



Conducting an Ensemble of Communication

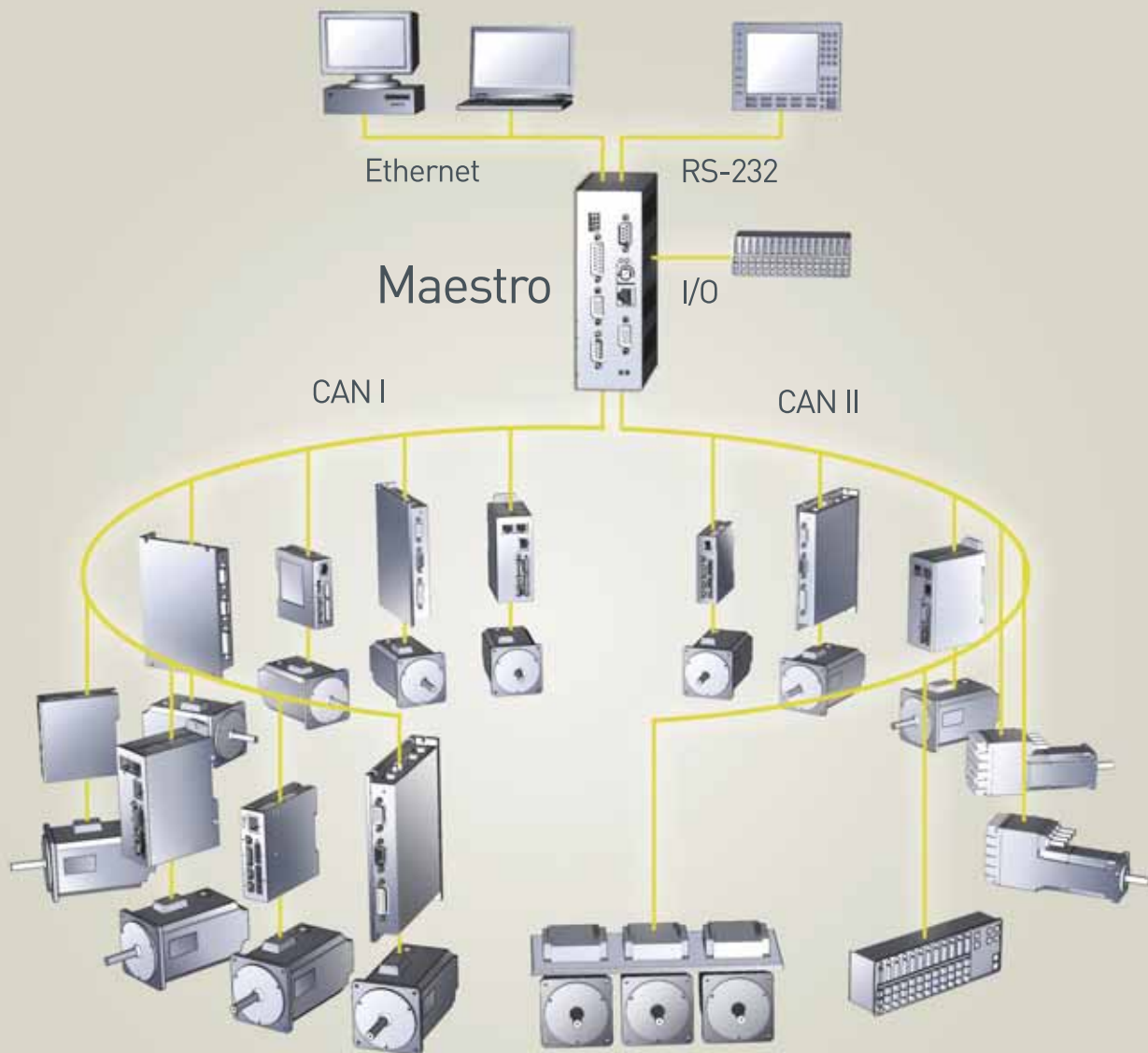
Elmo's approach to provide system-based solutions is delivered in two advanced network control products:

- **Maestro**- a sophisticated multi-axis motion controller capable of controlling the Elmo digital servo drives and CANopen-based nodes
- **Harp**- a powerful CAN-RS-232 gateway bridging communication between an RS-232 serial port and a CAN network

Maestro

Elmo's Maestro is a network-based, multi-axis motion controller that operates in conjunction with *SimpliQ* intelligent servo drives to provide a comprehensive system-based solution. The Maestro is based on an efficient and cost effective distributed motion control architecture to share the motion processing workload. It contains a rich feature set which combines sophisticated motion control, advanced communication and full programming capabilities.

Elmo Network-Based Motion Control

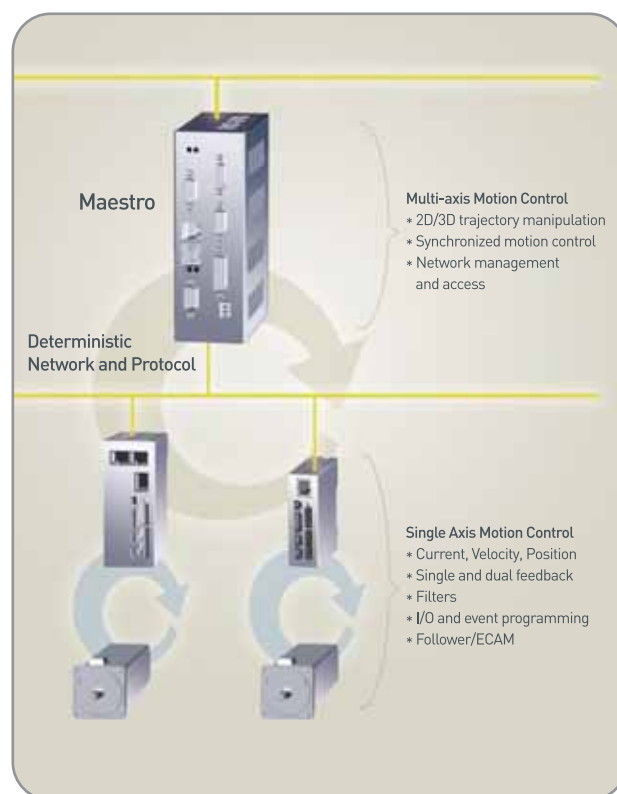


...Maestro

Axis Types	Axis: Elmo <i>SimplIQ</i> drives and CANopen DS-402 I/O: DS-401 Other: DS-301
Axis Functions	Full <i>SimplIQ</i> functions Motion Axis DS-402 supports
Number of Axes	Up to 80 axes per CAN bus 2-16 interpolated axes depending on bus load
CANopen Master	Heartbeat Network management, clock synchronization
I/O System	On-board isolated 8 DI, 8 DO, 4 AI CANopen DS-401
Feedback	Incremental encoder 20 mega-counts/sec
Interface	RS-232 Fast Ethernet (10/100 Mbps) 2 CAN buses
Execution Time	Interpolated points: 1 msec
Protocols	CANopen: DS-301, DS-305, DS-401, DS-402 Ethernet: Telnet, HTTP, FTP Ethernet/IP, ModBusTCP, RS232, ModBusRS232
Setup & Diagnostics	Direct drive access for tuning and setup Single and multi-axis recording Event driven error detection and comprehensive status/error codes Dynamic and Static IP address
Programming	Automated network configuration Elmo extended <i>SimplIQ</i> language
Operating System	Real-Time OS with Elmo's <i>SimplIQ</i> Kernel
Hardware	Stand-alone
Boot Up Time	30 sec
Connectivity	Variable access via Maestro API
Power Supply	24 VDC
Processor	300 MHz, Pentium compatible 16 bit ISA (PC104 standard)
Memory	64 MB internal flash 64 MB RAM (both expandable to 128 MB)
Diagnostic LEDs	Power, LAN speed, LAN activity
Dimensions	153 mm X 107 mm X 51 mm
Weight	400 gm (14 oz)
Operating Temp	0°C ~ 40°C

Distributed Motion Control Architecture

The Maestro's distributed motion control architecture enables allocation of the workload between the controller and the *SimplIQ* intelligent digital servo drives. Within this architectural framework, the Maestro's role is primarily a managerial one with responsibilities that include network management and access, motion control synchronization and trajectory manipulation. The servo drives are responsible for the servo loops (current, velocity, position) with single or dual feedbacks, deployment of local filters, local programming and execution as well as the other functions listed in the diagram to the left.



Implementation of the Maestro provides numerous advantages including:

- **Load balancing** on the system by distributing the intelligence between the controller and the intelligent drives
- **Flexibility** to add up to 80 drives on a single bus with only a simple Maestro re-configuration
- **Reliability** by using digital command signals on a real-time deterministic networking
- **Comprehensive diagnostics** of the network and individual drives
- **Cost effectiveness** by reducing expenses on wiring and space requirements, and offering a simple and dependable solution
- **Reduced cost of ownership** by eliminating the need for dedicated motor, drive and controller

Maestro Functionality

The Maestro offers rich functionality to provide a complete and flexible network management solution.

CAN Network Master

- Enables network configuration
- Recognizes existing CAN devices
- Maps CAN devices according to working mode
- Sends and receives CAN messages using standard CANopen communication objects
- Processes CAN Emergency messages
- Provides heartbeat control
- Synchronizes the clock via a SYNC / Timestamp mechanism
- Communicates with CAN devices using CANopen protocols DS301, DS305, DS401 and DS402
- Network management

Motion Synchronization

- Sends commands to motion objects simultaneously
- Synchronizes start and stop motion
- Monitors motion complete and drives events by mechanism callback function
- Sends notification messages to external host
- Contains a motion library which:
 - Creates motion trajectories for 1, 2, 2.5 dimensions
 - Resolves geometric and kinematical problems
 - Uses the Maestro proprietary program language to create PVT trajectories
 - Builds trajectories from motion primitives such as line, circle arc, polyline and spline
 - Inserts chamfering and corner rounding blocks automatically according to user definition

Host Communication

- Communicates with host applications via:
 - Ethernet TCP/IP
 - Communication with PLC by Ethernet/IP and ModBus (TCP/RS232)
 - RS-232
- Carries out processes such as:
 - Maestro interpreter command processing
 - Maintenance and file download/upload
 - Status requests and debugging user program
 - Direct-axis interpreter command processing gateway, "transparent path" to any drive

User Programs

- Behaves as a fully programmable motion controller
- Enables multi-axis programming
- Multi-program execution
- Offers a simple programming language with syntax based on *SimplIQ* language

Harp

Elmo's Harp is a CAN-RS232 gateway based on Elmo's *SimplIQ* .core. The gateway simplifies the communication between RS232 serial port and a CAN network. The Harp enables transferring data unobtrusively from one method to another via a simple communication protocol. Data integrity is checked using checksum. Typical applications use the Harp for setting motion set point, monitor motion status and inquiring faults details from the drives. Being a general gateway the Harp supports *SimplIQ* drive as well as any other CAN node, independent from specific protocol. We offer a DLL that can ease the integration from the PC to the Harp. A demo application is available as well.

