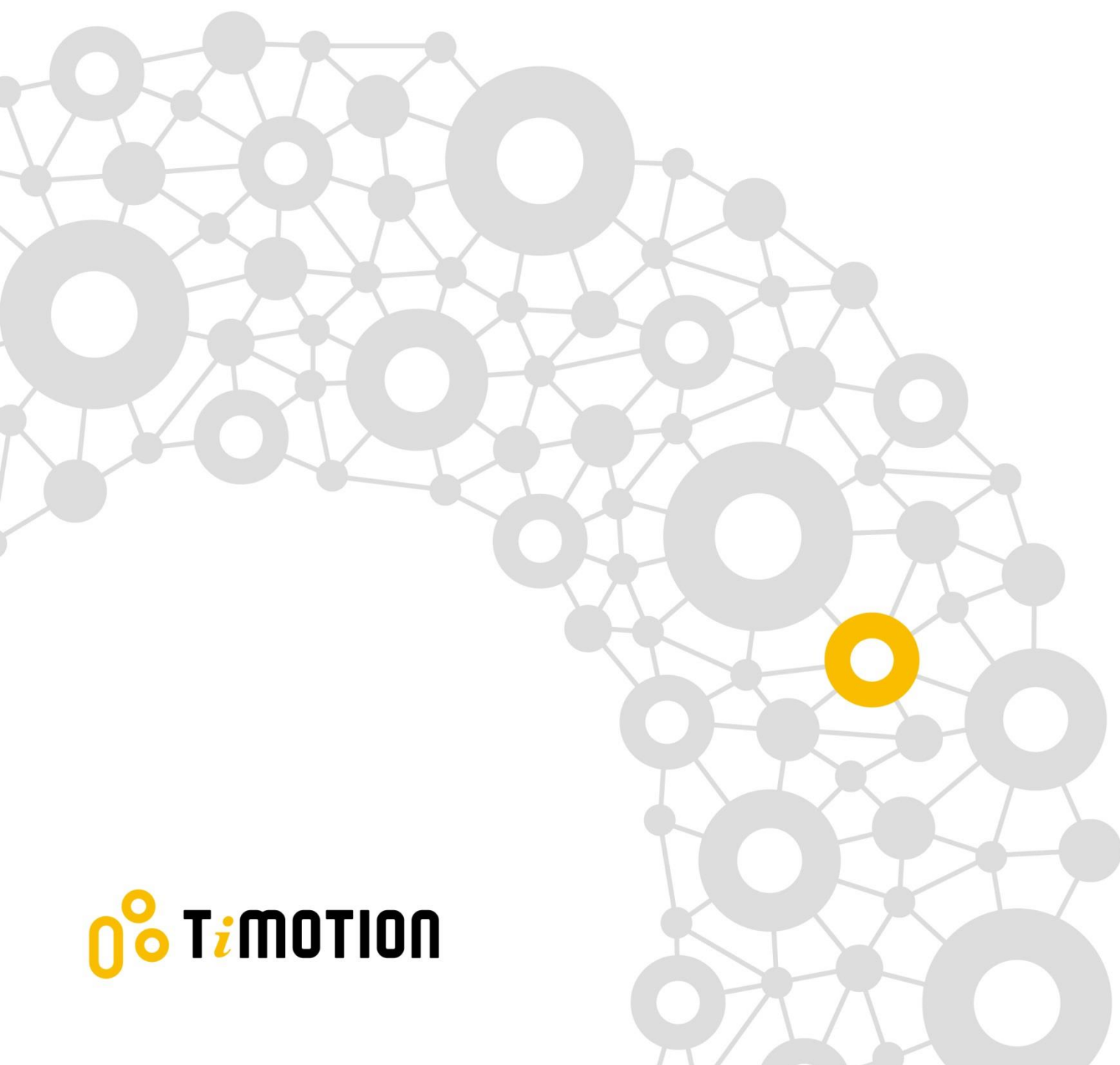


User Manual

MA2T



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Glossary

The following terms and acronyms are being used in this manual.

- **VDC+:** The positive pole of power input.
- **VDC-:** The negative pole of power input.
- **RPM:** Number of turns per minute.
- **AWG:** American wiring gauge.
- **Hall-POT:** Hall Effect Potentiometer (Provides analog voltage feedback).
- **EOS:** End of Stroke.

1. General

1.1 About this manual

This user manual is provided to the manufacturer of the equipment or system rather than end users. This manual provides information needed to install, use and maintain the TiMOTION products. Manufacturers are responsible to provide a user guide to the end users using the relevant safety information passed from this manual.

This manual contains installation directions as well as technical data for the TiMOTION industrial electric linear actuators. Carefully read through each section of the user manual before the equipment is unpacked, installed or operated. Please note all the dangers, warnings, cautions and notes stated in this manual. Please follow the instructions provided in this manual to ensure safe, reliable operation.

1.2 Target Personnel

Please allow qualified mechanical and electrical professionals to perform all installation, maintenance and replacement of the TiMOTION products. Please keep the products away from people who do not have the required experiences or knowledge of the product.

1.3 Warranty

In general, TiMOTION provides a 24-month warranty on Industrial Motion actuators based on the manufacturing date. The warranty is valid only if the equipment is properly operated and maintained correctly. The application of the product is the responsibility of the buyer. TiMOTION makes no representation or warranty as to the product's suitability for any particular use or purpose.

1.4 Transport and storage

The actuator should only be stored and transported in the original TiMOTION packaging. The temperature during transportation and storage must be between -40 to +85° C (-40 to +185° F). Please avoid shocks to the package. If the package is damaged, check the actuator for visible damage and notify the carrier and TiMOTION.

1.5 Packaging

The sample order packaging contains the product and the QR code directly to this manual. For large quantity orders, packaging may vary, and TiMOTION reserves the right to change it.

1.6 Support

If any technical support or information is needed for this product, please contact your TiMOTION sales engineer. You can also visit <https://www.TiMOTION.com/en> for the product or contact information.

1.7 Disclaimer

This user manual has been written based on our current technical knowledge. TiMOTION is continuously working on updating the product information. We reserve the right to carry out technical modifications.

1.8 Notification and warnings

1.8.1 Mounting/dismounting the actuator

- ◆ Please read through this user manual before working on the equipment that the actuator is or shall be a part of.
- ◆ Adhere to the information contained in this user manual and on the product label. Never exceed the performance limits stated herein.
- ◆ Be sure the actuator is not in operation.
- ◆ Ensure the actuator is free from loads that could be released during mounting or dismounting.
- ◆ Refrain from unplugging any cables or connectors during operation or while power is on.
- ◆ Immediately stop using the actuator if it seems faulty or damaged. Notify your TiMOTION sales engineer so corrective actions can be taken.
- ◆ Never disassemble the actuator as that will compromise the sealing and could impact the function of the actuator. Disassembly will lose warranty.
- ◆ Grease may be present on the extension tube. Contact with the grease is non-hazardous. Please refrain from removing the film.

1.8.2 Operation

- ◆ Be sure the actuator is correctly mounted as indicated in the user instructions.
- ◆ Be sure the equipment can be moved easily over the actuator's whole working area.
- ◆ Be sure the actuator is connected to a main electricity supply/transformer with the correct voltage specified on the actuator label.

- ◆ Be sure that the connection bolts are secured safely and can withstand the wear.
- ◆ Stop the actuator immediately if anything unusual is observed.
- ◆ Ensure there is no side load present on the actuator.
- ◆ Only use the actuator within the specified working limits.
- ◆ Refrain from having any contact with the actuator.

1.8.3 Equipment power off

- ◆ Switch off the main supply to prevent any unintentional operation.
- ◆ Regularly check for extraordinary wear.

1.8.4 Duty cycle

- ◆ The standard-duty cycle is 25%.
- ◆ If the product is customized, please refer to the approval drawings.

1.8.5 Temperature

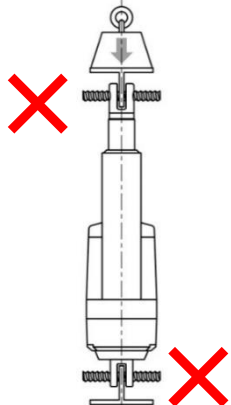
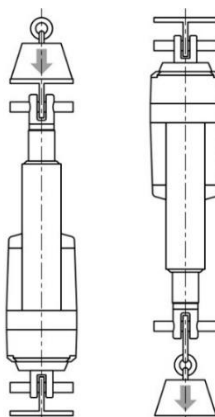
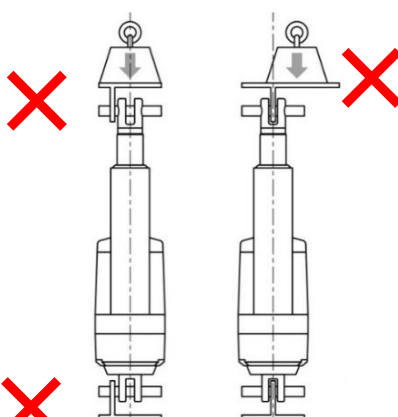
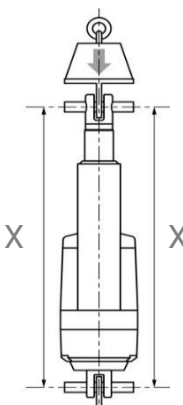
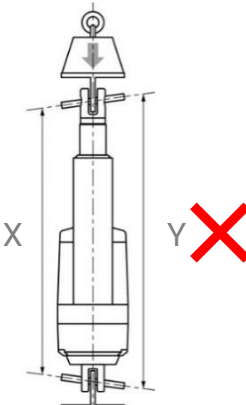
- ◆ The operating temperature range is -40°C ~+85°C.
- ◆ The operational temperature range at full performance is +5°C ~+45°C.

2. Installation

2.1 Mechanical installation

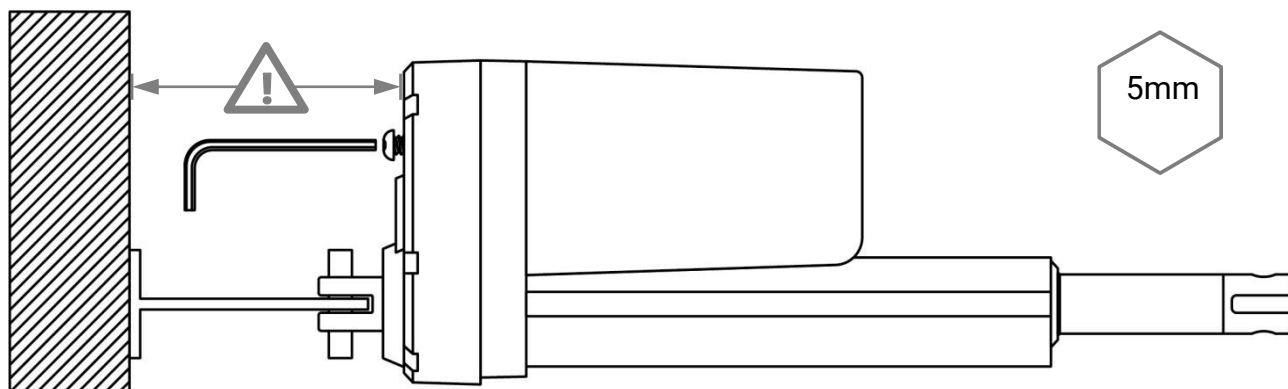
2.1.1 Mounting notice

- ◆ Use solid mounting pins with the proper dimension and support them at both ends.

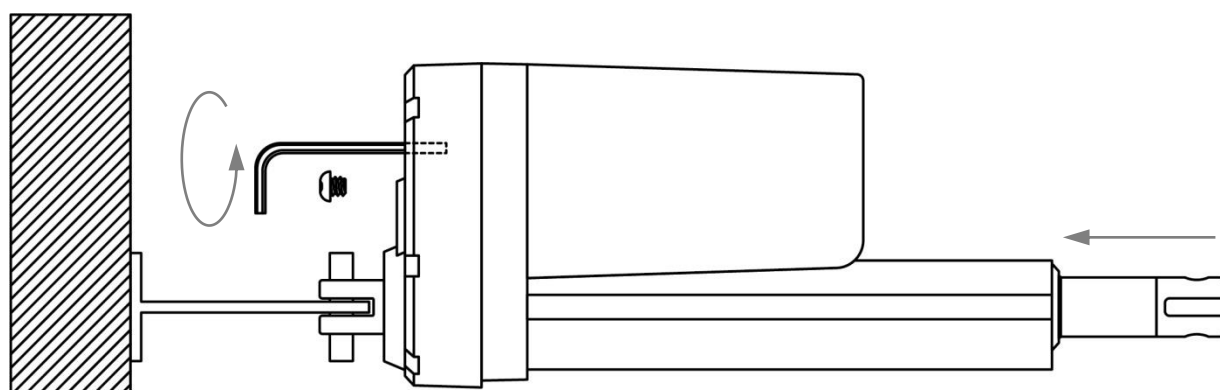
Note	Correct	Wrong
Please mount the actuator with the mounting pins of correct dimension and without threaded at both ends of the attachments.		
Do not mount the actuator with the pins in different rotated angles, this could cause stress on the nut during operation. The load should act along the stroke axis of the actuator from the front attachment, inner tube to the rear attachment. Off center or side loads may cause bending and lead to failure.		
Be sure the mounting pins must be parallel to each other. If the pins are not parallel to each other the actuator might be bend and could be damaged.		

2.1.2 Manual drive operation

- ◆ In case of a power failure, a manual hand crank can be used.
- ◆ Before performing, the power supply needs to be disconnected.
- ◆ When mounting the actuator, ensure there is enough space between the rear adapter and any objects. This will allow the user override to be operated.
- ◆ Use the 5mm Allen key for both the IP protection screw and the manual drive shaft inside.

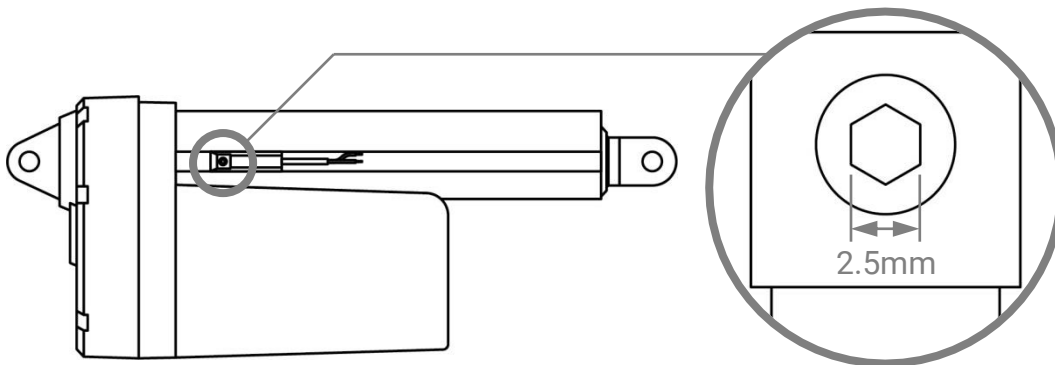


The torque required to manually move the extension tube is within 1.7 Nm, maximum 65 RPM. Please do not run the outer tube to the end of stroke, as that may damage the actuator.



2.1.3 Outer tube reed sensor adjustment

- ◆ The external limit switches are mounted in the two slots at the side of the cover tube.
- ◆ Use the 2.5mm Allen key inner hexagon to position and lock the reed sensor.
- ◆ Ensure the reed sensor doesn't meet other magnetic parts, as this may cause incorrect measurements.
- ◆ The torque required to secure the screw to fix the reed sensor is within 1.5 Nm
- ◆ The signal is potential free and independent from the motor power circuit.
- ◆ Connect the reed sensor with max 32V, <1A.
- ◆ The reed sensors are N.C..



2.2 Electrical installation

2.2.1 Important notice

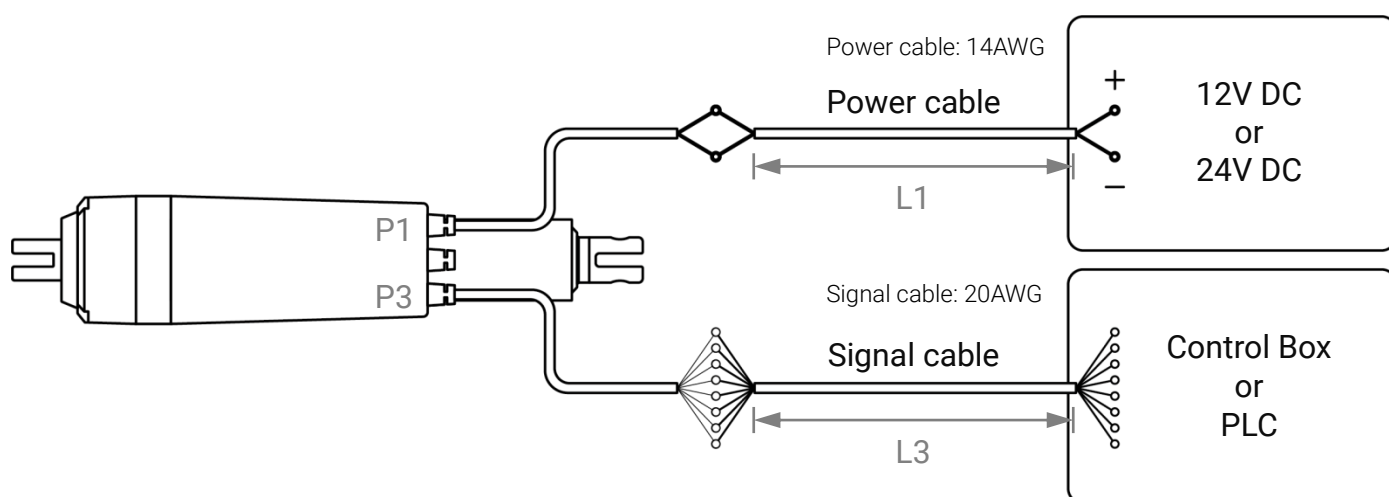
- ◆ Make sure the leads/cables leading to the motor are rated to handle the maximum current.
- ◆ To reduce the chance of a crushing hazard, we recommend an emergency stop.
- ◆ If you are not using soft stop on a DC-motor, a short peak of high voltage will be sent towards the power supply. When selecting the power supply, please ensure it is able to withstand the peak of high voltage.
- ◆ To reduce the chance of interference, refrain from placing signal cables along power cables.
- ◆ Use a two-wire system to prevent ground loop.
- ◆ Please use shielded signal cables with applications that can be sensitive or if there is interference risk.
- ◆ Please note, using long cables in combination with small lead cross-sections and low voltages could lead to a malfunction due to voltage drop.
- ◆ Use spark protection on relays and other coil operated devices.
- ◆ Please be sure the power to the actuator is off before working on the actuator and the wiring.

2.2.2 Extension power cable

The actuator is supplied with a power cable (and/or signal cable). The cable(s) has/have flying leads in one end for the user's equipment connections. On the other end of the actuator, the cable is integrated into the connector cover. The plug-in connector allows the user to replace the actuator without disconnecting the flying leads.

Using the extension power cable from the DC source with the proper size is important to avoid a significant voltage drop. The further away the DC source is, the larger the extension cable may need to be. Please refer to the following table for the recommendation of the extension power cable size.

Extension cable type	Length of cable (L)	Cross-section (X)	AWG
Power extension cable L1	0 - 4 m	2.08 mm ²	AWG 14
	4 - 10 m	3.31 mm ²	AWG 12
	>10 m	Check with your TiMOTION contact representative	
Signal extension cable L3	<10 m	0.5 mm ²	AWG 20
	>10 m	Check with your TiMOTION contact representative	



2.2.3 Inrush current

When starting the actuator, there is an inrush current to the motor that will last between 75 to 150 milliseconds (up to four times the rated current).

If using an AC power supply, please be sure it is sized to handle the inrush current (batteries typically have no issues delivering the inrush current). Please be sure all contacts, switches, and relays are sized appropriately to handle the inrush current.

It is not recommended to configure the hard start setting to the soft start function with the MA2T. PGMA setting with the soft start is not recommended to be set at 0 (zero) seconds.

2.2.4 Back EMF

It is recommended not to configure a hard stop setting to the soft stop function with MA2T (i.e., PGMA setting with soft stop is not recommended to be set as 0 sec) to lower the effect of back EMF when the motor is decelerated.

2.3 Wiring definition

The optional MA2T T-Smart system is integrated with the T-Smart PBCA and MCU. All the functionality can be achieved with proper configuration on PGMA. Please refer to the following table that describes the primary (but not limited) system, implying the required system and the relative connections for each pin, signal spec, and warnings.

Below is the standard wiring definition of the actuator. If your actuator is ordered with customized wiring, please contact TiMOTION's sales representatives for more detailed information.

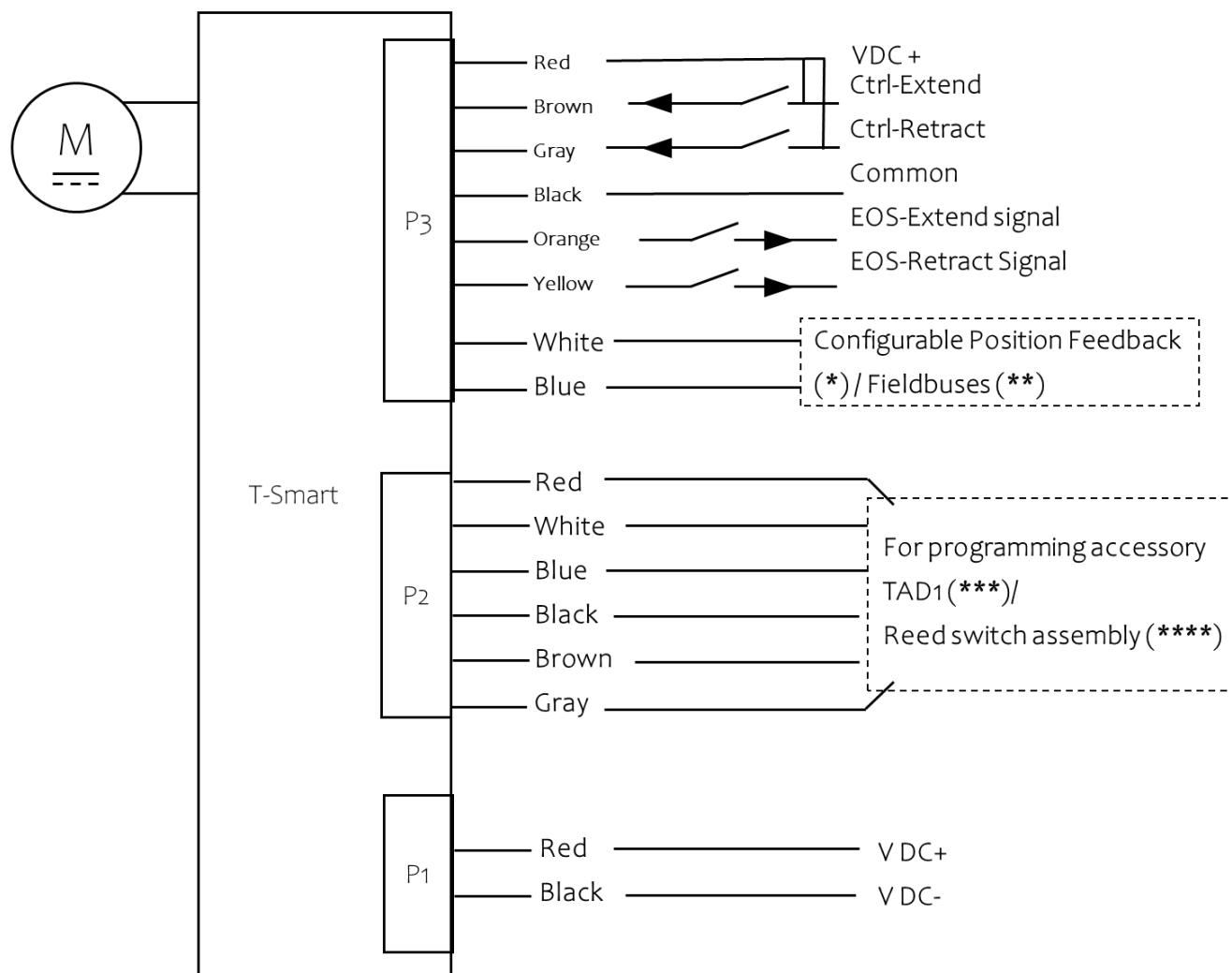
In general, the MA2T T-Smart version cable exit can have a maximum of 3 sets with 8 pins, 6 pins, and 2 pins. (2 power wire pins and/or up to 8 signal wire pins and/or up to 6 PGMA & Reed signal wire pins.)

Function	Connection description
T-Smart	• Stable DC power supply • Signal type switch to control actuator extended or retracted • Position Signal or EOS Signal output to control box or PLC • Reed switch signal output to control box or PLC • Synchronized up to 8 actuators

Note: Please contact your TiMOTION sales representative if the signal outputs are customized.

2.3.1 T-Smart

The actuator is equipped with T-Smart PCBA, allowing position feedback (Single Hall, Double Hall, PWM, Hall-POT) and EOS feedback to PLC, Reed switch signal output to PLC or up to 8 actuators having synchronized function when actuators extended or retracted.



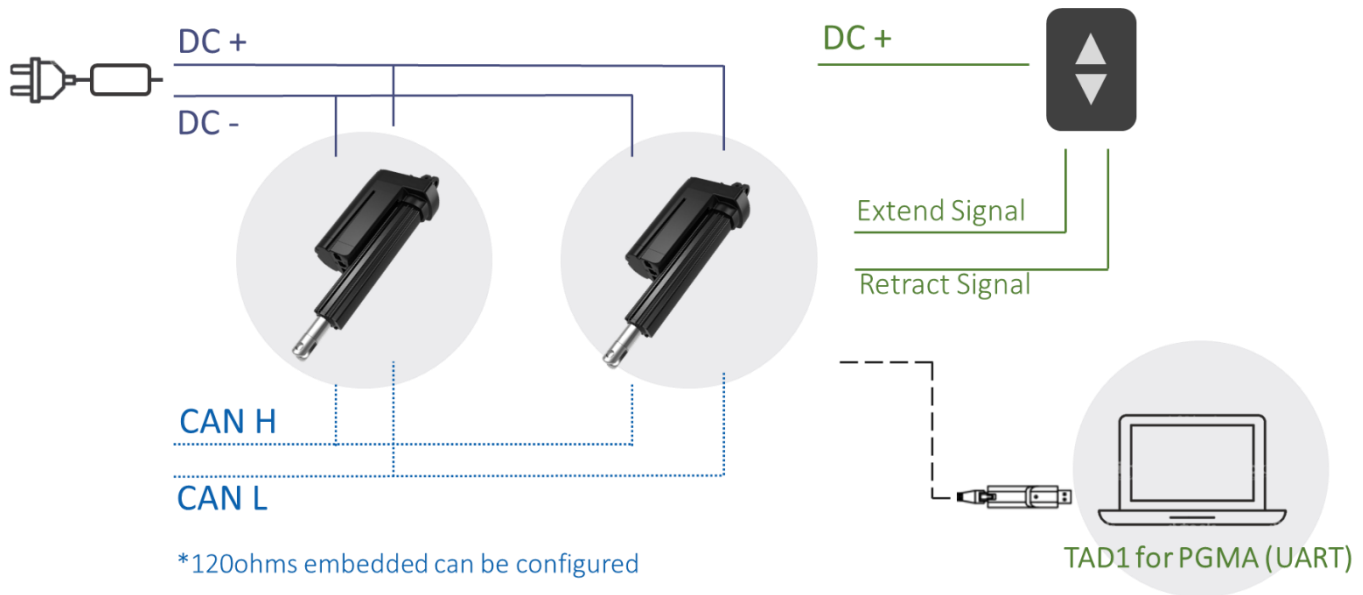
Port No.	Wire	AWG	Description	Spec
P1	Red	14	Connect Red to Vm+	24V version: Input voltage 18~34 V DC 12V version: Input voltage 9~16 V DC *Do not change the power supply polarity on the Red and Black wires.
	Black	14	Connect Black to Vm-	

P3	Red	20	Vm+ output for connecting to external control	
	Brown	20	Extend the actuator when short circuit with P3 Red	Input current $\leq 11\text{mA}$
	Gray	20	Retract the actuator when short circuit with P3 Red	
	Black	20	Signal ground	The signal is potentially free and independent from the motor power circuit.
	Orange	20	Connect to up limit switch normal close pin (N.C.)	Both brown and orange signal wires are normal close circuits when the actuator is in the middle of the stroke.
	Yellow	20	Connect to low limit switch normal close pin (N.C.)	The signal circuit is connected to the motor power circuit, and the value Vm+ depends on actuator voltage. Connect the limit switch signal wire to the load <1A.
	White	20	CAN High, Hall signal output_S1, Hall-POT signal output	For CAN High/Low: Input Voltage = 5V Embedded 120 Ohms resistor for synchronized function. For Hall and PWM signal output: Output Current $\leq 5\text{ mA}$ For Hall-POT
	Blue	20	CAN Low, Hall signal output_S2, PWM signal output	

				Output Voltage = 10V Output Current =10 mA
P2	Connector	NA	Connect TAD1 for programming Reed switch signal output	

Note:

1. If using a PLC, please contact your TiMOTION sales representative to determine the compatibility of T-Smart capable products with your desired communication protocol (e.g., CAN BUS or J1939).
2. Wire definition of two actuators in synchronized mode.

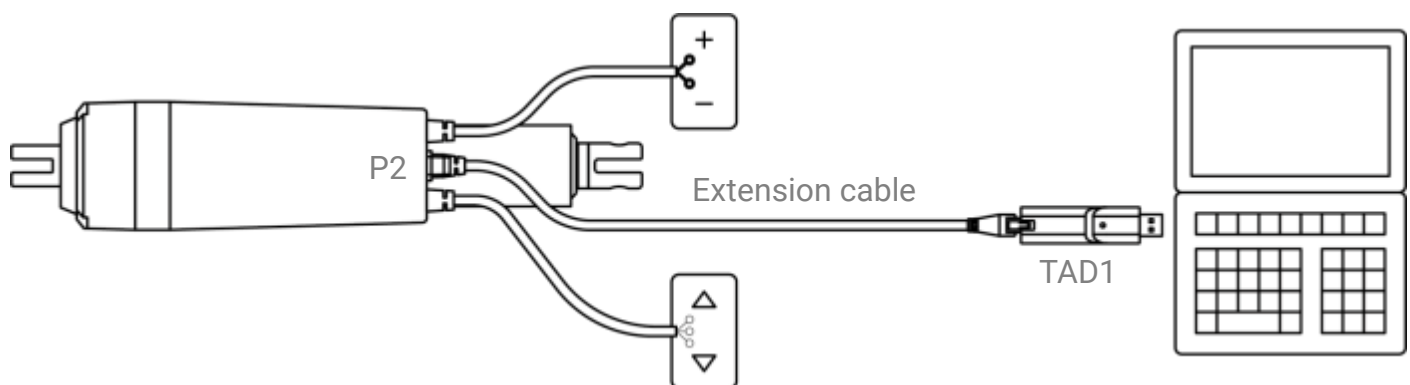


3.PGMA Installation

3.1 Connection

Unless the customer requests to ship separately, all cables will be fixed onto the actuator under the default installation procedure.

For PGMA settings, it is required to change the short circuit plug or the Reed sensor cable on P2. Either one needs to be replaced by a TAD1 extension cable.



PGMA setting connection

3.1.1 Cable replacement

- Unless the customer requests to ship separately, all cables will be fixed onto the actuator under the default installation procedure.



Without the reed sensor, P2 is connected with the short circuit plug by default.



With the outer tube reed sensor connected on P2

- All the cables will be tested according to TiMOTION's factory assembly standard procedure before shipping.
- Ensure to protect the plugs and pins during the process.
- Ensure the plug is in the right location and fully pressed in before mounting the cable lid.
- Please refrain from picking up or carrying the actuator by the cables.
- Be sure the cable end is kept inside a closed, protected area to guarantee high IP protection.
- This illustration shows an example with steps to replace the default installed P2 short circuit plug by the extension cables for the PGMA setting.

3.1.2 Steps for cable replacement

This illustration shows how to replace the default installed P2 short circuit plug with the extension cables for the PGMA setting.



Step 1: Unscrew the cover.



Step 2: Remove the cover.



Step 3: Unplug the short circuit plug.



Step 4: Replaced the TAD1 extension cable on P2.



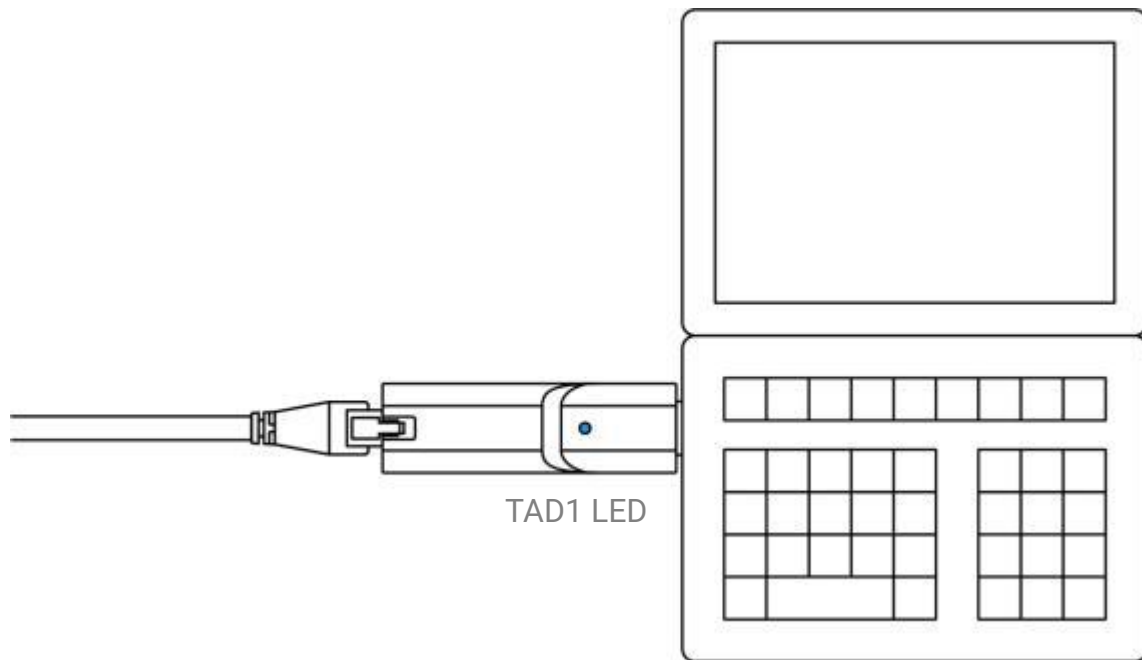
Step 5: Install the cover.



Step 6: Re-screw with the torque approximately 1.5Nm.

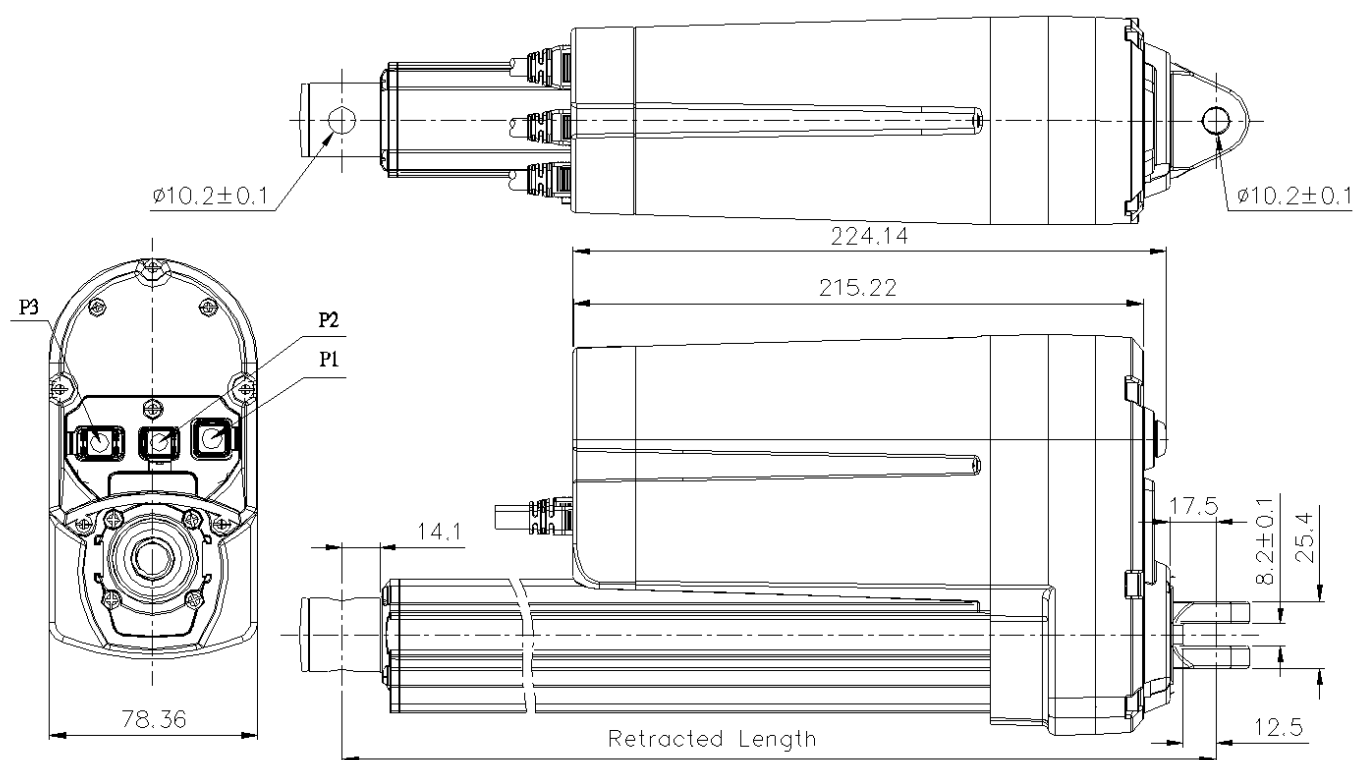
3.1.3 Power

1. Install the PGMA software on computers and close the program after completing installation.
2. Once the TAD1 extension cable is replaced, connect the TAD1 to the computer, the LED on the TAD1 will constantly shine, indicating a successful connection.
3. Connect the P1 cable to the DC power supply and turn on the power.
4. Execute PGMA.



4. Product specifications

4.1 2D drawings



4.2 Ordering key

*Please contact your TiMOTION sales engineer for the latest revision ordering key.

REV.D	MA2T-XX-XXXXXXX-XXX-TXD-X1XXX-XX-M	M A 2 T - X	X - X X X X	X X X X - X	X	X - T	X	D - X	1	X	X	X - X	X - M
Voltage													
12VDC													
24VDC													
36VDC													
48VDC													
Load and speed													
App.1													
Stroke													
App.2													
Retracted length													
App.2													
Rear attachment (mm)													
Aluminum casting, clevis U, slot 8.2, depth 12.5, hole 10.2													
Aluminum casting, clevis U, slot 8.2, depth 15.0, hole 10.2													
Aluminum casting, clevis U, slot 8.2, depth 15.0, hole 12.8													
Aluminum casting, clevis U, slot 8.2, depth 15.0, hole 12.2													
Customized													
Front attachment (mm)													
Iron inner tube with punched hole, without slot, hole 10.2													
Iron inner tube with punched hole, without slot, hole 12.2													
Iron inner tube with punched hole, without slot, hole 12.8													
Aluminum casting, clevis U, slot 8.2, depth 15.0, hole 10.2													
Aluminum casting, clevis U, slot 8.2, depth 15.0, hole 12.2													
Aluminum casting, clevis U, slot 8.2, depth 15.0, hole 12.8													
Rod end bearing, hole 12.8													
Customized													
Direction of rear attachment (counterclockwise)													
0°													
90°													
*App.3													
Functions for limit switches													
T-smart Limit Switch dedicated option													
Customized													
Reed sensor on the outer tube													
Without													
Reed sensor * 2 to control box, tinned lead													
Reed sensor * 1 to actuator P2													
*Choose which side the reed sensor is to be assembled, App.3													
Output signal													
Embedded Hall sensor*2 to T smart; configurable on PGMA with signal output type													
Output cable													
3 sockets with extension cable													
Direct cable out, 1+1 type													
*Direct cable out, 1+1 type please refer to output cable in App.3													
Connector													
Tinned lead													
Cable length													
500mm													
1000mm													
1500mm													
2000mm													
3000mm													
5000mm													
Customized, App.3													
*When choose direct cable out 1+1 type, if P1 & P3 cable length not same, customized and remarked it with P1=??? & P3=???App.3													
*3 sockets type, P1=P2=P3 for standard cable length, customized and remarked is needed when cable length not same													
IP rating													
IP54													
IP66													
IP66D													
IP69K													
*Front & rear attach. Vs IP rating, App.3													
Manual Drive													
With													
*Manual drive could reach IP69K													
T-Smart													
T-smart advanced													
T-smart basic													
Bus interface board													
CAN bus													
LIN bus													
RS485													
Customized, need proposal number													
Brake													
Motor brake													
*Please fill PGMA page for default spec code													

5. Troubleshooting

Please find the table which lists the symptoms, possible causes, and recommended action. If our suggested troubleshooting solutions cannot remedy the problem, please contact your TiMOTION sales representative.

Symptom	Possible cause	Action
Motor runs, but spindle does not move	Gearing system or spindle damaged	Please contact your TiMOTION sales representative.
No motor sound or movement	The actuator is not properly connected to the power supply	Check the connection to the power supply or the external control unit.
	Customer fuse burned	Check the fuse
	Cable damaged	Please contact your TiMOTION sales representative.
Excessive power consumption	Misalignment or overload in the application	Align or reduce the load. Try running the actuator without load.
The actuator cannot lift the full load, or the motor runs too slowly	Insufficient power supply	Verify the power supply is properly plugged in
	Load is higher than specified	Reduce the load
No signal or incorrect feedback output	Cable damaged	Please contact your TiMOTION sales representative.
	Wrongly connected	Check the wiring
	The signal is constantly high/low	Run the actuator to full extension and retraction
		Reconnect the cables and set parallel configuration again
No signal or incorrect feedback output	Incorrect feedback output/level	Connect the actuator to PGMA and check for the correct feedback option.
Actuator runs in smaller steps	Insufficient power supply	Check the power supply
	Load is higher than specified	Reduce the load
	Internal safety procedure activated	Connect the actuator to PGMA and check the following: Reason for last stop (detailed in

		PGMA user guide) Current cut-off levels in both directions
Symptom	Possible cause	Action
The actuator cannot hold the chosen load	The load is higher than specified	Reduce the load
Actuators do not move (Under parallel configuration)	The actuators are not correctly connected to the power supply	- Check the connection to the power supply and the external control unit (if any) - Please make sure the power supply polarity is connected correctly. Otherwise, you could damage the actuator.
	Wrong number of actuators in the system	Check if the number of actuators in the system matches the sync setting in PGMA.
	Communication wires are not properly connected	Check the parallel communication wires for all actuators
	Control signals extend/retract are not correctly connected	Check the wire connection on the control unit
	Position lost	Disconnect all cables, connect the actuators to PGMA one at a time and check the reason for the last stop.
		Reconnect the cables and set parallel configuration again.
Actuators cannot lift the full load (Under parallel configuration)	Insufficient power supply	Check the power supply while the actuator is running.
	Overload in application	Reduce the load
		Connect actuators to PGMA one at a time and check the following: - Type of chosen Parallel system - Reason for last stop - Current cut-off levels in both directions
		Reconnect the cables and set parallel

		configuration again
Symptom	Possible cause	Action
Actuators run in smaller steps before stopping (Under parallel configuration)	Insufficient power supply	Check the power supply while the actuator is running
		Connect the actuators to PGMA one at a time and check the following: - Reason for last stop - Current cut-off levels in both directions
		After everything is connected, supply power to all actuators at the same time. Then wait 10 seconds before the Run In/Run Out signals are activated.
Signal cable damaged or removed under operation (Under parallel configuration)	All actuators stop at the same position	The signal and power cables MUST be reconnected to all actuators. Ensure that no actuator is missing in the system. Otherwise, the system will not work, not even after re-powering. Please see the non-critical info below.
		After everything is connected, power on all actuators at the same time. Then wait 10 seconds before the Run In/Run Out signals are activated.