

Gold Lion 100 Network Motion Controller Installation Guide For Harsh Environments

(-40°C to +70°C, Vibrations up to 14GRMS)



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Catalog Number

GOLD-LION100	Motion Controller for Harsh Environments (-40°C to+70°C, Vibrations up to 14GRMS) 13VDC - 96VDC
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Revision History

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Ver. 1.003	Aug. 2017	Update
Ver. 1.004	May. 2018	Update



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Chapter 1: Safety Information

In order to achieve the optimum, safe operation of the Gold Lion 100 Multi-Axis Controller, it is imperative that you implement the safety procedures included in this installation guide. This information is provided to protect you and to keep your work area safe when operating the Gold Lion 100 and accompanying equipment.

Please read this chapter carefully before you begin the installation process.

Before you start, ensure that all system components are connected to earth ground. Electrical safety is provided through a low-resistance earth connection.

The following safety symbols are used in this manual:



Warning:

This information is needed to avoid a safety hazard, which might cause bodily injury.



Caution:

This information is necessary for preventing damage to the product or to other equipment.



1.1 Cautions

- The Gold Lion 100 must be connected to an approved 24 VDC power supply through a line that is separated from hazardous line voltages using reinforced or double insulation in accordance with approved safety standards.
- Before switching on the Gold Lion 100, verify that all safety precautions have been observed and that the installation procedures in this manual have been followed.



1.2 Directives and Standards

The Gold Lion 100 conforms to the following industry safety standards:

Safety Standard	Item
In compliance with EN 60204-1	Low Voltage Directive 73/23/EEC
In compliance with CE 2006/95/EC	Low-voltage directive 2006/95/EC
In compliance with IEC/EN 61800-5-1	Adjustable speed electrical power drive systems Safety requirements – Electrical, thermal and energy
In compliance with IEC 61800-3	EMC requirements and specific test methods

The Gold Lion 100 has been developed, produced, tested and documented in accordance with the relevant standards. Elmo Motion Control is not responsible for any deviation from the configuration and installation described in this documentation. Furthermore, Elmo is not responsible for the performance of new measurements or ensuring that regulatory requirements are met.

1.3 Warranty Information

The products covered in this manual are warranted to be free of defects in material and workmanship and conform to the specifications stated either within this document or in the product catalog description. The Gold Lion 100 is warranted for a period of 12 months from the date of shipment. No other warranties, expressed or implied – and including a warranty of merchantability and fitness for a particular purpose – extend beyond this warranty.



Chapter 2: Product Description

This specification describes the Gold Lion 100 Network Motion Controller.

2.1 Description

The Gold Lion 100 is Elmo's rugged network motion controller, designed to operate at extreme environmental conditions such -40C to +70C and vibrations up to 14GRMS, functioning in a network based system in conjunction with Elmo's intelligent servo drives to provide a total multi-axis motion control system solution in extreme environmental conditions.

The Gold Lion 100 is designed to support both the existing SimplIQ drives, based on standard CAN network architecture, as well as the new Gold Line, adding EtherCAT networking.

While being a true network controller, the Gold Lion 100 shares the motion processing workload with Elmo's SimplIQ and Gold Line drives, forming a distributed motion control system. The best servo and system performance is achieved combining the Gold Family drives, and the new real-time motion control capabilities of the Gold Lion 100 controller.

The Gold Lion 100 provides:

- Full, real-time, multi-axis motion synchronization
- Advanced user programming capabilities based on the leading standards
- Time deterministic control over motion, I/Os and processes in the system

The Gold Lion 100 offers real-time motion control support for full multi-axis system synchronization, using the well known industry interface PLCopen for Motion Control standard.

Various programming capabilities, such as the IEC-61131-3 standard languages, as well as native C programming support, dramatically accelerate user level program execution. Standard solutions were selected for ease of use.

Low level communication with drives and I/O devices over the device network uses the CAN industry standard (DS 301, DS 401 for I/O devices, and DS 402 for drives and motion device profiles). These are used over standard CAN networks, as well as with the new EtherCAT CoE (CAN over EtherCAT) protocols.

Host interfaces are implemented using industry standard communications protocols, such as Ethernet TCP/IP and higher level protocols such as Ethernet/IP and Modbus.

Standardization in protocols, definitions and APIs allows users rapid system level integration and opens the system to third party devices on the device network.



Chapter 3: Technical Specifications

3.1 Processor module

Feature	Details
Processor	PowerPC, 333 MHz, with double precision floating point support by hardware.
Memory Flash	Flash: 32 MB
Memory	64 MB (DDR2, 333 MHz)

3.2 Communications

Specification	Details
Ethernet for Host	1 port, Standard Ethernet, 10/100 Mbps, automatically detected
USB	One port, USB 2.0, 12 Mbps Used only for setup and determining IP address.
EtherCAT for device network	2 x EtherCAT master ports 100base-T, with redundancy support (optional)
CAN for device network	CANopen master port Maximum Baud Rate of 1 Mbits/sec.

3.3 Power Supply

Feature	Details
Supply input voltage	13 V to 96 V
Supply input power	4.5 W



3.4 Physical Specifications

Feature	Details
Weight	259 g (9.14 oz)
Dimensions	117.5 x 79 x 25.8 mm (4.63" x 3.11" x 1.02")
Mounting Method (with adapter)	Wall Mount ("Bookshelf")

3.5 General

Feature	Details
I/O System	All I/O interfaces are handled via the device network
Internal System BIT	The Gold Lion 100 supports internal hardware BIT (Built-in-tests) procedures to check the system integrity level on each power up.
Diagnostic LEDs	EtherCAT and Ethernet activity



Chapter 4: Gold Lion 100 Software Specifications

4.1 Operating System

- Linux Operating System, with Elmo's RT extension for real-time motion control support
- Motion Programming and Debugging
 - Native C Programming, running on the target CPU. Compiling and debugging via the Eclipse IDE using GCC under Cygwin
 - IEC 61131-3 with PLCopen Motion Library extension, using Elmo 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.

4.2 Axes

- Up to 96 axes, allowing mixed single axis, multiple axis and coordinated axes motions
- Axis Types
 - Intelligent Servo Drives (Elmo), supporting both the SimplIQ and Gold lines
 - Operation in Numeric Control – NC - (real-time master synchronization) as well as non-NC modes
 - DS 402 CoE for EtherCAT and standard DS 402 drives for CANopen
- Control System Update Rate
 - EtherCAT
 - Cycle Update Rate: $\geq 500 \mu\text{s}$ (up to 16 axes can be updated simultaneously at a rate of $500 \mu\text{s}$)
 - Cycle Jitter: $< 1 \mu\text{s}$, based on Master DC (Distributed Clock) support, for the full network
 - CAN
 - Cycle Update Rate $\geq 1 \text{ ms}$ (CAN physical network limitations only)
 - Cycle Jitter: $< 100 \mu\text{s}$ for CAN Sync message initiation (actual jitter dependent on the CAN network's physical limitations)

4.3 Motion Modes and Interfaces

- The Gold Lion 100 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



- Cyclic buffer for 1,000 function blocks (a buffer for 1,000 motion segments). The cyclical buffer removes any practical limit on the number of function blocks.
- Communication Protocols
 - Host
 - Ethernet TCP-IP/UDP for operational modes
 - Telnet communication for setup and configuration
 - USB: Using binary protocol (maintenance)
 - Application level: Ethernet-IP/Modbus
 - Device Network
 - EtherCAT: CoE/EoE/FoE, supports distributed clock master
 - CAN: CANopen device profiles, e.g., DS 301, DS 305, DS 402, DS 401 (I/O device profile)
- Host and Internal Software Interface
 - TCP/IP interface from Host Computer. Software Library is provided for easy TCP/IP communication interface.
 - Future version will also support Ethernet-IP and Modbus over the TCP-IP.
 - Internal Software libraries, for "C" user programs are provided, to write user code running on the Gold Lion 100 target processor (native mode).
- Data Recording
 - 4 MB data recording
 - Up to 32 vectors can be recorded simultaneously.
 - Supports more than 10 advanced triggering options and real-time scope capabilities
 - Very fast data upload using Ethernet
- Upload/Download Support
 - Firmware update support (Gold Lion 100 and drives)
 - System resource files
 - Axis parameter files

4.4 Drive Communication Bridge Support

- The Gold Lion 100 supports full communication with any specific drive (EtherCAT and CAN), 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 100 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 100 system, with Elmo's intelligent Gold 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.



4.5 Network Encoders

- Supports master based motion on network encoders

4.6 Position Error Mapping

- Supports 1-D and 2-D position-based error mapping compensation
- System Boot up Time: < 30 sec

Chapter 5: How to Use this Guide

This manual is part of a documentation set that can be used to set up and program the motion of any machine whose motors are controlled by Elmo's SimplIQ or Gold Line servo drives. When used in conjunction with the Gold Maestro Software Manual it describes everything needed to get the Gold Lion 100 up and running. Please read the safety instructions in the first chapter before starting.

After you have successfully mounted and installed the Gold Lion 100 we suggest that you read the Gold Maestro Software Manual. If you have not already done so, follow the instructions in the Installation Guide that arrived with your servo drive, and install a drive. At least one drive needs to be connected to the Gold Lion 100 in order for it to function as a motion controller.



Chapter 6: Installation

6.1 Environmental Conditions

You can guarantee the safe operation of the Gold Lion 100 by ensuring that it is installed in an appropriate environment.



Warning: During operation the Gold Lion 100 becomes hot to the touch (the case can heat up to 50 °C). Care should be taken when handling it.



Caution: The Gold Lion 100 dissipates its heat by convection. The maximum ambient operating temperature of 70 °C (160 °F) must not be exceeded.

The Gold Lion 100 supports the following extended environmental conditions.

Feature	Operation Conditions	Range
Ambient Temperature Range	Non-operating conditions	-50 °C to +100 °C (-58 °F to 212 °F)
	Operating conditions	-40 °C to +70 °C (-40 °F to 160 °F)
Temperature Shock	Non-operating conditions	-40 °C to +70 °C (-40 °F to 160 °F) within 3 min
Altitude	Non-operating conditions	Unlimited
	Operating conditions	-400 m to 12,000 m (-1312 to 39370 feet)
Maximum Humidity	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)
Vibration	Operating conditions	20 Hz to 2,000 Hz, 14.6 g
Mechanical Shock	Non-operating conditions	±40g; Half sine, 11 msec
	Operating conditions	±20g; Half sine, 11 msec
Protection level		IP32

The Gold Lion 100 servo drive has been developed, produced, tested and documented in accordance with the relevant standards. Elmo Motion Control is not responsible for any deviation from the configuration and installation described in this documentation. Furthermore, Elmo is not responsible for the performance of new measurements or ensuring that regulatory requirements are met.



6.2 Unpacking the Components

Before you begin working with the Gold Lion 100 system, verify that you have all of its components, as follows:

- The Gold Lion 100 multi-axis controller
- Gold Lion 100 software which may be downloaded from www.elmomc.com

The Gold Lion 100 is shipped in a cardboard box with Styrofoam protection.

To unpack the Gold Lion 100:

1. Carefully remove the Gold Lion 100 from the box.
2. Check the Gold Lion 100 to ensure that there is no visible damage to the instrument. If any damage has occurred, report it immediately to the carrier that delivered your controller.
3. To ensure that the Gold Lion 100 you have unpacked is the appropriate type for your requirements, locate the part number sticker on the side of the Gold Lion 100 as shown below.



G-LION011A

The part number at the top gives the type designation as follows:

GOLD-LION100

4. Verify that the Gold Lion 100 type is the one that you ordered.



6.3 Connectors

6.3.1 Connector Types

The Gold Lion 100 has the following connectors:

Pins	Type	Function
Front Connectors		
<p>Diagram showing front connectors: EtherCat (9 pins), Ethernet (9 pins), and CAN (9 pins). Pin numbers are indicated for each connector.</p>		
9	D-Type Male	EtherCAT1
		EtherCAT2
9	D-Type Male	Ethernet
9	D-Type Female	CAN
Bottom Connectors		
<p>Diagram showing bottom connectors: USB (4 pins) and GPIO&VL (15 pins). Pin numbers are indicated for the GPIO&VL connector.</p>		
4	USB	USB
15	D-Type	GPIO (not in use)
		VL+ /VL-



Table 1: Connector Types



6.4 Connector Pinouts

6.4.1 GPIO&VL

Pin	Signal	Function
15	VL+ DC Power	+24 V Supply Input Positive
14	VL- DC Power	24 V Supply Input Return
8	VL Shield	Drain wire cable
1, 2, 3, 4, 5, 6, 7, 9, 10, 11, 12, 13	Reserved	

Pin Positions

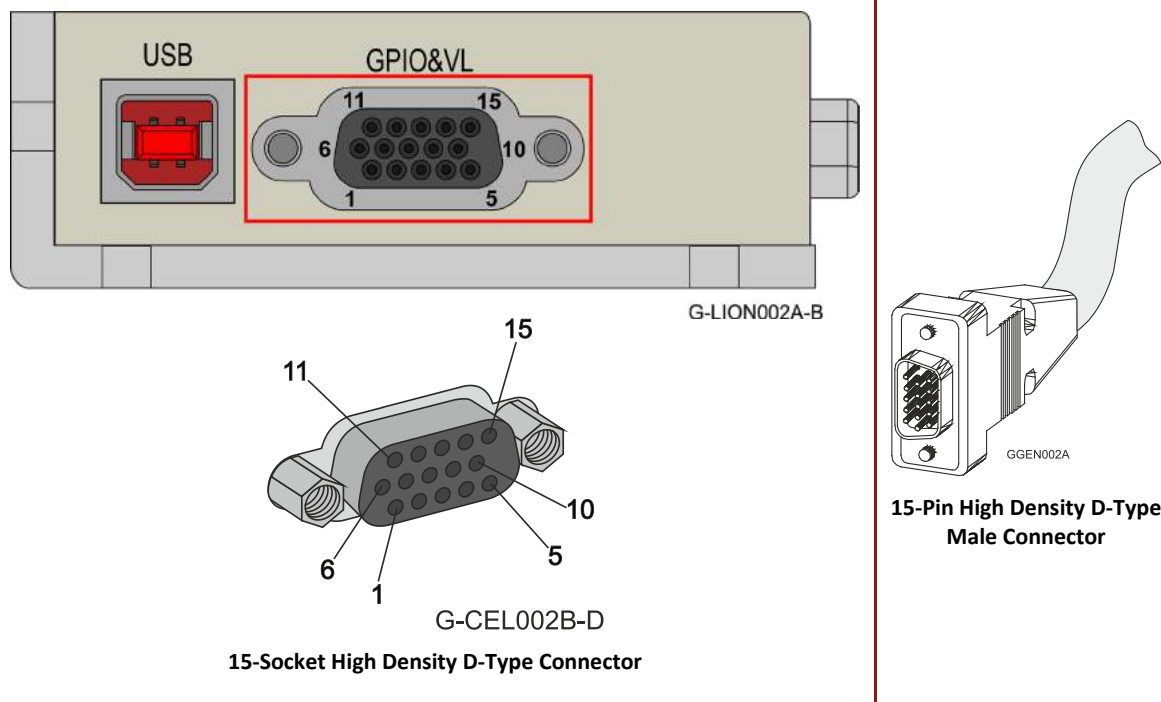


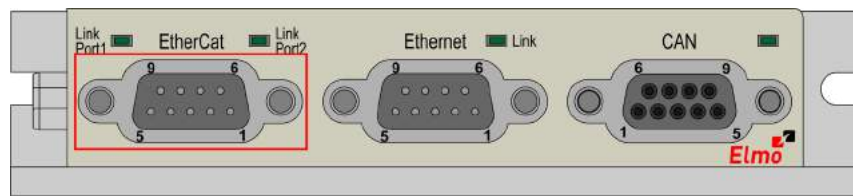
Table 2: Gold Lion 100 General Connector



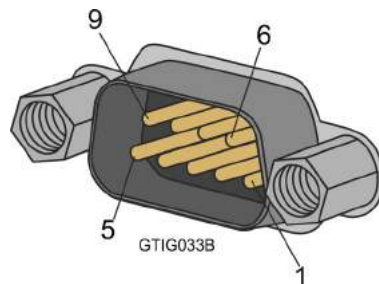
6.4.2 EtherCAT Connector

Pin	Signal	Function
1	Ethernet1_TX+	Ethernet1 transmit+
2	Ethernet1_RX+	Ethernet1 receive+
3	Ethernet2_TX+	Ethernet2 transmit+
4	Ethernet2_RX+	Ethernet2 receive+
5	Shield	Drain wire cable
6	Ethernet1_TX-	Ethernet1 transmit-
7	Ethernet1_RX-	Ethernet1 receive-
8	Ethernet2_TX-	Ethernet2 transmit-
9	Ethernet2_RX-	Ethernet2 receive-

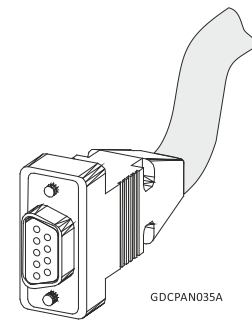
Pin Positions



G-LION001A-C



9-Pin male D-Type



9-Pin Female D-Type

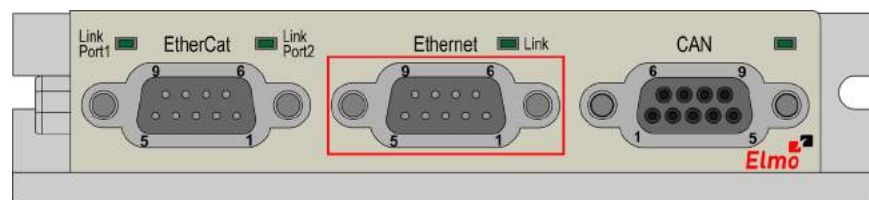
Table 3: EtherCAT Pin Assignments



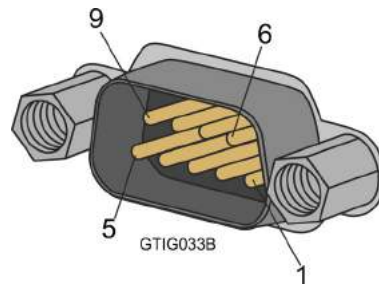
6.4.3 Ethernet Host

Pin	Signal	Function
1	Ethernet_Host_TX+	Ethernet Host transmit+
2	Ethernet_Host_RX+	Ethernet Host receive+
3	Not used	
4	Not used	
5	Shield	Drain wire cable
6	Ethernet_Host_TX-	Ethernet Host transmit-
7	Ethernet_Host_RX-	Ethernet Host receive-
8	Not used	
9	Not used	

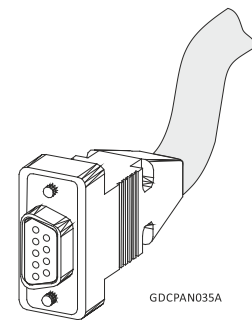
Pin Positions



G-LION001A-B



9-Pin male D-Type



GDPCAN035A

9-Pin Female D-Type

Table 4: Ethernet Host Pin Assignments



6.4.4 CAN Connector

Pin	Signal	Function
1, 3	CAN_H	CAN_H bus line (dominant high)
6, 8	CAN_L	CAN_L bus line (dominant low)
7, 9	CAN_RET	CAN Return
5	CAN_Shield	Drain wire cable

Pin Positions	Cable Connector
<p>G-LION001A-A</p> <p>G-CEL002B-C</p> <p>9-Pin D-Type Female Connector</p>	<p>GGEN001A</p> <p>9-Pin D-Type Male Connector</p>

Table 5: CAN Pin Assignments

6.4.5 USB 2.0 (Standard)

USB Pin	Signal	Function
1	USB VBUS	USB VBUS From Host
2	USBD-	USB _N line
3	USBD+	USB _P line
4	USB COMRET	USB communication return

Pin Postions	Cable Connector
<p>G-LION002A-A</p>	<p>GMAS011A</p> <p>USB Device Type B Plug</p>

Table 6: USB 2.0 Pin Assignments



Chapter 7: Mounting the Gold Lion 100

The Gold Lion 100 has three mounting options:

- Wall mount
- Surface mount

7.1.1 Wall Mount

Two M4 round head screws, one through each opening in the heat sink, are used to mount the Gold Maestro (see the diagram below) on a wall.

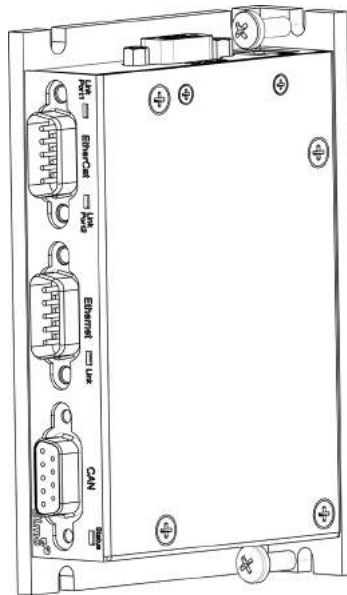


Figure 1: Wall Mounting the Gold Lion 100

7.1.2 Surface Mount

Use four M4 round head screws, one through each opening in the heat sink to connect the Gold Maestro to a surface.

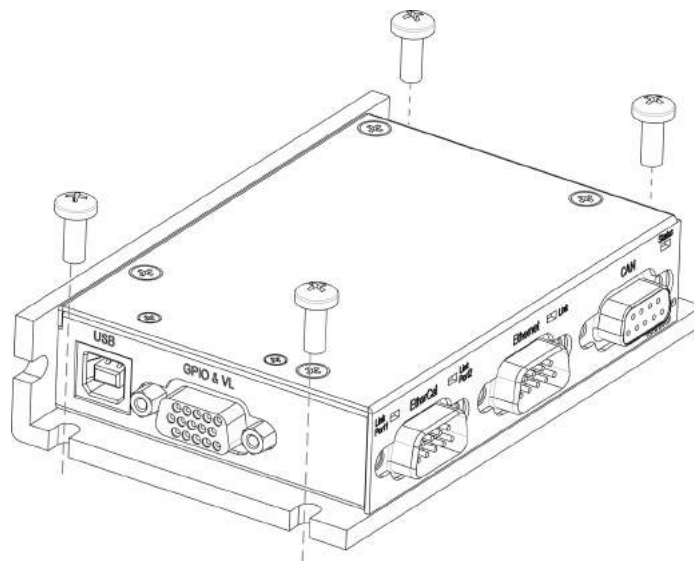


Figure 2: Surface Mounting the Gold Lion 100



7.2 Connecting the Cables

7.2.1 Wiring the Gold Lion 100

Once the Gold Lion 100 is mounted, you are ready to wire the device. Proper wiring, grounding, and shielding are essential for ensuring safe, immune and optimal performance of the Gold Lion 100.

7.2.2 Connecting the DC Power Supply

Connect the DC output from the power supply to the GPIO&VL Connector on the Gold Lion 100 according to Table 7.

To connect the power supply:

- Use 28 AWG twisted pair shielded cable. The shield should have copper braid.
- Before applying power, first verify the polarity of the connection (protected).

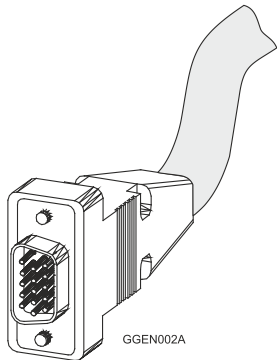
Pin	Signal	Function	Pin Position
15	VL+ DC Power	+24 V Supply Input Positive	 <p>15-Pin High Density D-Type Male Connector</p>
14	VL- DC Power	24 V Supply Input Return	
8	VL Shield	Drain wire cable	

Table 7: Power Plug

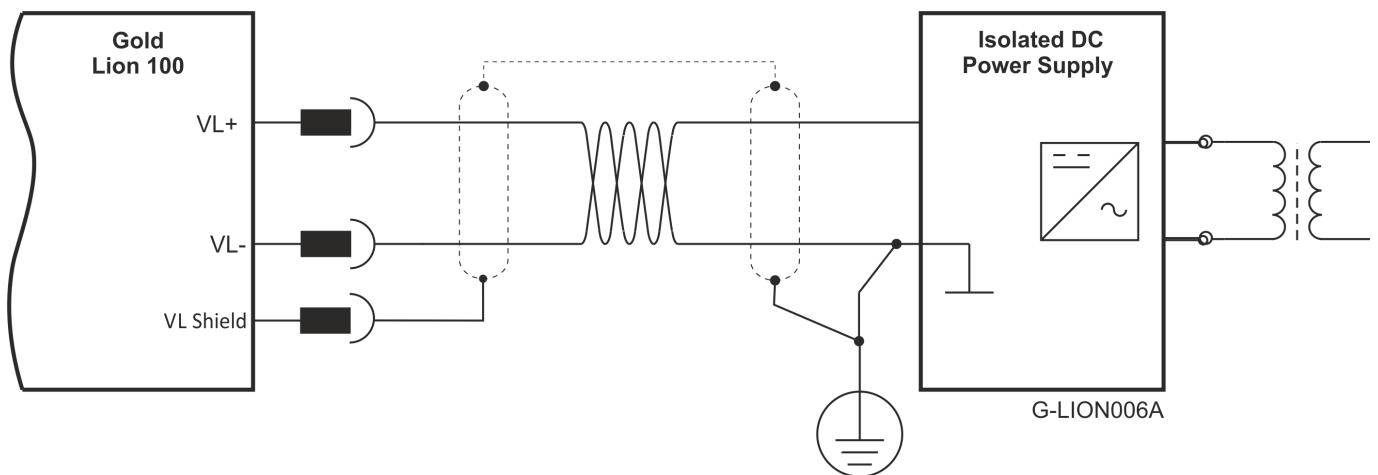


Figure 3: Power Supply Connection Diagram



7.2.3 Ethernet

Note: When connecting the Ethernet communication cable use a shielded CAT5e Ethernet cable.

The Gold Lion 100 connects to a PC either directly or through a hub, switch or router.

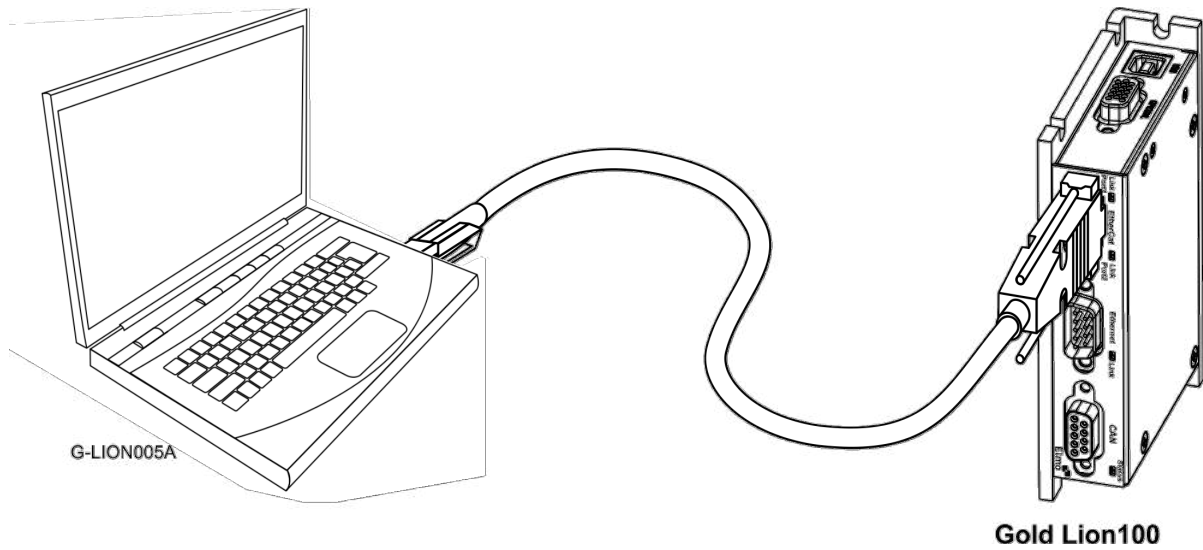


Figure 4: Gold Lion 100 Connected to a PC



7.2.4 USB 2.0 Communication

Pin	Signal	Function
1	USB VBUS	USB VBUS From Host
2	USBD-	USB _N line
3	USBD+	USB _P line
4	USB COMRET	USB Communication Return

Table 8: USB 2.0 Pin Assignments

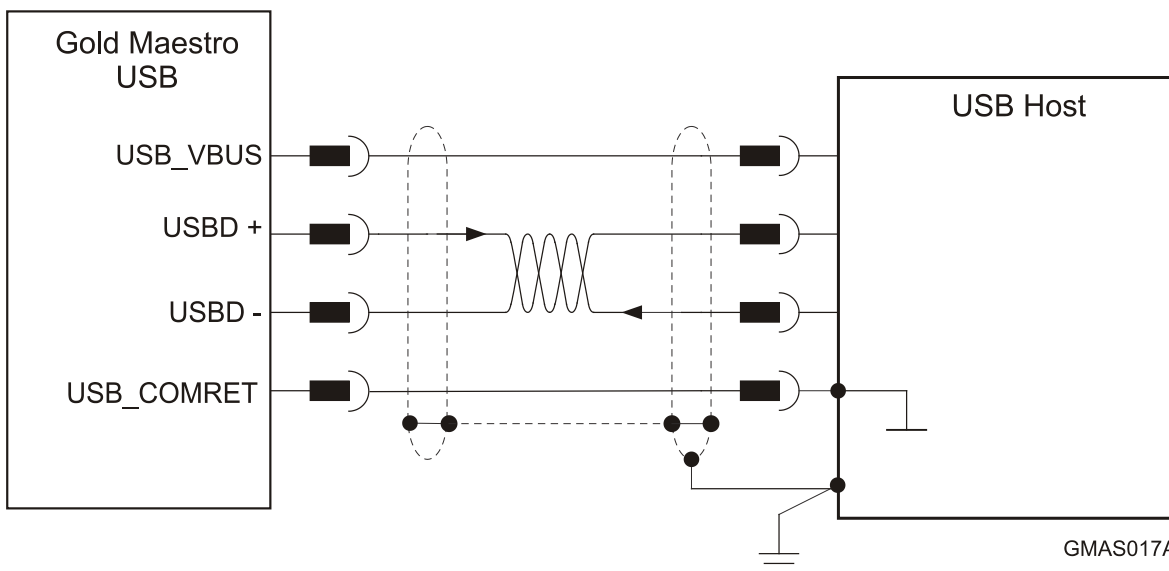


Figure 5: USB Network Diagram

To connect the USB communication cable:

- Connect the shield to the ground of the host (PC). Usually, this connection is soldered internally inside the connector at the PC end. You can use the drain wire to facilitate connection.
- Ensure that the shield of the cable is connected to the shield of the connector used for communications. The drain wire can be used to facilitate the connection.



7.2.5 CAN Communication

To connect the CAN communication cable:

- Use 26 or 28 AWG twisted pair shielded cables. For best results, the shield should have aluminum foil and be covered by copper braid with a drain wire (CAT5e FTP applicable).
- Connect the shield to the ground of the host (PC). Usually, this connection is soldered internally inside the connector at the PC end. You can use the drain wire to facilitate connection.
- Ensure that the shield of the cable is connected to the shield of the D-Type and RJ plugs. The drain wire can be used to facilitate the connection.
- Connect a 120 Ω termination resistor to each end of the network cable. (The Gold Lion 100 does not have an internal terminal.)
- Use the CAN termination dongle supplied as a second “device end”. Simply insert the termination resistor into the CAN connector of the second end device on the bus. This is only possible if there are two CAN connectors.

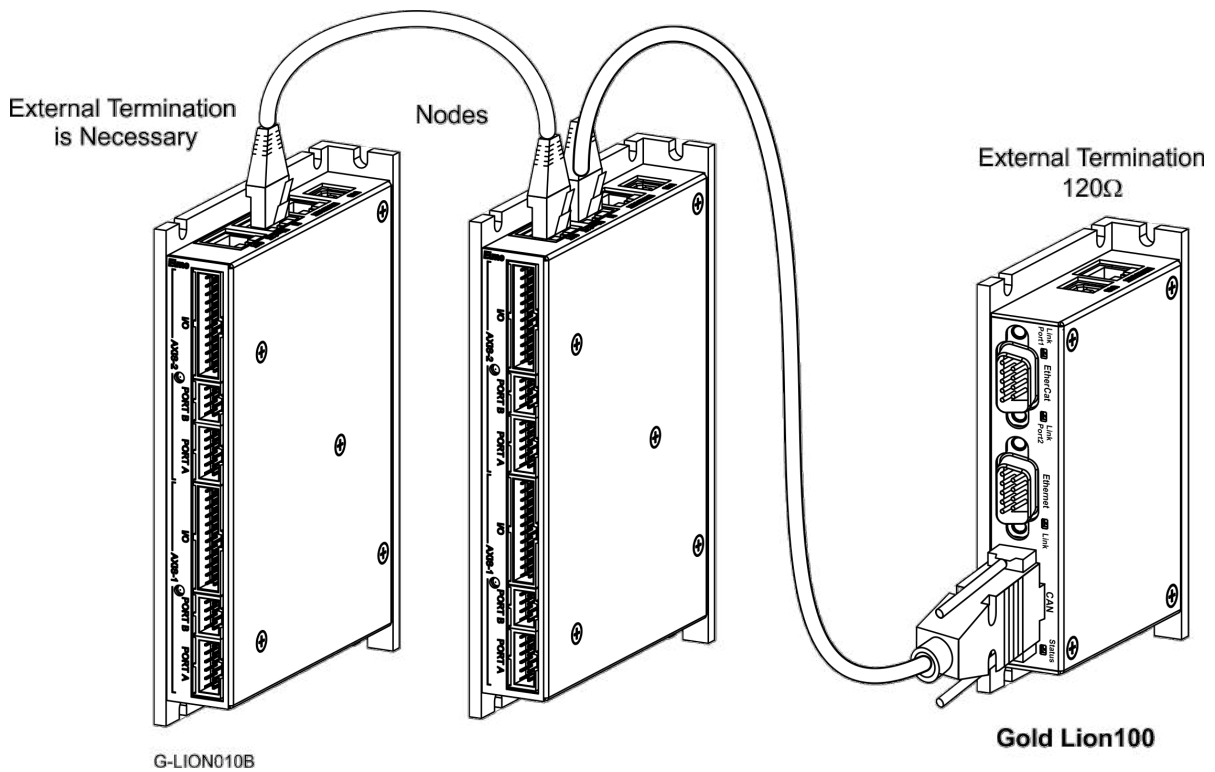


Figure 6: Connecting a 120 Ω Termination Resistor to Each End of the Network Cable



7.2.6 EtherCAT Communication

The Gold Lion 100 is the master of the EtherCAT network and must always be the first device in the line.

The Ethernet1 port of the Gold Lion 100 should be connected to the EtherCAT In port of the next device down the line. If redundancy is required, the EtherCAT Out port of the last device should be connected to the Ethernet2 port of the Gold Lion 100.

Note: When connecting the EtherCAT communication cable it is recommended to use CAT5e cable.

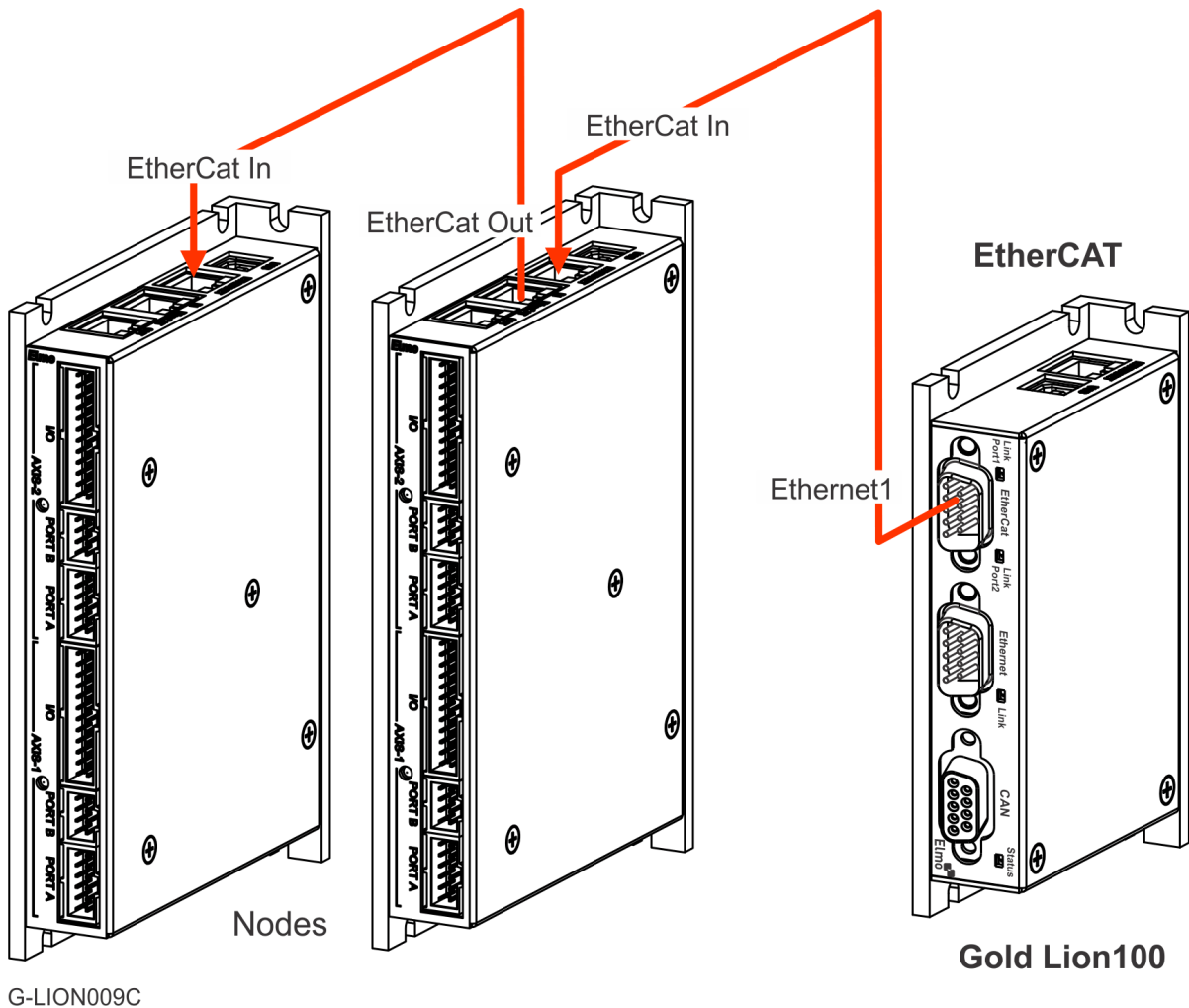
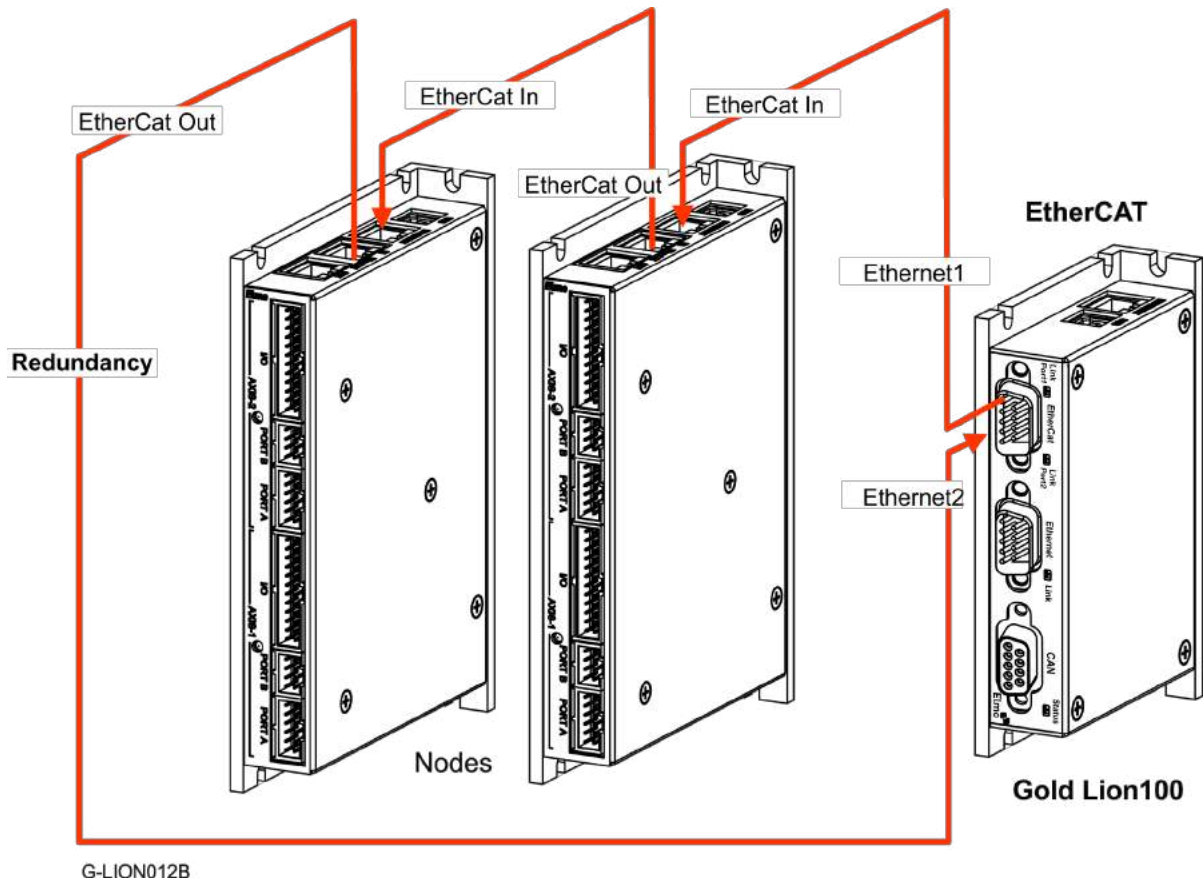


Figure 7: EtherCAT Network with no Redundancy



G-LION012B

Figure 8: EtherCAT Network with Redundancy – For Future use



7.3 Powering Up

After the Gold Lion 100 has been mounted, check that the cables are intact. The Gold Lion 100 is then ready to be powered up.

7.4 Initializing the System

After the Gold Lion 100 has been connected and mounted, the system must be set up and initialized. The minimum system requirements for a setup are:

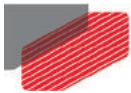
- Gold Lion 100 (and power supply)
- PC with the required Elmo software
- At least one servo drive and motor
- EtherCAT cables or a terminated CAN network
- A servo drive connected through an EtherCAT cable or a CAN cable (the terminated CAN network)

Users of SimplIQ servo drives:

Setting up the drives and motors is described in the Installation Guide for each servo drive and in the Elmo Application Studio User Guide. Advanced features are described in the SimplIQ Software Manual, Interlude API User Guide, SimplIQ Command Reference and CAN Implementation Guide.

Users of Gold Line servo drives:

Setting up the drives and motors is described in the Gold Line Servo Drive Installation Guide and Elmo Application Studio Users Guide. Advanced features are described in the Gold Line Software Manual, Gold Line Command Reference and CAN Implementation Guide.



Chapter 8: Gold Lion 100 Dimensions

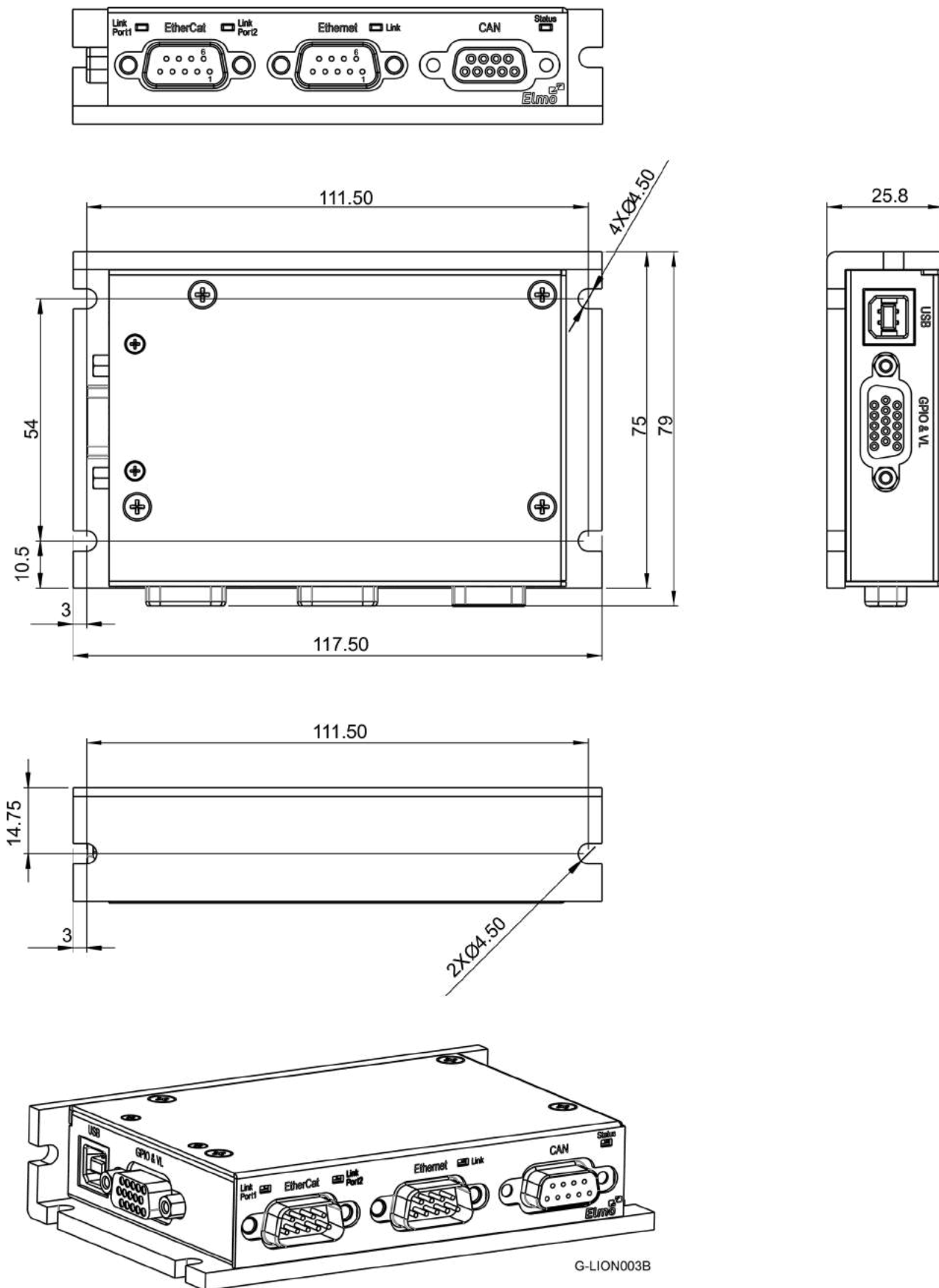


Figure 9: Gold Lion 100 Dimensions



Chapter 9: Other Compliant Standards

Quality Assurance	
ISO 9001:2008	Quality Management
Design	
<ul style="list-style-type: none"> • IPC-D-275 • IPC-SM-782 • IPC-CM-770 	Printed wiring for electronic equipment (clearance, creepage, spacing, conductors sizing, etc.)
Reliability	
MIL-HDBK- 217F	Reliability prediction of electronic equipment (rating, de-rating, stress, etc.)
Workmanship	
In compliance with IPC-A-610, level 3	Acceptability of electronic assemblies
PCB	
In compliance with IPC-A-600, level 3	Acceptability of printed circuit boards
Packing	
In compliance with EN 100015	Protection of electrostatic sensitive devices
Environmental	
In compliance with 2002/96/EC	Waste Electrical and Electronic Equipment regulations (WEEE) Note: Out-of-service Elmo drives should be sent to the nearest Elmo sales office.
In compliance with 2002/95/EC (effective July 2006)	Restrictions on Application of Hazardous Substances in Electric and Electronic Equipment (RoHS)

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For a list of Elmo's branches, and your local area office, refer to the Elmo site www.elmomc.com

