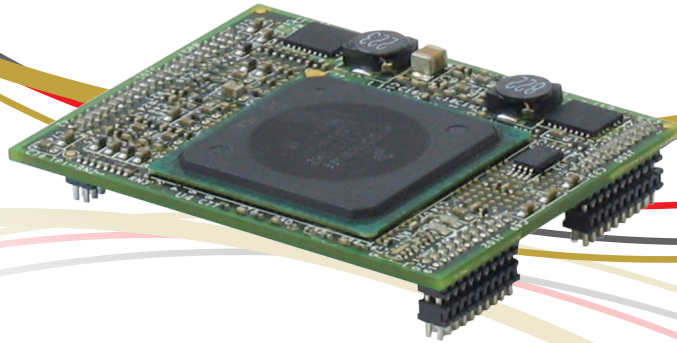


Elmo's **Gold** Line  
Our Best Ever Motion Control Solution



# The **Gold** Lion

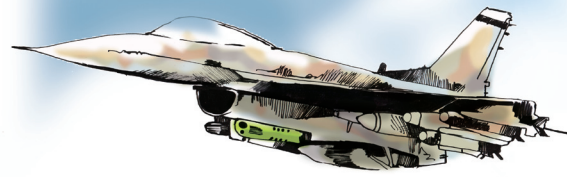
**The Ultimate Motion  
Control Solution for Military  
Applications**



Motion Control Solutions Made Small, Smart & Simple

# The Gold Lion

## Top level Multi-Axis Motion Controller



### Overview

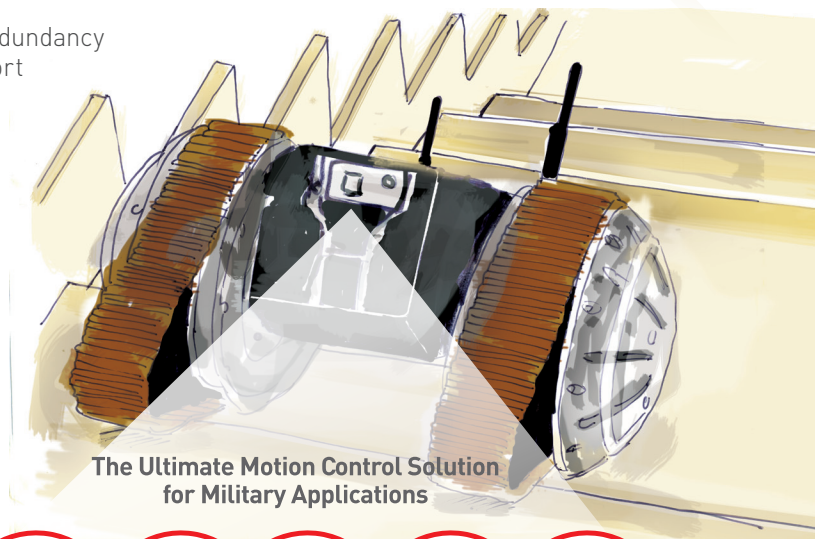
The Gold Lion is a complementary new member of Elmo's ExtrlQ product suite and expands Elmo's offering to a complete ready-to-use military motion control application.

The Gold Lion is a network-based, multi-axis motion controller that operates in conjunction with Elmo's senior ExtrlQ Line to provide the most comprehensive and advanced control system that is verified and qualified to operate in extreme environmental conditions.

The Gold Lion is based on the most advanced, easy to use and cost effective distributed motion control architecture which enables the motion processing tasks to be shared. It contains a rich feature set that combines sophisticated motion control and advanced communications with full programming capabilities. The Gold Lion uses standard protocols over its various communications channels (Ethernet, EtherCAT, CAN and USB), combined with IEC and C programming, and the PLCopen motion interface.

### Gold Lion Highlights

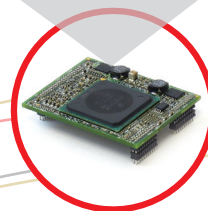
- Top level multi-axis motion controller
- Upper level (host) communications and protocols:
  - Ethernet, TCP/IP, UDP (Fast Binary Protocols, Modbus, Ethernet/IP, Telnet, FTP, HTTP)
  - USB 2.0
- EtherCAT master for distributed networking, with redundancy capabilities and distributed clock management support
- CANopen master distributed networking
- Controls up to 100 axes simultaneously
- Distributed intelligence: tasks are split between the Gold Lion and the ExtrlQ servo drives
  - Significant increase in the motion system's computation power and performance
  - Simpler high-level motion control interfaces, using the PLCopen standard
  - Faster and better motor control, improved event response times
  - Releases the Gold Lion's resources for the machine's synchronized motion control
  - Reduces the communication load
- The protocol implementation allows nodes to be easily added, removed and modified
- CANopen communication protocols: DS 301, DS 305, DS 401, DS 402
- Rich, high-level, multi-axis programming environment with a large amount of memory:
  - Native C programming using the PLCopen for Motion API
  - IEC 61131-3, PLCopen
- Ready-for-use application program templates for common automation applications
- Advanced data recording and live scope features for single and multiple axes
- Network statistics for diagnostics



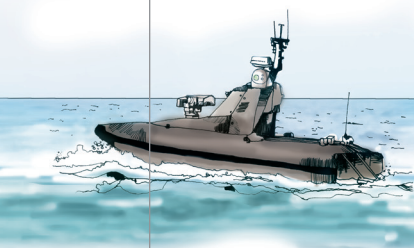
The Ultimate Motion Control Solution for Military Applications



5 x Hornet Digital Servo Drives



Gold Lion Multi-axis Motion Controller



## Gold Lion Environmental Conditions

<b>Ambient Temperature Range</b>	Non-operating conditions	-50 °C ~ 100 °C (-58 °F ~ 212 °F)	
	Operating conditions	-40 °C ~ 71 °C (-40 °F ~ 160 °F)	
<b>Temperature Shock</b>	Non-operating conditions	-40 °C ~ 71 °C (-40 °F ~ 160 °F) within 3 minutes	
<b>Altitude</b>	Non-operating conditions	Unlimited	
	Operating conditions	-400 to 150,000 m (-1,000 to 510,000 ft)	
<b>Relative Humidity</b>	Non-operating conditions	Up to 95% relative humidity non-condensing at 35 °C (95 °F)	
	Operating conditions	Up to 95% relative humidity non-condensing at 25 °C (77 °F), up to 90% relative humidity non-condensing at 42 °C (108 °F)	
<b>Vibration</b>	Operating conditions	20 Hz ~ 2000 Hz, 14.6 g	
<b>Mechanical Shock</b>	Non-operating conditions	±40 g	Half sine, 11 ms
	Operating conditions	±20 g	

## Distributed Motion Control Architecture

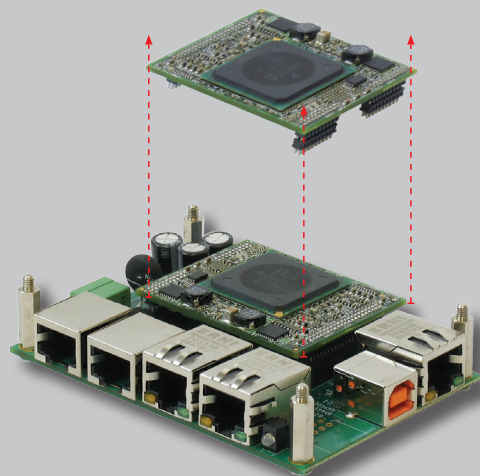
The Gold Lion's distributed motion control architecture lends itself to an intelligent and modular design of the overall motion control system, enabling optimal selection of the servo drive for each axis. When coupled with Elmo's ExtriQ Line network drives, the implementation of the overall motion system is extremely efficient. The intelligent servo drives execute the highly demanding local position, velocity, current and vector real-time control algorithms, and they also handle the local axis and I/O sequences using the drive's programming capabilities. Together with a wide variety of special functions and features, Elmo's drives have very high axis level performance.

The Gold Lion is a state-of-the-art, multi-axis motion controller. Its role is to supervise and synchronize the operation of the overall machine axes and I/Os. Using IEC-61131-3 or C programming, as well as a complete ready-to-use API for PLCopen functions, EtherCAT (or CANopen) master functionality and a wide variety of program templates for common applications, the user can easily create programs for machine control and NC axis synchronization. With up to 100 axes in the system and up to 16 axes in synchronized motion as well as a cycle time as low as 500 µs and 1 µs accuracy of the overall system distributed clock, the Gold Lion meets the needs of your application.

The Gold Lion is equipped with Ethernet and USB communication channels to communicate as well as the host computer, PLC or HMI, and supports standard communication protocols such as Modbus, Telnet, FTP and Ethernet/IP.



## Gold Lion Hardware Options



### Stand-alone Panel Mount

Ready-to-use military solution. With a DC power supply and communication cables, the **Gold Lion** is ready to control your system.

### Embedded

Elmo uniquely provides an option to use the **Gold Lion** core for embedded applications. This ensures minimal space/weight and allows tight integration. The **Embedded Gold line** is provided with support and guidelines for integration onto the application's board.

### Stand-alone Board Level

For space saving applications, the **Gold Lion** can be supplied without its enclosure and metal base. Power and communication cables are all that are needed to start working.

# Gold Lion Functionality

## Operating System

- Linux, with Elmo's RT extension for real-time motion control support.

## Number of Axes

- Up to 100 axes, allowing the following types of motion: mixed single axis, multiple axes and coordinated axes.

## Axis Types

- Intelligent servo drives (Elmo) support the ExtriQ Line.
- Operates in Numeric Control (NC, real-time master synchronization) and non-NC modes.
- Standard DS 402 drives for CANopen, and DS 402 CoE for EtherCAT.

## Control System Update Rate and Jitter

- EtherCAT
  - Cycle Update Rate: 500  $\mu$ s (up to 16 axes can be updated simultaneously at a rate of 500  $\mu$ s).
  - Drive Cycle Clock Jitter: < 1  $\mu$ s, based on Master Distributed Clock support, for the full network.
- CAN
  - Cycle Update Rate: 1 ms (CAN physical network limitations only)
  - Cycle Jitter: < 10  $\mu$ s for CAN Sync message initiation (actual jitter dependent on the CAN network's physical limitations).

## Supported Motion Modes and Interfaces

- The Gold Lion motion interfaces use the PLCopen standard.
- 64 bit, real-time, double precision profile calculations, allowing full on-the-fly control over speed, acceleration, deceleration and jerk.
- Complex motion schemes, including look-ahead optimizing of trajectory speed calculations for complex vector motions.
- Memory for 1,000 function blocks (a buffer for 1,000 motion segments). Beyond this the buffer is cyclic, so there is no practical limit on the buffer size.

## Motion Programming and Debugging

- Native C programming, running on target. Compiling and debugging. Supplied with the PLCopen Motion Library API.
- IEC 61131-3 with the PLCopen Motion Library extension using Elmo's IDE.  
The following languages are supported:
  - Structured text (ST): textual
  - Function block diagram (FBD): graphical
  - Ladder diagram (LD): graphical
  - Sequential function chart (SFC) has elements to organize programs for sequential and parallel control processing.

## Programming Execution Time, Threads, and I/O Layer Synchronization

- Minimal thread resolution timing: 1 ms
- Number of program execution threads: 10
- Typical programming execution time (IEC): 10  $\mu$ s per command.
- C code programming: Running as native code on the target CPU.
- I/O layer synchronization timing linked to the master controller sync time (EtherCAT/CAN). I/O level synchronization deterministic over control cycles.

## Communications Hardware

- Host
  - Ethernet: 1 port, Standard Ethernet, 10/100 Mbps, automatically detected.
  - USB: 1 port, USB 2.0, 12 Mbps.
  - RS-232 can be supported in an embedded configuration.
- Device Networks
  - EtherCAT: 2 x EtherCAT master ports, with redundancy support.
  - CAN: CANopen master port.

## Communications Protocols

- Host
  - Ethernet, TCP-IP/UDP for operational modes.
  - Telnet/FTP/HTTP communication for setup and configuration.
  - USB: Using binary protocol (maintenance).
  - Application level: Ethernet-IP/Modbus.
- Device Networks
  - EtherCAT: CoE/EoE/FoE, supports distributed clock master.
  - CAN: CANopen device profiles, e.g. DS 301, DS 305, DS 401 (I/O Device Profile), DS 402.

## Host and Internal Software Interface

- TCP/IP and UDP interface from the host computer. A software library provides a convenient TCP/IP or UDP communications interface.
- Future versions will support Ethernet/IP and Modbus over TCP/IP.
- Internal software libraries for C user programs are provided, to write user code running on the Gold Lion's target processor (native mode).

## Miscellaneous and Special Features

- Data Recording
  - 4 MB data recording.
  - Up to 32 vectors can be recorded simultaneously.
  - Supports advanced triggering options and real-time scope capabilities.
  - Very fast data upload using Ethernet.
- Upload/Download Support
  - Firmware update support (Gold Lion and drives)
  - System resource files
  - Axis parameter files
- Drive Communication Bridge Support
  - The Gold Lion supports full communication with any specific drive (CAN and EtherCAT), for the purpose of simple tuning or configuration at the drive level. I.e., there is no need for direct communication with the drive.
- Spatial Position-Based Pulse Generation
  - The Gold Lion supports spatial (along the path) position-based pulse generation. This is a unique feature, required for the generation of position-based events in 3D scanning systems.
  - The Gold Lion system, with Elmo's intelligent ExtriQ Line servo drives can support single axis and spatial enhanced position-based "compare" functions, resulting in trigger output signals accurate to 1 encoder count along the trajectory path.
- Network Encoders: Supports master based motion on network encoders.
- Position Error Mapping: Supports 1D and 2D position based error mapping compensation.
- System Boot-up Time: < 30 sec.
- Internal System BIT: The Gold Lion system supports internal hardware BIT (Built-in-tests) procedures to ensure system integrity on each power up.

## I/Os

- The Gold Lion is a fully networked controller. All I/O interfaces are carried out via the device network.

## Processor and Memory

- CPU: PowerPC 333 MHz, with double precision floating point supported by hardware.
- Flash: 32 MB
- RAM: 64 MB DDR2 333 MHz



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