Elmo
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Titanium Maestro
Network Motion Controller

Installation Guide

January 2025 (Ver. 1.000)

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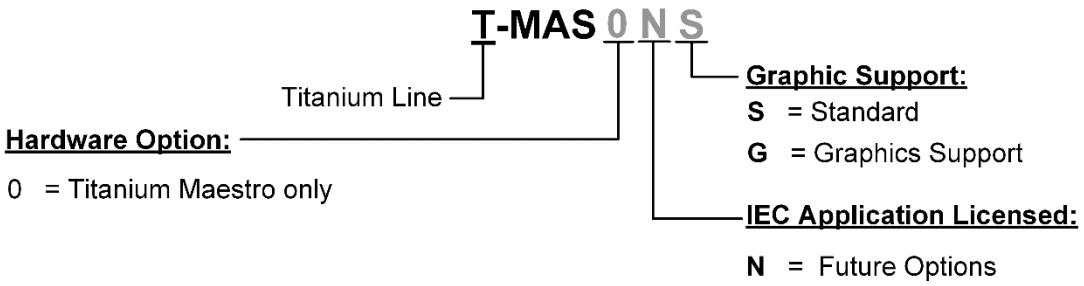
Catalog Number



Revision History

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Ver. 1.000	Jan 2025	Initial Release

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Chapter 1 This Installation Guide

This installation guide describes the Titanium Maestro Network Motion Controller and the steps for its wiring, installation and power up. Following these guidelines ensures maximum functionality of the system to which it is connected.

Chapter 2 Safety Information

In order to achieve the optimum, safe operation of the Titanium Maestro 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 Titanium Maestro 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 and all Elmo Motion Control manuals:

Warning: This information is needed to avoid a safety hazard, which might cause bodily injury or death as a result of incorrect operation.

Hot Surface Warning:
To alert against surfaces that may reach high temperatures. The heatsink and wires may reach high temperatures.

Caution: This information is necessary to prevent bodily injury, damage to the product or to other equipment.

Important: Identifies information that is critical for successful application and understanding of the product.

The following symbols are used in this document:

Note: Information critical to the understanding and\or operating the feature.

Tip: Information that helps understanding a feature, is good practice or a possible different way of action.

2.1 Cautions

- The Titanium Maestro must be connected to an approved 12V to 30V, or 24V nominal 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 Titanium Maestro, verify that all safety precautions have been observed and that the installation procedures in this manual have been follows.

2.2 Directives and Standards

The Titanium Maestro conforms to the following industry standards:

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

Table 1: Directives and Standards

The Titanium Maestro 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.

2.3 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 Titanium Maestro 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 3 Product Description

The Titanium Maestro is Elmo's premium network motion controller. It works in a network based system in conjunction with Elmo's intelligent servo drives to provide a total multi-axis motion control system solution.

The Titanium Maestro Motion Controller incorporates an integrated high-level computational quad core system (4 x 1.9 GHz) with various memory types (eMMC, RAM, EEPROM, and SD-Card), and onboard additional hardware peripherals.

The Titanium Maestro shares the motion processing workload with Elmo's SimplIQ, Gold, Platinum, and Titanium Line drives, forming a distributed motion control system. The best servo and system performance is achieved by combining the specific Family Line drives, and the new real-time motion control capabilities of the Titanium Maestro controller.

The Titanium Maestro provides:

- Self-sufficient machine motion control – No reliance on connection with PC server
- Time deterministic control over motion, I/Os and processes in the system
- Complete compatibility with recognized networking and communications protocols
- Full, real-time, multi-axis motion synchronization
- Advanced user programming capabilities based on the leading standards.
- Unified development platform that streamlines motion control solutions for novice and expert programmers alike

The Titanium Maestro 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, Python as well as native C, C++, and C# programming support, dramatically accelerate user-level program execution. Standard solutions are selected for ease of use.

In addition, Maestro "Software in the Loop" (SIL) is provided as an option.

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 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 4 Technical Specifications

4.1 Processor System

Feature	Details
Processor	Computational core system based on Quad-core (4 x 1.9GHz)
Memory	**eMMC** up to 16GB
	RAM Type - LPDDR4x, Capacity – Up to 16GB
	SD Card MicroSD™ Memory Card (push-push Type) SCHA Data rate up to 104MB/s
	EEPROM 256Kbit serial EEPROM
Video out	Display port, DP++ 1.4 5.4Gbps up to 4096 x 2160 @60Hz
RTC	Real Time Clock Option with 3V battery
Communication Interfaces supported by T-MAS	Host Ethernet, EtherCAT Master, USB HOST, USB DEVICE, CAN

Table 2: Processor System

4.2 Communications

Specification	Details
Ethernet for Host	1 Ethernet port 1000 base-T Automatically detected 10/100/1000Mbps CAT5e/6 Cable UDP, Telnet, TCP The redundancy port can be used, as an option, as an additional host port thus giving up redundancy.
EtherCAT Master Field bus	2 Ethernet ports 100 base-T for EtherCAT Master. Baud Rate: 100 Mbit/sec CAT5e/6 Cable CoE, EoE, FoE, Slave to Slave (S2S) EtherCAT Master with Full redundancy support
CAN for device network	1 CANopen master port with isolation Maximum Baud Rate of 1 Mbits/sec. **CAN Profile:** DS 301 **Device Profile** (drive and motion control)**:** CAN device profiles, e.g., DS301, DS505, DS402, DS401 (for I/O)
Host USB - Type A	Host USB: 2 x USB3.1 GEN1 SS (Up to 5Gbps)
Device USB - Type C	Device USB: 1 x USB2.0 HS (Up to 480Mbps)

Table 3: Communications

4.3 Power Supply

Feature	Details
Supply input voltage	Single power supply, 12V to 30V, 24V nominal
Supply input power	Max 18W (without loading the USB Host ports)

Table 4: Power Supply

4.4 Physical Specifications

Feature	Details
Weight	383 g (13.5 oz)
Dimensions	135 mm x 92 mm x 32 mm (5.31" x 3.62" x 1.26")
Mounting Method (with adapter)	Wall Mount (“Bookshelf”) or surface mount

Table 5: Physical Specifications

4.5 General

Feature	Details
Internal System BIT	The Titanium Maestro supports internal hardware BIT (Built-in-tests) procedures to check the system integrity level on each power up
Diagnostic LEDs	General Status LED EtherCAT and Ethernet activity & speed LEDs (RJ-45 integrated)

Table 6: General

Chapter 5 Titanium Maestro Software Specifications

5.1 Operating System

Feature	Details
Linux Operating System	With Elmo's RT extension for real-time motion control support
Motion Programming and Debugging	Native C, C++, C#, Programming, running on the target CPU. Compiling and debugging via the Visual Studio IDE.
	Python programming libraries from PC and directly on target, including remote debugging features via the Microsoft Visual Studio environment.

Table 7: Operating System

5.2 Axes

Feature	Details
Axes	Up to 96 axes, allowing mixed single axis, multiple axis and coordinated axes motions
Axis Types	Intelligent Servo Drives (Elmo), supporting the SimplIQ, Gold, Platinum, and Titanium lines Operation of Maestro Profiler (real-time master synchronization) as well as non-Maestro profiler modes DS 402 CoE for EtherCAT and standard DS 402 drives for CANopen
Control System Update Rate	**EtherCAT:** Cycle Simultaneous Update Rates: ≥ 100 µs for up to 16 axes 250 µs for 32 axes Cycle Jitter: < 1 µs, based on Master DC (Distributed Clock) support, for the full network. **CAN:** Cycle Update Rate ≥ 1 mSec. (CAN physically network limitations only) Cycle Jitter: < 100 µs for CAN Sync message initiation (actual jitter dependent on the CAN network's physical limitations)

Table 8: Axes

5.3 Motion Modes and Interfaces

Feature	Details
The Titanium Maestro motion interfaces use 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 Libraries are provided for easy TCP/IP communication interface. Available in .NET, C, C++. This version will also support Ethernet-IP and Modbus over the TCP-IP. Internal Software libraries, for "C", “C++” user programs are provided, to write user code running on the Titanium Maestro target processor (native mode).
Data Recording	8 MB data recording Up to 96 vectors can be recorded simultaneously. Supports more than 10 advanced triggering options and real-time scope capabilities. Fast data upload using 1Gb Ethernet
Upload/Download Support	Firmware update support (Titanium Maestro and drives) System resource files Axis parameter files

Table 9: Motion Modes and Interfaces

5.4 Drive Communication Bridge Support

Feature	Details
Communication	The Titanium Maestro supports full communication with any specific drive (EtherCAT and CAN) for the purpose of simple tuning or configuration at the drive level, i.e. not necessary to directly communicate with the drive.
Spatial Position-Based Pulse Generation	The Titanium Maestro 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 Titanium Maestro system, with Elmo's intelligent SimplIQ, Gold, Platinum, and Titanium 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.

Table 10: Drive Communication Bridge Support

5.5 General

Feature	Details
Network Encoders	Supports master-based motion on network encoders
Position Error Mapping	Supports 1-D, 2-D, and 3-D position-based error mapping compensation
Maestro SIL	Option for "Maestro Software in the Loop" (SIL) is supported

Table 11: General

5.6 Communication Options

The Titanium Maestro can communicate with a host PC either via a standard Ethernet port or through USB using a binary protocol for maintenance.

The Titanium Maestro communicates with its network devices using either EtherCAT or CAN networks.

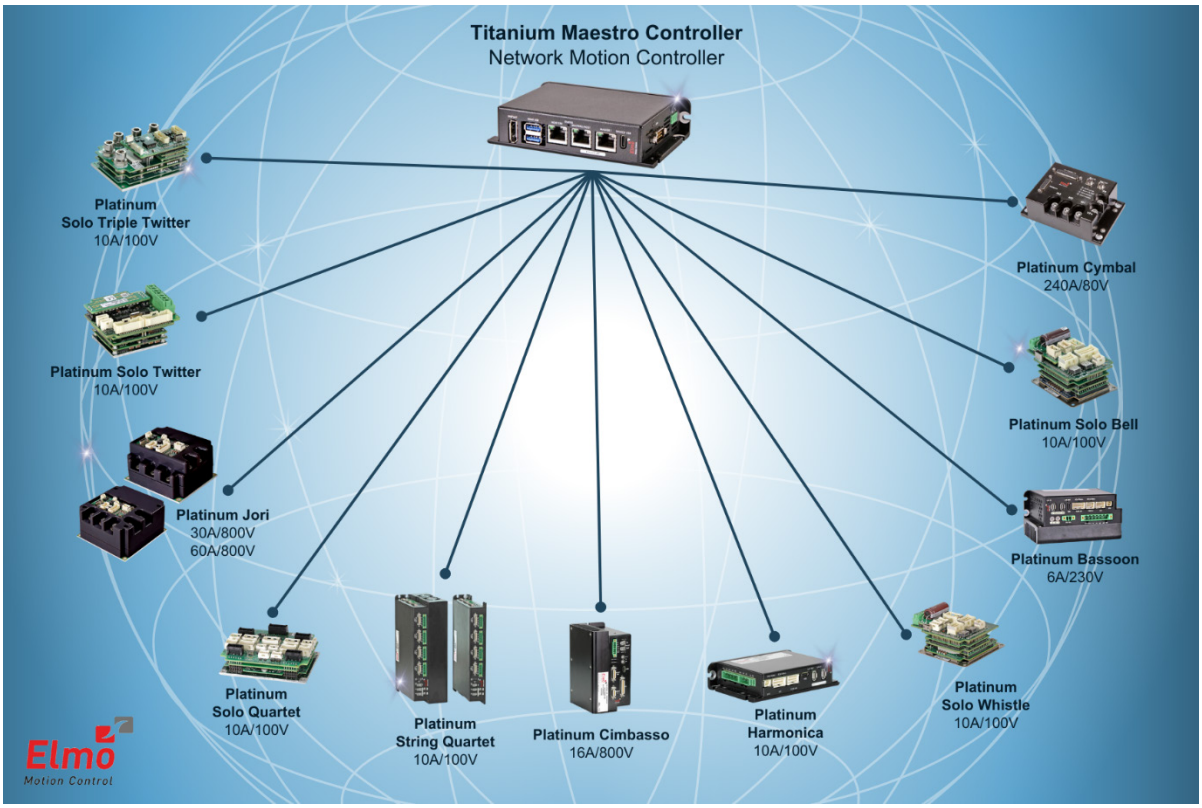


Figure 1: The Titanium Maestro Network Connections

Chapter 6 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, Gold, Platinum, and Titanium Line servo drives. When used in conjunction with the Maestro Software Manual it describes everything needed to get the Titanium Maestro up and running. Please read the safety instructions in the first chapter before starting.

After you have successfully mounted and installed the Titanium Maestro we suggest that you read the Titanium 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 Titanium Maestro in order for it to function as a motion controller.

Chapter 7 Installation

7.1 Environmental Conditions

You can guarantee the safe operation of the Titanium Maestro by ensuring that it is installed in an appropriate environment.

For safe operation of the Titanium Maestro make sure it is installed in an appropriate environment.

Feature	Value
Ambient operating temperature	0 °C to 40 °C (32 °F to 104 °F)
Storage temperature	-20 °C to +85 °C (-4 °F to +185 °F)
Maximum non-condensing humidity	90%
Operating area atmosphere	No flammable gases or vapors permitted in area

Table 12: Environmental Conditions for Installation

7.2 Unpacking the Components

Before you begin working with the Titanium Maestro, verify that you have all of its components, as follows:

- The Titanium Maestro multi-axis motion controller
- The Elmo Application Studio (EASIII) software and software manual
- Titanium Maestro software which may be downloaded from www.elmomc.com

The Titanium Maestro is shipped in a cardboard box with Styrofoam protection.

To unpack the Titanium Maestro:

1. Carefully remove the Titanium Maestro from the box and the Styrofoam.
2. Check the Titanium Maestro 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 Titanium Maestro you have unpacked is the appropriate type for your requirements, locate the part number sticker on the top of the Titanium Maestro. It looks like this:

Figure 2: Part Number

The part number at the top gives the type-destination.

4. Verify that the Titanium Maestro type is the one that you ordered.
   Refer to the appropriate part number in the Catalog Number section at the beginning of the installation guide.

7.3 Mounting the Titanium Maestro

The Titanium Maestro has two mounting options:

- Wall Mount
- Surface mount

7.3.1 Wall Mount

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

Figure 3: Wall Mounting the Titanium Maestro

7.3.2 Surface Mount

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

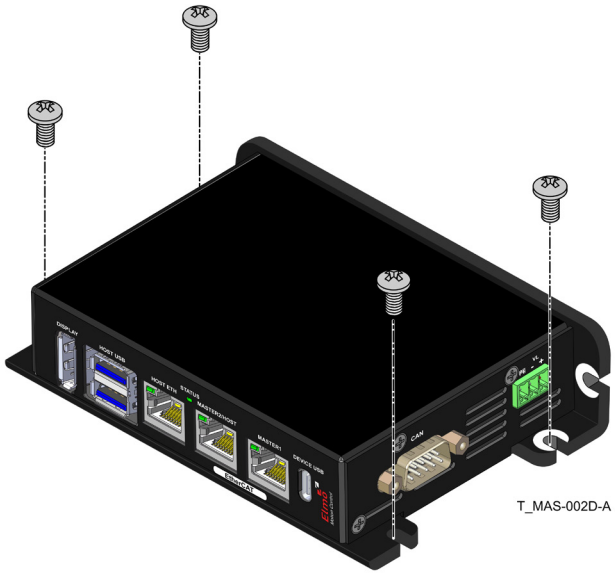


Figure 4: Surface Mounting the Titanium Maestro

Chapter 8 Wiring

8.1 Wiring the Titanium Maestro

Once the Titanium Maestro 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 Titanium Maestro.

- Use shielded CAT5e/6 cables for Ethernet and EtherCAT communication.
- After completing the wiring, carefully inspect all wires to ensure tightness, good solder joints and general safety.

8.2 Connector Types

The Titanium Maestro has the following connectors:

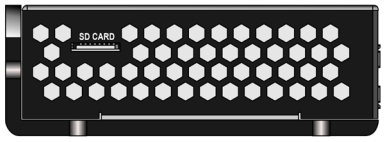
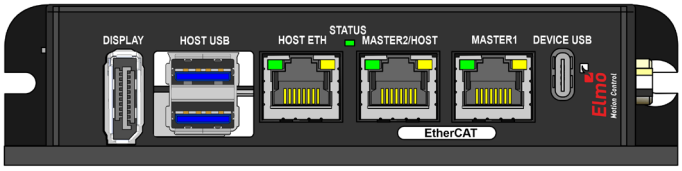
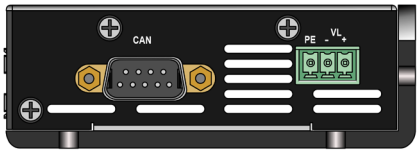
Connector	Pins	Type	Function
Topside Connector			
 T-MAS-003F-A			
J3	8	uSD Card socket (push-push) SCHA	uSD Card
Frontside Connectors			
 T-MAS-003F			
J1	20	Display Port	Display
X5	9x2	Dual USB 3.1 (Type A)	Host USB
X1	8	RJ-45	Host Ethernet
X3	8	RJ-45	EtherCAT Host/Master 2
X2	8	RJ-45	EtherCAT Master 1
X4	14	USB2.0 (Type C)	Device USB
Lower side Connectors			
 T-MAS-003F-E			
J2	9	9 pin D-type male	1 port isolated CAN
P1	3	3.81 mm Pitch Header	Power In (VL)

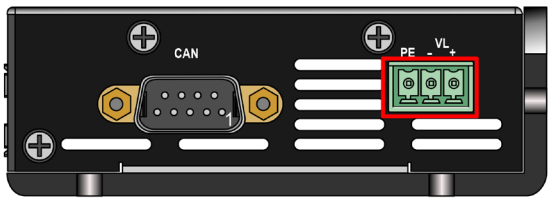
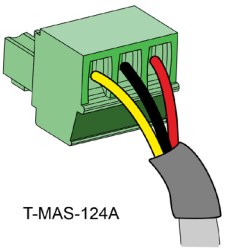
Table 13: Connector Types

8.3 Connector Locations

Figure 5: Connector Locations

8.4 Power Connector (P1)

Pin#	Signal	Function
1	VL+	Input Voltage 12V – 30V, 24V Nominal
2	VL-	Input Voltage Return Connect to COMRET (Common Return)
3	PE	Protective Earth

Connector Location	Cable Connector
 **3-Pin 3.81 mm Pitch Phoenix Header (MC 1.5/3-G-3.81)**	 **3-Pin Phoenix Plug (MC 1.5/3-ST-3.81)**

Type	Manufacturer & Part No.	Mating Connector
3.81 mm pitch Header and Plug	Phoenix Header MC 1.5/3-G-3.81	Phoenix Plug (supplied) MC 1.5/3-ST-3.81

Table 14: Titanium Maestro Power and Ground Connectors

8.5 Connecting the DC Power Supply

The Titanium Maestro requires a maximum of 18W (without loading the USB Host ports) when turned on. Any isolated power supply that can supply that power is acceptable. The supplied power must be within the rated voltage range of 12 V to 30 V.

Connect the DC output from the power supply to the power input port on the Titanium Maestro using the 3-pin power plug provided.

To connect the power supply:

- Use a 22 to 16 AWG shielded cable. The shield should have copper braid.
- Before applying power, first verify the polarity of the connection (protected).

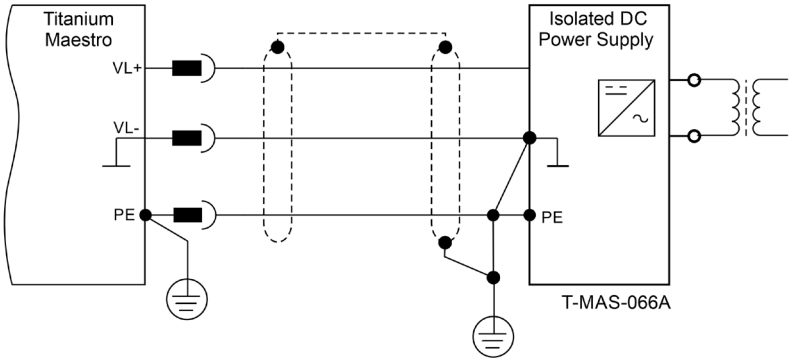


Figure 6: Power Supply Connection Diagram

8.6 Status Indicator

Figure 7 shows the position of the red/green dual LED, for the Titanium Maestro, which is used for immediate indication of the Initiation and Working states.

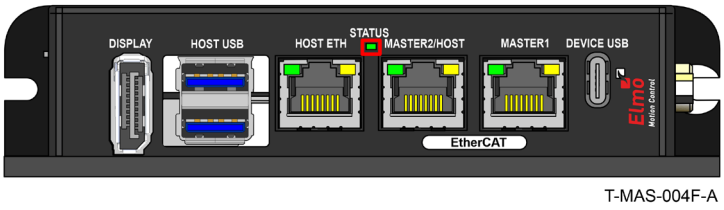


Figure 7: Titanium Maestro Status Indicator

The red/green dual LED is used for immediate indication of the following states:

- **Initiation state:** In this state the LED indicates whether the Maestro is in the boot state (steady red) or in the operational state (steady green).
- **Error state:** In this state the LED indicates whether the motion controller is in error state (blinking green and red).

8.7 Display Port (J1)

Pin	Signal	Function
1	DP_L0+	Display Port Lane 0+
2	GND	COMRET (Common return)
3	DP_L0-	Display Port Lane 0-
4	DP_L1+	Display Port Lane 1+
5	GND	COMRET (Common return)
6	DP_L1-	Display Port Lane 1-
7	DP_L2+	Display Port Lane 2+
8	GND	COMRET (Common return)
9	DP_L2-	Display Port Lane 2-
10	DP_L3+	Display Port Lane 3+
11	GND	COMRET (Common return)
12	DP_L3-	Display Port Lane 3-
13	DP_AUX_SEL	Display Port Auxiliary selection
14	DP_CONFIG2	Connected to COMRET through a pull-down resistor
15	DP_AUX+	Display port Auxiliary+
16	GND	COMRET (Common return)
17	DP_AUX-	Display port Auxiliary-
18	DP_HPD	Display Port Hot Plug Detect
19	PWR_RET	Display Port Power Return (COMRET)
20	DP_PWR	3.3V Up to 500mA

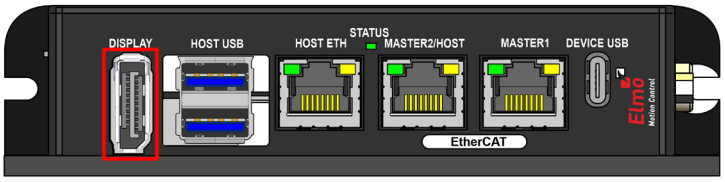
Connector Location	Cable Connector
 T-MAS-004F-L	 T-MAS-053B

Table 15: Display Port Pin Assignments

8.8 EtherCAT and Ethernet Connectors

8.8.1 Ethernet Host Connector (X1)

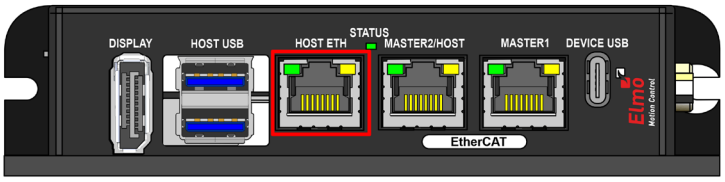
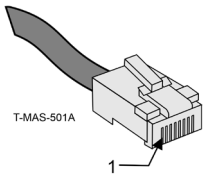
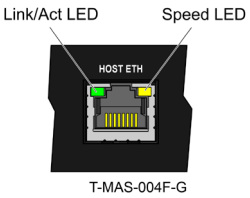
Pin	10Base-T		100Base-T		1000Base-T	
	Signal	Description	Signal	Description	Signal	Description
1	TX+	Transmit Data+	TX+	Transmit Data+	BI_DA+	Bi-Directional Data A+
2	TX-	Transmit Data-	TX-	Transmit Data-	BI_DA-	Bi-Directional Data A-
3	RX+	Receive Data+	RX+	Receive Data+	BI_DB+	Bi-Directional Data B+
4	N/A		N/A		BI_DC+	Bi-Directional Data C+
5	N/A		N/A		BI_DC-	Bi-Directional Data C-
6	RX-	Receive Data-	RX-	Receive Data-	BI_DB-	Bi-Directional Data B-
7	N/A		N/A		BI_DD+	Bi-Directional Data D+
8	N/A		N/A		BI_DD-	Bi-Directional Data D-
Connector Location						**Cable Connector**
 T-MAS-004F-F						 **8 pin RJ-45 plug**

Table 16: Ethernet Host RJ-45 MDI Port Pinout Assignments

8.8.2 Ethernet Host Activity Indicators



T-MAS-004F-G

The left side LED is the link/activity indicator. It shows the state of the applicable physical link and the activity on that link.

The right side LED is the speed indicator. It shows the speed of the connection on the Ethernet line. The possible states of these LEDs are summarized in Table 17.

LED	State	Meaning
Link /Activity	Off	No link is established
	On	A link is established
	Blinking	There is data transmission activity

LED	State	Meaning
Speed	On (Green)	The connection speed is 1000 Mbps
	On (Yellow)	The connection speed is 100 Mbps
	Off	The connection speed is 10 Mbps

Table 17: LED States

8.8.3 Ethernet Communication

Note:
When connecting the Ethernet communication cable use a shielded CAT5e/6 Ethernet cable.

The Titanium Maestro connects to a PC either directly or through a hub, switch or router. Use a standard shielded CAT5e/6 Ethernet cable.

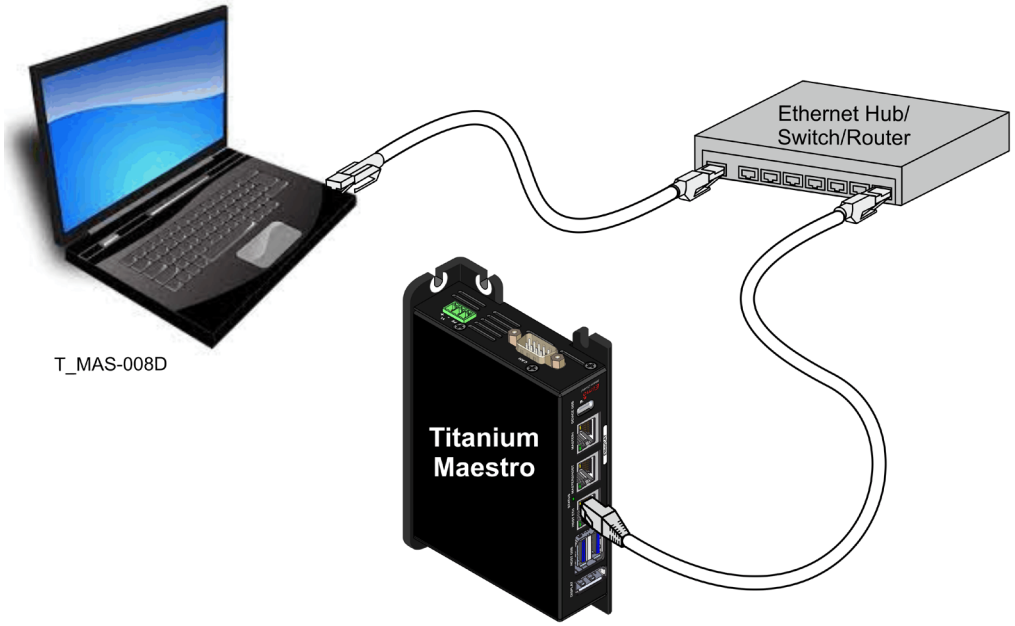


Figure 8: Titanium Maestro Connected to a Network

Figure 9: Titanium Maestro Connected Peer-to-Peer to a PC

8.8.4 Additional Host Connection

It is possible to have a dual host system, for instance, for different networks requesting to connect to the Maestro. This can be done by connecting the X3 connector to the additional host.

8.8.5 EtherCAT Master Port 1 Connector (X2)

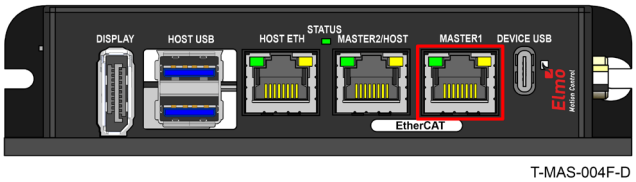
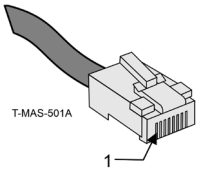
Pin	Signal	Function – 100Base-T
1	MASTER1_TX+	MASTER1 Transmit Data+
2	MASTER1_TX-	MASTER1 Transmit Data-
3	MASTER1_RX+	MASTER1 Receive Data+
4	N/A	
5	N/A	
6	MASTER1_RX-	MASTER1 Receive Data-
7	N/A	
8	N/A	
Connector Location		**Cable Connector**
 T-MAS-004F-D		

Table 18: EtherCAT Master RJ-45 MDI Port 1 Pinout Assignments

8.8.6 EtherCAT Master Port 2 / Host Connector (X3)

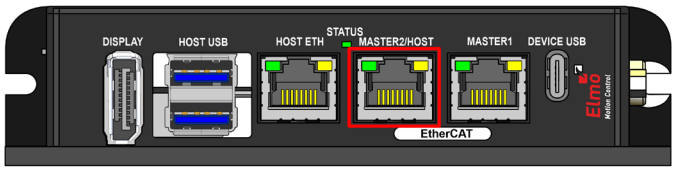
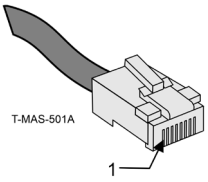
Pin	Signal	Function – 100Base-T
1	MASTER2_TX+	MASTER2 Transmit Data+
2	MASTER2_TX-	MASTER2 Transmit Data-
3	MASTER2_RX+	MASTER2 Receive Data+
4	N/A	
5	N/A	
6	MASTER2_RX-	MASTER2 Receive Data-
7	N/A	
8	N/A	
Connector Location		**Cable Connector**
 T-MAS-004F-K		

Table 19: EtherCAT Master RJ-45 MDI Port 2/Host Port Pinout Assignments

8.8.7 EtherCAT Activity Indicators

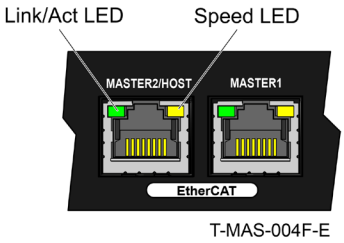


Figure 10: EtherCAT LEDs

The left side LED is the link/activity indicator (Figure 10). It shows the state of the applicable physical link and the activity on that link.

The right side LED is the speed indicator (Figure 10). It shows the speed of the connection on the Ethernet line. The possible states of these LEDs are summarized in Table 20.

LED	State	Meaning
Link /Activity	Off	No link is established
	On	A link is established
	Blinking	There is data transmission activity
Speed	On (Yellow)	The connection speed is 100 Mbps The speed of the EtherCAT line must be 100 Mbps. Otherwise, there is no EtherCAT data transmission
	Off	The connection speed is 10 Mbps

Table 20: LED States

8.8.8 EtherCAT Network

The Titanium Maestro is the master of the EtherCAT network and must always be the first device in the line.

The Ethernet Master 1 port of the Titanium Maestro should be connected to the EtherCAT In port of the next device down the line. The EtherCAT Out port of the last device in line can be left open. If redundancy is required, the **Out** port of the last device should be connected to the MASTER2/HOST port of the Titanium Maestro.

Note:
When connecting the EtherCAT communication cable it is recommended to use shielded CAT5e/6 cable

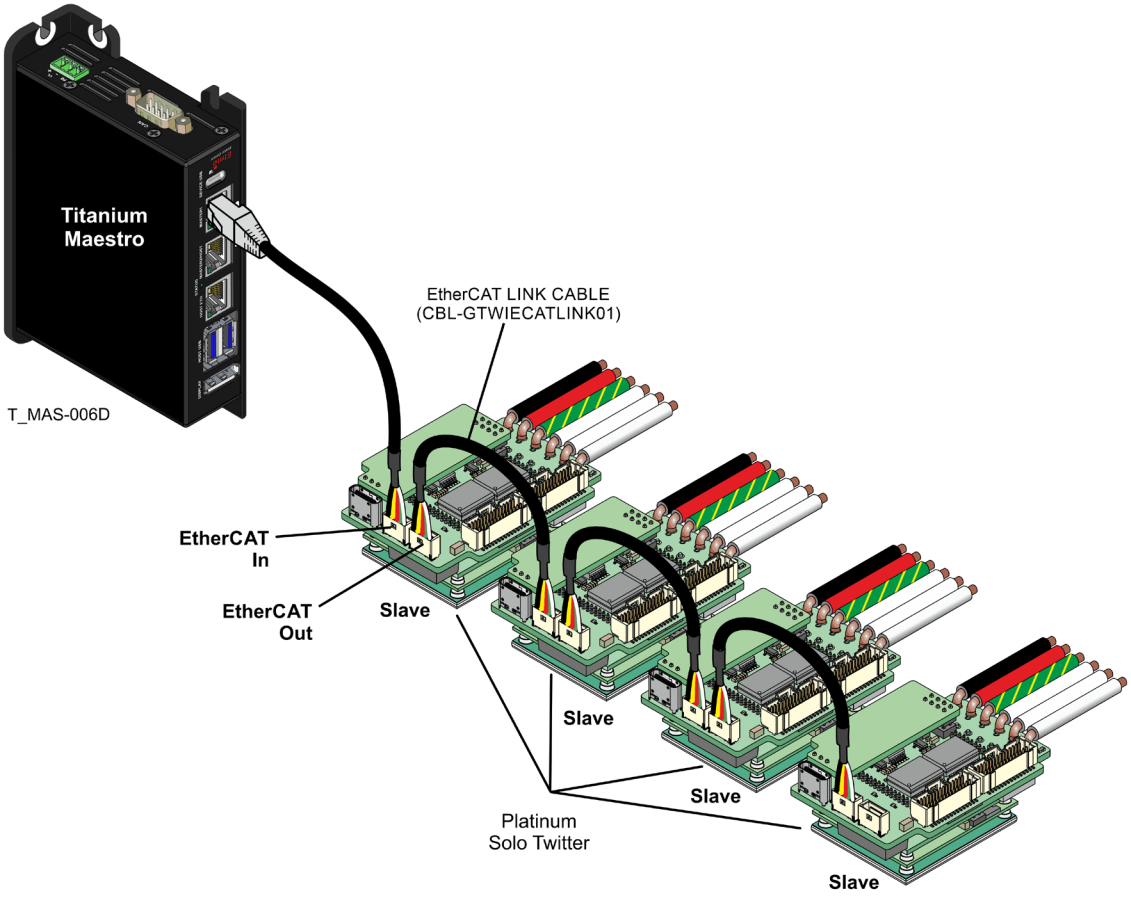


Figure 11: EtherCAT Platinum Drives Network with No Redundancy

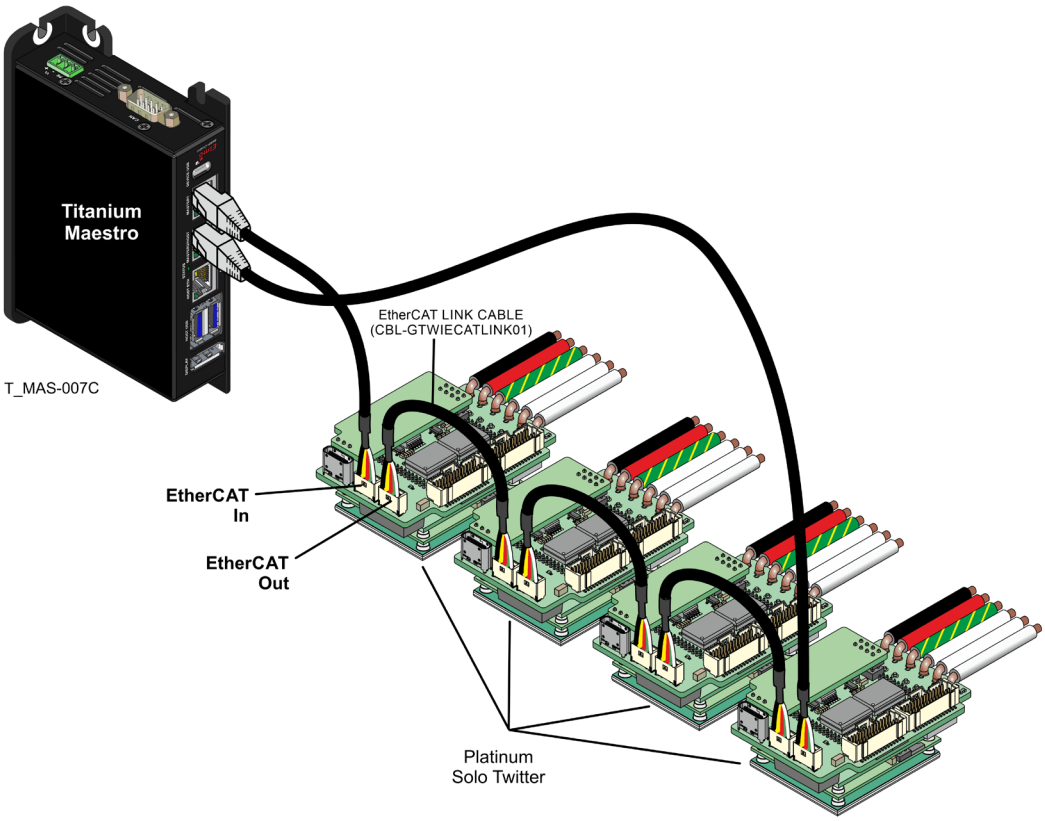
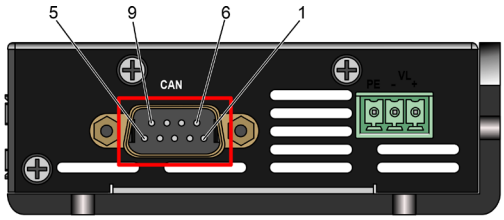
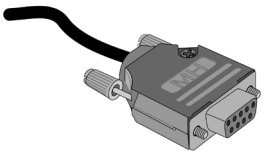


Figure 12: EtherCAT Platinum Drives Network with Redundancy

8.9 CAN Connector (J2)

Pin	Signal	Function
1	N/A	
2	CAN_L	CAN_L bus line (dominant low) isolated
3	CAN_GND	CAN Communication Return (isolated)
4	N/A	
5	N/A	
6	CAN_GND	CAN Communication Return (isolated)
7	CAN_H	CAN_H bus line (dominant high) isolated
8	N/A	
9	N/A	

Connector Location	Cable Connector
 T-MAS-004F-H	 TMAS-051B

Type	Manufacturer & Part No.	Mating Connector
9 pin D-type male (isolated CAN)	NELTRON: 5504F1-09P-02-03-F1	9 pin D-Type Female Connector

Table 21: CAN Cable Pin Assignments

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.
- Connect the cable's Braid (shield) to the D-Type female shell (metal housing).
- Connect the cable's Braid (at the other end) to the device chassis (PE). You can use the drain wire to facilitate connection.
- **Connect a 120Ω termination resistor to each end of the network cable.**

8.10 Dual Host USB 3.1 Type A (X5)

Pin	Signal	Function
Host1 LOWER CONNECTION USB3.1		
1	Host1_VBUS	Host1 USB VBUS 5V±5%/ up to 900mA
2	Host1_D-	Host1 USB _N line
3	Host1_D+	Host1 USB _P line
4	GND	USB power return. Connect to COMRET (Common return).
5	Host1_SSRX-	Host1 Super Speed transmit differential pair
6	Host1_SSRX+	
7	GND_DRAIN	USB signal return. Connect to COMRET (Common return).
8	Host1_SSTX-	Host2 Super Speed receive differential pair
9	Host1_SSTX+	
Host2 UPPER CONNECTION USB3.1		
10	Host2_VBUS	Host2 USB VBUS 5V±5% / up to 900mA
11	Host2_D-	Host2 USB_N line
12	Host2_D+	Host2 USB_P Line
13	GND	USB power return. Connect to COMRET (Common return).
14	Host2_SSRX-	Host2 Super Speed transmit differential pair
15	Host2_SSRX+	
16	GND_DRAIN	USB signal return. Connect to COMRET (Common return).
17	Host2_SSTX-	Host2 Super Speed receive differential pair
18	Host2_SSTX+	

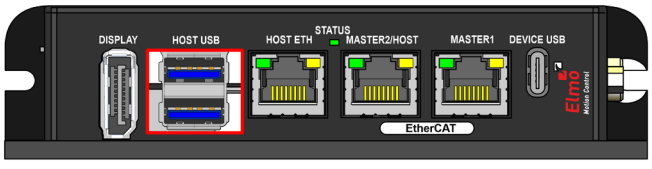
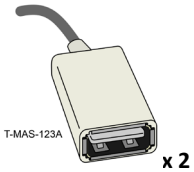
Connector Location	Cable Connector
 T-MAS-004F-I	 x 2

Table 22: Dual Host USB 3.1 (Type A) Pin Assignments

8.11 Device USB 2.0 Type C (X4)

Pin	Signal	Function
A1	GND	USB GND. Connect to COMRET (Common return).
A4	VBUS	**Device mode** – 5V input from Host
A5	CC1	N.C
A6	D+	USB_P Line
A7	D-	USB_N Line
A9	VBUS	**Device mode** – 5V input from Host
A12	GND	USB GND. Connect to COMRET (Common return).
B1	GND	USB GND. Connect to COMRET (Common return).
B4	VBUS	**Device mode** – 5V input from Host
B5	CC2	N.C
B6	D+	USB_P Line
B7	D-	USB_N Line
B9	VBUS	**Device mode** – 5V input from Host
B12	GND	USB GND. Connect to COMRET (Common return).

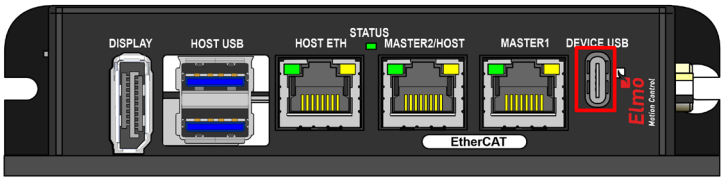
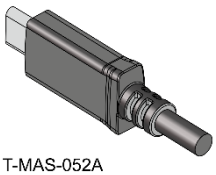
Connector Location	Cable Connector
 T-MAS-004F-J	 T-MAS-052A **USB Device Type C Plug**

Table 23: USB Pin Assignments

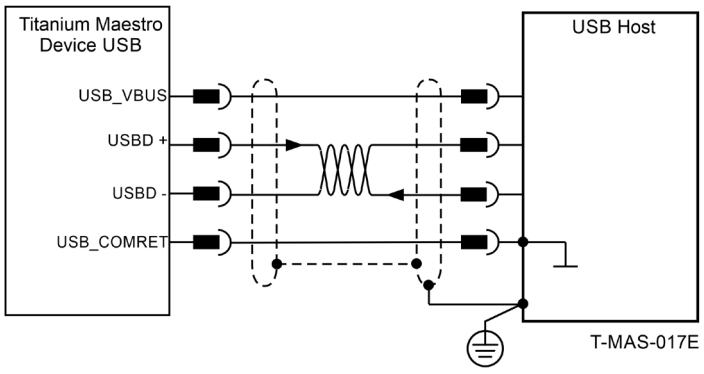


Figure 13: USB Network Diagram

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.

8.12 microSD™ Memory Card (Push-push Type) SCHA (J3)

Push the card once to insert it into the slot, and then push it again for removal.

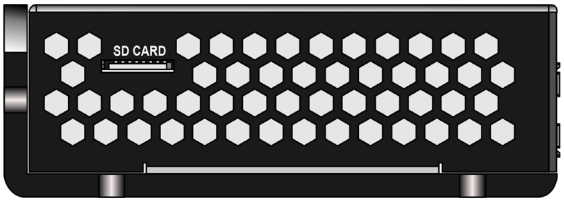
Connector Location	MicroSD Memory Card
 T-MAS-003F-A	 **MicroSD Memory Card**

Table 24: microSD™ Memory Card (Push-push Type) SCHA

8.13 Powering Up

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

8.14 Initializing the System

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

- Titanium Maestro (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 Gold, Platinum, or Titanium Line servo drives:
Setting up the drives and motors is described in the Gold, Platinum, or Titanium Line Servo Drive Installation Guide and Elmo Application Studio Users Guide. Advanced features are described in the Gold or Platinum Line Software Manual, Gold or Platinum Line Command Reference and CAN Implementation Guide.

Chapter 9 Titanium Maestro Dimensions

These are the dimensions of the basic Titanium Maestro model.

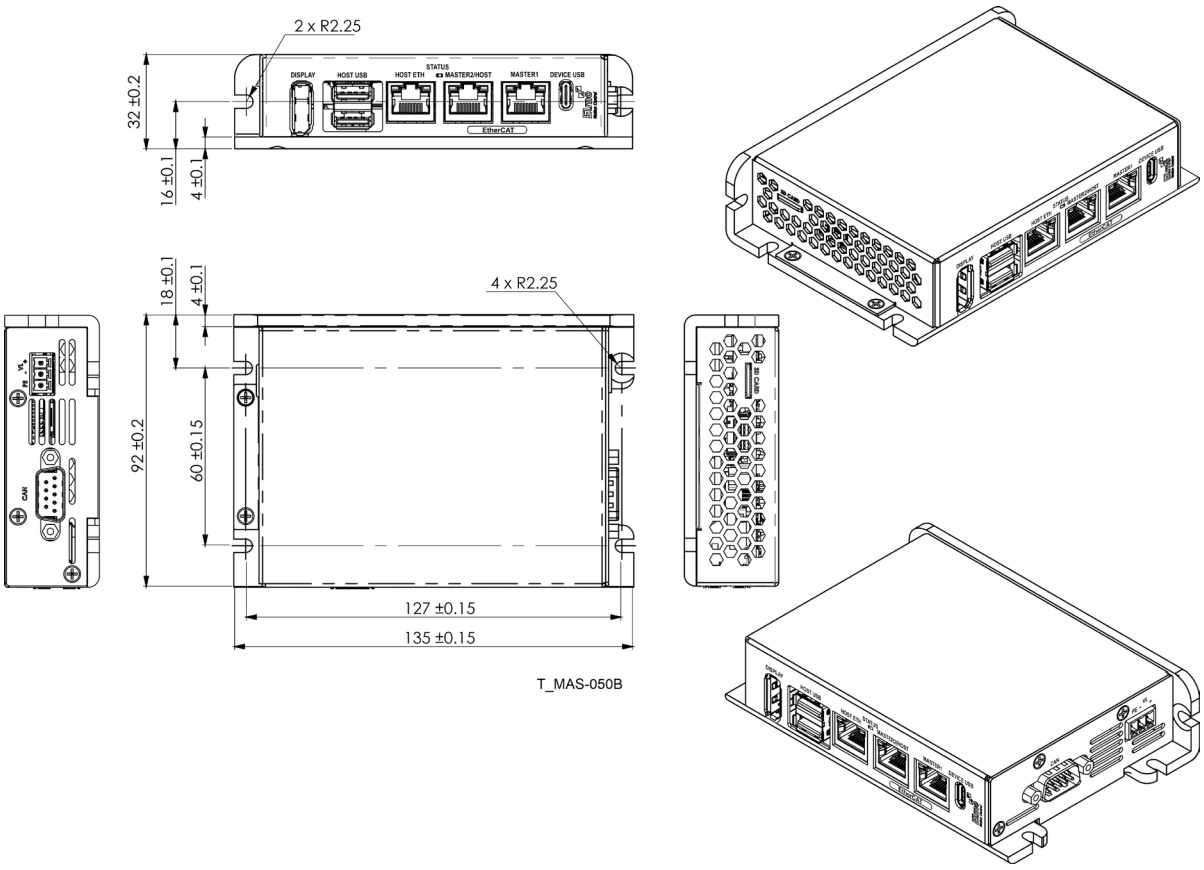


Figure 14: Titanium Maestro Basic Dimensions

Chapter 10 Compliance with Standards

The Titanium Maestro network motion controller 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.

10.1 Low Voltage Directive

Specification	Details
The related standards below apply to the performance of the motion controller as stated in the environmental conditions paragraph 7.1 Environmental Conditions. The Titanium Maestro does not require UL compliance, as its maximum voltage is 32 VDC.	
In compliance with **EN 60204-1**	Low Voltage Directive 73/23/EEC
In compliance with **CE 2014/35/EU**	Low-voltage directive 2014/35/EU

Table 25: Low Voltage Directive

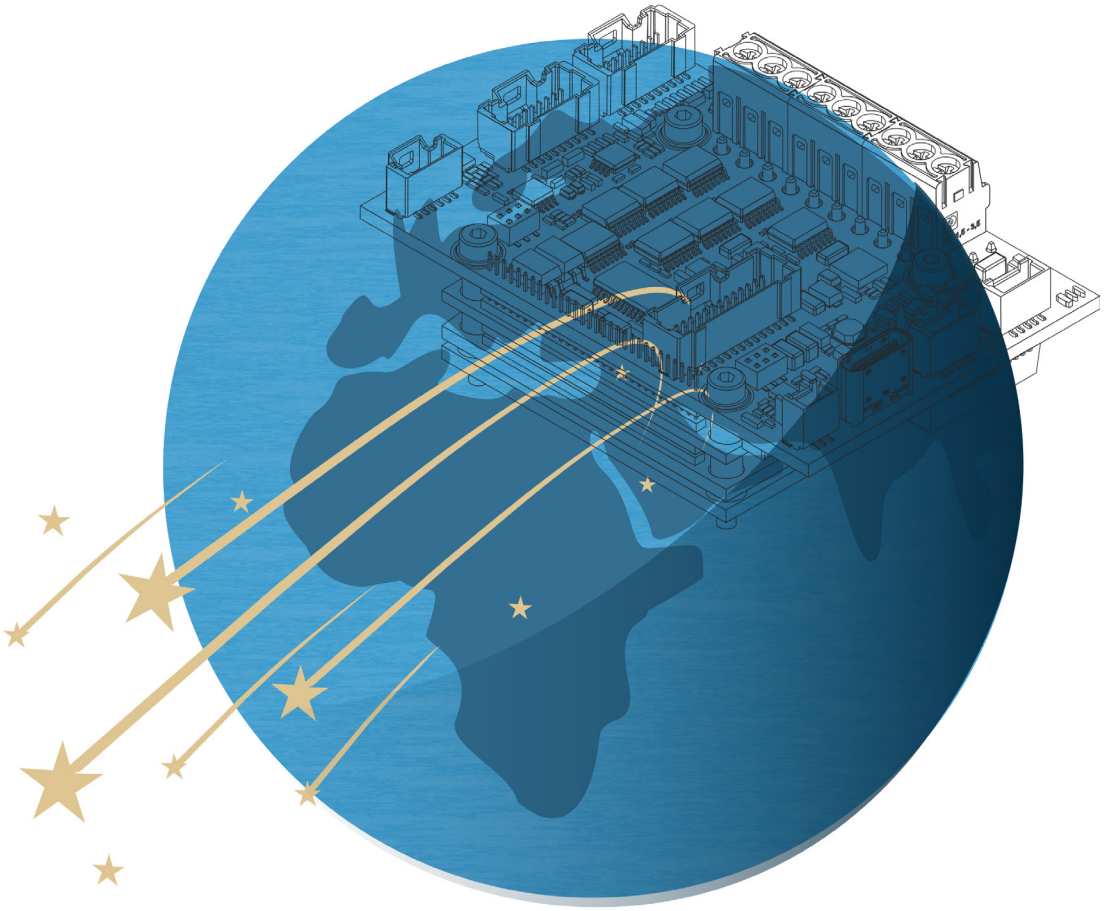
10.2 Other Compliant Standards

Quality Assurance	
ISO 9001:2008	Quality Management
Design	
• 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)

Table 26: Compliant Standards

Elmo

Dedicated To Excel



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