Real-Time Ethernet
Motion Solutions
Baldor’s e100 control products provide a cutting edge solution to machine control. The e100 family includes compact single phase drives, three phase AC drives with DC bus energy sharing and Baldor’s Mint® motion control technology. Combined with real-time Ethernet, they provide a platform for implementing a wide variety of machine control applications.

**e100 Key Features:**

- Multi-axis machine controllers
- Single and three phase drives solutions
- Programmable intelligent drive options
- Integrated real-time Ethernet
- TCP/IP operating modes for less time critical applications
- CANopen networking for low cost IO and system interfacing
- Single and three phase drive solutions
- DC shared drive systems for optimal energy efficiency
- Expansion options provide an adaptable architecture
- Fieldbus communication options to interface to 3rd party systems

**Integrated Real-Time Ethernet**

Ethernet is now the de facto standard for motion control in automation. With thousands of installed nodes, Ethernet Powerlink has led the way in real-time Ethernet since its beginnings in 2003.

Powerlink communication software is integrated within all of Baldor’s e100 products as standard, and is the core around which its flexibility and scalability is achieved.

e100 products can also operate in a non real-time mode using TCP/IP communications for less demanding applications.
Real-Time Ethernet
New Possibilities

As designers, engineers are constantly pushing technology to its limits, control solutions have been constrained by the performance of traditional fieldbus systems and device hardware, but the advent of real-time industrial Ethernet is expanding these boundaries, providing the platform for next generation machine development. Built on established standards such as IEEE802.3u, and solving the issue of determinism without compromising standard Ethernet message frames, Ethernet Powerlink is a technology which combines bandwidth, functionality, flexibility and scalability for innovative new system designs.

Plug & Play – Connect & Control
For drive control, Powerlink provides a digital replacement for traditional control signals, analog demands and feedback signals. Additionally, it absorbs and expands on the function of typical fieldbus devices and networks. The plug & play technology provides a truly networked solution allowing access to all devices from a single connection. As a result, installation costs and system design cycles are drastically reduced. At the same time performance is enhanced considerably by replacing the analog world with digital precision. This is clearly shown in the diagrams opposite.

Rapid Prototyping and Design.
Designers using Ethernet can quickly alter system configuration, passing real-time data instead of wired digital and analog signals. This improves performance and reliability, but also provides a rapid prototyping and development scheme for system control ideas to be tested and implemented, without hardware change.

Centralized or Decentralized
Ethernet is ideal for distributing technology around a machine, or groups of machines, and networking them together. I/O devices can be mounted next to sensors and valves, while drives can be local to the axes being controlled. This inherently allows designs to follow both centralized and decentralized approaches as required.
**Traditional System Architecture**

The image below represents a typical control system of one or more machines connected to a corporate network.

- Multiple controller architecture – costly, complex and results in extended development time
- Typically 4 – 8 axes per controller, sometimes expandable by hardware expansion at extra cost and panel space

**e100 Ethernet System Architecture**

The same system designed around Baldor’s NextMove e100 multi-axis motion controller and MicroFlex e100 AC servo drive shows significant system benefits.

- Fewer motion controllers
- Reduced cabling complexity
- Shorter machine build time
- Enhanced performance
- Improved reliability
- Flexible design scheme
- Scaleable system
- Total network visibility
- Centralized or decentralized
- CANopen expansion
- EPL DSP 402 positioning drives
Ethernet Powerlink
Real-Time Technology

Ethernet is the single technology replacing traditional drive interfaces, discrete signals, fieldbus communications and service interface in applications today. As the first real-time Ethernet solution in industry, Ethernet Powerlink (EPL) is a proven technology, working in real applications world wide. It embraces standard Ethernet technology and infrastructure, uses standard CAT5e shielded cabling and does not compromise standard Ethernet frames in order to achieve its results.

Flexible System Architecture
In addition to these characteristics Ethernet Powerlink is also well suited to both centralized platforms such as Baldor’s NextMove® e100 motion control products and distributed intelligent drives such as MotiFlex and MicroFlex e100.

Open Standard Driven by Industry
Ethernet Powerlink is a truly open technology independently managed by the Ethernet Powerlink Standardization Group.


Deterministic Ethernet – The Simple Solution
Ethernet Powerlink (EPL) achieves its performance by managing the device communication within allocated time slots in a defined sequence. This approach prevents collisions from ever occurring and ensures that data is exchanged precisely and on schedule.

Asynchronous communications, such as service data, takes place at the end of each cycle during a dedicated time segment.
Jitter Free Operation
Controlling devices such as servo drives requires precision in timing of information updates without significant deviation, otherwise artificial variations in demand torque, speed or position occur resulting in degraded performance. Powerlink meets this requirement by achieving less than 1µs variation (or jitter).

Network Security, by Design
Powerlink operates as a protected segment by design, and connects to a non-deterministic Ethernet network via a gateway/router device. This gateway acts as a defensive barrier against attacks by providing firewall security measures.

Total Network Visibility
By maintaining the integrity of standard Ethernet, Powerlink provides visibility of all devices on the network. This allows any device to be monitored, configured, diagnosed, or upgraded from any accessible network point.

Commissioning Made Easier
With e100 controllers all e100 devices on the Powerlink network can be accessed via the USB port of the e100 network manager, simplifying commissioning and machinery production.

Remote Access
A Powerlink system can be remotely accessed by means of an EPL router, providing the potential to service and maintain a system remotely via access technologies such as VPN.

Bandwidth Optimization - Multiplexing
Powerlink provides the freedom to prioritize nodes on the network by multiplexing within time slots. In the diagram below, nodes 1, 2 and 3 are critical and are updated every cycle. Nodes 4 through 11 share time slots. This allows fast cycle times to be maintained with optimized network bandwidth.
Real-time Ethernet
Superior Drive Control

One major aspect of Real-Time Ethernet is its advancement in control of drive technologies such as Servo and Vector drives. State of the art in terms of control network, Ethernet Powerlink also excels in replacing traditional drive interfaces and fieldbus systems.

The table below highlights some of the benefits over traditional control wiring.

<table>
<thead>
<tr>
<th>Installation</th>
<th>Traditional Servo system</th>
<th>Ethernet Powerlink</th>
<th>Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analog demand – 2 core + shield</td>
<td>Single Ethernet cable (per axis)</td>
<td>Reduced hardware requirements</td>
<td></td>
</tr>
<tr>
<td>Simulated Encoder – minimum 7 wires + shield</td>
<td></td>
<td>Less cabling / interconnections</td>
<td></td>
</tr>
<tr>
<td>Signal wires – Application dependant (typically enable and error)</td>
<td></td>
<td>No soldering or complex connectors</td>
<td></td>
</tr>
<tr>
<td>Fieldbus – Special purpose cable, and specific connectors</td>
<td></td>
<td>Single widely available cable type</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Elimination of traditional fieldbus systems</td>
<td></td>
</tr>
</tbody>
</table>

| Performance | | |
|-------------| | |
| Dependant on ADC and DAC resolutions and linearity | Pure digital demand | No ADC/DAC dependency |
| Signal sampling and conversion delays | | Consistent, repeatable operation |
| Prone to noise issues | | No drift, noise or offsets |
| Offsets/drift with temperature are often significant | | Higher resolution digital demand signals |
| | | Absolute precise demands |

| Communications | | |
|---------------| | |
| Additional fieldbus connection | 100Mbit communications network | No additional costs (integrated into Baldor products) |
| Usually additional cost for hardware per node and cable cost | TCP/IP and UDP/IP messaging structure is intact | Higher bandwidth than traditional Fieldbus systems |
| Fieldbus type typical bandwidth 1Mbit to 12Mbit | | Tighter integration |
| Limited device configuration / parameter access. | | Provides single point of connection for commissioning all devices |
| | | Improved diagnostics |
| | | Total network visibility (EPL uses standard Ethernet protocols TCP/IP and UDP) |
Powerlink Utilizes CANopen Standards
Powerlink utilizes the well established and proven CANopen application layer and device profiles (in accordance with EN 50325-4) and provides the perfect choice for CANopen users looking to migrate to real-time Ethernet.

DSP 402 Positioning Drive Profile

e100 drives are built on the CAN in Automation (CiA) DSP 402 profile for positioning drives, now part of IEC 61800-7. This results in a drive technology which is inherently more flexible and intelligent. Drives not only provide velocity or torque regulation, but can also perform positioning tasks such as point to point motion, and homing sequences. And all with minimal overhead on the motion controller.

Using DSP 402 for Auxiliary Axes
The NextMove e100 can coordinate up to 16 axes in precisely coupled motion such as vectors, arcs and helical paths. Additional DSP 402 drives can be configured to perform their own motion tasks, when commanded to do so. This vastly expands the number of axes that can be controlled. This is ideal for axes such as positioning guides, indexers, conveyors, tension rollers and many more.

Integrated Powerlink - CANopen Gateway Function

All e100 products, including drives, feature an integrated CANopen port and can manage a network of CANopen devices including DSP 401 I/O and DSP 406 Encoders.

As such, CANopen I/O can be connected to any convenient e100 drive, which will manage the I/O devices, making the I/O available as process data via Ethernet, back to to the machine controller. There can be multiple independent CANopen networks distributed around the machine managed by each drive, but controlled centrally from the motion controller.

CANopen Slice I/O
System I/O can be expanded at any drive or motion controller via the on board CANopen port. The DIN-rail mount I/O system is configured from a selection of digital and analog I/O slices to suite the application requirements. Special purpose slices are also available.
System Solutions
Multi-Axis Machine Control

Machine control systems, requiring up to 16 axes of interpolation, can be implemented using the NextMove e100 family of motion controllers. Additional MotiFlex drives fitted with Mint option modules can be used to provide more powerful programmable local axis control, coordinated and managed as part of the total system.

Advanced Multi-Axis Machine Controller
NextMove e100 can coordinate 16 axes of interpolated motion and command additional DSP 402 positioning drives via Powerlink. On board communications include, RS232/485 (selectable), USB, CANopen and Ethernet Powerlink or TCP/IP.

Mixed Technology Motion Control
In addition to Powerlink axes, NextMove e100 supports 3 axes of analog control with incremental encoder feedback and 4 stepper axes, providing a mixed technology platform. Analog axes can be servo, vector, inverter or servo - hydraulic valves for example. Encoder inputs can be used as line-shaft inputs and all analog outputs can be used for general purpose functions.

System Wide Access to Device Resources
Digital I/O, analog I/O and encoders of any drives can be ‘mapped’ to the NextMove e100 and are then usable within the application program, as if it were local hardware of the NextMove itself. This includes any CANopen I/O devices connected to the drives. This approach greatly simplifies software access to resources and allows use of available I/O of any device for almost any purpose.
Example 1 - Multi-axis DC Shared Solution with NextMove e100

- Powerful external machine controller which can profile up to 16 axes in tight coordinated motion and additional DSP 402 independent axes
- HMI connected to the NextMove on CANopen
- Additional distributed I/O on CANopen from any drive
- Additional line shaft encoders can be connected to drive or motion controller
- Additional MicroFlex e100 drive axes on Powerlink
- Up to 4 additional stepper axes and 3 analog controlled axes

NextMove e100 solution providing mixed technology solution including Ethernet Powerlink, CANopen, stepper and analog axes.

Tree, Star or Line Network Connection

Ethernet Powerlink supports flexible wiring structures, the simplest being line (daisy chain), but Tree, Star and mixed structures can be easily achieved for wiring convenience or network optimization using class 2 repeating hubs, as shown in example 4 below. Integrated 2 port hubs makes daisy chain connection extremely simple. Hubs are also recommended for systems with more than 10 devices.

Example 2 - Multi-axis system with NextMove e100 and intelligent MotiFlex Mint sub-system

- Powerful external machine controller which can profile up to 16 axes in tight coordinated motion and additional DSP 402 independent axes
- HMI connected on CANopen
- Distributed I/O on CANopen from any drive
- Additional line shaft encoders can be connected to MotiFlex drives or motion controller
- MicroFlex e100 drive axes on Powerlink
- Class 2 repeating hub, allows tree structure network cabling.
- Single axis Mint intelligent drive system as a controlled device on the Powerlink network

NextMove e100 distributed control solution, with drives and local slice I/O where required. Intelligent sub systems via Mint plug-in options on MotiFlex.
**Intelligent Drives**

**Mint® Machine Modules**

Mint machine modules transform MotiFlex e100 drives into powerful intelligent drive systems, assuming complete control of the drive on-board IO, communications, and networking features, eliminating the need for external controllers or PLCs.

**Features and Benefits**

- Ethernet Powerlink manager (multi-axis version) and controlled node operation
- Powerful Mint multitasking programming
- CANopen manager function (via drive on-board hardware)
- Non-volatile ram for data storage and Flash program storage
- Control of one analog axis using the encoder input and analog output, or use independently for other control functions
- Compact solution, requiring less panel space and wiring
- Elimination of external controller or PLC saving cost and reducing complexity

**Dual Axis Mint Module**

The dual axis Mint module provides a simple but powerful solution to applications requiring a fully programmable drive. The encoder input and analog output can be used to control a secondary axis such as an analog servo or vector drive. Alternatively the encoder input can be used as a line shaft encoder for electronic gearing motion. Combine this with options such as additional feedback or expanded I/O options to tailor the drive for your application.

Once installed, the Mint module will assume control of the CANopen port and Ethernet interface.

The Ethernet port can be used as a TCP/IP interface from a host PC using the Mint ActiveX tools. CANopen HMI and expanded system I/O can be added and distributed around the machine. It can also be a controlled node of a much larger Powerlink control system, receiving control information from NextMove e100 for example, and controlling a local intelligent subsystem.

**Example 3 - Dual Axis Solution with TCP/IP Ethernet Communications**

Options fitted:

1. Dual Axis Mint Module
2. Second feedback card for 'line shaft' following or dual loop feedback
3. HMI connected to the drive on CANopen
4. Additional distributed I/O managed on CANopen by the drive

![Diagram showing Dual Axis Mint Module configuration](image-url)
Advanced Multi-Axis Module

This option provides an extremely compact multi-axis motion control package. It can coordinate multiple axes via the MotiFlex Ethernet interface. MotiFlex option cards within the system become available to the Mint card as additional I/O, encoder channels, and fieldbus communication ports to other systems, such as PLCs. The drive CANopen port can be used extend system I/O or add an HMI and the USB port provides convenient configuration access using Mint Workbench.

MicroFlex e100 can also be controlled via Powerlink, providing all the same motor control capabilities in a smaller package for single and three phase supply 105 to 230VAC. in 3, 6 and 9 Amp (rms) continuous ratings.

Example 4 - Multi-axis Solution with Fieldbus Communications Module

Options fitted:
1. Multi-axis Mint Machine Module
2. Second feedback card for line-shaft following or dual loop control
3. Fieldbus interface
4. HMI connected to the first drive on CANopen
5. Additional distributed I/O on CANopen from any drive

Complete machine solution, with a fieldbus interface to provide data exchange with 3rd party systems such as PLC's. A range of fieldbus options are available. There are two high speed latch inputs on every drive that can be used for functions such as registration control.
TCP/IP, Simply Ethernet
Communicate and Control

Ethernet Powerlink is simply an addition to the underlying IP protocols (TCP and UDP) and behaviour of IEEE802.3 Ethernet. As such, all e100 products are able to operate as traditional Ethernet devices in applications that do not require the timing precision and deterministic operation of Ethernet Powerlink.

TCP/IP as a Control Interface
MicroFlex e100 and MotiFlex e100 drives have built in single axis positioning capability. This functionality can be controlled by TCP/IP communications to instruct axes to execute positional moves, homing sequences, jogs and much more. This can be used to implement multi-axis applications, where interpolated or tightly coordinated motion of multiple axes is not required and timing performance is not critical.

Mint ActiveX TCP/IP Support
TCP/IP communications from a Windows based PC, can easily be implemented using the Mint ActiveX tools, which hide the complexity of Ethernet messages and provide a simple interface of all the Mint commands and functions supported by e100 products including:

- Positional move commands
- Drive configuration
- Status and monitoring
- Firmware update and parameterization

Example 5 - TCP/IP Controlled e100 Drive System

1. Host Windows PC HMI / control software using Mint ActiveX TCP/IP communications interface
2. Ethernet 100Mbit Switches
3. Distributed I/O on CANopen from any drive can be controlled / monitored by Host PC
4. MotiFlex e100 drives can be AC powered or as a DC shared group
5. MicroFlex e100 drives

Multiple drives can be controlled via Ethernet in this way, each positioning an axis based on commands issued by the host. In this example a PC running Microsoft Windows operating system uses the Mint ActiveX tools to send motion commands. The entire Mint command set, drive parameters and functionality is available via the ActiveX components in this way.
NextMove e100 TCP/IP Operation

The Ethernet port can also be used for TCP/IP as a data exchange interface, providing information such as trajectory data, or simply recipe control information as data values to the Mint application.

The NextMove e100 can coordinate 3 analog and 4 stepper axes of interpolated motion. Combine this with numerous digital and analog IO, CANopen and serial communications and it provides a powerful stand-alone machine controller.

Ethernet RAW

NextMove e100 has a reserved port (5002) which provides serial port (VT100) emulation. This allows a simple means to create custom ASCII based messages to and from the NextMove controller via Ethernet. Combined with an appropriate Mint program, it can be used to interpret and construct Ethernet frames such as ModbusTCP IO messages.
Ethernet Powerlink Router

Remote Access and Control

- Ethernet access to Powerlink networks
- Integrated firewall security
- Network Address Translation (NAT)
- User configured IP addressing
- Compact DIN-rail mounting
- 24VDC operation
- Diagnostics LEDs

The EPL router provides convenient networking access to Baldor e100 systems utilizing the real-time Ethernet protocol, Ethernet Powerlink (EPL).

EPL routers operates in a similar manner to any normal Ethernet router on its non-real-time Ethernet port. A second port behaves in accordance to Ethernet Powerlink specification for EPL router devices.

The device manages Ethernet message exchanges between the nondeterministic factory Ethernet network and the real-time Ethernet network of the e100 system.

The EPL Router can be used to provide data access, such as process data exchange for visualization and control, or remote access for maintenance and diagnostics.

Technical Data

<table>
<thead>
<tr>
<th>Power</th>
<th>+24VDC, 150mA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Communication Ports</td>
<td>1 x TCP/IP, 1 x Ethernet Powerlink, IEEE802.3 compliant</td>
</tr>
<tr>
<td>Programming</td>
<td>Integrated HTML web interface</td>
</tr>
<tr>
<td>IP Address Configuration</td>
<td>EPL via hex rotary switches. TCP/IP side via HTML. 2 off switches for quick selection of user defined / default IP addresses</td>
</tr>
<tr>
<td>Mounting</td>
<td>Din Rail with integrated grounding</td>
</tr>
<tr>
<td>Connectors</td>
<td>RJ45 Ethernet ports. Two part screw terminals for power</td>
</tr>
<tr>
<td>Indicators</td>
<td>LED indicators for Power, Activity, Error, State (see user manual for more information)</td>
</tr>
<tr>
<td>Dimensions</td>
<td>H: 115 mm (4.53in) W: 23 mm (0.91in) D: 100 mm (3.94in)</td>
</tr>
<tr>
<td>Weight</td>
<td>0.116 Kg (4.1 oz)</td>
</tr>
<tr>
<td>Operating Temperature</td>
<td>0°C to +55°C (+32°F to +131°F)</td>
</tr>
</tbody>
</table>
Network Address Translation

Network Address Translation (NAT) allows public IP addresses to be configured for EPL devices via a simple HTML interface, allowing the EPL IP addresses to be represented by IP addresses within your network.

Network Security, by Design

Powerlink operates as a protected segment by design, and connects to a non-deterministic Ethernet network via a router device. This gateway acts as a defensive barrier against attacks by providing firewall security measures.

Total Network Visibility

By maintaining the integrity of standard Ethernet, Powerlink can provide visibility of any or all devices on the network. This allows any devices you choose, to be monitored, configured, diagnosed, or upgraded from any accessible network point.

Remote Access

A Powerlink system can be remotely accessed by means of a EPL router, providing the potential to service and maintain a system remotely via access technologies such as VPN.

Order Information

<table>
<thead>
<tr>
<th>Catalog Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>OPT036-501</td>
<td>Ethernet Powerlink Router</td>
</tr>
</tbody>
</table>

Block diagram showing a Powerlink protected network segment connected to a standard Ethernet network via an EPL router with integrated firewall.
Mint® – Machine Intelligent Programming Language

- 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
- Common programming interface for both NextMove and Baldor’s intelligent drives reduces the learning curve

Mint - Simply Advanced
With more than two decades in real world applications, Mint® fully embraces advanced programming functionality, such as multitasking, user-defined functions and procedures, structure data types and events. Presented in BASIC programming form, Mint makes it easy to develop modular programs that are easily understood, maintained and re-used across different applications and hardware platforms.

Mint Code Library
Mint’s Code Library makes code re-use even simpler by allowing code to be stored and used for other projects, one of the many features in the Mint WorkBench, designed to streamline your applications.

Mint - More than just Motion Control
Mint excels in motion control applications, but is equally accomplished at tasks such as:
- HMI interaction
- Serial and fieldbus communications
- I/O logic processing
- Complex mathematical functions
- Recipe data management

Multitasking Streamlines Program Flow
With many devices to control and machine functions to coordinate, it helps to be able to structure code into specific tasks and allocate resources dynamically at runtime. Multitasking is one of the key features of Mint. Numerous software tasks can be initiated, suspended, terminated and prioritized as required, to optimize machine performance.

Time Critical Functions Handled with Ease
Time critical functions, such as responding to the change of state of inputs are handled with ease by Mint EVENTS (interrupt handlers). Using events within Mint is more code efficient and faster than polling the state of an input or process variable. Events can be triggered for digital inputs, ‘move buffer low’, errors, position latches and more. Events handlers can also be installed in host PC applications using the Mint ActiveX tools.
Comprehensive Library of Motion Types

**Powerful Move Buffer Enables Continuous Motion and More**

All axes have a flexible and powerful move buffer system that allows multiple move commands to be loaded and then executed. Each entry in the move buffer can contain a unique identifier, independent Speed, Acceleration, Deceleration and Jerk settings. A configurable Move buffer low system event will trigger either a Mint routine or ActiveX service which you can customize to refill the buffers. Output transitions states, pulse durations and even dwell times can be loaded into the move buffer to ensure they are synchronous to the axes motion.

**Motion Profiles – Master/Follower**

Master follower applications can be geared off any of the encoder inputs, pulse/direction input, virtual axes or from an Ethernet Powerlink encoder.

- **Electronic Gearbox & Clutch**: Enables two or more shafts to be linked with a programmable ratio. Any axis can be geared to any other axis. Clutch allows precise start and stop distances when synchronizing.

- **Registration on the fly**: Offset moves can be superimposed on geared motion for position correction. This can be triggered from any of the registration inputs or within Mint.

- **Electronic CAM**: Replaces traditional mechanical CAMs with servo/vector/stepper motor and software programmable profiles (relative or absolute).

- **Flying Shear**: Allows position synchronization of a slave axis to a master, with defined acceleration and deceleration profiles - all linked by software to product movement.

- **Virtual Axes**: Allows motion to be executed without virtually. Can be used to test applications or as a virtual master for electronic line-shaft applications.

Refer to Catalog BR1202-B for further information on the Mint programming language.
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:

- 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

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:

- 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 Navigator

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

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

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 easily 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.

ActiveX Components

ActiveX® components are provided with Mint WorkBench as standard and form a powerful toolkit for developing PC based visualization, machine control and even OEM production tools. All of the functionality underlying the Mint WorkBench, is available to the user as ActiveX functions, such as ‘compile and download’, ‘firmware update’, oscilloscope data capture (graphing separate) as well as all Mint motion functions such as multi-axis motion commands, I/O operations, and much more.

ActiveX® is a registered trademark of Microsoft® Corporation.
Mint® WorkBench

Complete System Configuration

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. Once complex tasks are simplified through the use of experience based wizards and graphical interfaces.

**Mint Machine Center - System Design**

A graphical tree-view interface represents all connected devices within a Mint network or system. Devices can be added off-line and the design implemented later, or the system simply scanned and devices detected. This view is useful for visualizing all devices and to start commissioning. The *machine view* allows you to group devices into a logical order other than by address or type sequence of the network view. By allowing group names to be defined and each device given a logical name, you can create a custom view of the system which represents your application or machine configuration.

**Configure With Ease**

Making configuration changes to any device is simple. Click on the device icon within the network or application view, to launch the Mint WorkBench directly connected to that device via Mint redirection. Wizards, auto-tuning, and online help have been designed to guide you through the process of device configuration.

**Program Development and Debugging.**

Advanced debugging tools provide task status information and control, hover over variable watch, single step, breakpoint and watch-point features to make code development and testing simple.

**Automated Web Update via SupportMe™**

If you have web access, you can take advantage of the web updates feature. This will check for firmware updates for your specific motion controller or drive. The firmware files can be downloaded and installed into a maintained database on your PC, allowing you to use them as required.

**SupportMe™ Technical Support**

When faced with difficulty, Baldor’s SupportMe™ feature will gather a host of important information from the controller. An email will be generated automatically, offering you the option of attaching programs and additional files. This can be sent directly to your chosen local technical support contact, providing an efficient support mechanism to help you get back up and running. (Requires e-mail client).
Drives Set-up Wizard

Simple step by step guide
- Motor Selection
- Application limits
- Mode of operation
- Network configuration

Auto-tuning wizard including:
- User configured operation e.g. direction inhibit
- Feedback verification
- Automatic commutation test
- Load model identification
- Automatic adaptation of current speed and position control gain terms

Wizard Setup Minimizes Knowledge Requirement and Saves you Time.

Wizards have been designed to automate many tasks, reducing set up time and minimizing knowledge required by incorporating the knowledge of skilled technicians. These step-by-step guides automate processes such as network configuration, drive configuration, auto-tuning and more.

Detailed access to drive configuration is catered for by a parameter viewer which also provides useful tools for parameter file comparison, highlighting changes between files and changes from factory defaults.

Filters Eliminate Resonance

Advanced digital filtering techniques can be applied to reduce the effect of mechanical resonance on system performance.

The drive has two separate digital filters. Each can be adapted to specific frequencies as notch filters, or as low pass filters. Adapting the filters to eliminate or reduce the effects of resonance allow higher system gains and tighter control to be attained. This maximizes machine control bandwidth, without suffering from the increased resonance and performance degradation that would otherwise result.

Configuring these filters is aided by a simple filter design interface which, combined with the Mint WorkBench oscilloscope and FFT (Fast Fourier Transform) analysis, allows the user to test the axis open and closed loop frequency response. The resonant components can then be identified and filter designs tested for effectiveness.

Software Oscilloscope

- Multiple channels of display
- Cursor measurement
- Save/open/print functions
- Independent axes scaling
- Plot X against Y position
- Trigger and repeat capture modes
- FFT analysis

Parameter Viewer

- System and axes configuration on motion controllers
- View / monitor / edit / save and print parameter files
- Live or offline mode
- Multiple parameter file comparison
- Changed from default indication
- User configured parameter views

Digital Filter Designer

- Tools to combat mechanical resonance effects
- Integrated tests designed to identify problem frequencies
- FFT analysis built in to software oscilloscope
- Design tools to create digital filters
- Support for low pass and notch filter designs
- Fast Fourier Transform analysis highlights resonant frequencies.
NextMove e100
Real-time Ethernet Motion Controller

- Ethernet Powerlink + integrated hub
- 8, 12 or 16 axes of interpolated motion
- CANopen network manager
- RS232/485 and USB communications
- Integrated digital and analog I/O
- 4 stepper axes / 3 analog axes
- Multitasking Mint®
- ActiveX® Controls

The NextMove e100 builds on the proven NextMove controller family and now integrates management of a real-time Ethernet network. Drives, I/O devices, sensors, absolute encoders and more can be added to the Powerlink network and controlled from the Mint programming language. Ethernet greatly simplifies system design and installation and simultaneously expands the capabilities of the NextMove e100 as a machine control platform.

Interpolation on 16 Axes
NextMove e100 can perform interpolation on 16 axes, as either a single coordinate group or as multiple coordinate systems operating independently with their own scale factors and move buffers. Alternatively all 16 can operate as independent axes.

Add I/O, Encoders and More
A Powerlink network can contain many devices including, I/O, absolute encoders, gateways and DSP 402 positioning drives, such as the MicroFlex e100. DSP 402 axes provide simple point-to-point motion, homing sequences, jog control and torque demand functions. Example applications include guide axes, indexers, conveyors, tension rollers and more.
**TCP/IP Communications via ActiveX**

In addition to the deterministic mode of Ethernet Powerlink, the NextMove e100 can also operated in an open mode using TCP/IP messaging. This feature is supported by Baldor's Mint ActiveX tools, which can provide control of a network of drives from a Windows® based PC. In this mode the Ethernet interface acts as a standard TCP/IP network port.

**USB Interface with ActiveX Support**

An integrated USB interface provides a configuration and programming port. It allows access to the entire network from a single point, providing access to all Baldor devices connected to the Ethernet port of the controller. Mint ActiveX tools also allow use of the USB port for HMI or control purposes.

**Serial Interface for PLC, PC, HMI**

A user selectable RS485/RS232 serial port is available and accessible in Mint to create a simple interface to devices such as PLC's, text displays, printers etc. Users can access the serial port directly to implement their own protocols, or make use of a predefined simple ASCII protocol (Host Comms Protocol) to simplify the task of host communications.
### On-board Digital and Analog Interfaces

Integrated digital and analog I/O provide the facility for system interlocks and logic control normally afforded by an additional PLC. This I/O can equally be expanded via Ethernet or CANopen.

### Encoder Inputs and Fast Position Latch.

The servo control interfaces include three incremental TTL encoder channels which can also be used as additional position or velocity sensors. Alternatively, these can be used as master axes for synchronization applications. Four digital inputs can be used to latch the position of any of these encoders within 1µS and generate software events. This is ideal for registration based applications such as labeling and printing.

### Analog Drive Interfaces

Integrated hardware interfaces provide a means of utilizing existing drive technologies such as simple inverters, stepper drives and servo pneumatics controlled from the industry standard ±10V analog outputs and encoder feedback. NextMove e100 is perfectly matched to Baldor’s FlexDrive-II and MicroFlex™ range of servo drives, BSM servo and linear motor range for a complete servo control system.

### Open Loop / Stepper Control

Stepper axes can be controlled from any of the four onboard step and direction outputs. The stepper outputs can also be used to interface to Baldor’s FlexDrive-II or MicroFlex™ servo drives.

### Integrated Stepper Motor/Drive Technology

Baldor’s range of DSM integrated stepper motors/drivers are ideally suited for use with NextMove ESB/e100. Combining both a high torque stepper motor and microstepping drive in one compact integrated package, the DSM motor/driver combination requires only power and pulse/direction signals in order to operate.

### Technical Data

<table>
<thead>
<tr>
<th><strong>Number of Axes</strong></th>
<th>16 interpolated axes in single or multiple coordinate groups. Manage additional independent DSP 402 positioning Drives (non interpolated). Limit application dependant.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Axis Type</strong></td>
<td>Ethernet Powerlink (EPL) v2</td>
</tr>
<tr>
<td></td>
<td>3 closed loop axes +10V Interface with 5V RS422 incremental encoder inputs</td>
</tr>
<tr>
<td></td>
<td>4 open loop axes - Stepper Interface (Step &amp; Direction outputs) 5V differential line driver (5MHz)</td>
</tr>
<tr>
<td></td>
<td>or 5V Darlington open collector, single ended (500KHz max) selected by order option</td>
</tr>
<tr>
<td><strong>Powerlink Device Type Support</strong></td>
<td>EPL DSP 401 I/O devices for I/O expansion</td>
</tr>
<tr>
<td></td>
<td>EPL DSP 402 Positioning Drives such as MicroFlex e100</td>
</tr>
<tr>
<td></td>
<td>EPL Absolute Encoders</td>
</tr>
<tr>
<td></td>
<td>Manage up to 16 interpolated axes and additional DSP 402 axes</td>
</tr>
<tr>
<td></td>
<td>Contact Baldor for information on additional 3rd party products supported.</td>
</tr>
<tr>
<td><strong>Ethernet</strong></td>
<td>Specification: 100Mbit - IEEE802.3u compliant</td>
</tr>
<tr>
<td></td>
<td>Protocol: Ethernet Powerlink V2 (EPL) and IP protocols TCP/UDP</td>
</tr>
<tr>
<td></td>
<td>Interface: Integrated 2 port Hub for daisy chain connection</td>
</tr>
<tr>
<td></td>
<td>Cable type: CAT5e braided shielded cable, RJ45 connectors, Max 100m (330ft) each. Address: 2 off rotary HEX switches sets node and private device IP address</td>
</tr>
<tr>
<td><strong>On-Board Memory</strong></td>
<td>4MByte Flash for firmware and non-volatile program storage, 2MByte SRAM</td>
</tr>
<tr>
<td></td>
<td>32kByte FRAM for non-volatile variable data storage</td>
</tr>
<tr>
<td><strong>Digital Inputs</strong></td>
<td>20 opto-isolated 24VDC. 1mS sample rate. All inputs Interrupt capable. May be connected positive or negative common for use with NPN or PNP output transistors</td>
</tr>
<tr>
<td></td>
<td>Software configurable for limits (forward and reverse), home, stop and drive error</td>
</tr>
<tr>
<td><strong>Fast Inputs</strong></td>
<td>The first 4 of digital inputs can be configured for high speed position capture of axis position</td>
</tr>
<tr>
<td></td>
<td>1µsec capture time</td>
</tr>
</tbody>
</table>
Digital Outputs
- 12 opto-isolated 12-24VDC PNP
  - Software configurable for drive enable
  - 50mA typical per channel, 350mA max load for single channel up to 500mA total for 8 channels

Relay Output
- Single output for drive enable. Form C (SPDT) relay rated at 24V (150mA)
  - Common, normally open, normally closed. Fail safe operation - relay de-energized on an error
  - Function defined in Mint

Analog Outputs
- 3 outputs for drive command signals
  - ±10V, 12-bit resolution
    - 1 general purpose ±10V 12-bit output

Analog Inputs
- 2 differential ±10V operation 12 bit resolution

Serial Port
- User selectable RS485/232 via 9 pin Sub-D. Maximum baud rate 115,200
  - USB 1.1 2Mbit/sec supported on Windows 2000/XP. A 2m (6.6ft) cable is supplied

CANopen
- Single CAN port via standard 9 pin Sub-D connector
  - CANopen DS301
  - Support for CANopen DSP 401 I/O, DS406 encoders and other devices.
  - Master functionality for peer-to-peer communications with other Mint nodes
  - DSP 402 Positioning drives management

Power Requirements
- 24VDC ±10% : 50W

Environmental Limits
- Operating Temperature 0°C to 45°C (32°F to 113°F)
- Weight 0.85Kg (1.87 lbs)
- Dimensions L 262mm (10.3") : W 135mm (5.32") : H 45mm (1.77")

Programming
- Mint® - Multitasking Motion Basic
  - Windows 9X/NT/2000/XP/Vista 32bit via Mint ActiveX controls
  - Note: USB only supported on Windows 2000/XP/Vista 32bit
  - All Windows programming libraries supplied free of charge.

Catalog Number Description

NXE100-16xxDB
- NextMove e100 - Differential stepper output
  - xx = axis variant. 08, 12, 16

NXE100-16xxSB
- NextMove e100 - Single ended open collector step-per outputs for use with DSM integrated stepper motors

Note
MicroFlex e100
Compact AC Servo Drive

- Real-time Ethernet with integrated hub
- CiA DSP 402 Positioning on Powerlink or CANopen
- CANopen DSP 401 network manager for low cost I/O expansion
- USB port for service / PC control via ActiveX®
- Linear and rotary motor control
- Universal encoder interface
- 105 – 230 VAC 50/60Hz supply
- 3, 6 and 9 Amp versions with 200% peak capability

MicroFlex e100 is built on Baldor’s expertise in servo drive technology. The advanced capabilities of real-time Ethernet Powerlink provide superior performance, network integration and cost savings. MicroFlex e100 uses Space Vector Modulation (SVM) for superior motor control and efficiency. Numerous protection features are designed in for reliability and safety.

Auto-tuning of all Axis Gain Terms Made Easy.
Auto-tuning takes place on the drive itself, adapting the current controller, velocity and position loops for the axis. In addition, it verifies feedback device signals and cabling errors. Because the position loop is tuned on the drive itself, there is no tuning to do on the motion controller. This further simplifies system tuning with all control terms in the drive.
TCP/IP Communications via ActiveX

In addition to the deterministic mode of Powerlink, the MicroFlex e100 can also be commanded in an open mode using TCP/IP messages. This feature is supported by Baldor’s MintActiveX tools, which can provide control of a network of drives from a Windows based PC. In this mode the drives perform simple motion tasks such as point-to-point moves and homing sequences. Interpolated motion across axes is not supported in this mode.

Universal AC Power Supply for a Global Market

MicroFlex operates from a single or three phase supply, 105 to 230 VAC. The control electronics are maintained by an external customer supplied 24 VDC supply, in the event of main AC power removal, for typical safety schemes.
Universal Encoder Interface
A unique interface design provides support for leading encoder technology. Incremental encoders (with or without Hall-effect tracks), absolute single or multi-turn encoders such as BiSS, EnDat 2.1/2.2, Synchronous Serial Interface (SSI) and 1V Sin/Cos encoders, are all supported on a single platform. This ensures the capability to utilize high performance feedback devices for optimum precision, accuracy and smooth speed regulation.

Matched Performance™ Motors
Baldor designs and manufactures both the drives and the rotary and linear motors they control. We ensure that the motor and drive are matched to operate together with optimal performance, and provide trouble free installation. The Mint Workbench configuration tool has access to all Baldor motor data, simplifying drive configuration.

Digital I/O for Axis Functions
Digital inputs provide typical drive and motion signals such as home sensor limit switches, a hardware enable interlock. Two can be used for high speed registration, capturing position in typically less than 1µS. The outputs can be configured for functions such as motor brake control and drive ready.

This I/O is available to the NextMove e100 motion controller as though the I/O is local to the controller itself. Limit errors, for example, will call the Mint error handler on the NextMove e100. A position latch on the MicroFlex e100 drive will result in the position latch event being called within the Mint program on the NextMove e100. This greatly simplifies system expansion.

Technical Data

<table>
<thead>
<tr>
<th>Ethernet</th>
<th>Specification: 100Mbit - IEEE802.3u compliant</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Protocol: Ethernet Powerlink V2 (EPL) and IP protocols TCP/UDP</td>
</tr>
<tr>
<td></td>
<td>Interface: Integrated 2 port hub for daisy chain connection</td>
</tr>
<tr>
<td></td>
<td>Cable type: CAT5e Shielded cable, RJ45 connectors, Max 100m (330ft)</td>
</tr>
<tr>
<td></td>
<td>Address: 2 off rotary HEX switches sets node and IP address</td>
</tr>
<tr>
<td></td>
<td>Function: EPL /CiA DSP 402 Positioning Drive</td>
</tr>
<tr>
<td>USB</td>
<td>Configuration and diagnostics via Mint Workbench. ActiveX support for custom user interfaces.</td>
</tr>
<tr>
<td>CANopen</td>
<td>Isolated CAN port via standard 9 pin Sub-D connector. CANopen DS301 Manager of CANopen DSP 401 I/O devices and DSP 406 Encoder support when used with NextMove e100 products CANopen DSP 402 Positioning drive mode via CANopen (controlled device) and Ethernet Powerlink</td>
</tr>
<tr>
<td>Digital Inputs</td>
<td>4 off total - opto-isolated 24V, 1mS sample rate including the following functions: 1 reserved for drive hardware enable 2 inputs with high speed position latch - for registration applications. 1µS latency May be connected positive or negative common for use with NPN or PNP signals Software configured level/edge triggered and application functions e.g. HOME, LIMIT, STOP, LATCH</td>
</tr>
<tr>
<td>Digital Outputs</td>
<td>2 off total - opto-isolated 12-24VDC PNP. 50mA per channel, 100mA max load for single channel, 200mA Fuse level (self resetting) Software configured functions including Motor Brake control (requires external relay)</td>
</tr>
<tr>
<td>Indicators</td>
<td>1 off LED for drive status/health 2 off LEDs for Ethernet activity 2 off LEDs for CANopen activity</td>
</tr>
<tr>
<td>Control Supply</td>
<td>24 VDC ±10%: Nominal 1.5 Amp externally supplied. No current drawn with AC power applied</td>
</tr>
<tr>
<td>Operating Modes</td>
<td>CiA DS402 Profiled Torque (current), Profiled Velocity (speed), Profiled Position - including Homing, Incremental and absolute moves. Interpolated position mode with Mint motion controllers via Powerlink. Servo &amp; closed loop vector motor support</td>
</tr>
</tbody>
</table>
## Ordering Information

<table>
<thead>
<tr>
<th>Catalog Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>MFE230A003B</td>
<td>MicroFlex e100 AC Servo Drive 3 Amp continuous, 105-230VAC 50/60Hz</td>
</tr>
<tr>
<td>MFE230A006B</td>
<td>MicroFlex e100 AC Servo Drive 6 Amp continuous, 105-230VAC 50/60Hz</td>
</tr>
<tr>
<td>MFE230A009B</td>
<td>MicroFlex e100 AC Servo Drive 9 Amp continuous, 105-230VAC 50/60Hz</td>
</tr>
</tbody>
</table>

## Accessories

A range of accessories for MicroFlex e100 are available to make system integration easier. These include 24V power supplies, pre-made motor and Ethernet cables in different lengths, braking resistors, EMC filters and cooling fans. Full information on these accessories can be found in the Accessories brochure - BR1202-H.

### Diagram

[Diagram showing system components: Ethernet Port, USB Port, CAN Port, 150MHz DSP, FPGA, 1MByte SRAM, 4MByte Flash, 1MByte SRAM, 32KByte EEPROM, 1MByte SRAM, 4MByte Flash, Parameter Storage, Communications Processor, 2 Port Hub, Digital Out, Drive Enable, Digital In, 2 channels NPN/PNP opto-isolated 12-24V, 1 channel NPN/PNP opto-isolated 12-24V, 3 channels 12 high speed NPN/PNP opto-isolated 12-24V, ABZ Differential Hall tracks, EnDat, 1V Sin/Cosine.

### Table

<table>
<thead>
<tr>
<th>Type</th>
<th>MFE230A003B</th>
<th>MFE230A006B</th>
<th>MFE230A009B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power Requirements</td>
<td></td>
<td>1 or 3 Phase 105-230 VAC 50/60Hz</td>
<td></td>
</tr>
<tr>
<td>Current rating</td>
<td>3 Amp continuous, 6 Amp peak 3 seconds</td>
<td>6 Amp continuous, 12 Amp peak 3 seconds</td>
<td>9 Amp continuous, 18 Amp peak 3 seconds</td>
</tr>
<tr>
<td>Feedback Devices</td>
<td>Universal Encoder Interface, supporting: - SSI single and multi-turn absolute encoders - BISS single and multiturn absolute encoders - EnDat absolute encoders, (v2.1 and v2.2i) - Incremental encoders (with Hall effect sensors, 5V differential signals), - Hall sensor only for DC trapezoidal control - 1V Peak - Peak Sin/Cos analog encoders with onboard interpolation Additional devices supported by Feedback Option Cards - Resolver with simulated encoder output - Incremental encoders (with Hall effect sensors, 5V differential signals), Simulated encoder output. Refer to technical manual for full description of supported encoder types and manufacturer part numbers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Regenerative braking</td>
<td>Integrated IGBT output. An external regen resistor can be fitted if required</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Protection</td>
<td>DC bus over-voltage, DC bus under-voltage, Phase-Loss, Peak over-current, Motor short circuit, Over-temperature, I²T over current, hardware dead-time protection, motor thermal trip input, network failure modes.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dimensions and Weight</td>
<td>H: 180 mm (7.09&quot;) W: 79.6 mm (3.13&quot;) L: 157 mm (6.18&quot;), Weight 1.5 Kg (3.3 lbs.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operating Temperature Range</td>
<td>Temperature range 0°C to 45°C (50°F to 113°F) with derating to 55°C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shock / Vibration</td>
<td>10G Shock / 1G, 10-150Hz Vibration</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Altitude / Humidity</td>
<td>1000m (3300ft) nominal. Derate 1.1% /100m (per 330ft) above 1000m (3300ft). / Humidity - maximum 93% non condensing</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Features

- **Ethernet** Specification: 100Mbit - IEEE802.3u compliant
- **Protocol**: Ethernet Powerlink V2 (EPL) and IP protocols TCP/UDP
- **Interface**: Integrated 2 port hub for daisy chain connection
- **Cable type**: CAT5e Shielded cable, RJ45 connectors, Max 100m (330ft)
- **Address**: 2 off rotary HEX switches sets node and IP address
- **Function**: EPL /CiA DSP 402 Positioning Drive
- **USB**: Configuration and diagnostics via Mint Workbench. ActiveX support for custom user interfaces.
- **CANopen**: Isolated CAN port via standard 9 pin Sub-D connector. CANopen DS301 Manager of CANopen DSP 401 I/O devices and DSP 406 Encoder support when used with NextMove e100 products. CANopen DSP 402 Positioning drive mode via CANopen (controlled device) and Ethernet Powerlink
- **Digital Inputs**: 4 off total - opto-isolated 24V, 1mS sample rate including the following functions:
  - 1 reserved for drive hardware enable
  - 2 inputs with high speed position latch - for registration applications. <1µS latency
  - May be connected positive or negative common for use with NPN or PNP signals
  - Software configured level/edge triggered and application functions e.g. HOME, LIMIT, STOP, LATCH
- **Digital Outputs**: 2 off total - opto-isolated 12-24VDC PNP. 50mA per channel, 100mA max load for single channel, 200mA Fuse level (self resetting)
  - Software configured functions including Motor Brake control (requires external relay)
- **Indicators**: 1 off LED for drive status/health
  - 2 off LEDs for Ethernet activity
  - 2 off LEDs for CANopen activity

### Type

- **Type**: MFE230A003B
- **Power Requirements**: 1 or 3 Phase 105-230 VAC 50/60Hz
- **Current rating**: 3 Amp continuous, 6 Amp peak 3 seconds
- **Feedback Devices**: Universal Encoder Interface, supporting:- SSI single and multi-turn absolute encoders - BISS single and multiturn absolute encoders - EnDat absolute encoders (v2.1 and v2.2i) - Incremental encoders (with Hall effect sensors, 5V differential signals).
- **Regenerative braking**: Integrated IGBT output. An external regen resistor can be fitted if required.
- **Protection**: DC bus over-voltage, DC bus under-voltage, Phase-Loss, Peak over-current, Motor short circuit, Over-temperature, I²T over current, hardware dead-time protection, motor thermal trip input, network failure modes.
- **Dimensions and Weight**: H: 180 mm (7.09") W: 79.6 mm (3.13") L: 157 mm (6.18"), Weight 1.5 Kg (3.3 lbs.).
- **Operating Temperature Range**: Temperature range 0°C to 45°C (50°F to 113°F) with derating to 55°C
- **Shock / Vibration**: 10G Shock / 1G, 10-150Hz Vibration
- **Altitude / Humidity**: 1000m (3300ft) nominal. Derate 1.1% /100m (per 330ft) above 1000m (3300ft). / Humidity - maximum 93% non condensing

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### Diagram Features

- **Ethernet Port**: 100 Mbit/s ETHERNET Powerlink TCP/IP
- **USB Port**: USB 1.1 12 Mb/s
- **CAN Port**: 500 kbaud isolated CAN
- **150MHz DSP**: Processor
- **FPGA**: Universal Encoder Input
- **1MByte SRAM**: 4MByte SRAM
- **32KByte EEPROM**: Parameter Storage
- **Digital Out**: 2 channels NPN/PNP opto-isolated 12-24V
- **Drive Enable**: 1 channel NPN/PNP opto-isolated 12-24V
- **Digital In**: 3 channels 12 high speed NPN/PNP opto-isolated 12-24V
- **Universal Encoder Input**: ABZ Differential Hall tracks, EnDat, 1V Sin/Cosine
- **USB Port**: 1.1 Mbit/s, 12 Mbit/s
- **CAN Port**: 500 kBaud, isolated CAN
- **Communications Processor**: 3 channels (2 high speed)
- **NPN/PNP**: opto-isolated
- **12-24V**: 2 channels, NPN/PNP
- **opto-isolated**: 1 channel, PNP
- **opto-isolated**: 1 channel, NPN
- **USB Port**: 1.1 Mbit/s
- **CAN Port**: 500 kBaud
- **Parameter Storage**: 1MByte SRAM, 32KByte EEPROM
- **DSP FPGA**: 150MHz, 1MByte SRAM, 32KByte EEPROM, 315MHz DSP, 2 Port Hub
- **Communications Processor**: 1MByte SRAM, 4MByte FLASH, 315MHz DSP, 2 Port Hub
Real-Time Ethernet for advanced control

Universal AC operation 3 phase 180 to 528VAC (max) 50/60Hz

1.5 to 33.5 Amp in only two package sizes

Flexible overload ratings to match application

Servo and AC vector, software selectable

Rotary and linear motor control

Universal encoder input

Expansion slots for a flexible architecture

Intelligent Drive Systems
MotiFlex e100 drives can be expanded with a range of option modules to provide Fieldbus access, additional IO or feedback inputs.

Plug-in Mint controller modules create a powerful fully integrated intelligent drive based solution for machine control.

For more information on plug-in Mint machine modules, refer to page 12-13
MotiFlex™ e100
High Performance AC Servo Drive

- Real-time Ethernet with integrated hub
- CiA DSP 402 Positioning Drive Profile
- CANopen DSP 401 manager for expansion
- USB port for service / PC control via ActiveX®
- Linear and rotary motor control
- Universal encoder interface and Resolver Option
- Options for fieldbus, IO, programmable controllers
- Stand alone AC power and DC shared operation
- 180 – 528 VAC 50/60Hz supply
- 1.5 to 33.5A with flexible overload ratings
- Servo and AC closed loop vector control

MotiFlex e100 drives offers a broad range of application capabilities in a single platform and are designed to satisfy single axis stand-alone systems and multi-axis applications alike. This system flexibility, combined with servo, AC vector and linear motor control from the same hardware, and a wealth of expansion options, provides a platform for solutions in a wide range of applications.

### Technical Data

**Ethernet**
- Specification: 100Mbit - IEEE802.3u compliant
- Protocol: Ethernet Powerlink V2 (EPL) and IP protocols TCP/UDP
- Interface: Integrated 2 port hub for daisy chain connection
- Cable type: CAT5e Shielded cable, R45 connectors, Max 100m (330ft)
- Address: 2 off rotary HEX switches sets node and IP address
- Function: EPL/CiA DSP 402 Positioning Drive

**USB**
- Configuration and diagnostics via Mint Workbench. ActiveX support for custom user interfaces.

**CANopen**
- Isolated CAN port via standard 9 pin Sub-D connector. CANopen DS301 Manager of CANopen DSP 401 I/O devices and DSP 406 Encoder support when used with NextMove e100 products
- CANopen DSP 402 Positioning drive mode via CANopen (controlled device) and Ethernet Powerlink

**Digital Inputs**
- 4 off total - opto-isolated 24V, 1mS sample rate including the following functions:
  - 1 reserved for drive hardware enable
  - 2 inputs with high speed position latch - for registration applications, <1µS latency
  - May be connected positive or negative common for use with NPN or PNP signals
  - Software configured level/edge triggered and application functions e.g. HOME, LIMIT, STOP, LATCH

**Digital Outputs**
- 2 off total - opto-isolated 12-24VDC PNP.
  - 50mA per channel, 100mA max load for single channel, 200mA Fuse level (self resetting)
  - Software configured functions including Motor Brake control (requires external relay)

**Indicators**
- 1 off LED for drive status/health
- 2 off LEDs for Ethernet activity
- 2 off LEDs for CANopen activity

**Control Supply**
- 24 VDC ±10% : Nominal 1.5 Amp externally supplied. (No current drawn with AC power applied)

**Operating modes**
- CiA DS402 Profiled Torque (current), Profiled Velocity (speed), Profiled Position - including Homing, Incremental and absolute moves, Interpolated position mode with Mint motion controllers via Powerlink, Servo & closed loop vector motor support
Baldor reserves the right to change technical data.

Ethernet
- Specification: 100Mbit - IEEE802.3u compliant
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Digital Outputs
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Indicators
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- 2 off LEDs for CANopen activity

Control Supply
- 24 VDC ±10% : Nominal 1.5 Amp externally supplied. (No current drawn with AC power applied)

Operating modes
- CiA DS402 Profiled Torque (current), Profiled Velocity (speed), Profiled Position - including Homing, Incremental and absolute moves.
- Interpolated position mode with Mint motion controllers via Powerlink. Servo & closed loop vector motor support

Feedback Devices
- Universal Encoder Interface, supporting:
  - SSI single and multi-turn absolute encoders
  - BISS single and multturn absolute encoders
  - EnDat absolute encoders (v2.1 and v2.2)
  - Incremental encoders (with Hall effect sensors), 5V differential signals.
  - Hall sensor only for DC trapezoidal control
  - 1V Peak - Peak Sin/Cos analog encoders with onboard interpolation
- Additional devices supported by Feedback Option Cards
  - Resolver with simulated encoder output
  - Incremental encoders (with Hall effect sensors), 5V differential signals. Simulated encoder output.
- Refer to technical manual for full description of supported encoder types and manufacturer part numbers

Regenerative Braking
- Integrated IGBT output. An external regen resistor can be fitted if required

Protection
- DC bus over-voltage; DC bus under-voltage; Phase-Loss; Peak over-current; Motor short circuit; Over-temperature; I2t over current, hardware dead-time protection, motor thermal trip input, network failure modes.

Dimensions
- Size A: H: 350 mm (13.78") W: 79 mm (3.13") D: 260 mm (10.31")
- Size B: H: 350 mm (13.78") W: 129 mm (5.07") D: 260 mm (10.31")

Weight
- Size A: 1.9kg (4.2lb) to 5.8kg (12.8lb)
- Size B: 6.5kg (14.3lb)

Operating Temperature Range
- Temperature range 0˚C to 45˚C (32˚F to 113˚C) with derating to 55˚C

Shock \ Vibration
- 10G Shock \ 1G, 10-150Hz Vibration

Altitude
- 1000m (3300ft) nominal. Derate 1.1% /100m (per 330ft) above 1000m (3300ft)

Humidity
- Maximum 93% non condensing

PWM Switching Frequency

<table>
<thead>
<tr>
<th></th>
<th>4 kHz</th>
<th>8 kHz</th>
<th>16 kHz</th>
</tr>
</thead>
<tbody>
<tr>
<td>300%</td>
<td>2.75 (8.25A)</td>
<td>2.75 (8.25A)</td>
<td>2.75 (8.25A)</td>
</tr>
<tr>
<td>200%</td>
<td>4 (8A)</td>
<td>3 (6A)</td>
<td>3 (6A)</td>
</tr>
<tr>
<td>150%</td>
<td>5 (7.5A)</td>
<td>3.8 (5.7A)</td>
<td>3.8 (5.7A)</td>
</tr>
<tr>
<td>110%</td>
<td>5.5 (6.05A)</td>
<td>4.5 (4.95A)</td>
<td>4.5 (4.95A)</td>
</tr>
</tbody>
</table>

Optimize the Drive to the Application
Flexible Overload and PWM Selection

Each MotiFlex power rating can be optimized by choice of overload rating and PWM operating frequency to allow the drive to be adapted to the motor and application. For example an overload of 300% for 3 seconds for linear motor control or 150% for 30 seconds for vector motor control. All are easily software selected and the drive ratings adapt automatically to match these requirements.

1 Derating applies above 45˚C (113˚F) and above 1000m (3300ft)
Key Features

AC Power input - Plug-in Connector

Regen Braking Output - Plug-in Connector for External Brake Resistor

DC Bus Connection - Convenient Robust DC Link System
- Pre-made slot-in links
- Simple to install
- No proprietary backplanes required
- Screw fixed cover for additional safety
- Share regenerative energy
- Improves system efficiency
- Reduces the need for braking resistors

User I/O - Digital - Analog - 24V Back-up
- Drive enable input
- 2 fast inputs 1µS latency ideal for registration
- 1 additional input
- 2 digital outputs (e.g. motor brake control)
- +/-10V differential analog input
- 24V backup input to maintain communications and position feedback with convenient 24V / signal routing channel for neighboring drives

Motor Power - Labeled Plug-in Connector for Ease of Wiring

Motor Thermal Trip Input - Prevent Overheating of the Motor

Motor Feedback - Universal Encoder Interface
- Incremental encoders with/without Halls
- BISS and SSI single/multi-turn absolute encoders
- EnDat 2.1 / 2.2 absolute encoders
- 1V peak-peak SinCos encoders
- Resolver supported via plug-in option
- Dual feedback capability
- Master encoder (line shaft) functions such as electronic gearing and CAMS
**Ethernet Integrated** - **Real-Time Ethernet Powerlink**

- 2 port hub integrated - ease of connection
- Real-time Ethernet performance
- TCP/IP mode of operation (non real-time)
- 3rd party Powerlink products support
- Compatible with Baldor’s e100 solutions

**CANopen Integrated** - **Expand System I/O via DSP 401**

- CANopen network manager function
- CANopen - Ethernet gateway function
- DSP 402 positioning drive (as a controlled device)
- DSP 401 I/O manager function to expand the system I/O from any drive
- DSP 406 encoder support for position indication
- Electrically isolated CAN interface

**LED Status indication** - **Power - CANopen - Ethernet**

- Power / health status
- CANopen communications
- Ethernet communications
- Simple Ethernet node address selection
- USB interface for service local access
- Part number / serial number label, repeated for ease of reference

**2 Expansion Slots** - **Range of Plug-in Options**

- Modular approach to drive configuration
- Digital and analog I/O expansion
- Additional feedback devices
- Programmable Mint® motion controllers
- Fieldbus option including:
  - Profibus
  - DeviceNet
  - Modbus RTU
  - Profinet I/O
  - Ethernet/IP
  - ModbusTCP
- Safety functions in preparation
- For the latest options and availability please visit [www.baldormotion.com](http://www.baldormotion.com)
Flexible Solutions
Modular Enhancements

Modern machine design requires different solutions for each industry, application and even classes of machines within a product range. MotiFlex provides a platform which can be tailored to each application by use of modular design. Expansion and enhancement options can be fitted in the field to MotiFlex drives.

Dual Feedback and Line Shaft Encoders
Secondary feedback channels can be added to MotiFlex to provide dual feedback solutions for eliminating mechanical transmission errors. Alternatively they can be used to provide a convenient system source for encoders or resolvers. These can also be used in electronic line shaft applications, where drives in the system will electronically synchronize to an external source.

I/O expansion
System I/O can be optimized by adding digital or analog modules to one or more drives within a system. Where a few fast I/O are required the option modules provide a cost effective and compact route. For greater I/O count or distributed approaches, the integrated CANopen port can be used to manage CANopen DSP 401 I/O devices.

Fieldbus Modules
A range of plug-in fieldbus interfaces provide a simple approach to interfacing to other systems. The fieldbus option allows any Baldor e100 system to communicate with devices such as PLC’s, PC’s and embedded controllers. Recipe data, control interlocks and system status information can easily be exchanged. This is particularly useful for interfacing to existing machine sub systems or for OEM’s that must provide the end users PLC of choice, while maintaining a common motion platform.

Programmable Option Modules
The addition of the single axis Mint motion control card will convert the standard MotiFlex into a fully programmable multitasking intelligent drive.

The multi-axis Mint module will control a number of drives connected on Ethernet Powerlink as a self contained coordinated machine control system. This provides major savings on installation and component costs in the most compact package. See page 12-13 for more information.
MotiFlex has an integrated Universal Encoder Input (UEI) as standard. This supports incremental + Halls, SSI, EnDat 2.1/2.2 and Sin/Cos encoders. Additional feedback options can be fitted and used as motor commutation, position loop feedback (dual loop) or line shaft masters for system wide electronic gearing. The simulated encoder output on some options can be generated from the drives integrated encoder interface, and scaled to provide the required output resolution.

**Resolver + Simulated Output**

- 12/14 bit resolution, software selectable
- Single speed 2:1 transformation ratio
- Simulated incremental encoder output with scaled resolution to provide a custom count per revolution for external devices such as counters or PLCs

**Application notes**

- For applications where the motors are exposed to high shock and vibration, or higher operating temperatures
- Medium performance applications
- Dual feedback or electronic line shaft (gearing)
- Simulated output can represent resolver input or Drive’s integrated Universal Encoder Interface. Software selectable and scalable

**Incremental Encoder + Simulated Output**

- 5V RS422 differential signals + Halls
- 5VDC supply 200mA load for the encoder
- Voltage sense line, max supply voltage 7V
- Simulated incremental encoder output with scaled resolution to provide a custom count per revolution for external devices such as counters or PLCs

**Application notes**

- Medium to high performance applications. (Performance is encoder precision and resolution dependant)
- Simulated encoder output can selected from drives integrated encoder input or from the option card input
- This option can be used for motor commutation when a high performance encoder is required for other purposes and is connected to the integrated UEI

**Digital I/O Module**

- 6 inputs 12-30VDC operation
- 4 Outputs 12-28VDC (150 mA max)
- Sampling rate 1kHz
- Pluggable connection

**Application notes**

- Inputs are AC opto-coupled allowing for positive or common ground connection
- Outputs are protected via self resetting fuse rated at 200 mA
- Can be controlled by the machine controller via Ethernet Powerlink as system I/O, or used to expand the I/O count in combination with a Mint Machine Module
- Polled or Event based (interrupt) operation

**Analog I/O Module**

- 4 off 12 bit analog inputs +/- 10V
- Sampling rate 8kHz
- 4 off 12 bit analog outputs +/- 10V
- Update rate 8kHz
- Pluggable connection

**Application notes**

- Inputs can be used in differential or single-ended configuration
- Digital Gain, Offset, Dead-band, Hysteresis and filter time constant can be applied to all analog inputs
- Analog I/O can be accessed via the Ethernet Powerlink network and controlled by the machine controller as distributed I/O, or used to expand the drive I/O in combination with a Mint Machine Module.
Fieldbus Modules

Simple Plug-in Networking

Simple plug-in modules provide a powerful and consistent approach to fieldbus communications, providing data exchange gateway solutions, or drive control interfaces as required. A range of fieldbus types are available as simple modules which can be installed in the field.

A Consistent Motion Platform Approach

MotiFlex provides fieldbus connection to e100 control systems by routing data between the fieldbus and real-time Ethernet. Using this approach data can be easily exchanged between the application program on the Mint controller and any external device, such as a PLC.

OEMs designing for different geographic markets, are often faced with supporting multiple PLC platforms and their respective fieldbus of choice. Using MotiFlex fieldbus modules a standard motion control strategy using e100 products can be implemented, maintaining a single motion solution and simply interface to the PLC for control interlocks, visualisation and application data exchange.

Example 2 - Multi-Axis System with Fieldbus Interface to PLC or Other Device

1. Powerful external machine controller which can profile up to 16 axes in tight coordinated motion and additional DSP 402 independent axes
2. HMI connected on CANopen
3. Distributed I/O on CANopen from any drive
4. Additional line shaft encoders can be connected to MotiFlex drives or motion controller
5. MicroFlex e100 drive axes on Powerlink
6. PLC or other controller
7. Fieldbus module installed in one or more MotiFlex e100 drives to provide

Fieldbus modules used to application data exchange between a real-time Ethernet motion control system and a 3rd party device such as embedded controller or PLC.
Fieldbus Modules

Field fittable, plug-in modules
Physics and connectors match the relevant Fieldbus standard
Access to drive object dictionary
Powerlink to Fieldbus data exchange
Operation in top slot of MotiFlex e100

Application notes
- Fieldbus modules provide a means of application data exchange between the Baldor systems and other control systems. This provides a simple and consistent interface method independent of fieldbus type. Ideal for OEM’s designing machines with different end user systems to integrate with such as PLCs.
- Fieldbus functionality and performance varies with each module type and fieldbus specific features.
- Additional modules are in preparation Contact your sales office if your specific requirement is not listed.

<table>
<thead>
<tr>
<th>Fieldbus</th>
<th>Features</th>
</tr>
</thead>
</table>
| **Ethernet/IP** | › CIP Parameter Object Support  
› Explicit and implicit messaging  
› Transformer isolated Ethernet interface 10/100 Mbit/s full duplex |
| **PROFINET IO** | › PROFINET IO conformance class A  
› Transformer isolated interface 100 Mbit/s full duplex Ethernet |
| **Modbus/TCP** | › Coil/bit/register, single and multiple read/write access via process data  
› Transformer isolated interface 100 Mbit/s full duplex Ethernet |
| **EtherCAT** | › EtherCAT node- supporting CANopen PDO and SDO communication objects  
› 100 Mbit/s full duplex with dual RJ-45 connectors |
| **DeviceNet** | › CIP Parameter Object support  
› Explicit messaging support  
› Galvanically isolated interface with auto baud rate detection 125 - 500 kbit/s  
› Change-of-state / Cyclic I/O / Polled I/O, Bit-strobed I/O, Explicit messaging |
| **PROFIBUS DP** | › Profibus-DP/DPV1 slave  
› Additional acyclic parameter data  
› Supports master class 1 & class 2 access  
› Galvanically isolated Profibus interface with auto baud rate detection 9.6 kbit/s - 12 Mbit/s |
| **Modbus RTU** | › Modbus-RTU slave  
› Galvanically isolated Modbus RTU interface (RS-232/485) with baud rates 1.2 - 115.2 kbit/s |

Notes
- The fieldbus interface supports exchange of up to 64 process data values in each direction (read and write), dependant on system configuration and limitations of some specific networks. Refer to technical documentation for more details.
- For a fieldbus not listed please enquire with your local sales office or visit www.baldormotion.com
DC Shared Operation

Energy Efficient Design

As energy costs rise, efficiency of machine operation becomes an increasingly critical measure of modern machine design. Energy generated by axes during braking, or load driven operations is often wasted as heat in regeneration resistors. The simplest and most cost effective solution is allowing other drives to consume the energy. All MotiFlex drives include the ability to share DC energy as standard and more uniquely are able to provide power to other drives. Each MotiFlex drive can convert power from the AC supply to share with other drives, eliminating the need for separate power supplies.

Installation Cost Savings

MotiFlex DC shared systems reduce the number of line side components such as contactors, circuit breakers, fuses and cabling, reducing cost, simplifying design and inherently improving reliability through reduction of components and complexity.

The ability to power other drives eliminates the need for a separate DC power supply in many applications, further reducing system costs. And where required, a single regenerative resistor can be added to provide any occasional or safety margin power dissipation requirements.

Shared DC Bus Benefits

› Installation cost savings
› Fewer AC side components such as contactors, fuses or circuit breakers
› Less cabling, connectors, terminals, and other components
› Reduced design time
› Simplified build and reduced wiring time
› Lower component count and inventory
› Lower energy costs
› Reduced panel heating
› Reduced panel space
› Higher reliability through reduced complexity
› Improved ‘ride-through’ capability
› Shared energy reserve and braking capacity

Energy generated by any axis is absorbed and used by the system, reducing energy wasted as heat. The potential need for braking resistors is therefore greatly reduced.
Energy Savings for the Life of the Machine

Energy costs are rising and machine efficiency is now a key challenge for modern machine designers. A simple but effective DC shared bus scheme, means that the benefits of single AC supply system and the machine lifetime energy savings, can be employed in a greater number of applications. DC bus systems usually become cost effective for typically 5 axes or more. MotiFlex however, has been designed to offer cost effective DC sharing from 2 axes and above.

Intelligent DC Bus Pre-Charge Control

Inrush current can be problematic, causing troublesome fuse trips. This often leads to over sized fusing, contactors and cabling to compensate. Each MotiFlex drive features an intelligent pre-charge system. Powered from AC, in stand-alone operation, or as a shared DC system, the pre-charge is active in all drives. This reduces the peak charging currents preventing fuse failure and inherently reducing stress on capacitors, increasing the operational life of the drives.

Determining Power Requirements

The optimum method to analyzing the system power requirements is by developing a power flow analysis. This can be done by calculating power against time for each axis for a complete machine cycle. This will provide peak (overload) power usages, average power usage and any regenerative energy cycles for each axis. By summing these individual axis graphs it is then possible to determine the power supply requirement of continuous and overload requirements and sizing of regenerative braking resistors.
### DC Power Data

#### 415VAC 50/60Hz Operation

<table>
<thead>
<tr>
<th>Temperature</th>
<th>Power Supply Overload</th>
<th>MFE460A001</th>
<th>MFE460A003</th>
<th>MFE460A006</th>
<th>MFE460A010</th>
<th>MFE460A016</th>
</tr>
</thead>
<tbody>
<tr>
<td>45°C (113°F)</td>
<td>Continuous AC Supply Current (rms)</td>
<td>10A</td>
<td>14A</td>
<td>18A</td>
<td>20A</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Power Supply to DC Bus (continuous) (1)</td>
<td>5.8kW</td>
<td>8.05kW</td>
<td>10.35kW</td>
<td>11.5kW</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Power supply to DC Bus (Overload) (1)</td>
<td>9.6kW</td>
<td>12kW</td>
<td>16.6kW</td>
<td>20.2kW</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Motor Power Output (415v 0.7PF)</td>
<td>0.75kW</td>
<td>3kW</td>
<td>5.28kW</td>
<td>8kW</td>
<td></td>
</tr>
</tbody>
</table>

#### 55°C (131°F)

<table>
<thead>
<tr>
<th>AC Supply Current (rms)</th>
<th>MFE460A001</th>
<th>MFE460A003</th>
<th>MFE460A006</th>
<th>MFE460A010</th>
<th>MFE460A016</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.5A</td>
<td>8.4A</td>
<td>15A</td>
<td>17.5A</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Drive Current Ratings

<table>
<thead>
<tr>
<th>Size A Drives</th>
<th>MFE460A001B</th>
<th>MFE460A003B</th>
<th>MFE460A006B</th>
<th>MFE460A010B</th>
<th>MFE460A016B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overload Mode</td>
<td>PWM</td>
<td>Continuous</td>
<td>Overload</td>
<td>Continuous</td>
<td>Overload</td>
</tr>
<tr>
<td>300% for 3 Seconds</td>
<td>4kHz</td>
<td>1.15</td>
<td>2.75</td>
<td>8.25</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>8kHz</td>
<td>1.15</td>
<td>3.45</td>
<td>2.75</td>
<td>8.25</td>
</tr>
<tr>
<td></td>
<td>16kHz</td>
<td>1.15</td>
<td>3.45</td>
<td>2.7</td>
<td>8.1</td>
</tr>
<tr>
<td>200% for 3 Seconds</td>
<td>4kHz</td>
<td>1.75</td>
<td>4</td>
<td>8</td>
<td>7.5</td>
</tr>
<tr>
<td></td>
<td>8kHz</td>
<td>1.5</td>
<td>3</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>16kHz</td>
<td>1.5</td>
<td>3</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>150% for 60 Seconds</td>
<td>4kHz</td>
<td>2.2</td>
<td>5</td>
<td>7.5</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>8kHz</td>
<td>2</td>
<td>3</td>
<td>3.8</td>
<td>5.7</td>
</tr>
<tr>
<td></td>
<td>16kHz</td>
<td>2</td>
<td>3</td>
<td>3.8</td>
<td>5.7</td>
</tr>
<tr>
<td>110% for 60 Seconds</td>
<td>4kHz</td>
<td>3</td>
<td>5.5</td>
<td>6.05</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>8kHz</td>
<td>2.7</td>
<td>4.5</td>
<td>4.95</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>16kHz</td>
<td>2.7</td>
<td>4.5</td>
<td>4.95</td>
<td>5.5</td>
</tr>
</tbody>
</table>

### Notes
- Nominal drive ratings shown in red, are based on 200% overload at 45°C (113°F).
- Ratings shown are nominal based on 8kHz PWM with 200% overload unless otherwise stated refer to technical manual for complete rating information.
### Size B Drives

<table>
<thead>
<tr>
<th>PWM Mode</th>
<th>MFE460A021B</th>
<th>MFE460A026B</th>
<th>MFE460A033B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overload A</td>
<td>Overload A</td>
<td>Overload A</td>
<td>Overload A</td>
</tr>
<tr>
<td>300% for 3</td>
<td>17 51 20 60</td>
<td>24.5 73.5</td>
<td></td>
</tr>
<tr>
<td>5kHz</td>
<td>15 45 19 57</td>
<td>19 57</td>
<td></td>
</tr>
<tr>
<td>1kHz</td>
<td>10 30 12.5 27.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>200% for 3</td>
<td>24 48 29 58</td>
<td>33.5 67</td>
<td></td>
</tr>
<tr>
<td>5kHz</td>
<td>21 42 26 52</td>
<td>26 52</td>
<td></td>
</tr>
<tr>
<td>1kHz</td>
<td>14 28 12.5 25</td>
<td></td>
<td></td>
</tr>
<tr>
<td>150% for 6</td>
<td>25 37.5 29 43.5</td>
<td>33.5 50.25</td>
<td></td>
</tr>
<tr>
<td>5kHz</td>
<td>23 34.5 26 39</td>
<td>26 33</td>
<td></td>
</tr>
<tr>
<td>1kHz</td>
<td>14 21 12.5 18.75</td>
<td></td>
<td></td>
</tr>
<tr>
<td>110% for 6</td>
<td>25 27.5 29 31.9</td>
<td>33.5 36.85</td>
<td></td>
</tr>
<tr>
<td>5kHz</td>
<td>23 25.3 26 28.6</td>
<td>26 28.6</td>
<td></td>
</tr>
<tr>
<td>1kHz</td>
<td>15 16.5 12.5 13.75</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Notes
Nominal drive ratings shown in red, are based on 200% overload at 45°C (113°F).

### 415VAC 50/60Hz Operation

<table>
<thead>
<tr>
<th>Temperature</th>
<th>MFE460A021</th>
<th>MFE460A026</th>
<th>MFE460A033</th>
</tr>
</thead>
<tbody>
<tr>
<td>45°C (113°F)</td>
<td>Continuous AC Supply Current (rms) [3]</td>
<td>30A 26A</td>
<td>35A 28A</td>
</tr>
<tr>
<td></td>
<td>Power Supply to DC Bus (continuous) [4]</td>
<td>18.3kW 15.9kW</td>
<td>21.3kW 17.1kW</td>
</tr>
<tr>
<td></td>
<td>Power supply to DC Bus (Overload) [4]</td>
<td>36.6kW 23.8kW</td>
<td>42.7kW 25.6kW</td>
</tr>
<tr>
<td></td>
<td>Motor Power Output (415v 0.7PF)</td>
<td>10.5kW</td>
<td>13kW</td>
</tr>
</tbody>
</table>

#### Notes
Ratings shown are nominal based on 8kHz PWM with 200% overload unless otherwise stated refer to technical manual for complete rating information.

### Regeneration Resistor Ratings

<table>
<thead>
<tr>
<th>Drive Type</th>
<th>Size A</th>
<th>Size B</th>
</tr>
</thead>
<tbody>
<tr>
<td>MFE460A001B</td>
<td>MFE460A003B</td>
<td>MFE460A006B</td>
</tr>
<tr>
<td>MFE460A010B</td>
<td>MFE460A016B</td>
<td></td>
</tr>
<tr>
<td>MFE460A021B</td>
<td>MFE460A026B</td>
<td>MFE460A033B</td>
</tr>
</tbody>
</table>

#### Switching Thresholds
- 800VDC (on)
- 775VDC (off)

#### Switching Current (Max)
- 13.3A<sub>Pk</sub>
- 24.2A<sub>Pk</sub>
- 53.3A<sub>Pk</sub>

#### Resistance (1) (10% Duty)
- 60Ω
- 33Ω
- 15Ω

#### Resistance (2) (100% Duty)
- 150Ω
- 68Ω
- 60Ω

#### Peak Power (1) (10% Duty)
- 10.7kW
- 19.4kW
- 42.7kW

#### Rated Power (2) (100% Duty)
- 4.2kW
- 9.4kW
- 10.7kW

(1) 10% duty ratings are based on absolute minimum resistance value.
(2) For drives connected in DC bused shared operation, use the 100% duty rating and resistors.

### The rating information shown is provided as a guide for the nominal operating conditions of 45°C (113°F) on 415VAC supply. A detailed set of rating data can be found in the technical manuals. 55°C (131°F) derated information is also shown.

(3) The continuous AC current rating of size B drives is dependent on the drives overload operating mode (3 seconds or 60 seconds).

(4) Power supplied to the DC bus is dependent on AC supply voltage and current. Figures shown assume V<sub>supply</sub> 415VAC.
MotiFlex® e100 AC servo/vector drives with DC sharing capability, integrated Ethernet technology and modular expansion.

### Option Cards

<table>
<thead>
<tr>
<th>Catalog Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>OPT-MF-001</td>
<td>Analog I/O +/-10V 16bit 4 inputs / 4 outputs differential operation 1ms sampling rate</td>
</tr>
<tr>
<td>OPT-MF-005</td>
<td>Digital I/O 12-24V 6 digital inputs / 4 digital outputs</td>
</tr>
<tr>
<td>OPT-MF-011</td>
<td>Encoder 5V line receiver with Halls. Simulated encoder output with selectable encoder output ppr scaling</td>
</tr>
<tr>
<td>OPT-MF-013</td>
<td>Resolver input 12/14bit resolution. Simulated encoder output with selectable encoder output ppr scaling</td>
</tr>
</tbody>
</table>

Note: resolver option card must be fitted in the lower option slot.

### Programmable Options

<table>
<thead>
<tr>
<th>Catalog Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>OPT-MF-100</td>
<td>Dual axis (drive) control + 1 analog axis interface. Digital and analog I/O, 5V incremental encoder input.</td>
</tr>
<tr>
<td>OPT-MF-101</td>
<td>Multiaxis control 4 EPL axes + 1 analog axis interface. Digital and analog I/O, 5V incremental line receiver encoder input.</td>
</tr>
</tbody>
</table>

### Fieldbus Options

Fieldbus gateway modules provide a means to communicate between an e100 system and a 3rd party controller such as a PLC.

- **OPT-MF-030**: Fieldbus Carrier Card (required for all fieldbus options)
- **OPT-FB-001**: DeviceNet
- **OPT-FB-002**: Profinet DP
- **OPT-FB-003**: Modbus RTU
- **OPT-FB-004**: EthernetP
- **OPT-FB-005**: ModbusTCP
- **OPT-FB-006**: Profinet IO
- **OPT-FB-007**: CCLink

### DC Bus Bars

<table>
<thead>
<tr>
<th>Catalog Number</th>
<th>To Fit</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>OPT-MF-DC-A</td>
<td>Size A</td>
<td>Pack of 2 links for drives 1.5A to 16A</td>
</tr>
<tr>
<td>OPT-MF-DC-B</td>
<td>Size B</td>
<td>Pack of 2 links for drives 20A to 34A</td>
</tr>
</tbody>
</table>

### EMC Filters

<table>
<thead>
<tr>
<th>Catalog Number</th>
<th>Current rating rms</th>
<th>Voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>FI0035A00</td>
<td>8A</td>
<td>3 x 520VAC</td>
</tr>
<tr>
<td>FI0035A01</td>
<td>16A</td>
<td>3 x 520VAC</td>
</tr>
<tr>
<td>FI0035A02</td>
<td>25A</td>
<td>3 x 520VAC</td>
</tr>
<tr>
<td>FI0035A03</td>
<td>36A</td>
<td>3 x 520VAC</td>
</tr>
<tr>
<td>FI0035A04</td>
<td>50A</td>
<td>3 x 520VAC</td>
</tr>
<tr>
<td>FI0035A05</td>
<td>66A</td>
<td>3 x 520VAC</td>
</tr>
</tbody>
</table>

All filters meet EN61800-3 Drives Standard.

- **FI0014A00**: 16A Optional EMC Filter for 24V Supply

### Line Reactors

<table>
<thead>
<tr>
<th>Catalog Number</th>
<th>Inductance</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>LRAC000802</td>
<td>3mH</td>
<td>1.5A or 3A units operating stand alone on poor quality AC supply</td>
</tr>
<tr>
<td>LRAC02502</td>
<td>1.2mH</td>
<td>6A to 16A units operating stand alone on poor quality AC supply</td>
</tr>
<tr>
<td>LRAC03502</td>
<td>0.8mH</td>
<td>10.5A and 16A units DC shared systems</td>
</tr>
<tr>
<td>LRAC05502</td>
<td>0.5mH</td>
<td>21A, 26A and 33.5A units DC shared systems</td>
</tr>
</tbody>
</table>

Line reactors for DC shared systems or operation on poor quality AC supplies. Refer to the technical manual for more information.

### MotiFlex Braking Resistors

<table>
<thead>
<tr>
<th>Catalog Number</th>
<th>Rating</th>
<th>Single Drive</th>
<th>DC Shared or Duty x0.2</th>
<th>MotiFlex Cat Nr.</th>
</tr>
</thead>
<tbody>
<tr>
<td>RGJ160</td>
<td>100W</td>
<td>60 Ohm</td>
<td>150 Ohm</td>
<td>MFE460A001</td>
</tr>
<tr>
<td>RGJ260</td>
<td>200W</td>
<td>60 Ohm</td>
<td>150 Ohm</td>
<td>MFE460A003</td>
</tr>
<tr>
<td>RGJ360</td>
<td>300W</td>
<td>60 Ohm</td>
<td>150 Ohm</td>
<td>MFE460A006</td>
</tr>
<tr>
<td>RGJ1150</td>
<td>100W</td>
<td>150 Ohm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RGJ2150</td>
<td>200W</td>
<td>150 Ohm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RGJ3150</td>
<td>300W</td>
<td>150 Ohm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RGJ533</td>
<td>500W</td>
<td>33 Ohm</td>
<td>68 Ohm</td>
<td>MFE460A010</td>
</tr>
<tr>
<td>RGJ368</td>
<td>300W</td>
<td>68 Ohm</td>
<td></td>
<td>MFE460A016</td>
</tr>
<tr>
<td>RGJ515</td>
<td>500W</td>
<td>15 Ohm</td>
<td>60 Ohm</td>
<td>MFE460A021</td>
</tr>
<tr>
<td>RGJ360</td>
<td>300W</td>
<td>60 Ohm</td>
<td></td>
<td>MFE460A026</td>
</tr>
</tbody>
</table>

Refer to the technical manual for more detailed sizing information.

### Cable Management Brackets

<table>
<thead>
<tr>
<th>Catalog Number</th>
<th>To Fit Drive Size</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>OPT-CM-001</td>
<td>A / B</td>
<td>AC power / motor power brackets + clamps</td>
</tr>
<tr>
<td>OPT-CM-002</td>
<td>A</td>
<td>Signal and feedback bracket + cable clamps</td>
</tr>
<tr>
<td>OPT-CM-003</td>
<td>B</td>
<td>Signal and feedback bracket + cable clamps</td>
</tr>
</tbody>
</table>

Refer to the technical manual for more detailed sizing information.
System Cables

A range of cables, both pre-made and raw, are available. These include motor power cables, feedback cables and communication cables. Available in different lengths.

Further details can be found in the brochure BR1202-H

Programmable HMI Panels

Baldor’s programmable HMI range from simple text displays through to large touch screen panels.

» Text displays from 4x20 character displays to 8x40 with keyboard entry
» Touch screen displays from mono 3.8” to color TFT 12.1”

All displays are programmable with an easy to use Windows tools Refer to catalog BR1202-H for full information.
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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