

User Manual

MA3



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Glossary

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

- **Vm+**: The positive pole of power input.
- **Vm-**: The negative pole of power input.
- **RPM**: Number of turns per minute.
- **AWG**: American wiring gauge.
- **LS**: Limit switch installed inside the outer tube.
- **Up LS**: Upper limit switch is installed in fully extended end of stroke.
- **Low LS**: Lower limit switch is installed in fully retracted end of stroke.
- **Mid LS**: Middle limit switch is installed and the position is set by customer's request.
- **N.C.**: It is the pin of limit switch which is normally short circuit and changed to open when the switch is triggered.
- **N.O.**: It is the pin of limit switch which is normal open and changed to short circuit when the switch is triggered.
- **C.**: It is the common pin of limit switch when the circuit is either open or short.
- **Vp**: The reference voltage input to POT signal.
- **Vout**: The POT signal wire output value.
- **Hall-POT**: T-smart technology converts Hall sensor signal to voltage output.
- **EOS**: Abbreviation of 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

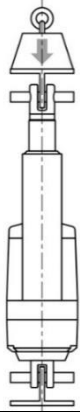
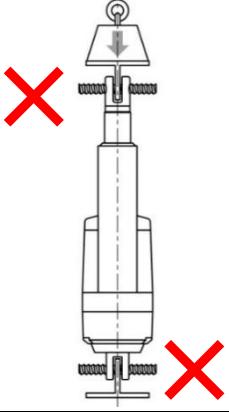
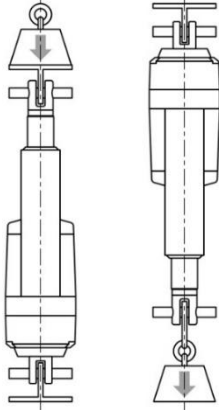
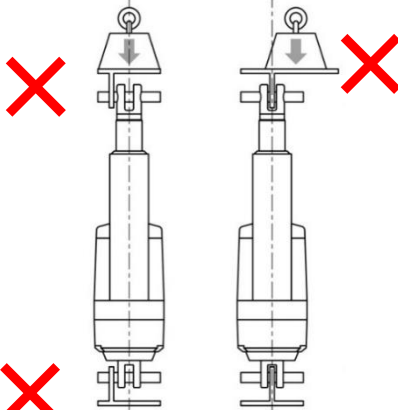
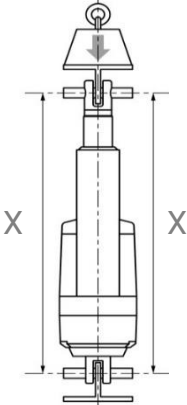
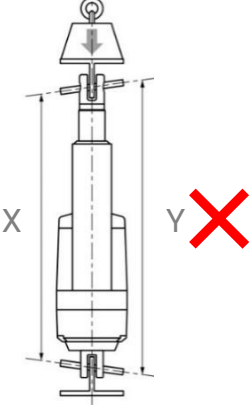
- ◆ The operating temperature range is $-40^{\circ}\text{C} \sim +85^{\circ}\text{C}$.
- ◆ The operational temperature range at full performance is $+5^{\circ}\text{C} \sim +45^{\circ}\text{C}$.

2. Installation

2.1 Mechanical installation

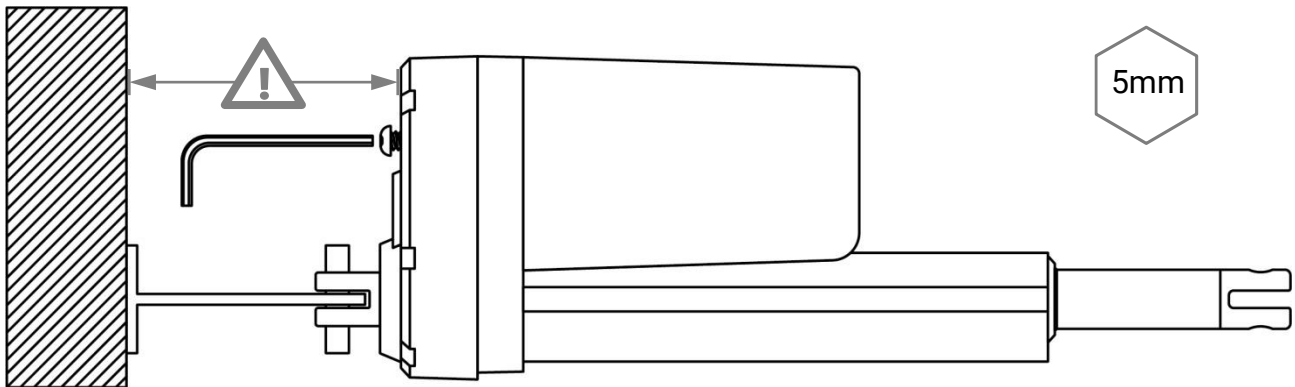
2.1.1 Mounting notice

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

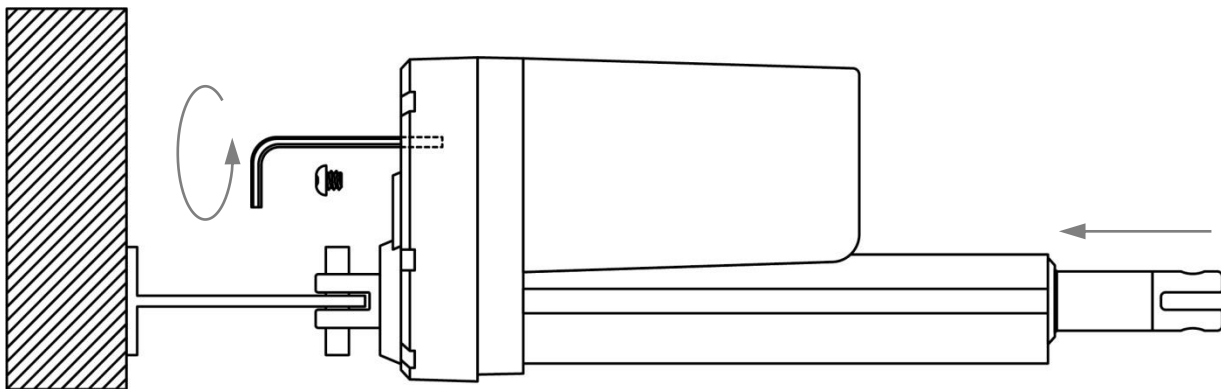
| Note | Correct | Wrong |
|---|---|---|
| <p>Please mount the actuator with the mounting pins of correct dimension and without threaded at both ends of the attachments.</p> |  |  |
| <p>Do not mount the actuator with the pins in different rotated angles, this could cause stress on the nut during operation.</p> <p>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.</p> |  |  |
| <p>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.</p> |  |  |

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.

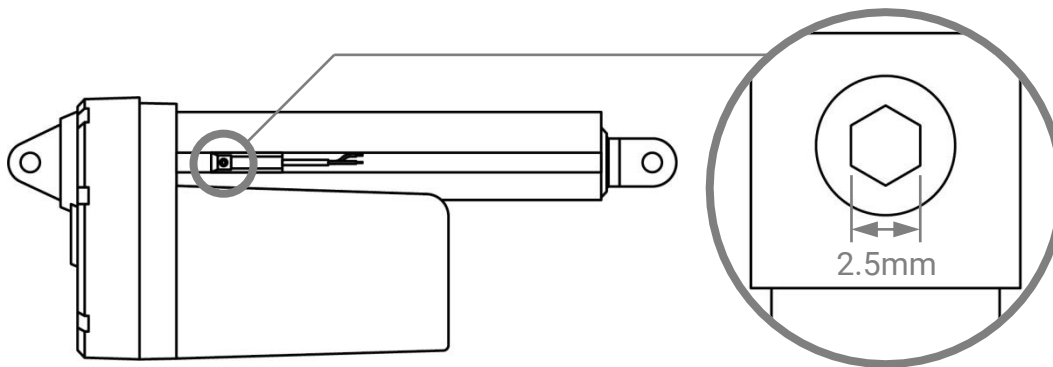


The torque required to manually move the extension tube is within 1.7 Nm, maximum 65 RPM. Please do not run the outer tube to the end of stroke, as that may damage the actuator.



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

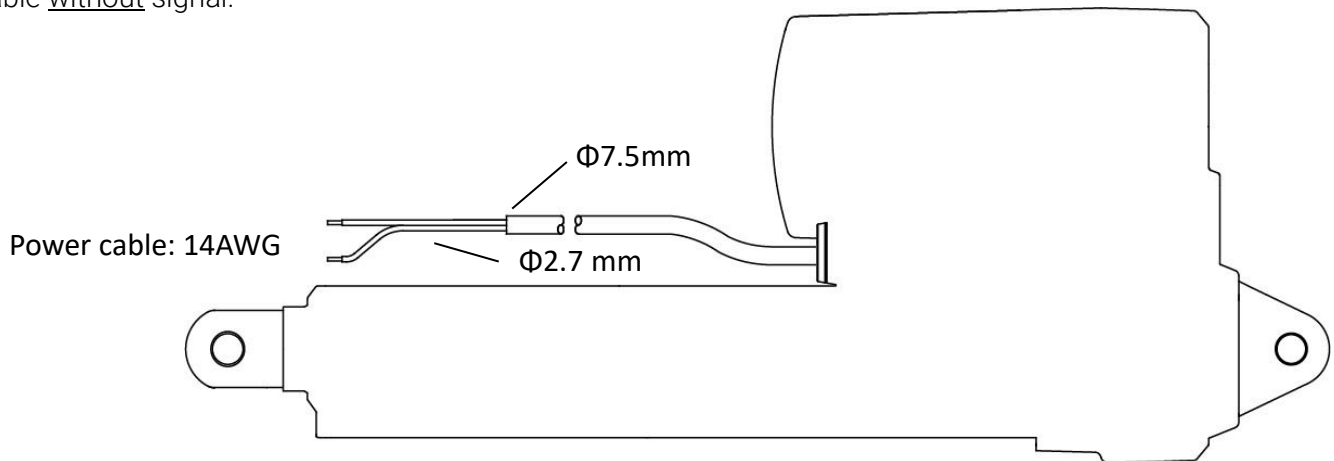
- ◆ Make sure the leads/cables leading to the motor are rated to handle the maximum current.
- ◆ To reduce the chance of a crushing hazard, we recommend an emergency stop.
- ◆ If you are not using soft stop on a DC-motor, a short peak of high voltage will be sent towards the power supply. When selecting 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 Cable

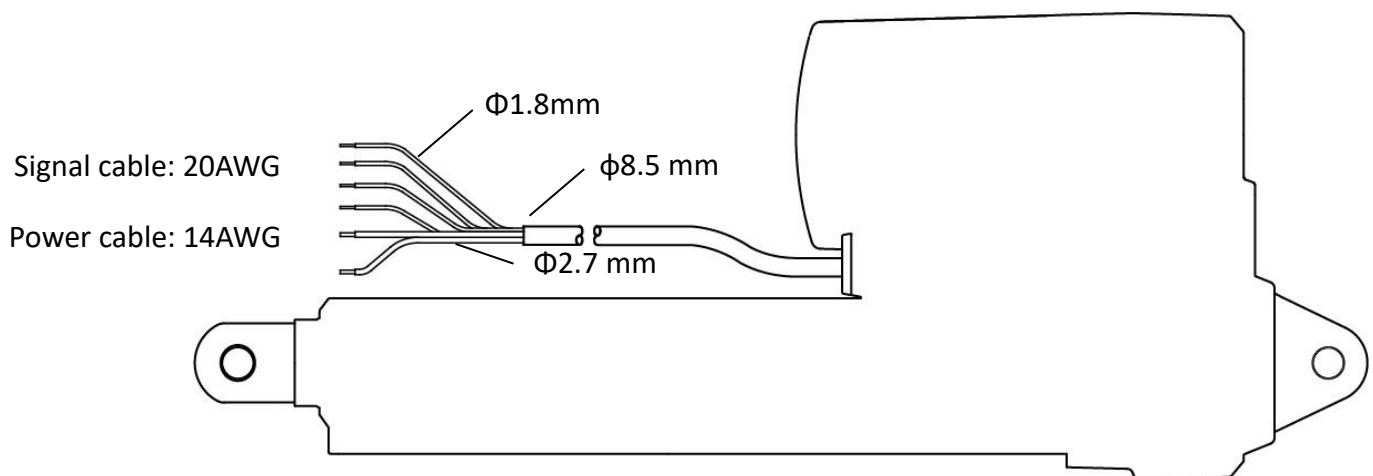
The actuator is supplied with a power cable (with/without signal wire). The standard cable, for industrial applications, has/have flying leads in the end for the user's equipment connections.

*Please refer to the approved drawing of any customized cable/connector.

Cable without signal:



Cable with signal:



2.2.3 Inrush current

When the actuator starts to work, there is an inrush current to the motor that will be less than 0.2 seconds (up to four times the rated current).

Please select a power supply that is able to withstand the inrush current. Also, all contacts, including switches and relay, should be chosen with caution.

2.3 Wiring definition

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

2.3.1 Limitations for limit switches output signals

In general, the MA3 cable can have a maximum of 9 pins– (2 power wire pins and/or up-to 7 signal wire pins) The function limitations for limit switches to output signals are shown in the table below:

| Function for limit switches | Signal output | | | |
|--|---------------|-------|-------------|-------------|
| | Without | POT | Single Hall | Double Hall |
| 2 limit switches to cut off the actuator | 2.3.2 | 2.3.5 | 2.3.7 | 2.3.9 |
| 2 limit switches to send a signal | 2.3.3 | 2.3.6 | 2.3.8 | 2.3.10 |
| 2 limit switches to send a signal and cut off the actuator | 2.3.4 | x | x | x |

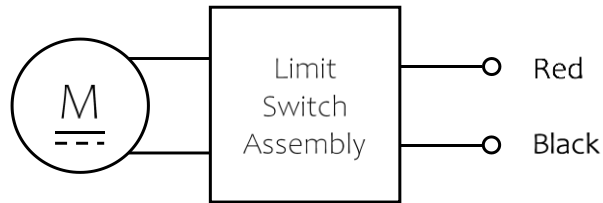
* OK = Selectable

** x = Not Compatible

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

2.3.2 Two limit switches to cut off the actuator (without signal output)

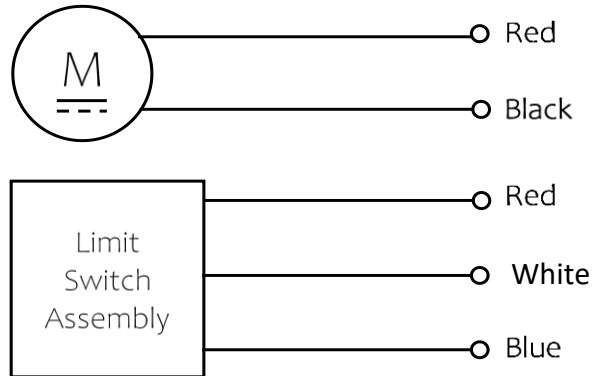
The actuator is equipped with two limit switches to cut off the actuator when the actuator moves to the end of each stroke and without any output signal.



| Wire | AWG | Description | Spec |
|-------|-----|---|---|
| Red | 14 | Connect to Vm+ to extend the actuator. Connect to Vm- to retract the actuator. | 24V version: Input voltage 18~32 V DC. 12V version: Input voltage 9~16 V DC. |
| Black | 14 | Connect to Vm- to extend the actuator. Connect to Vm+ to retract the actuator. | |

2.3.3 Two limit switches to send the signal

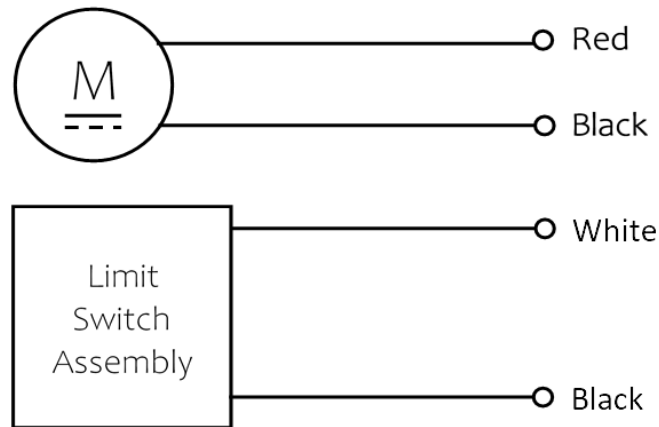
The actuator has two limit switches to send out the signal at fully extended or retracted stroke positions.



| Wire | AWG | Description | Spec |
|-------|-----|---|--|
| Red | 14 | Connect to Vm+ to extend the actuator. Connect to Vm- to retract the actuator. | 24V version: Input voltage 18~32 V DC. 12V version: Input voltage 9~16 V DC. |
| Black | 14 | Connect to Vm- to extend the actuator. Connect to Vm+ to retract the actuator. | |
| White | 20 | Connect to up limit switch normal close pin (N.C.) | The signal is potentially free and independent from the motor power circuit. Both white and blue signal wires are normally closed circuits when the actuator is in the middle of the stroke. 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. |
| Black | 20 | Connect to low limit switch normal close pin (N.C.) | |
| Red | 20 | Common wire | |

2.3.4 Two limit switches to cut off the actuator and send the signal

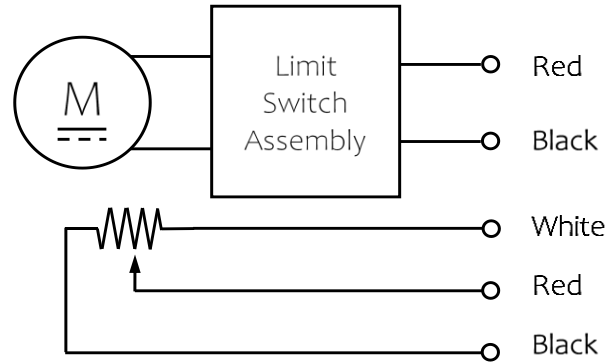
The actuator is equipped with two limit switches to cut off the actuator and send a signal when the actuator moves to the end of each stroke.



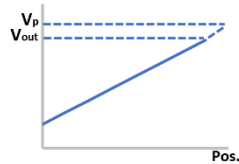
| Wire | AWG | Description | Spec |
|-------|-----|---|---|
| Red | 14 | Connect to Vm+ to extend the actuator Connect to Vm- to retract the actuator | 24V version: Input voltage 18~32 V DC 12V version: Input voltage 9~16 V DC |
| Black | 14 | Connect to Vm- to extend the actuator Connect to Vm+ to retract the actuator | |
| White | 20 | Connect to up limit switch normal closed pin (N.O..) | The signal is NOT potential free and actively outputs voltage at each end of stroke. Both of the white and black signal wire are normal open circuit when the actuator is in the middle of stroke. The signal circuit is connected to motor power circuit and the value Vm+ depends on actuator voltage. Connect the limit switch signal wire to the load <1A. |
| Black | 20 | Connect to low limit switch normal closed pin (N.O..) | |

2.3.5 Two limit switches cut off the actuator and POT

The actuator is equipped with two limit switches to cut off the actuator when the actuator moves to the end of each stroke and has a POT position signal output.

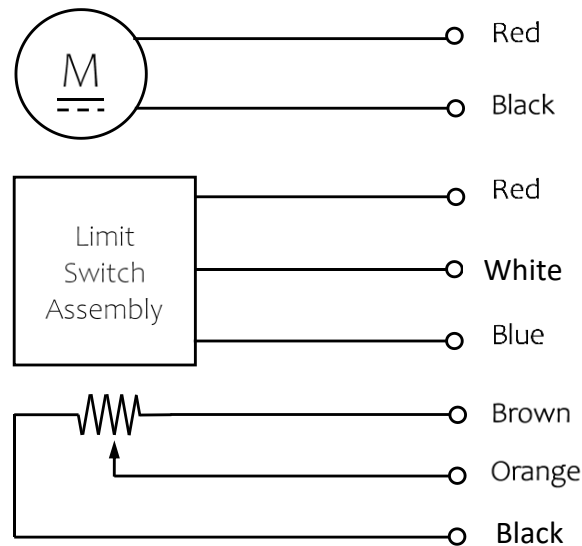


*Please refer to section 2.3.2 for cut current module.

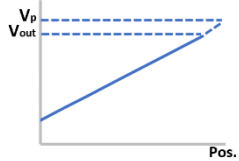
| Wire | AWG | Description | Spec | | | | |
|----------------------------|---|---|---|-----------------|----------------|----------------------------|---|
| Red | 14 | Connect to Vm+ to extend the actuator Connect to Vm- to retract the actuator | 24V version: Input voltage 18~32 V DC 12V version: Input voltage 9~16 V DC | | | | |
| Black | 14 | Connect to Vm- to extend the actuator Connect to Vm+ to retract the actuator | | | | | |
| Black | 20 | POT signal ground. | POT output signal type is the voltage in proportion to the reference voltage input, which is relative to the position of the actuator.  The recommended power of the POT input is <2W. | | | | |
| Red | 20 | POT signal output $V_{out} = \{r(\Omega) / 10K(\Omega)\} V_p$ <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%;">Fully retracted</td> <td style="width: 50%;">Fully extended</td> </tr> <tr> <td>$r = 300 \sim 500(\Omega)$</td> <td>r depends on the configuration (note)</td> </tr> </table> <p>Note: Users can refer to the drawing for fully extended resistance details.</p> | | Fully retracted | Fully extended | $r = 300 \sim 500(\Omega)$ | r depends on the configuration (note) |
| Fully retracted | Fully extended | | | | | | |
| $r = 300 \sim 500(\Omega)$ | r depends on the configuration (note) | | | | | | |
| White | 20 | POT reference voltage input V_p , 5~32V DC (Recommended: 10V). | | | | | |
| | | | The brand and spec of the potentiometer embedded is Bourns, 0~10Kohm, 10 turns. | | | | |

2.3.6 Two limit switches to send signal and POT

The actuator has two limit switches to send out a signal at fully extended or retracted stroke positions and POT position signal output.

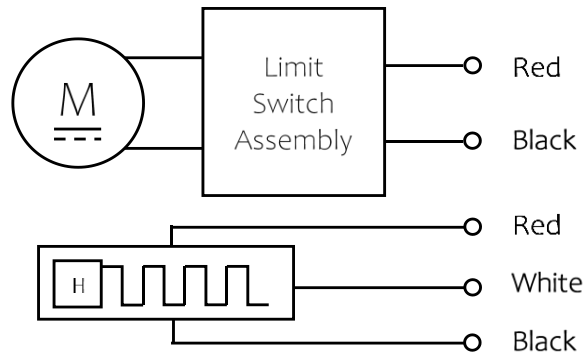



| Wire | AWG | Description | Spec |
|-------|-----|---|--|
| Red | 14 | Connect to Vm+ to extend the actuator Connect to Vm- to retract the actuator | 24V version: Input voltage 18~32 V DC 12V version: Input voltage 9~16 V DC |
| Black | 14 | Connect to Vm- to extend the actuator Connect to Vm+ to retract the actuator | |
| White | 20 | Connect to up limit switch normal close pin (N.C.) | The signal is potentially free and independent from the motor power circuit. |
| Blue | 20 | Connect to low limit switch normal close pin (N.C.) | |
| Red | 20 | Common wire | The signal circuit is connected to the motor power circuit, and the value Vm+ depends on actuator voltage. |

| | | | | |
|----------------------------|---|--|---|-----------------|
| Black | 20 | POT signal ground. | <p>Connect the limit switch signal wire to the load <1A.</p> <p>POT output signal type is the voltage in proportion to the reference voltage input, which is relative to the position of the actuator.</p>  | |
| Orange | 20 | POT signal output $V_{out} = \{r(\Omega) / 10K(\Omega)\} V_p$ | | |
| | | <table border="1"> <tr> <td>Fully retracted</td> <td>Fully extended</td> </tr> <tr> <td>$r = 300 \sim 500(\Omega)$</td> <td>r depends on the configuration (note)</td> </tr> </table> <p>Note: Users can refer to the drawing for fully extended resistance details.</p> | | Fully retracted |
| Fully retracted | Fully extended | | | |
| $r = 300 \sim 500(\Omega)$ | r depends on the configuration (note) | | | |
| Brown | 20 | POT reference voltage input V_p , 5~32V DC (Recommended: 10V). | <p>The recommended power of the POT input is <2W.</p> <p>The brand and spec of the potentiometer embedded is Bourns, 0~10Kohm, 10 turns.</p> | |

2.3.7 Two limit switches and a single Hall sensor

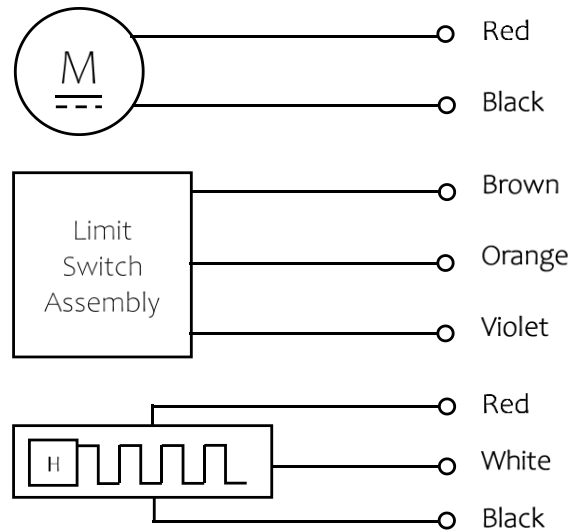
The actuator is equipped with two limit switches to cut off the actuator when the actuator moves to the end of each stroke and with a single Hall sensor sending position signal output.




| Wire | AWG | Description | Spec |
|-------|-----|---|--|
| Red | 14 | Connect to Vm+ to extend the actuator Connect to Vm- to retract the actuator | 24V version: Input voltage 18~32 V DC 12V version: Input voltage 9~16 V DC |
| Black | 14 | Connect to Vm- to extend the actuator Connect to Vm+ to retract the actuator | |
| Red | 20 | +5V DC input signal power for Hall sensor board. | Hall sensor output signal type is a square wave with Hi voltage 5V and Low voltage 0V, and with the output current of 0.1A (please refer to the approval drawing for the resolution and details).  Hall sensor circuit is independent to motor power circuit. |
| White | 20 | Output Hall sensor signal during the actuator moves. | |
| Black | 20 | Hall sensor signal ground. | |

2.3.8 Two limit switches send the signal and a single Hall sensor

The actuator is equipped with two limit switches to send out the signal at fully extended or retracted stroke positions and with single Hall sensors sending position signal output.



| Wire | AWG | Description | Spec |
|-------|-----|---|---|
| Red | 14 | Connect to Vm+ to extend the actuator Connect to Vm- to retract the actuator | 24V version: Input voltage 18~32 V DC 12V version: Input voltage 9~16 V DC |
| Black | 14 | Connect to Vm- to extend the actuator Connect to Vm+ to retract the actuator | |
| Red | 20 | +5V DC input signal power for Hall sensor board. | Hall sensor output signal type is a square wave with Hi voltage 5V and Low voltage 0V, and with the output current of 0.1A (please refer to the approval drawing for the resolution and details). |
| White | 20 | Output Hall sensor signal during the actuator moves. | |
| Black | 20 | Hall sensor signal ground. | |

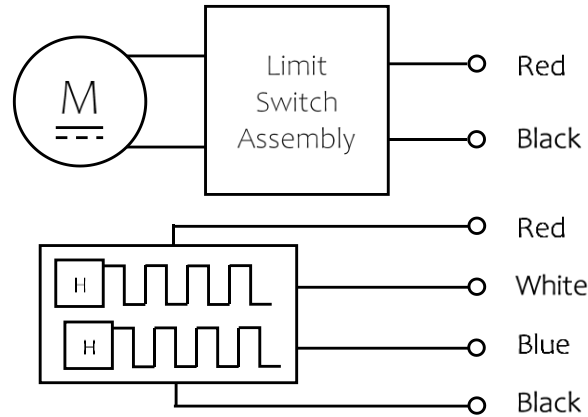


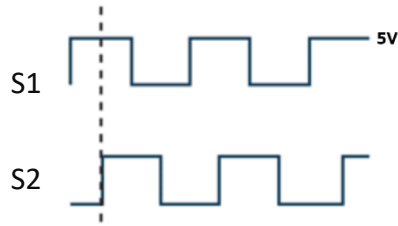
The Hall sensor circuit is independent of the motor power circuit.

| | | | |
|--------|----|--|--|
| Brown | 20 | Connect to up limit switch normal open pin (N.O.) | <p>The signal is NOT potential free and actively outputs voltage at each end of the stroke.</p> <p>Both of the brown and orange signal wire are normal open circuit when the actuator is in the middle of the stroke.</p> <p>The signal circuit is connected to motor power circuit and the value V_{m+} depends on actuator voltage. Connect the limit switch signal wire to the load $<1A$.</p> |
| Orange | 20 | Connect to low limit switch normal open pin (N.O.) | |
| Violet | 20 | Common wire | |

2.3.9 Two limit switches and double Hall sensors

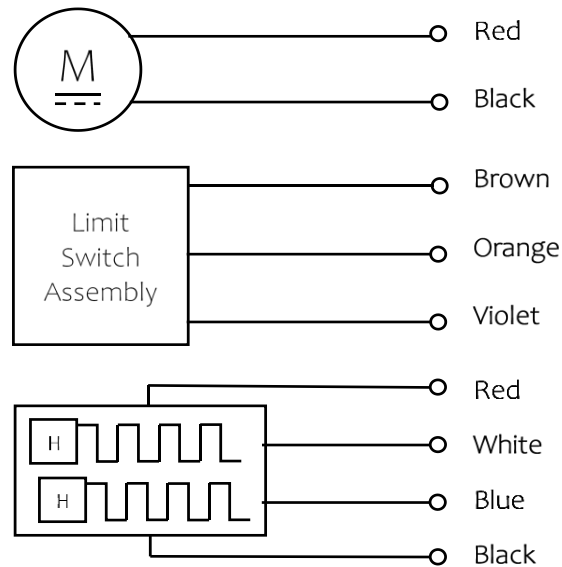
The actuator is equipped with two limit switches to cut off the actuator when the actuator moves to the end of each stroke, and with double Hall sensors sending position signal output.

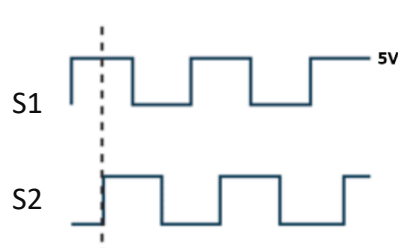


| Wire | AWG | Description | Spec |
|-------|-----|---|--|
| Red | 14 | Connect to Vm+ to extend the actuator Connect to Vm- to retract the actuator | 24V version: Input voltage 18~32 V DC 12V version: Input voltage 9~16 V DC |
| Black | 14 | Connect to Vm- to extend the actuator Connect to Vm+ to retract the actuator | |
| Red | 20 | +5V DC input signal power for Hall sensor board. | Hall sensor output signal type is a square wave with Hi voltage 5V and Low voltage 0V, and with the output current of 0.1A (please refer to the approval drawing for the resolution and details). S1 leads 90 degrees' phase to S2.  |
| White | 20 | Output Hall sensor signal S1 during the actuator moves. | |
| Blue | 20 | Output Hall sensor signal S2 during the actuator moves. | |
| Black | 20 | Hall sensor signal ground. | |
| | | | |

2.3.10 Two limit switches send the signal and double Hall sensors

The actuator is equipped with two limit switches to send out the signal at fully extended or retracted stroke positions and with double Hall sensors sending position signal output.

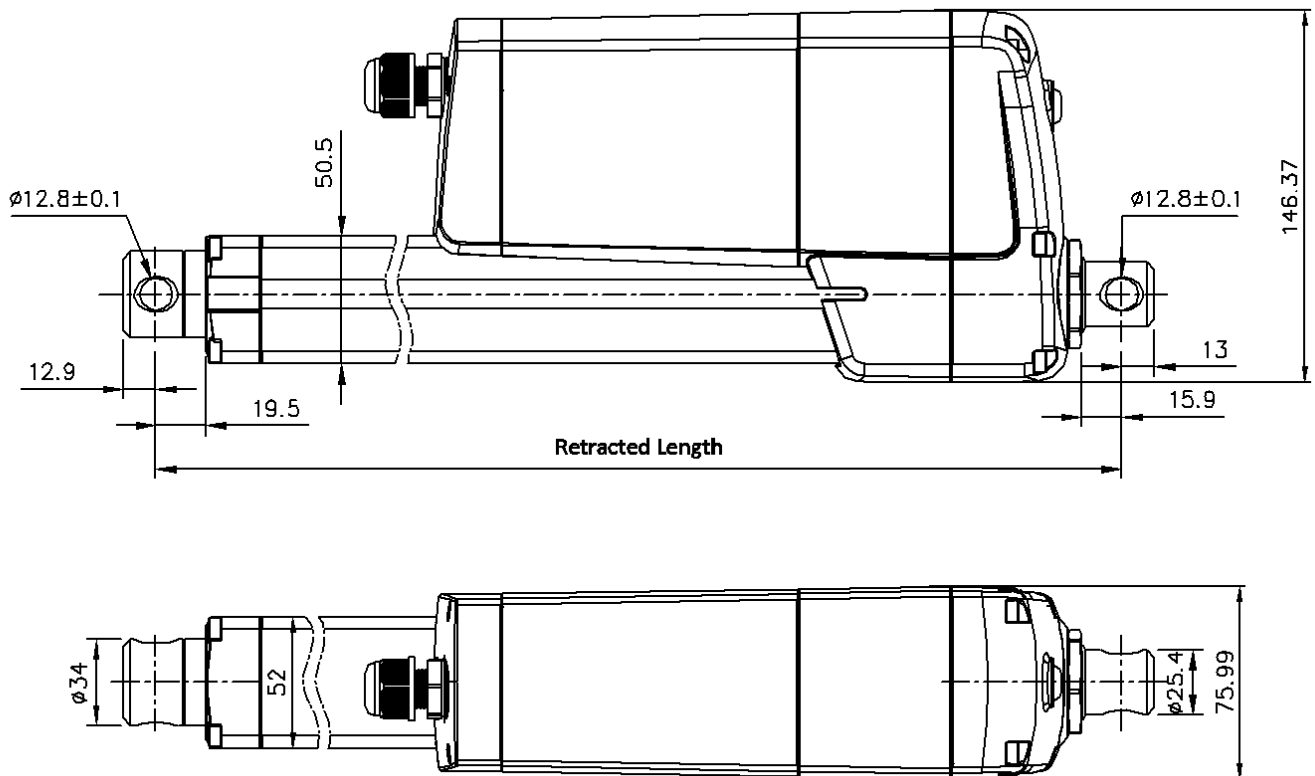


| Wire | AWG | Description | Spec |
|-------|-----|---|--|
| Red | 14 | Connect to Vm+ to extend the actuator Connect to Vm- to retract the actuator | 24V version: Input voltage 18~32 V DC 12V version: Input voltage 9~16 V DC |
| Black | 14 | Connect to Vm- to extend the actuator Connect to Vm+ to retract the actuator | |
| Red | 20 | +5V DC input signal power for Hall sensor board. | Hall sensor output signal type is a square wave with Hi voltage 5V and Low voltage 0V, and with the output current of 0.1A (please refer to the approval drawing for the resolution and details). S1 leads 90 degrees' phase to S2.  |
| White | 20 | Output Hall sensor signal S1 during the actuator movement. | |
| Blue | 20 | Output Hall sensor signal S2 during the actuator movement. | |
| Black | 20 | Hall sensor signal ground. | |
| | | | The Hall sensor circuit is independent of the motor power circuit. |

| | | | |
|--------|----|---|--|
| Brown | 20 | Connect to upper limit switch normal close pin (N.C.) | <p>The signal is potentially free and independent from the motor power circuit.</p> <p>Both brown and orange signal wires are normally closed circuits when the actuator is in the middle of the stroke.</p> <p>The signal circuit is connected to the motor power circuit, and the value V_{m+} depends on actuator voltage.</p> <p>Connect the limit switch signal wire to the load <1A.</p> |
| Orange | 20 | Connect to lower limit switch normal close pin (N.C.) | |
| Violet | 20 | Common wire | |

3. Product specifications

3.1 2D drawings



4. Troubleshooting

Please find the table which lists the symptoms, possible cause and recommend action.

If the problem could not be solved, please contact your TiMOTION sales engineer.

| Symptom | Possible cause | Action |
|---|--|---|
| Motor runs, but spindle does not move | Gearing system or spindle damaged | Please contact your TiMOTION sales engineer. |
| 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 engineer. |
| Excessive power consumption | Misalignment or overload in the application | Align or reduce the load Try running the actuator without load |
| Actuator cannot lift full load or motor runs too slowly | Insufficient power supply | Check 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 engineer. |
| | Wrongly connected | Check the wiring |
| | Signal is constantly high/low | Run the actuator to full extension and retraction |
| | | Reconnect the cables and set parallel configuration again |