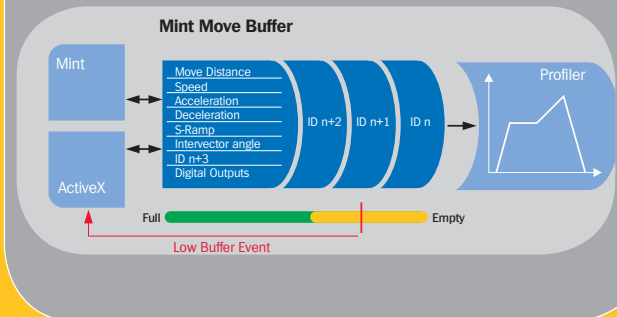
In addition to Mint's multi-tasking capabilities, Mint is also able to react to external events, such as the change of state of a digital input, or the move buffer getting critically low. There is not need to poll for events, as these are handled automatically by placing the event code within the project. Events can also be called through the ActiveX control, interrupting a host application.

Time Critical

For time critical applications many features are build into the hardware of the controllers. This includes fast position latches for position verification and position based output synchronization.

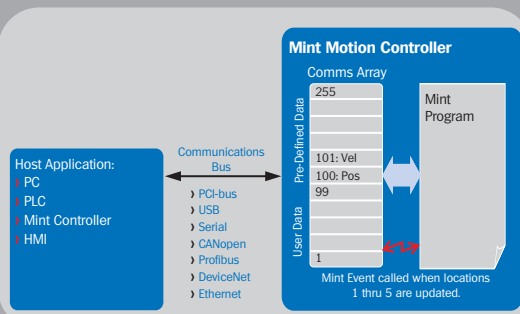
Flexible Move Buffer

A flexible and deep move buffer handles high speed applications with minimum overhead. For interpolated motion, the buffer handles speed changes and inter-vector angle control. Moves can be tracked using the move buffer ID and a low buffer event ensures that the move buffer is kept full. The move buffer can even be synchronized with digital outputs, without the need for polling.



Communications

Mint provides the means to exchange data between executing programs and host applications such as a PC, PLC or HMI. In multi-node applications, data can be exchanged between other Mint nodes either over CANopen or Ethernet Powerlink for distributed machine control.



Compiled for Speed

Mint is a compiled language which increases the speed and reduces errors within the program. Using the power of the PC, Mint programs are rigorously tested for errors and warnings during compilation. This significantly reduces run-time errors and reduces time to market.

Powerful Debugging

The Mint WorkBench provides a fully integrated development suite for Mint applications. Features include:

- › Color coded editor with auto-completion of keywords
- › Online help
- › Full debugging including breakpoints, step over, step into and watch windows
- › Code library for code re-use

Mint® WorkBench



Program Navigator

Command Line

Mint Code Library

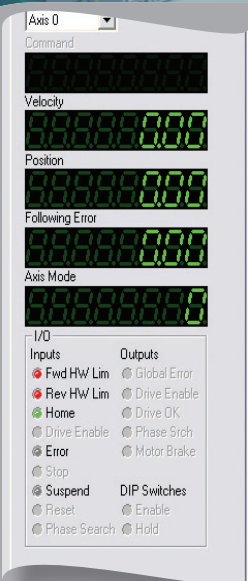
Quick Access Tools

Monitoring Tools

The 'SPY' window provides a number of simple monitoring and test features organized into tabs. The default tab shows useful axis status information and allows the user to select the axis to monitor. Other tabs include the following features:

When fine tuning of axis performance from the auto-tuned results is necessary, the 'Fine tuning' workspace is selected from the tool bar and, the available Spy tabs change to suit axis tuning functions and provide the following features:

- › Peer to Peer Comms data exchange
- › DPR (Dual Port RAM) for PCI products
- › CANopen network status
- › Fieldbus monitoring
- › Monitor window with 6 user configured readouts
- › I/O status monitor
- › Current loop performance and testing
- › Speed loop performance testing / tuning tab
- › Position loop performance testing / tuning tab
- › S-Ramping test / design tab
- › Digital Notch/low pass filter design for drives



Program Editor

Monitoring Tools

Context Sensitive Help

Watch Window

Application Development Made Easy

Mint® WorkBench provides a suite of tools in a single software platform, from network configuration, drive commissioning, control programming and diagnostics, streamlining your design cycle to save you time and money.

Program Editor

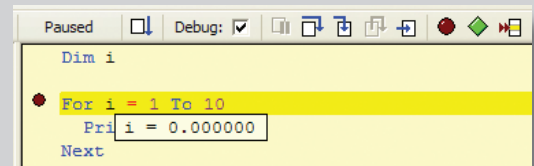
The program editor features a rich set of high-level language editing features, including :

- › Color syntax highlighting
- › Breakpoints and single step debugging
- › Watch-point monitoring
- › Tree-view software navigator
- › Variable watch-window
- › Task status window
- › Compilation errors and warnings report
- › Virtual Controller

Sophisticated Debugging

Mint WorkBench provides sophisticated debugging features for Mint development. Debugging tools

include real-time task status information and control, hover over variable watch, single step, breakpoint and watch-point features to make code development and testing simple.



Integrated Context Sensitive Help

A press of the F1 key takes you to the Mint integrated help, instantly presenting you with information relating to the feature you are trying to use. For example this could be a stage in the drive commissioning wizard or the highlighted Mint keyword in the program editor.

Program Navigation

The tree-view Program Navigator provides structural overview of your program and a fast method to find code sections, tasks, functions or subroutines. Simply click on the name of the code section you are looking for. You can use it to insert new tasks, subroutines and functions from the Program Navigator pop-up menu and reorganize your program.

Mint Code Library

The Mint code library allows you to easily store and re-use functions, subroutines or entire Mint programs for future use. These code segments can be recalled and inserted into new projects, streamlining code development. Simply select and insert code segments into your current program or copy segments of code into the library area.

Quick Access Toolbox

The most commonly required functions are easily accessed from a tool bar, changing the workspace to suit the job at hand. This toolbox adapts to the type of product being configured and includes:

- › Ethernet configuration
- › Drive setup wizard
- › Fine tuning
- › Edit & debug
- › Oscilloscope mode
- › Parameter viewer
- › Homing
- › I/O configuration
- › Error log



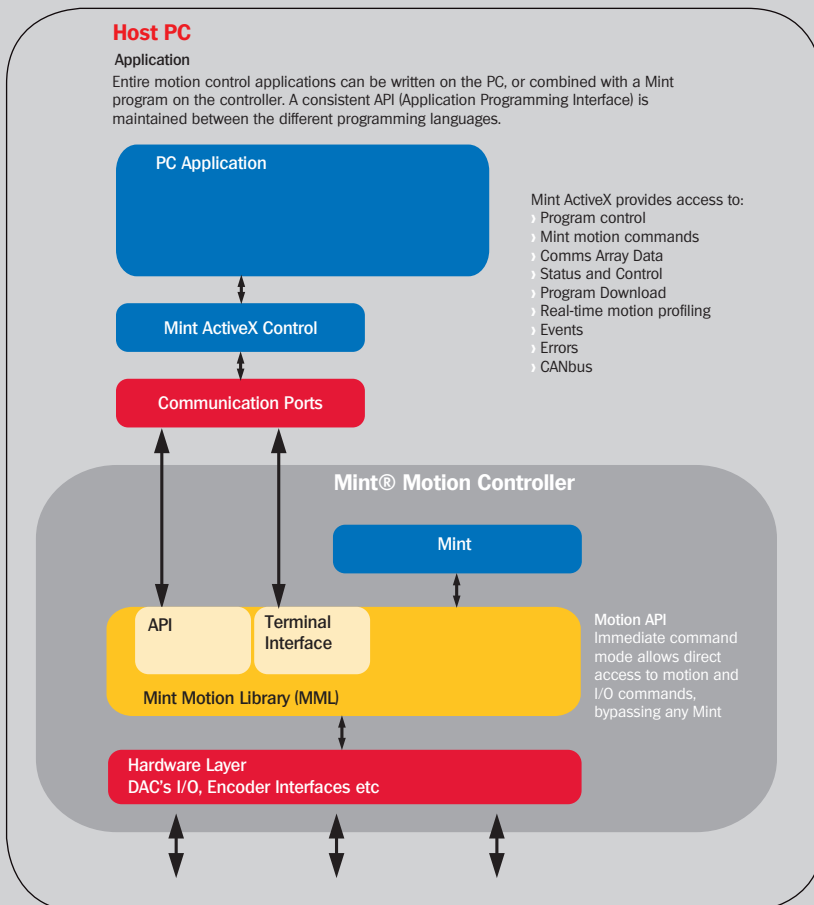
ActiveX®

Microsoft Windows is often used as the operator interface for a machine, or as the machine controller. Mint's ActiveX control (supplied free of charge with every controller) provides a comprehensive interface to the controller from any supported programming environment (such as National Instruments LabView, Visual Studio and Microsoft Office products). The ActiveX control provides all the capabilities to provide diagnostics, recipe data handling and full motion and I/O sequencing. Features include:

- › Common API (Application Programming Interface) with Mint
- › Full access to all I/O and motion functions of the controller/drive
- › Interrupt capability on Mint events – operational over PCI-bus and USB
- › Controller objects allow projects to be quickly and easily moved between Baldor products
- › Support for all Baldor motion controllers and servo drives

Common Application Programming Interface

The ActiveX command names share the same names as used within Mint. This makes it easier to translate sections of code from one programming environment to another.



Motion and I/O Sequencing

Complete motion and I/O sequencing can be performed within a Windows based application. Full access is given to all of the Mint motion and I/O commands.

A Choice of Programming Environments

Any programming environment that supports ActiveX can control Baldor's motion controller or servo drive. This includes environments such as National Instruments LabView, Microsoft Visual Basic and Microsoft Visual Studio. You can even interface to a machine from within Microsoft Excel or Word!

Parallel Execution of Mint

A Mint application, embedded within the controller, can run in parallel to the ActiveX control. The host application may be supplying recipe data to a Mint program. Alternatively, you may have a host application such as a CNC type front end that is performing the motion sequencing on the PC and the Mint application is handling I/O and safety interlocks.

Support Multiple Controllers with Ease

It takes a change to only one line of code to talk to a different controller, or change the communications bus. The following Visual Basic example shows first a connection to a Virtual Controller, which can be used to test the software before connecting to hardware. The control link is then changed to communicate with a USB based Mint controller, such as NextMove ESB-2 or NextMove e100. MintController1 is the name given to the ActiveX controller when it was added to the Visual Basic project.

```
'Connect to virtual controller
MintController1.setVirtualControllerLink
MintController1.MoveR(0) = 20.0
MintController1.DoGo1 0
MintController1.OutX(1,0) = 1

'Connect to NextMove ESB-2 controller
MintController1.setUSBControllerLink 2
MintController1.MoveR(0) = 20.0
MintController1.DoGo1 0
MintController1.OutX(1,0) = 1
```

Develop and Test Offline

Virtual controllers are supported within the ActiveX control. This allows you to develop and test a user interface without connecting to the controller. All the capabilities of the controller are supported.

Integrated Command Line

Both the Mint WorkBench command line interface and terminal window are available within the ActiveX control for inclusion within the user interface. The command line interface provides direct control of Mint command for instant diagnostics and can be used while a Mint program is executing.

Reduce Overheads with Events

The ActiveX control can handle events from the Mint controller, removing the need to poll. For example, a change in state of a digital input could call an event handler within the Visual Basic application.

Virtual Controller

Mint's virtual controller provides all the capabilities to test and debug Mint applications offline without being connected to the motion controller. Full access is given to the Mint command set, including I/O and all moves. Moves can be started and plotted within the Mint WorkBench oscilloscope.

The virtual controller can be used in conjunction with the Mint ActiveX control allowing the development of a user front end without the need to connect to the controller. Once debugged, only one line of code needs to be changed within the host application to talk to the controller.

The Virtual Controller runs within Mint WorkBench. The Mint WorkBench can be downloaded for free from www.baldormotion.com.

Mint®NC – CAD to Motion



- › HPGL, DXF and G-Code to motion
- › No graphic or CNC programming language to learn
- › Offline mode for planning and object ordering
- › Graphical interface allowing re-ordering of geometry
- › Machine control panel for direct machine control
- › Interfaces to NextMove multi-axis motion controllers

Mint®NC is a comprehensive Windows based CAD tool for 2, 2.5D and 3D profiling, for example laser cutting, glue laying or simple plotting. Geometry from different sources can be imported into MintNC and optimized to suit the operation. The geometry can be re-ordered to optimize job speed, or to maximize material use and minimize waste. MintNC can import files from various CAD/CAM sources.

Geometry is shown in both a 2D graphical format and as a list format, detailing all the vectors that make up the geometry. This geometry can be easily manipulated in both views, including re-ordering, copying, deleting etc.

MintNC allows components larger than the machine frame to be cut with support for overlapping frames in both longitudinal and lateral directions.

Using the Machine Control Panel, full machine control is possible, allowing axes to be homed and jogged to new positions. Alternatively, MintNC can be used to translate different CAD and CNC formats to Mint code which can be executed directly on the motion controller.

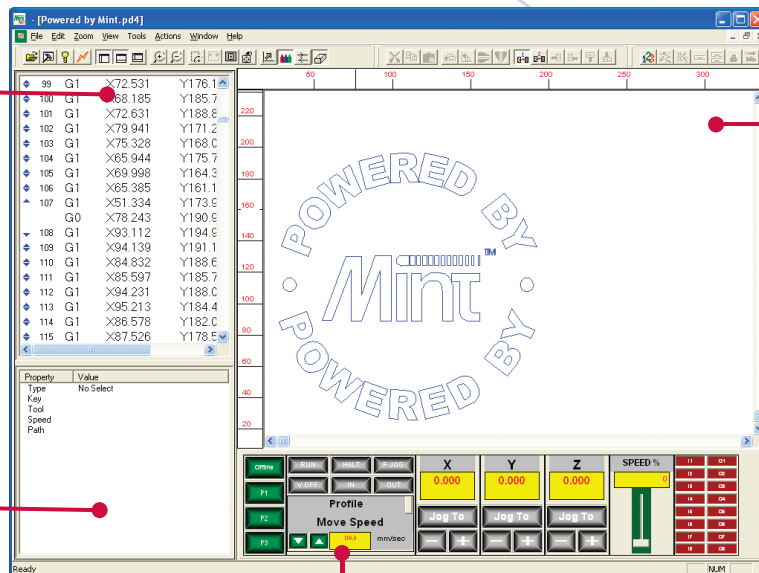
Machine configurations are dealt with using a Mint application resident on the NextMove controller. This acts as a scripting language for complete machine configuration. Whether a start-up sequence or new tool sequence is required, Mint provides complete control over I/O and motion.

Applications include:

- › Tangential Knife
- › Cutting
- › Grinding
- › Glue Laying
- › Welding
- › Engraving
- › Inspection
- › Water Jet

Object List displays the shape segments in a list format. These can be shown in native format or G-code. Selected items also appear on the graphical representation to enable optimum selection of an object. Objects can be re-ordered or grouped.

The Object Property window presents detailed information about the object including tool assignment and coordinates. Coordinates and control data can be easily managed from this window.



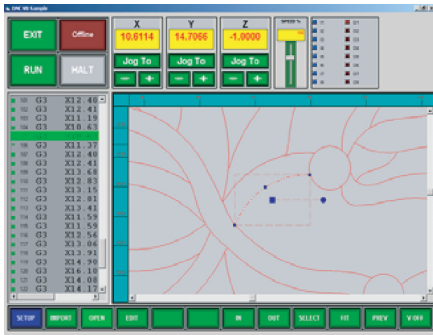
Graphical presentation of the job is shown in multiple document windows. Objects can be manipulated on-screen, including re-sizing, moving, flipping, rotating and tool assignment. Objects can be cloned and nested for optimum use of material.

The multiple document interface allows objects to be exchanged between different drawings.

Machine Control panel allowing online for control of machine or offline for job planning.

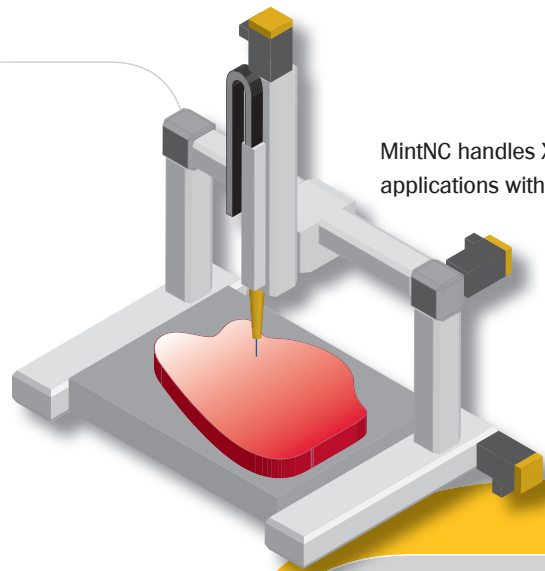
Customize through ActiveX®

Where a simpler operator interface is required, a developer library is available using ActiveX technology. This allows custom machine front ends to be quickly and easily realized in applications such as Visual Basic and Visual C++.



MintNC interfaces directly to the NextMove controller through either the USB or PCI interface.

A demonstration version of MintNC is available for download from the Baldor motion website www.baldormotion.com.



MintNC handles XYZ applications with ease

Ordering Information

Catalog Number	Description
MNC001-501	MintNC Single Machine License

HPGL – Low Cost, Industry Standard Interpolation

HPGL (Hewlett Packard Graphics Language) is an open standard that describes 2D vectored drawing and is typically used in plotters. With many CAD and drawing applications offering HPGL output, Baldor's HPGL interpreter is ideally suited for low cost XY and 2.5D applications such as pen plotters, routers, engravers and knife cutters.

Standard Commands

The HPGL interpreter is able to take standard commands sent over the serial interface and interpret these in real time. Commands in HPGL allow straight lines, circles and rectangles to be executed.

Fast Profiling

Full use is made of Mint's move buffer to provide fast and accurate profiling. Features such as inter-vector angle allow Mint to make decisions about when to slow down or stop for corners. Feed rate control allows the machine speed to be controlled by the operator using, for example, an analog input.

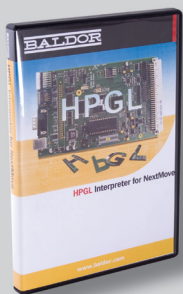
Mint – Power and Flexibility

Baldor's HPGL interpreter is written in Mint, demonstrating not only the power and flexibility of the programming language, but also providing a fully customized solution. The HPGL interpreter is available as Mint source and can be tailored to suit applications such as:

- › Routers with different Z depth
- › Pen plotters
- › Knife cutting with tangential knife control
- › Glue laying
- › Engraving

HPGL is supported on all NextMove controllers. The HPGL data is sent to Mint's serial buffer. This is supported on RS232/485, USB and PCI buses.

HPGL is available to download from the Baldor motion website www.baldormotion.com.



Comprehensive Library of Move Types

Mint provides a comprehensive library of motion types to suit many different application requirements. The most complex moves types are accessible through simple keywords. All of these move types can be initiated from a Mint program or via ActiveX®. NextMove motion controllers support single and multiple coordinate groups or alternatively, all axes can operate independently.

A library of typical applications are available to view at www.baldormotion.com/solutions.

Library of Moves



Speed Control



Positional (index) Moves



Interpolated Moves



Helical Interpolation



Tangential Knife



Splining



Electronic Gearbox & Clutch



Registration on the Fly



Electronic CAM



Flying Shear



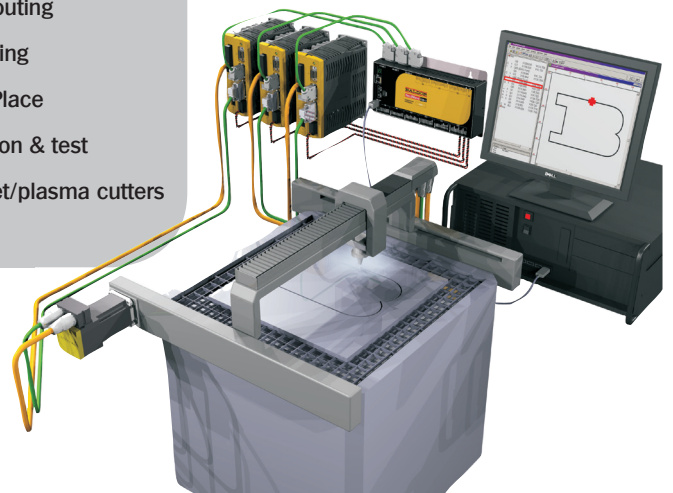
Virtual Axes

Multi Axis Interpolated Motion

Mint supports linear interpolation across all supported axes, circular interpolation across two and helical interpolation across three axes. Circular and linear moves can be blended together to achieve a smooth continuous motion along a complex path. Inter-vector angle control allows Mint to make decisions about sharp corners, i.e. whether to slow down or stop. An axis can even be configured as a tangential knife, following the outline profile of a shape. Baldor's MintNC and HPGL products make extensive use of Mint's move buffer and interpolation capabilities.

Applications

- › Sign cutting
- › Wood routing
- › Glue laying
- › Pick & Place
- › Inspection & test
- › Water jet/plasma cutters



Teach & Replay

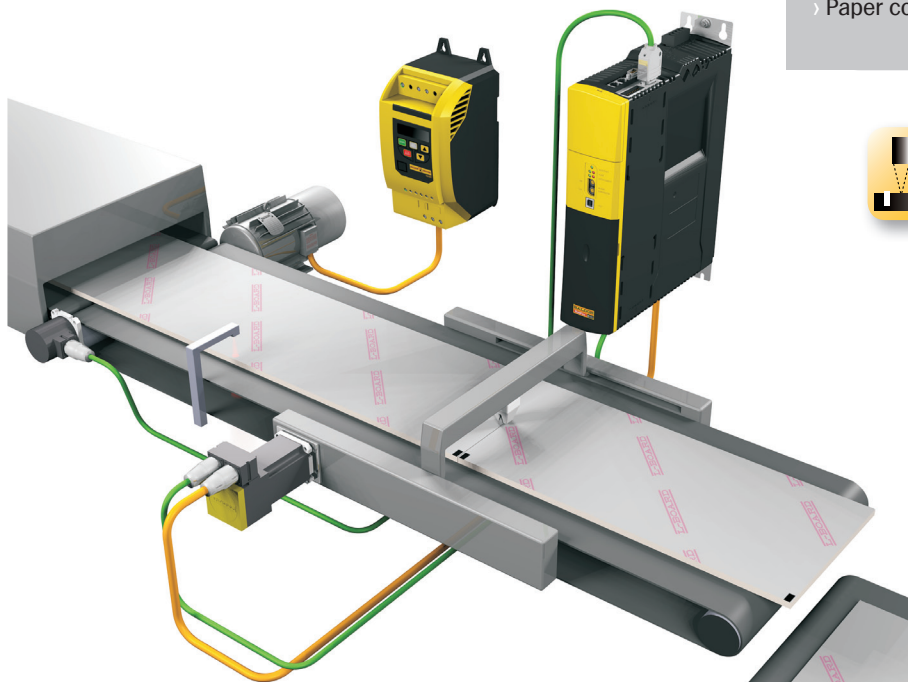
Mint's data array capabilities are ideal for teaching and replaying positions, such as those from a pick and place robot. Axis positions can be numerically programmed from Baldor's HMI panels or manually taught by jogging each axis to the desired position. Arrays provide an efficient way of storing a large number of position points and they offer the flexibility of editing, deleting or replaying a small segment of the data.

Indexing

Many applications require rapid incremental moves with minimal mechanical jerk, and control of processes such as cut, crimp, or seal. Mint can position an axis fast and accurately, using smooth velocity profile with precise jerk limitation. Mint's move buffers allow multiple moves to be loaded with different feed rates. Digital outputs can be loaded into the move buffer to ensure highly accurate synchronization of the move with the I/O logic. Final target position can be changed on the fly, for example on the basis of an input signal.

Applications

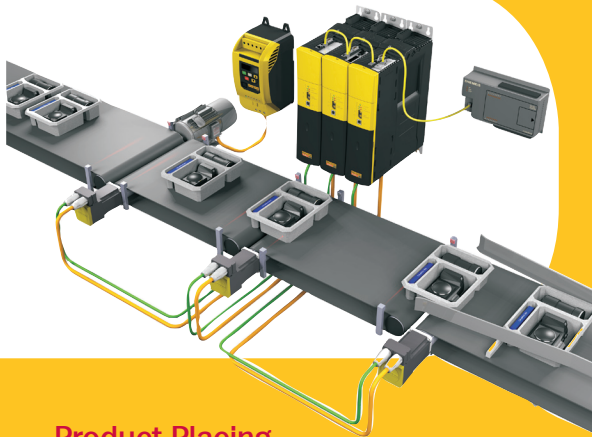
- › Press feeders
- › Wrapping machines
- › Cut to length
- › Labeling
- › Component alignment
- › Paper converting



Cut to Registration Example

Cut to length, press feeders, and label feeding are typical applications requiring a change in target position during the move without stopping and based on some form of reference signal. An example would be cutting pre-printed material to length, so that the printed information is always in the same location on the sheet of material. This is often referred to as "cut registration". In this example, printed material is fed along a conveyor line to a flying knife.

A sensor detects the pre-printed registration mark. This sensor is connected to the high speed Fast Input of the Baldor controller. This automatically latches the position of the conveyor encoder in $<1\mu\text{s}$ and triggers a section of code within a pre-defined Mint event. The captured position is used to calculate a new target position for the flying knife. In this case the new desired position will be set so that the material will always be cut in the correct place relative to the printed registration mark.

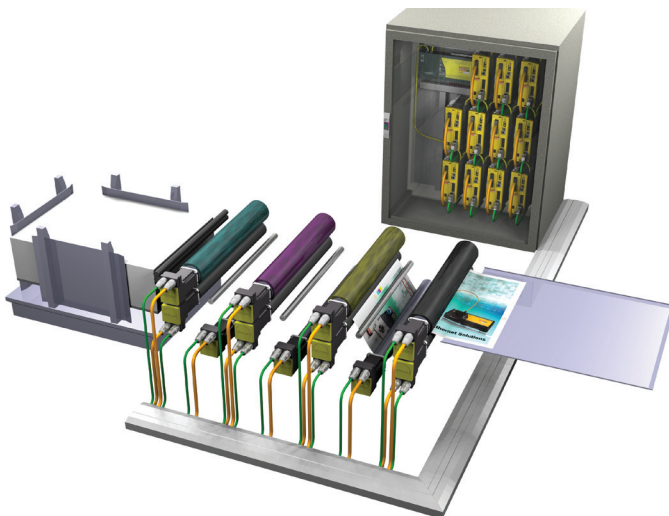


Product Placing

Packages arrive at irregular intervals from an input conveyor and must be aligned to the next part of the process. The packages are transferred to a correction conveyor which advances or retards the position of the package so that it enters a flight on the output conveyor. In the illustration, the position of the next available flight on the output conveyor is captured as the next package passes the sensor. Correction is calculated and initiated to ensure the package arrives in the flight accurately.

Applications

- › Line shaft replacement
- › Packaging machines
- › Printing machines
- › Paper and plastics
- › Steel processing
- › Bag making



Printing Example (Electronic Line Shaft)

Multi-color printing applications require precise synchronized lock of numerous roller axes, including, ink, impression and chiller rolls. Each print tower must lay down ink in accurate registration to the previous color. Mint's software gearbox features, fast position capture and position correction features provide an elegant solution to this type of application.

Software Gearbox

Advanced software gearbox and clutch functions enable two or more axes to be linked together in precise synchronization, replacing traditional mechanical linkages such as pulleys, belts, gearboxes and line shafts with precise but flexible electronic ratios. Ratio configurations can be changed in an instant for rapid production changes increasing productivity by reducing set-up time. There is less mechanical wear, and hence maintenance requirements. Transmission errors of mechanical linkages are removed resulting in higher precision and production quality.

Single or multiple axes can be position locked to a master axis in much the same way as a mechanical linkage would be used. The input shaft (Master) can be any position feedback encoder or a Mint virtual axis.

Software Clutch

Software clutches can be used to accelerate a following axis from standstill to match the speed of the Master speed at the defined gear ratio. The acceleration can be controlled over a defined distance on the Master machine to maintain precise position registration, eliminating the need for mechanical clutch systems.

Position Advance and Retard

In many applications it is necessary to correct for irregularities in processed materials or mechanical deficiencies: plastic film webs used for wrap packaging stretch and distort; cartons exiting a filling machine do so in random orientations and spacings; worn mechanical elements introduce backlash or slip into a line process; product slip and slide on a continuous conveyor line.

Such irregularities can be compensated by advancing or retarding the position of a controlled axis in relation to a measured product or axis position. Mint can be used to introduce a positive or negative positional adjustment, on top of the current speed of an axis, with controlled acceleration and differential speed. Speed reversal during correction can also be prevented.

Fast Position Registration

Mint products have multiple fast inputs which can latch axis positions to within 1µs. Software events for each input can be automatically executed in response to perform calculations and initiate any determined corrective motion, based on this sensed information. This is widely used in applications such as printing, packaging, labeling, inspection and test machines.

Electronic CAMS

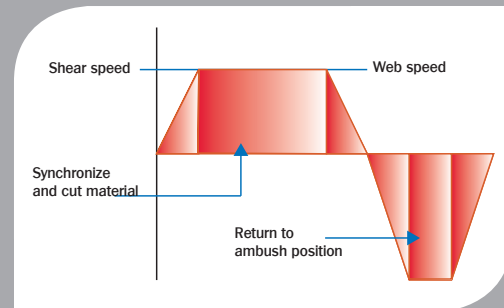
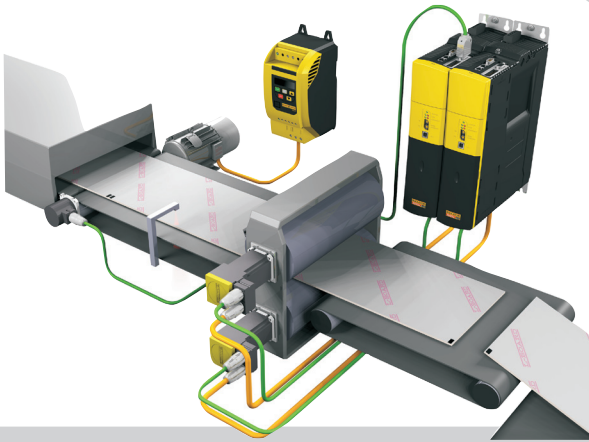
Software CAMs are more flexible and dynamic than mechanical versions. They do not suffer from CAM bounce, or mechanical wear. CAM profiles can be calculated in software or downloaded from CAD software packages as numeric data. Multiple CAM profiles can be stored and used as required. CAM stroke can be scaled dynamically, allowing a machine operator to adjust on the fly.



Flying Shear Motion

There are numerous applications where the motion of one axis must be either speed or position locked with another axis. In some instances the axis must perform incremental or absolute moves in position lock i.e. synchronous to the product or process. For example cutting lengths from a continuous moving material. Mint encompasses a host of motion functions to provide this capability.

Flying shear functions perform operations at accurate intervals on a moving product tracked by feedback from a measuring encoder. In a typical application, the cutter is mounted on a linear reciprocating stage, and is synchronized with the moving product for each cut. The acceleration, synchronization and deceleration phases can be specified and linked by software to the movement of the product, so accurate position reference is always maintained.



Applications

- › Flying shears/knives
- › Electronic clutch simulation
- › Labeling on the fly
- › Press feeding
- › Pick & place from a moving conveyor
- › Packaging applications
- › Cut to length



Labeling Machine Example

Labeling, flying shear cutters and flow wrapper applications require axis coordination to a moving web. In a labeling example, the label strip must accelerate to match the speed of the product onto which the label will be placed. It must remain locked at this speed while the label is applied. The Mint flying shear command achieves this by breaking down the move into discrete acceleration, constant speed and deceleration phases. Each phase is locked to the master position and will maintain position lock regardless of machine speed. Label position is registered to correct minor errors and product position is also registered to ensure accurate placement.



Baldor's Motion Solutions Catalogs

- BR1202-A** Motion Control Solutions
- BR1202-B** Mint® Software and Applications
- BR1202-C** NextMove Multi-Axis Motion Controllers
- BR1202-D** AC Servo Drives
- BR1202-E** AC Servo Motors
- BR1202-F** DC Servo Motors and Drives
- BR1202-G** Linear Motors and Stages
- BR1202-H** Motion Product Accessories
- BR1202-I** Real-Time Ethernet Motion Solutions

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