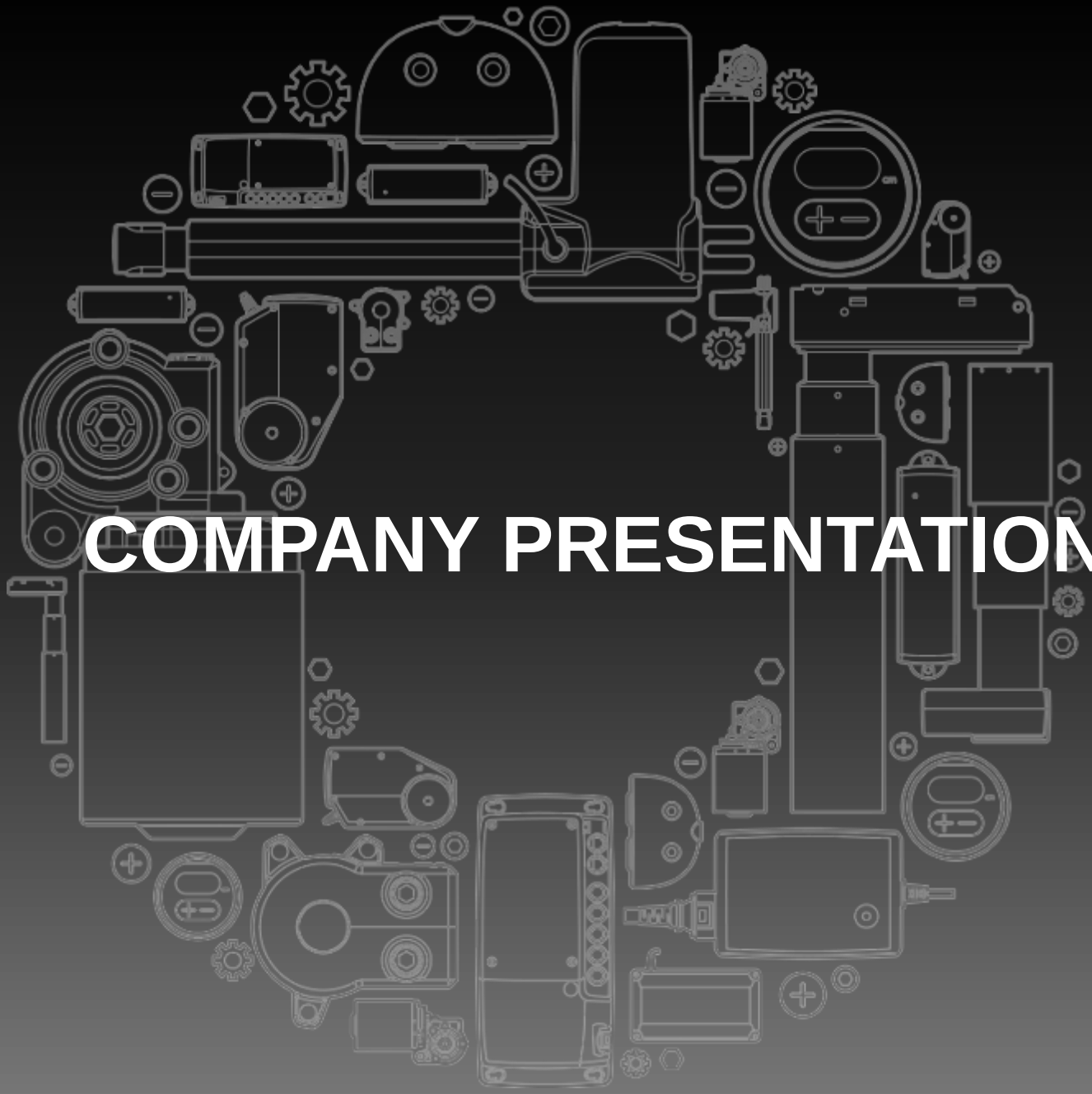

TiMOTION
Flexibility · Customization · Tailor-made



COMPANY PRESENTATION

TiMOTION Background

- Founded in Dec. **2005**
- Having **15+** years R&D and Sales experiences in actuation system
- With **1000+** employees worldwide

Milestone

2005
Founded in Dongguan City, China in Dec.

2006
Set up DC Motor production line.

2009
Kunshan subsidiary established. Obtained ISO 9001: 2008 and ISO 13485: 2003 certification.

2010
2nd factory established. Overseas subsidiaries set up in Japan and Korea.

2011
Overseas subsidiaries in France, Italy, and Germany. Employees worldwide over 500.

2012
Employees worldwide reached 1000; kick-off 5-year plan of factory automation.

2013
Set up 3rd factory; USA subsidiary.

2014
Set up 4rd factory.

TiMOTION
Flexibility · Customization · Tailor-made

Vision and Key Values

- Our vision :

  become a worldwide **leading** actuation system provider
- Our belief :

  customer’s requests and needs come to the **FIRST** priority
- Our key values : **S.P.E.Q**

TiMOTION

Flexibility · Customization · Tailor-made

This is TiMOTION

We care about what you need

High customization with complete flexibility
Tailor-made spec. , software function, user interface..etc.

Complied with severe medical standards
IEC 60601-1, EN/UL 60601-1, RoHS, CB, ISO,… etc. compliant

With Bus system protocol
Seamless communication between various accessories and our control system

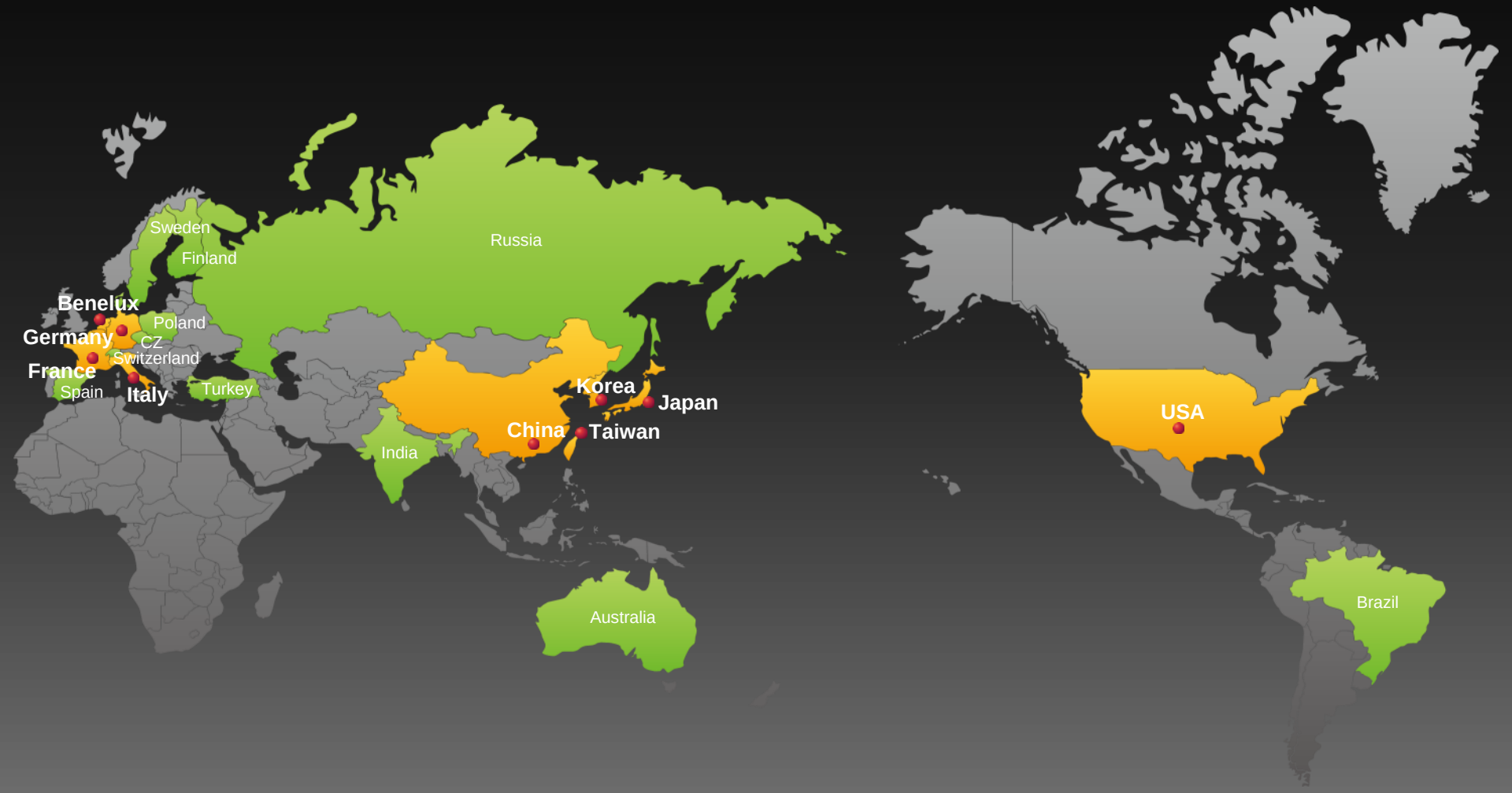
Introducing stable and sustainable wireless technology
Safer and more efficient signals transmission in medical environment

Enhancing power efficiency, and embracing green power
Electric devices with low standby power consumption of 0.1W

TiMOTION
Flexibility · Customization · Tailor-made

Global Service Networks

4 factories , **8+** subsidiaries, and **12+** distributors



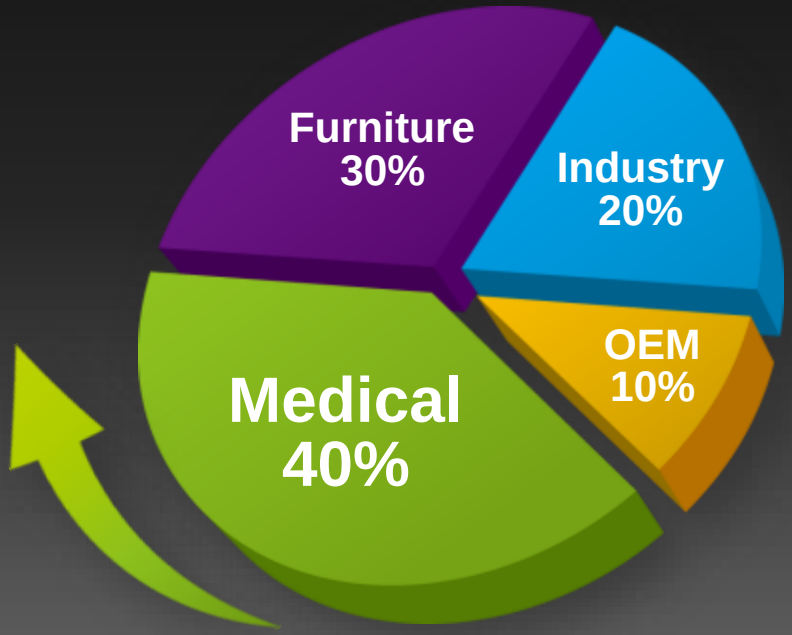
TiMOTION Flexibility · Customization · Tailor-made

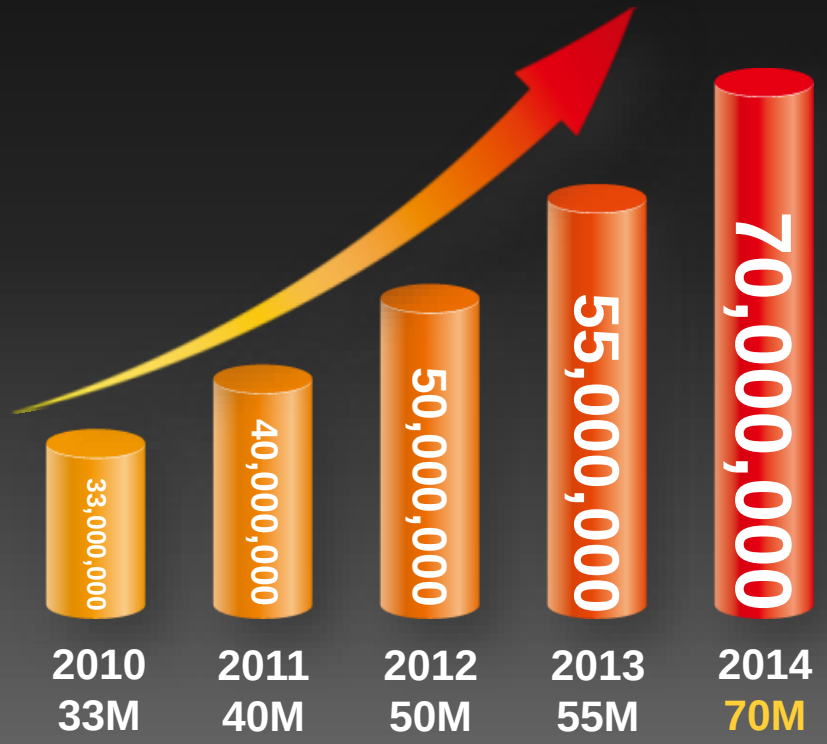
Annual Revenue and Distribution

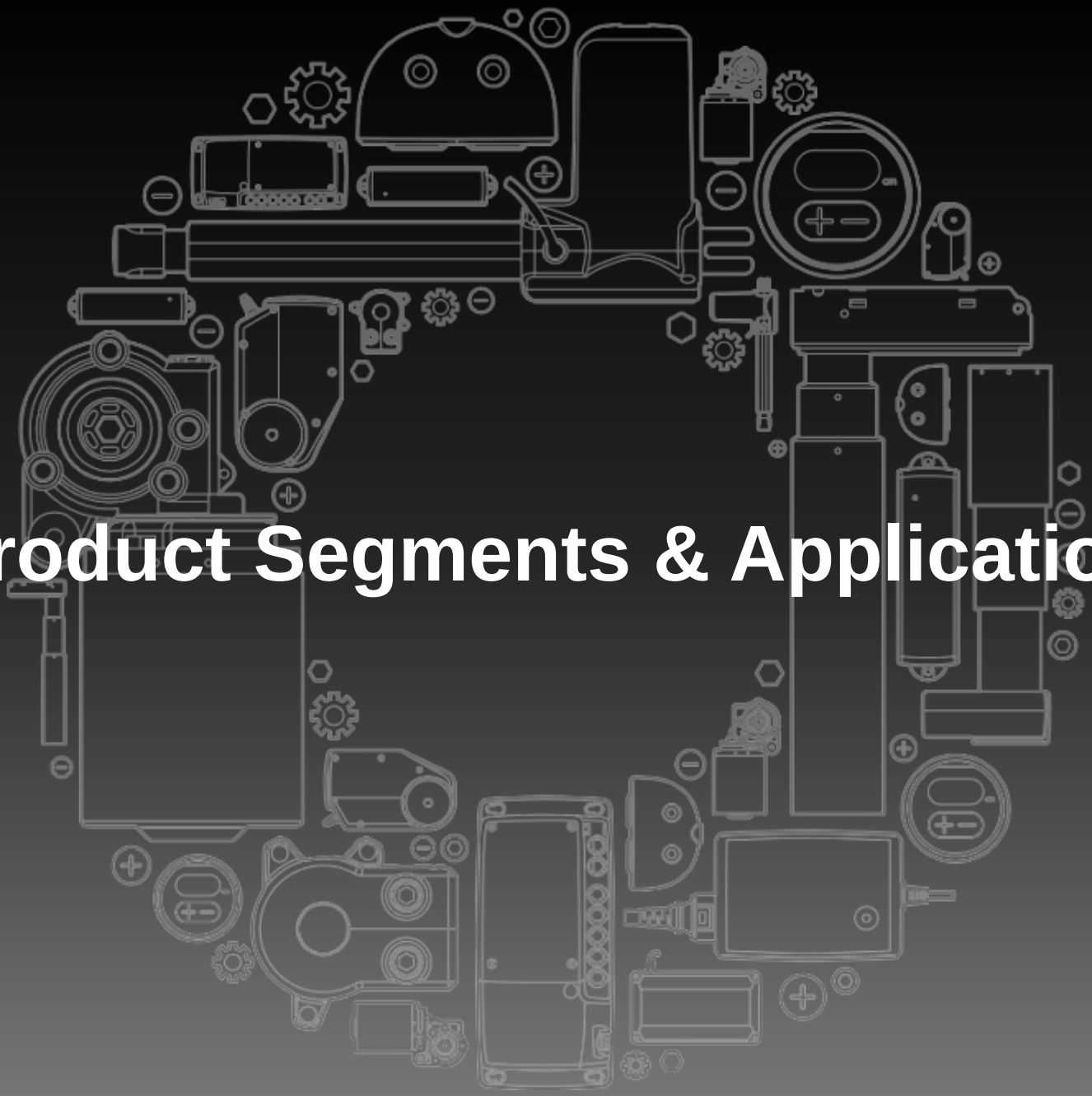
- Core markets are **medical** and **furniture** industry
- **Industrial** market is growing and starts to be our focus

55M USD revenue in 2013;

70M USD by 2014







Product Segments & Application

Product Segments

4 distinctive product segments can be applied in various applications.

Care Motion

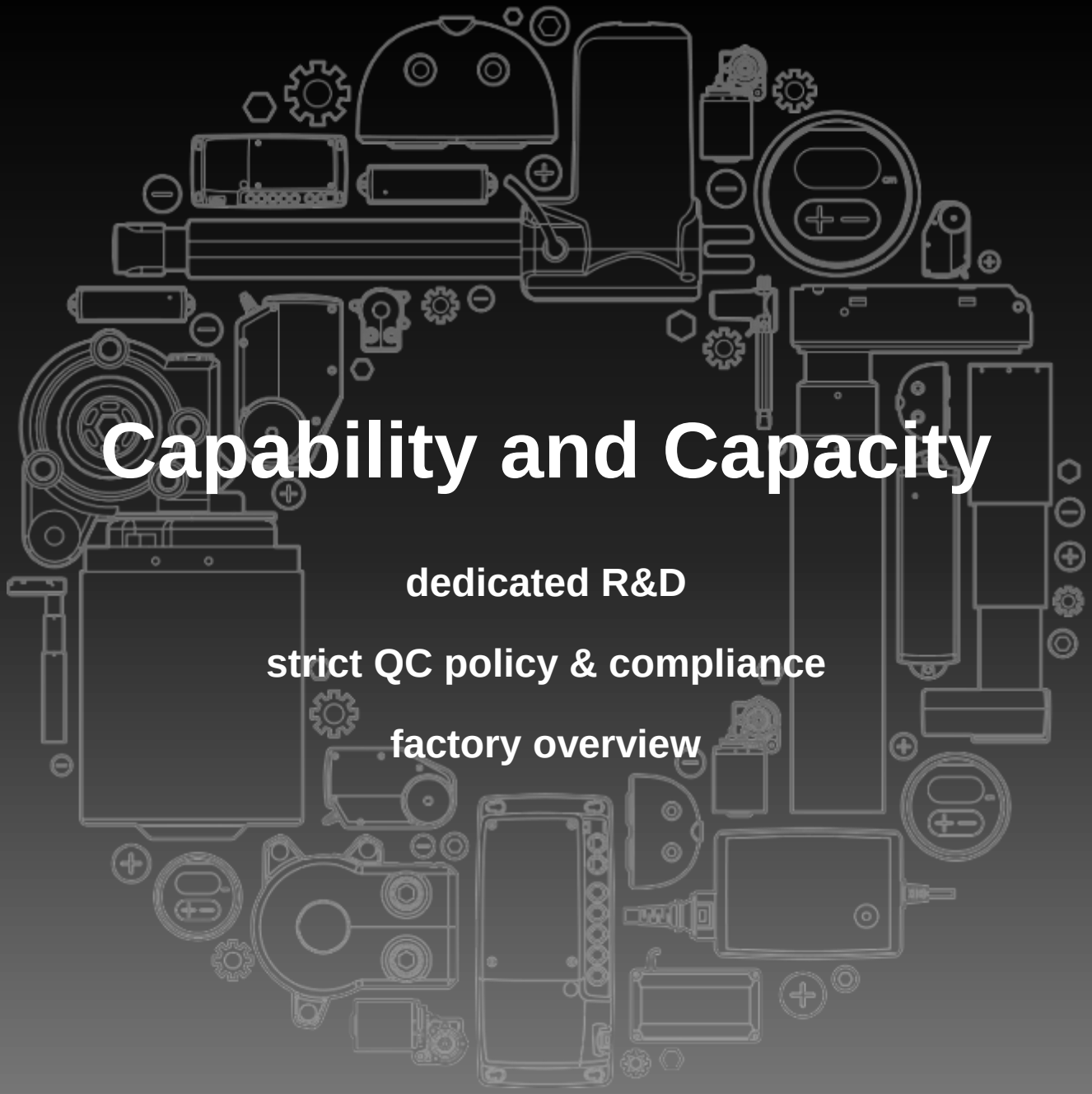
Auto Motion

Comfort Motion

Ergo Motion

TiMOTION

Flexibility · Customization · Tailor-made



Capability and Capacity

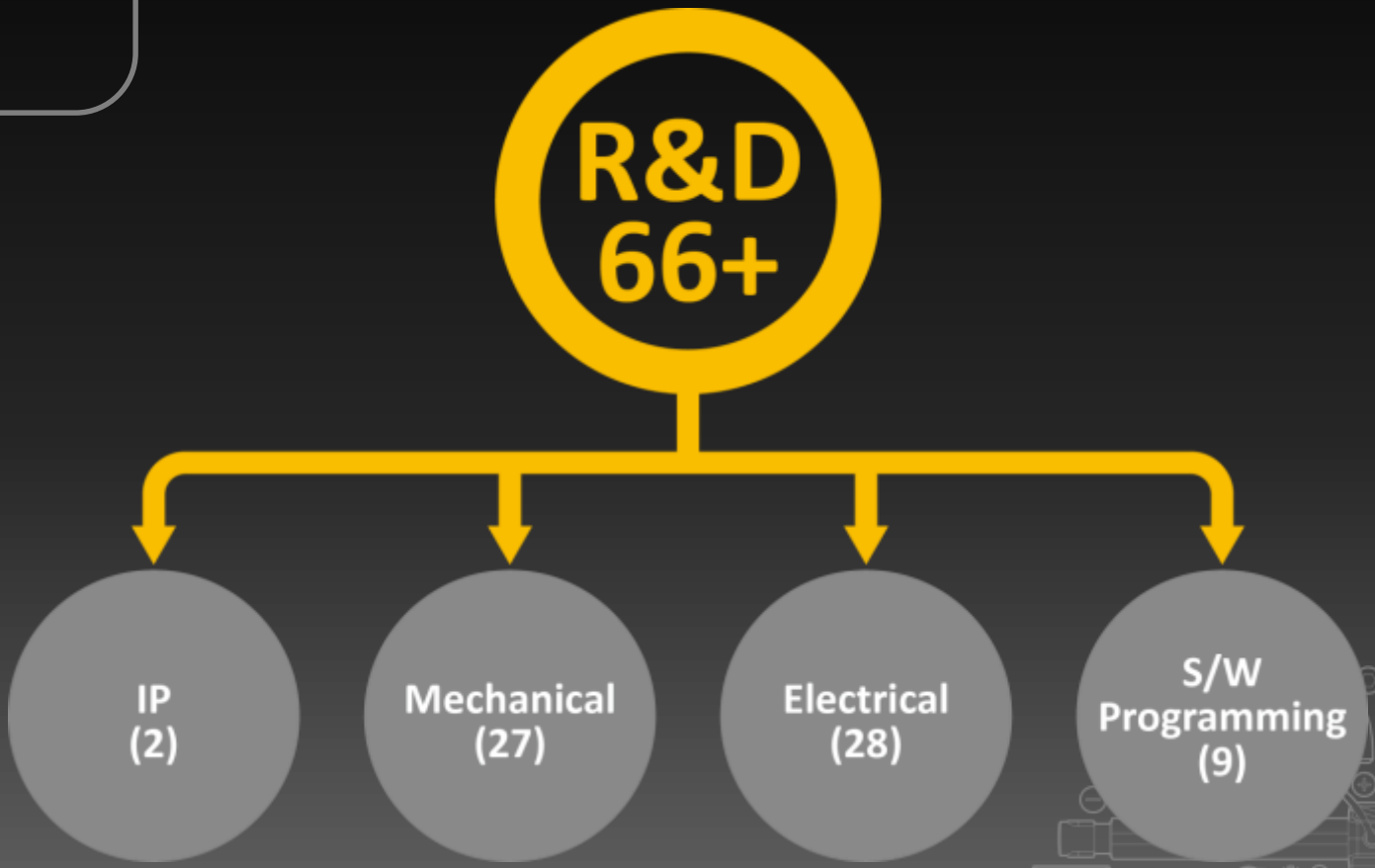
dedicated R&D

strict QC policy & compliance

factory overview

R&D Capacity

In the pursuit of excellence and best quality, TiMOTION has dedicated resources of R&D.



TiMOTION

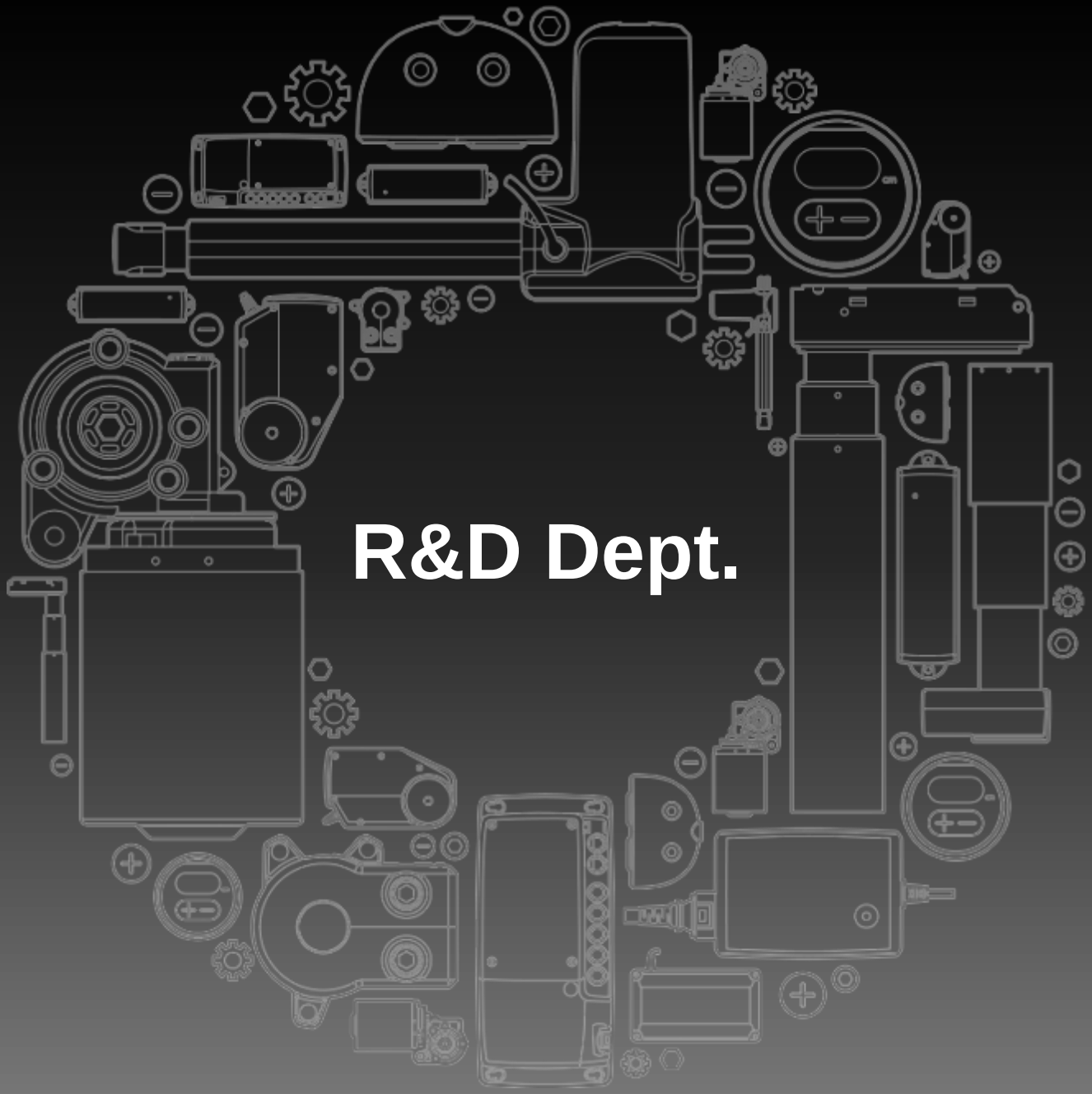
Flexibility · Customization · Tailor-made

Industry Certified

- TiMOTION products are **ISO, TUV, CE, IEC, and RoHS** compliant
- All quality control procedures follow **ISO9001, ISO13485** and International Quality Control requirement

TiMOTION

Flexibility · Customization · Tailor-made



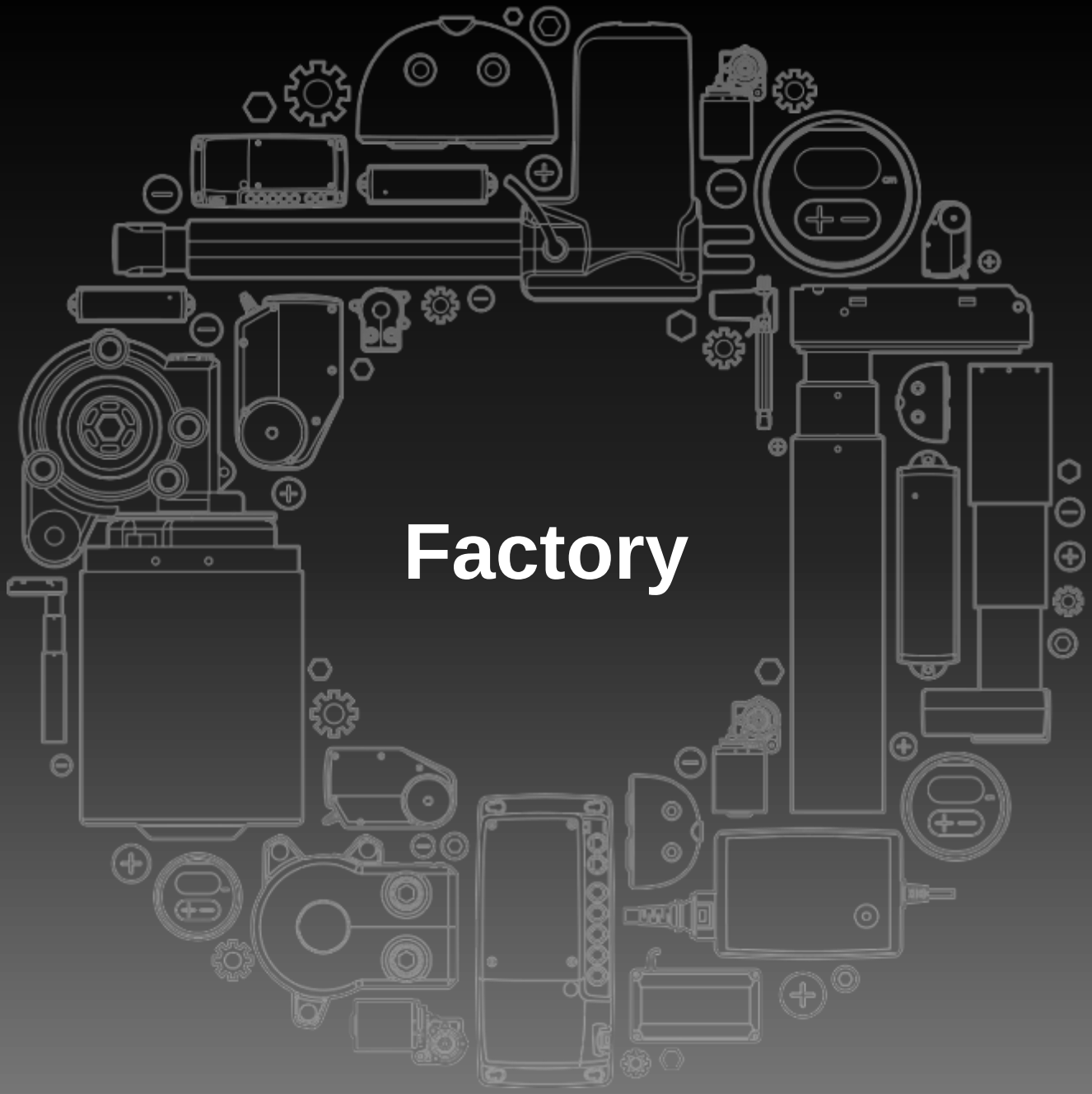
R&D Dept.

Taipei

- S/W Programming
- Patent

China

- Mechanical
- Electronic


Factory

F1

- DC motor production
- Actuator assembling

F2

- Electronic assembling
- Injection molding

F3

- Spindle
- Cable molding
- SMD (Surface mount device process)

F4

- Columns manufacturing

DC motor production

Actuator

Electronic assembling

Injection molding

Spindle

Cable molding

Surface mount device process

TiMotion Europe

- 26 persons
- Sales office
- Stock for Europe
- Production workshop for samples (< 10 units): TA2,TA2P, TA4

-> **Very soon** (early 2016): TA7,TA16, TA19 & TA23 samples production.

Common Linear Actuator Styles

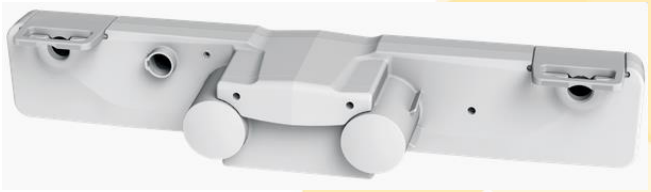
Parallel Drive actuator

Gear motor

Right-angle Mount (“L”) Drive actuator

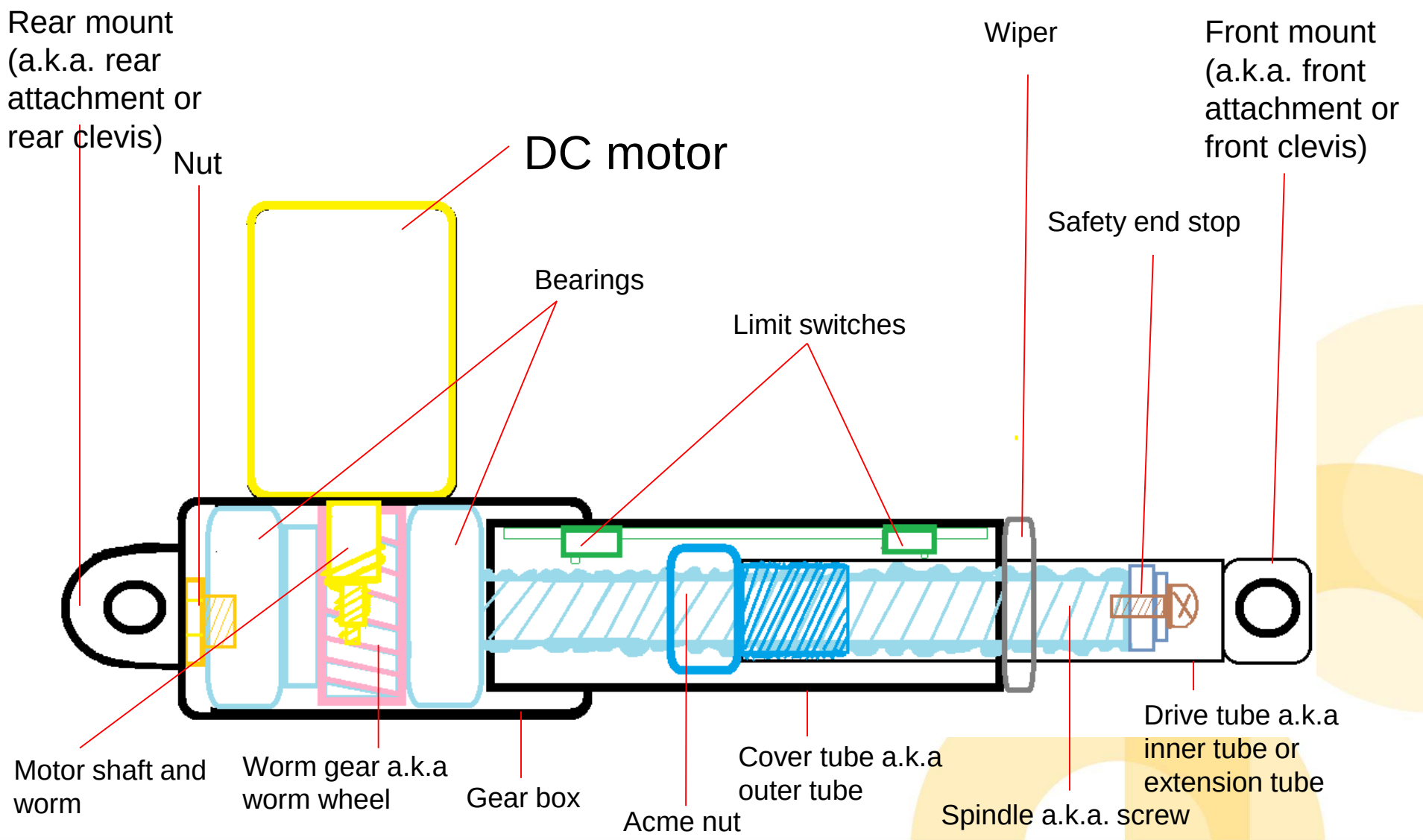
Inline Actuator

Column actuator

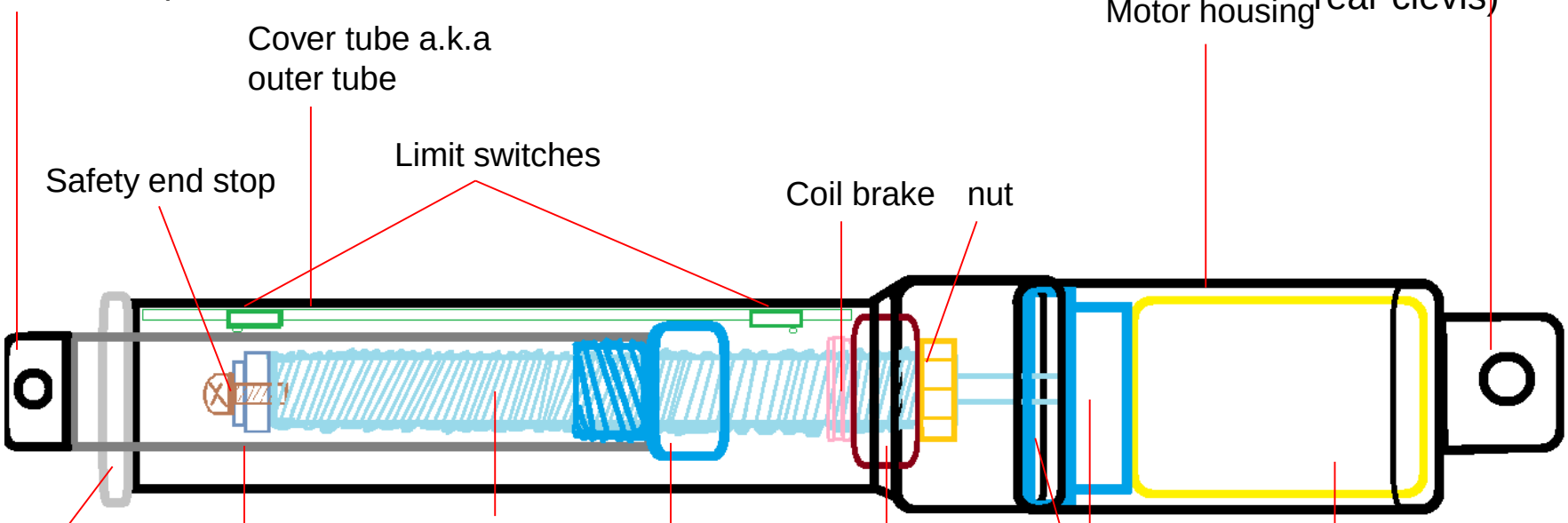


Dual motor actuator

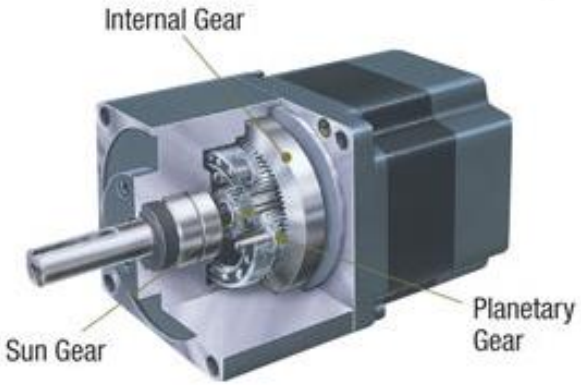
Basic Components of a Right Angle Linear Actuator (Acme screw)

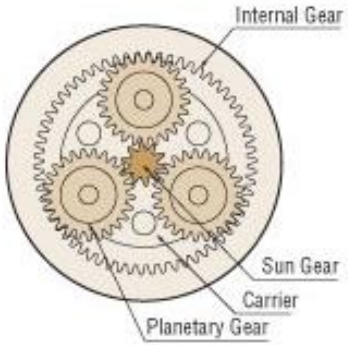


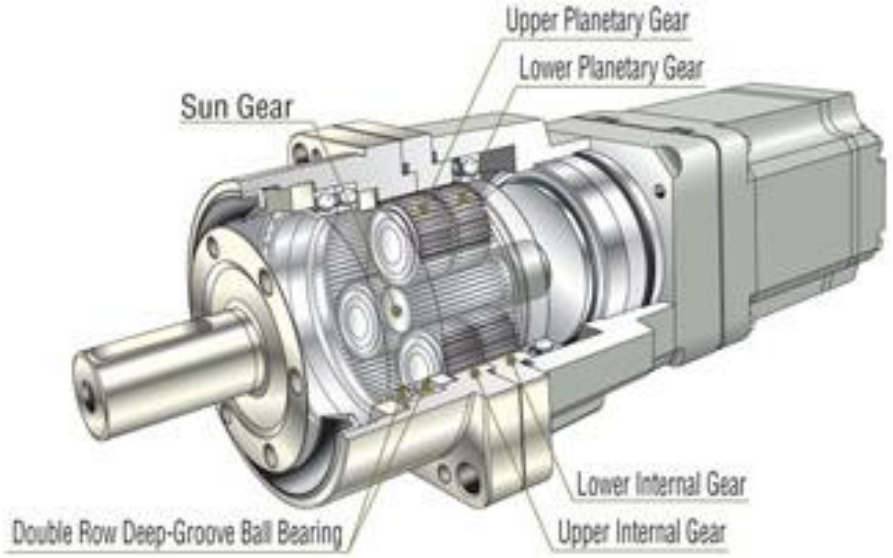
Basic Components of an Inline Actuator



Examples of internal view of Planetary gear motor gear box







TiMOTION's Parallel Drive Actuators: Current Industrial range

TA2P

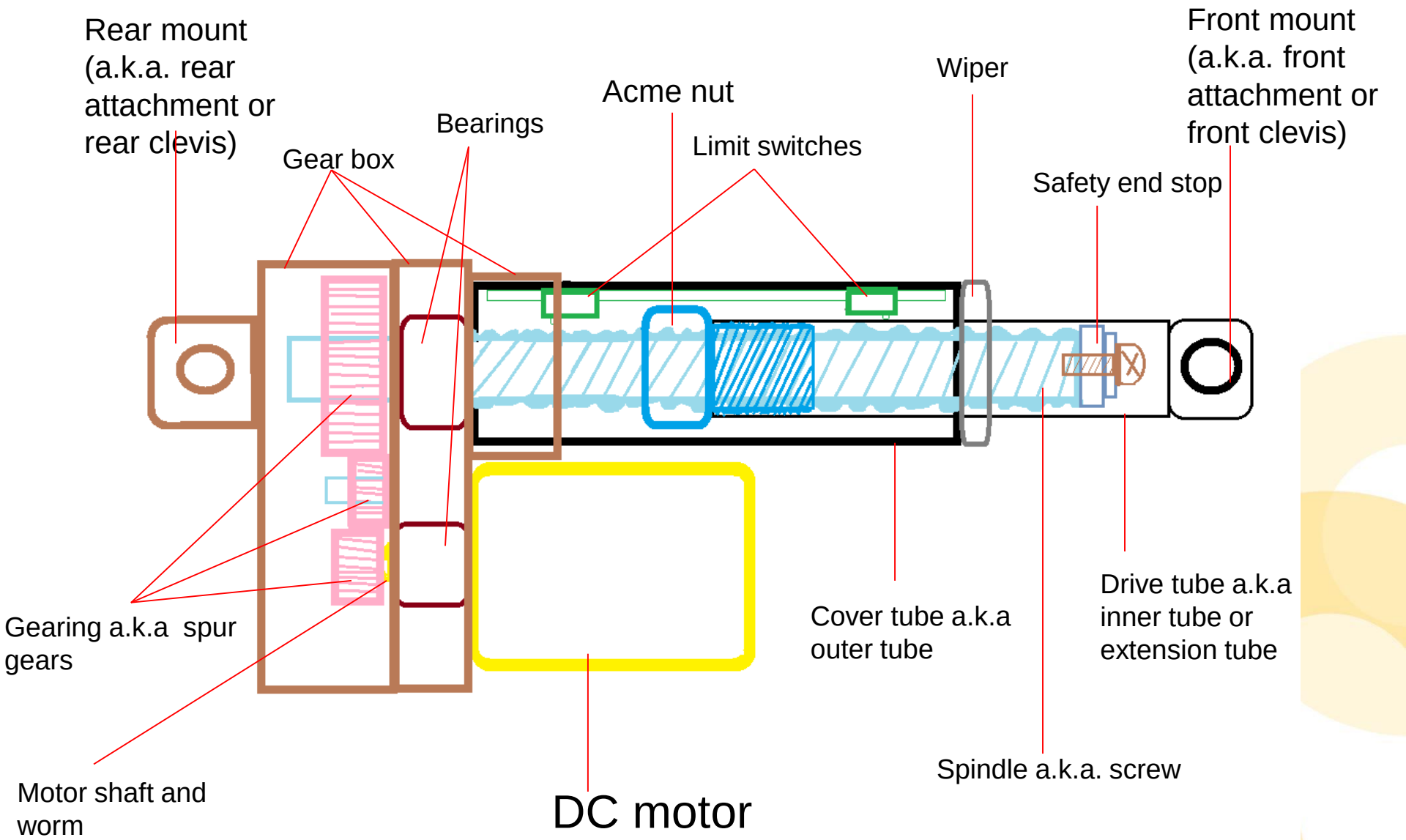
TA2

TA16

- 20,000 cycles
- 20% Duty cycle

TA3

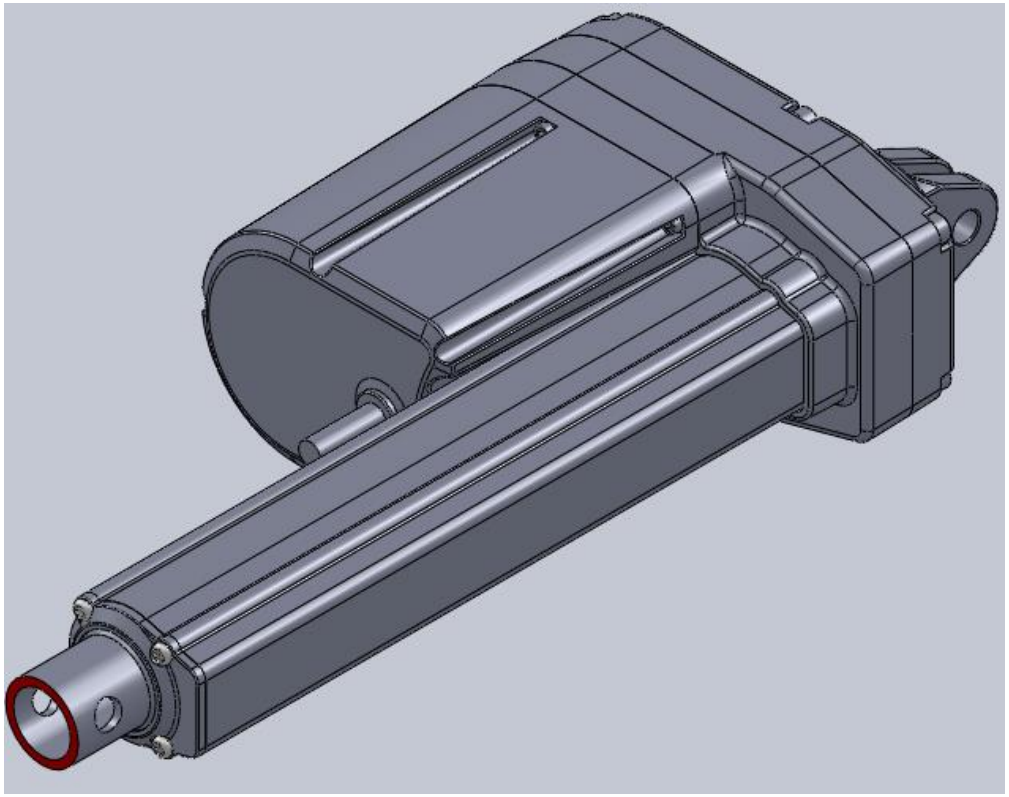
Basic Components of a Parallel Drive Linear Actuator (Acme Screw)



New Industrial product range

under development…

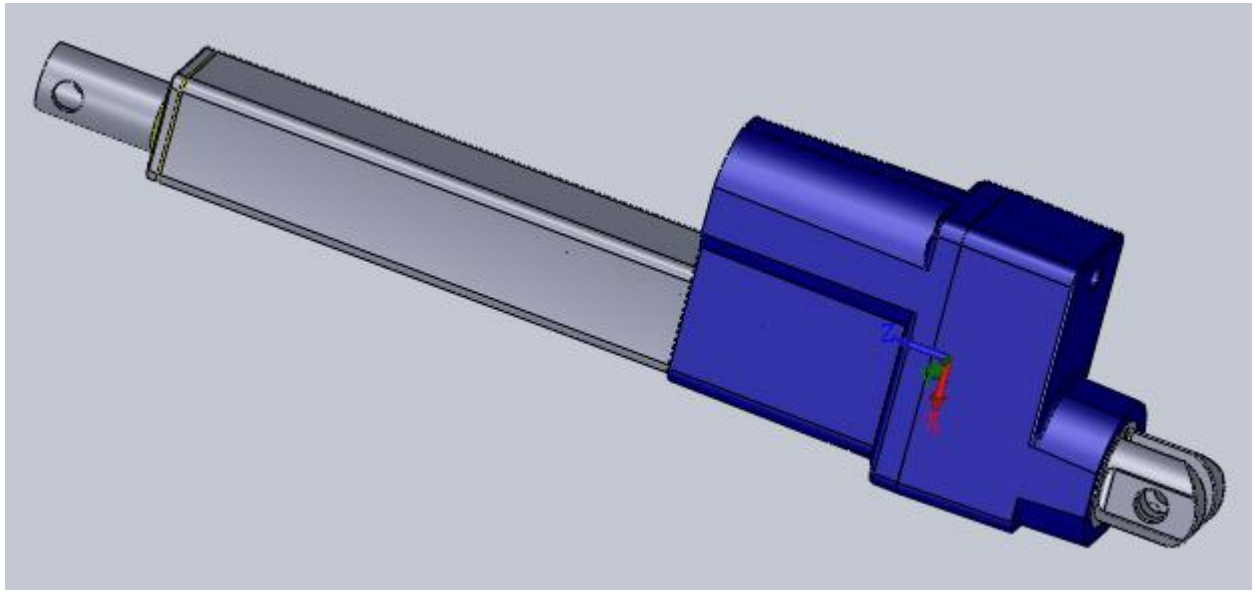
TA28 Actuator



Features:

1. Rated load max. 6000N
2. Motor :5540 3800RPM (duty cycle 25%) and 5200RPM(duty cycle 10%)
3. Gear sets: 5:1;10:1;20:1;40:1
4. From IP66 to IP69K
5. All metal covers available
6. Adjustable reed sensor signals available
7. Power & Control incorporated inside, DC power input and handset up&down to control with “Direct cut”
8. PCB for overcurrent protection
9. Maximum temperature = 80°C
10. POT as an option
11. Retracted length=S+130(without POT);S+140(with POT)
12. Inner tube: aluminum as standard and metal as optional

TA29 Actuator



1. compact dimensions:47*96mm
2. max. load : target 6000N
3. IP66W

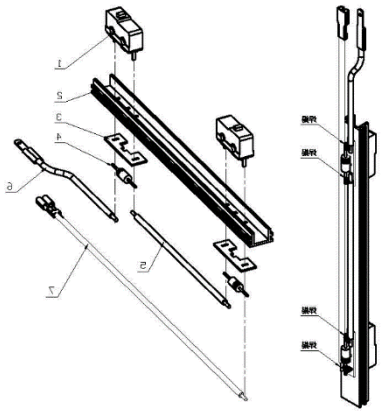
TA30 Actuator

- Ball screw
- AC Motor
- New competitive model (basic + options)

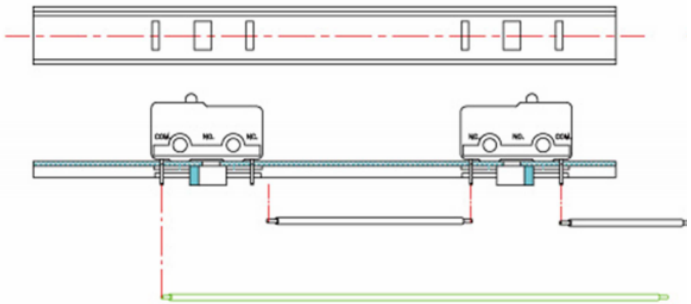
TECHNICAL INFORMATION

Stroke Length Considerations and Limit Switches

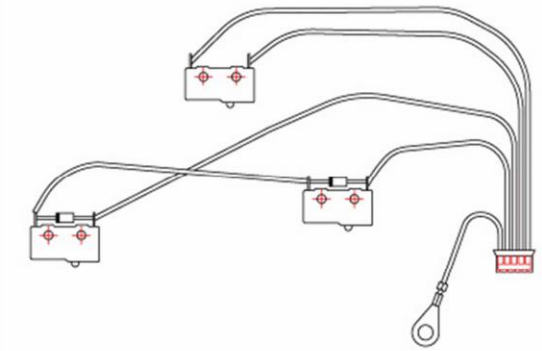
- In almost all applications, TiMOTION's stroke length is controlled by using limit switches (a.k.a. micro switches)
- The drive nut will travel down the lead screw. As the drive nut presses the limit switch button, it will cut the electrical circuit and cause the actuator to stop.
- Stroke length can be controlled by software as well, but in most applications it is simply controlled by the limit switches.



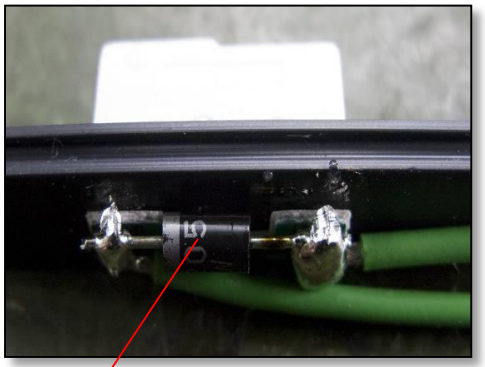
LS (limit switch) cable assembly with diode



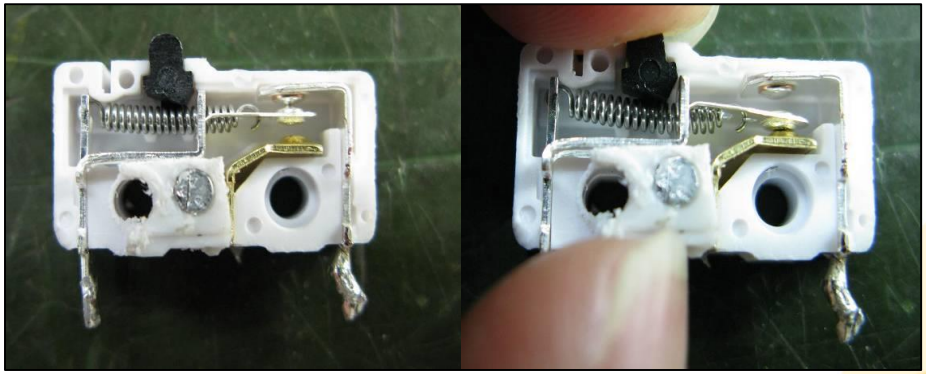
Two switches at the retracted/extended positions and the third one in between to send signal



Stroke Length Considerations and Limit Switches

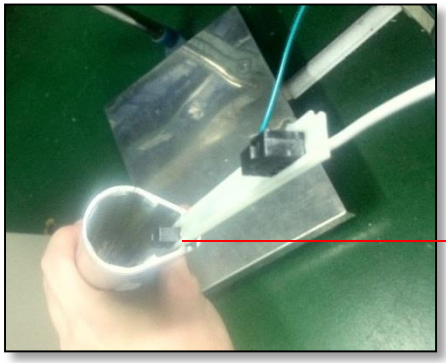


Diode



Limit Switch is normally closed

When the drive nut reaches the limit switch, it will push down the button and open the switch which cuts the electric circuit.

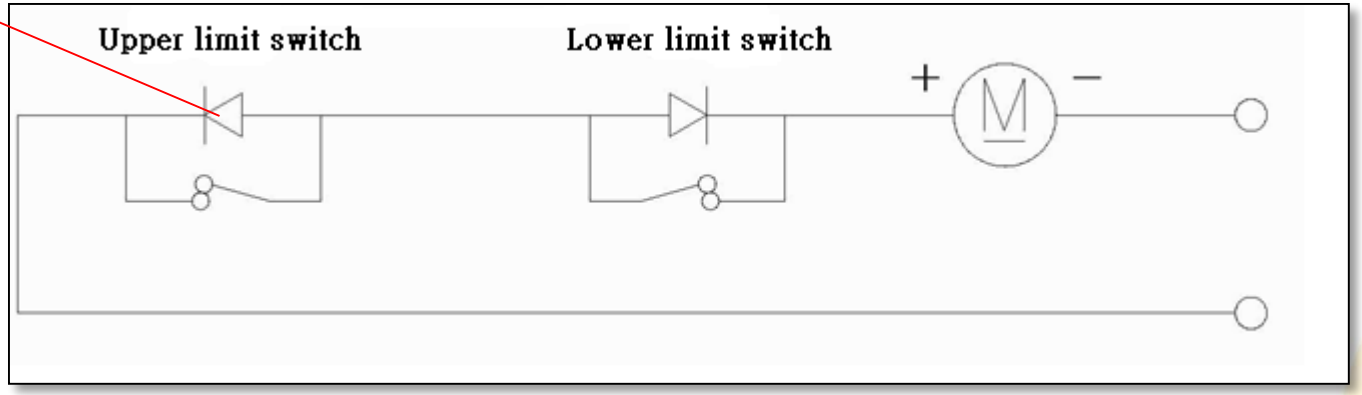


Limit switch assembly goes here in the outer tube

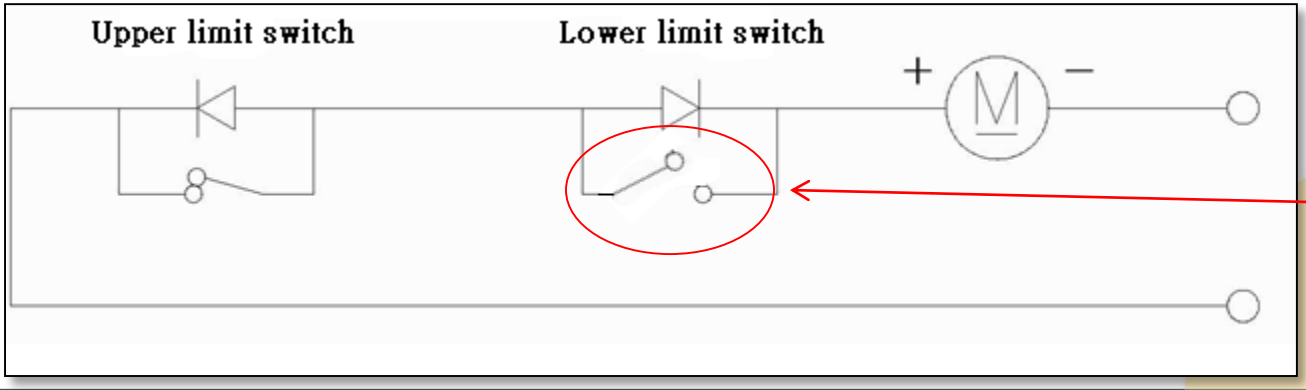
Limit Switch Circuit Schematic

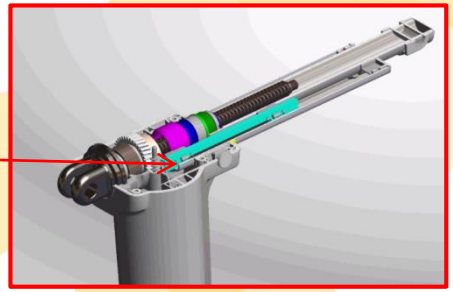
Diode

Standard TiMOTION Circuit Diagram (Drive nut is mid-stroke)



Standard TiMOTION Circuit Diagram (Drive nut has hit the lower limit switch and cuts the circuit)





TiMOTION Output Sensor Options

- TiMOTION's output sensors are required to communicate actuator stroke position to the control box MCU in order the control box can precisely control the actuator stroke. Typically required when an actuator system requires higher level functions. For example: Multiple-actuator synchronization, memory position, "Home" positions, controlling the stroke length by MCU rather than limit switch, etc.

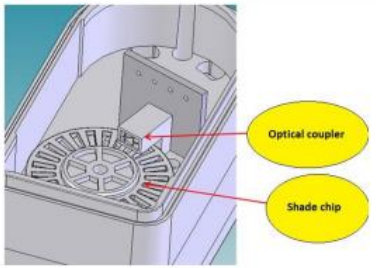
TiMOTION Output Sensor Options

- Hall Effect Sensor
- Reed Sensor
- Potentiometer
- Optical Sensor

Example photos from our actuators

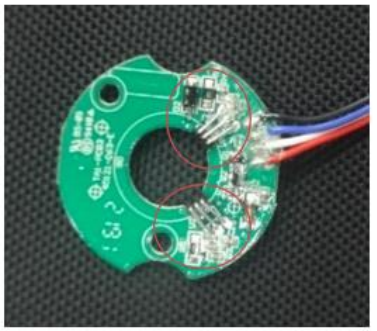
1. Potentiometer

2. Optical



3. Reed sensor

4. Hall sensor

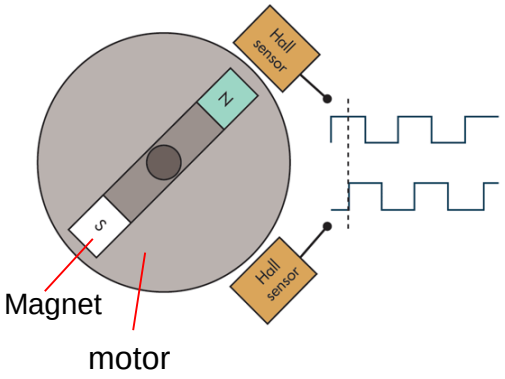


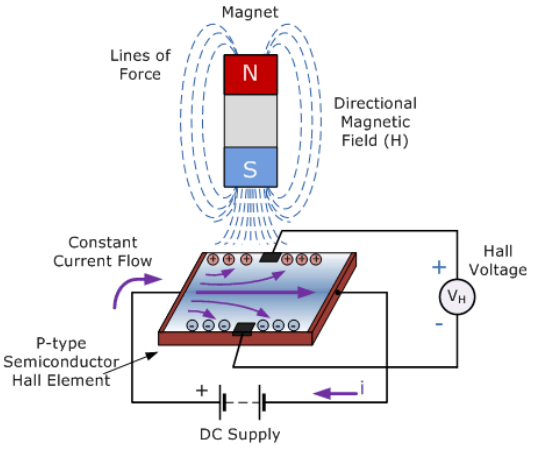
Hall Effect Sensors

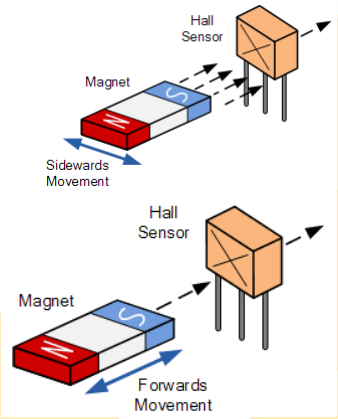
- Most recommended of TiMOTION position sensors because it is small (typically fits inside the motor) and provides higher resolution.

- Hall Effect Sensors are devices which are activated by an external magnetic field. We know that a magnetic field has two important characteristics flux density (B) and polarity (North and South Poles). The output signal from a Hall effect sensor is the function of magnetic field density around the device. When the magnetic flux density around the sensor exceeds a certain pre-set threshold, the sensor detects it and generates an output voltage called the Hall Voltage, VH.

- It basically consists of a thin piece of rectangular p-type semiconductor material such as gallium arsenide (GaAs), indium antimonide (InSb) or indium arsenide (InAs) passing continuous current through itself.



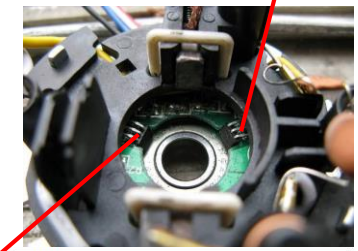


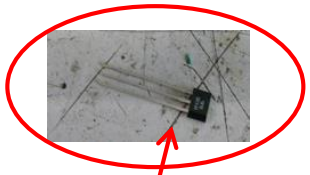


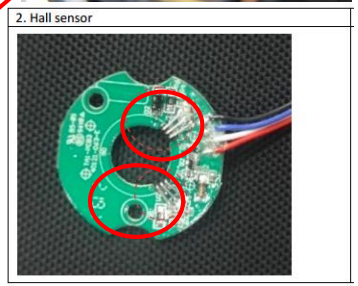
TiMOTION's Hall Effect Sensors

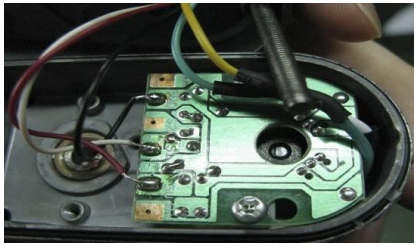
- TiMOTION's Hall Effect Sensor provide digital output.
- They are located inside the motor of most of our linear actuators. The exception is our TA2. The Hall Effect Sensor is located inside the gearbox of the TA2.

Example: TA1, TA5, TA5L, TA5P, TA6, TA7, TA10 motor Hall Effect Sensors

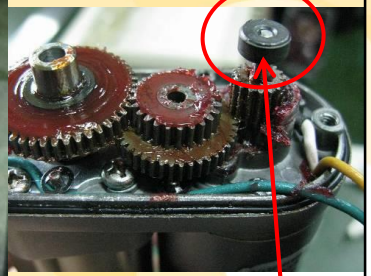








TA2

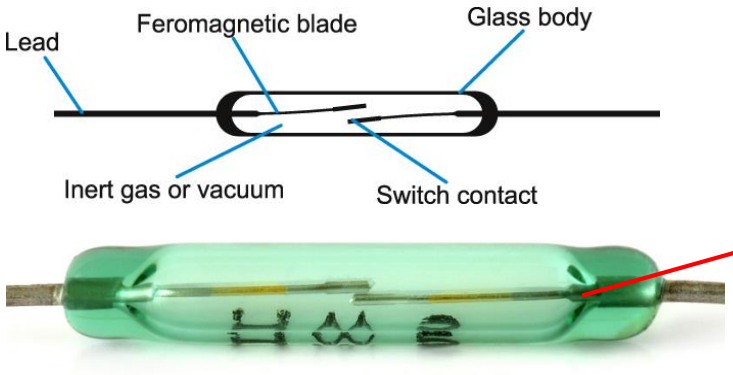


Magnet on end of motor shaft

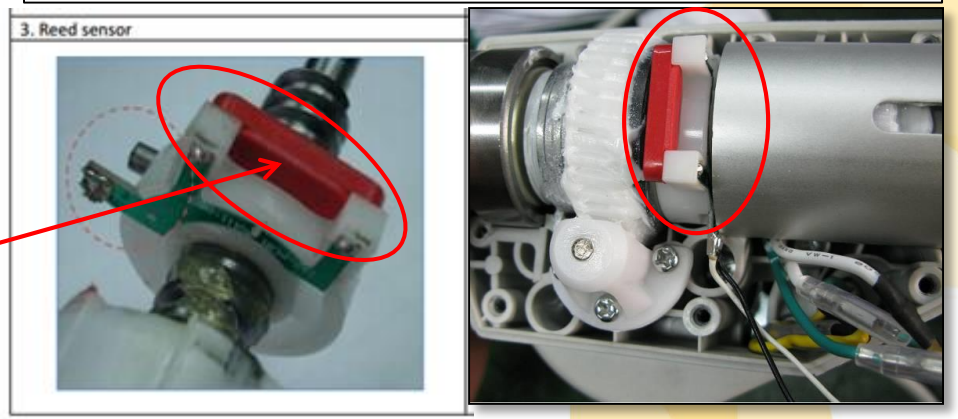
Reed Sensors

The reed switch is a magnetic positional sensor. It is an electrical switch operated by an applied magnetic field. It consists of a pair of contacts on ferrous metal reeds in a hermetically sealed glass envelope. The contacts may be normally open, closing when a magnetic field is present, or normally closed and opening when a magnetic field is applied. The switch may be actuated by a coil, making a reed relay, or by bringing a magnet near to the switch. Once the magnet is pulled away from the switch, the reed switch will go back to its original position. For each rotation of the lead screw and position of the linear actuator stroke length, the reed switch will open or close.

We even use a Reed sensor inside our handsets with a safety key function to send a signal when the key has been removed.



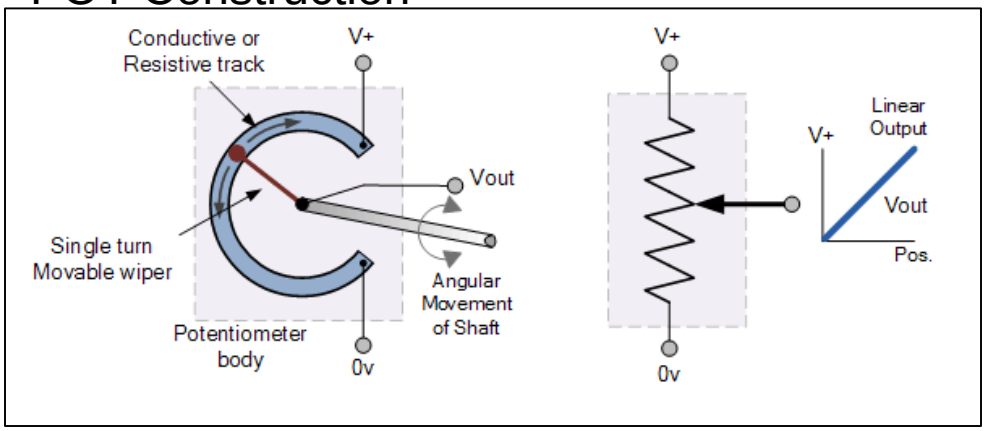
Example: TiMOTION's Reed sensor inside the TA7 gear box.



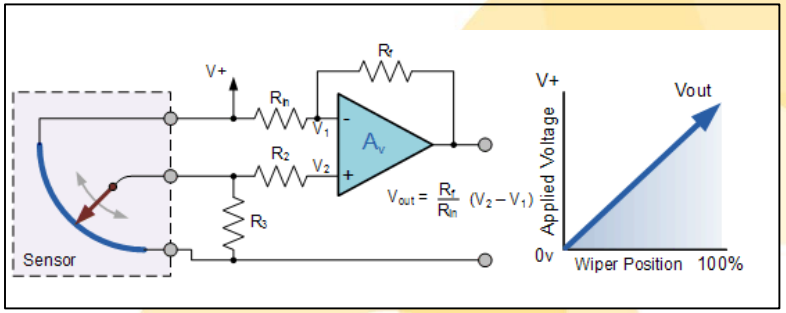
Potentiometer (a.k.a. POT)

- Most commonly used position sensor in industry. It has a wiper contact linked to a mechanical shaft that can be either angular (rotational) or linear (slider type) in its movement, and which causes the resistance value between the wiper/slider and the two end connections to change giving an electrical signal output that has a proportional relationship between the actual wiper position on the resistive track and its resistance value. In other words, resistance is proportional to position. As the linear actuator lead screw turns, the resistance value between the wiper/slider and the two end connections will change. Each resistance value will correspond to a position in the linear actuator's stroke.

POT Construction



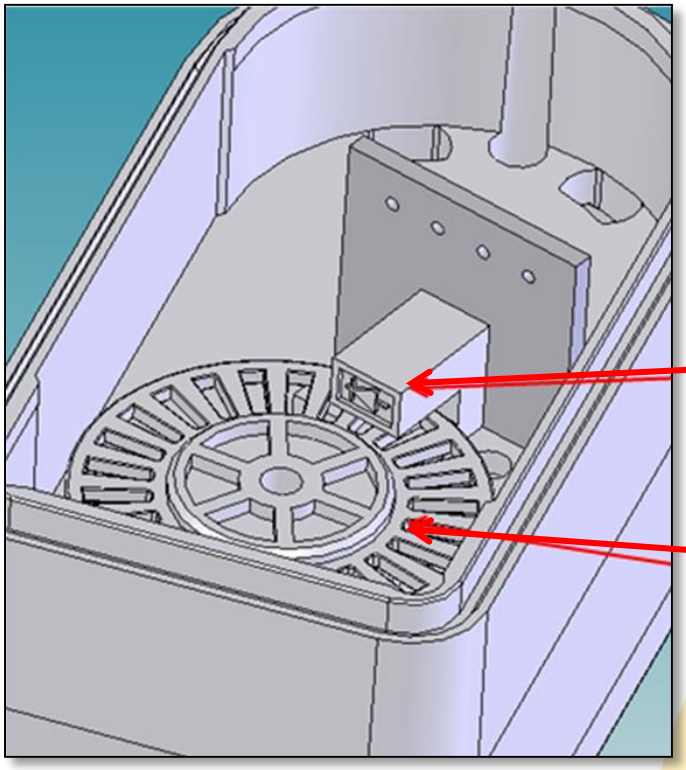
Sample Sensing Circuit



The output (Vout) from the POT is taken from the center wiper connection as it moves along the resistive track and is proportional to the angular position of the shaft.

Optical Sensor

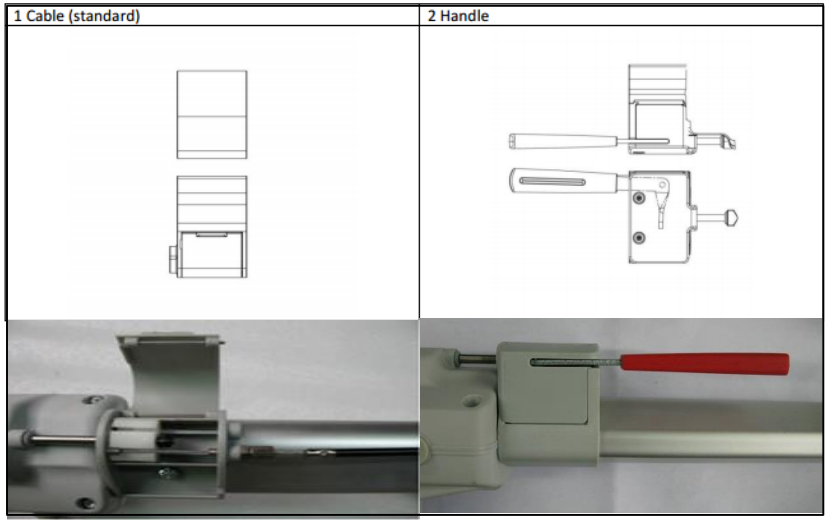
The light blocking wheel is mounted directly onto the lead screw. As the lead screw rotates, the light blocking wheel will also rotate at the same time blocking the light to the optical coupler. The optical coupler will send a signal each time it senses the light being blocked. The light blocking wheel revolves will cause the optical coupler to send 25 signals each revolution. This sensor is rarely used. It is only available for the TA2 and TA2P.

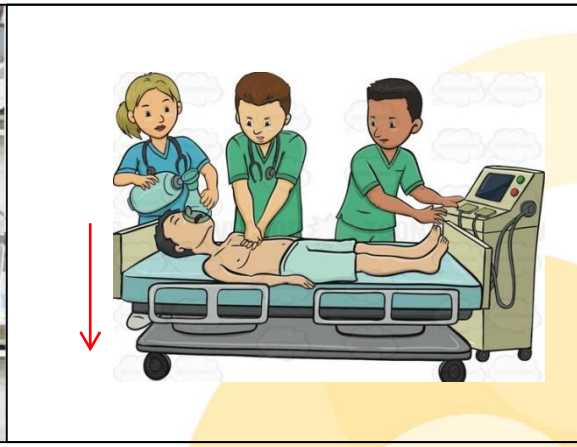


Safety Features (Quick Release)

- TiMOTION's "quick release" is a clutch which allows the actuator to quickly backdrive when it is released. The "quick release" comes in two options: Pull by cable or pull by handle.
- The "quick release" is designed mainly for medical bed applications: It is designed for the backrest of a medical bed. When the "quick release" is triggered, the actuator can quickly backdrive allowing the nurse, doctor or other medical staff quickly lay the patient flat. This feature comes in handy when emergency CPR compressions must be performed. The quick release will also allow the bed backrest to be easily lowered in case the power goes out in the hospital or care location.

- Actuators with the quick release option: **TA1&TA15**





The bed backrest can be quickly lowered so medical staff can perform CPR.

I. Quick release

Without	0
Cable (standard)	1
Handle	2

Note 1: Only compatible with load & speed options #C / #E, #M and #T
Note 2: If with QR, it cannot choose coil brake options #3, #4, #8, #N

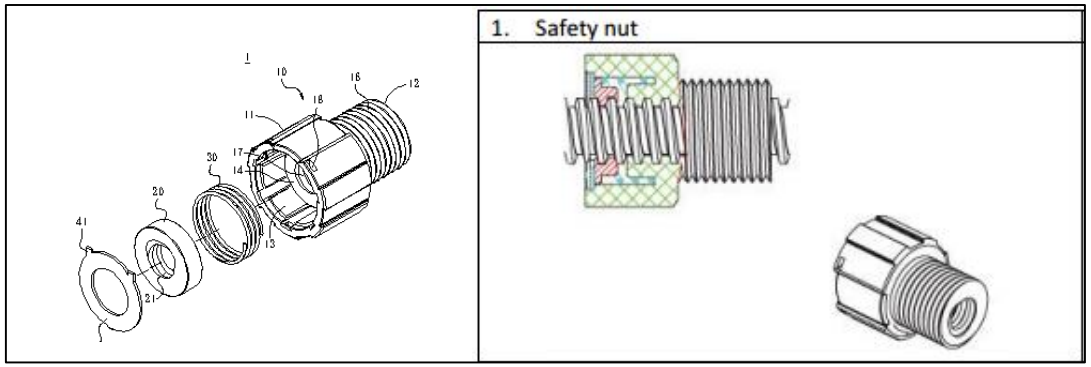
Safety Nut

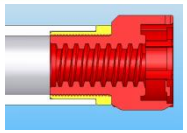
- The safety drive nut option is essentially just a metal-reinforced acme drive nut.

The safety nut option should be considered when the actuator will be moving loads of ≥6000N. If the actuator will be expected to move loads of ≥8000N, the safety nut is **MANDATORY.**

- When moving loads of ≥6000N, the internal stress of the linear actuator is higher. Internal friction and heat are also higher which can weaken the drive nut as well as decrease the life expectancy of the linear actuator by wearing down the plastic threads of the drive nut. Extreme loads can lead to possible unexpected actuator failure due to these higher stresses on the system. Therefore, in order to protect the actuator from sudden failure and collapse, a safety nut assembly should be installed.

- The metal ring will prevent the extension tube/drive nut from completely collapsing in this situation.





Standard “Push Only” Nut

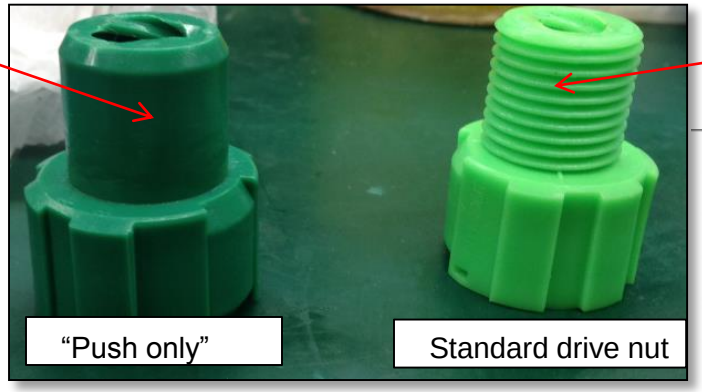
- A “push only” nut is essentially an acme drive nut without threads to connect it to the extension tube. A standard drive nut will have threads to screw into the extension tube. A “push only” nut won’t have threads.

- **Reason for push only nut:** It’s for safety. When a standard actuator retracts, there is a danger it will continue pulling even if something is in the way because the nut is fixed to the extension tube. A linear actuator pulls with a lot of force and can do a lot of damage if something is in the way. In a “push only” system, the extension tube is pushed by the drive nut and moves with the drive nut due to gravity rather than being pulled. Therefore, if there is an obstruction, the extension tube will not be pulled by the nut and crushed whatever is obstructing it.

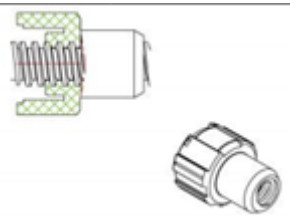
- With a “push only” nut system, if something obstructs the extension tube while it is retracting, the extension tube will stay in place while the “push only” nut slowly spins and continues to retract.

- **Problem with this system**: If the extension tube is blocked for too long, the extension tube and nut will actually separate leading the extension to crash down when the obstruction is cleared.

No screw threads



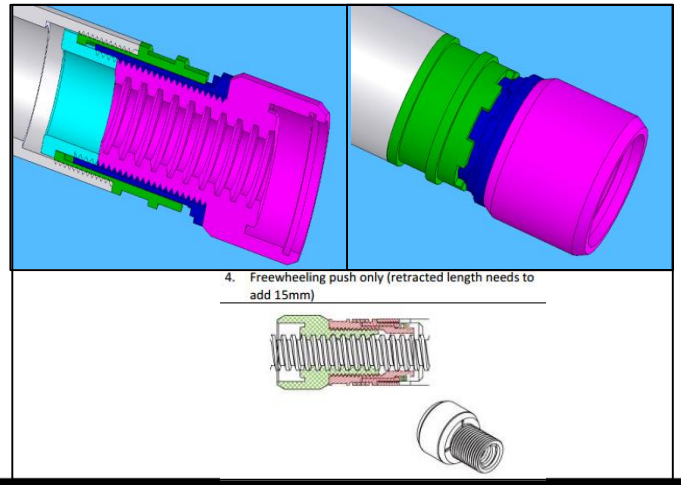
Screw threads to fix onto the extension tube

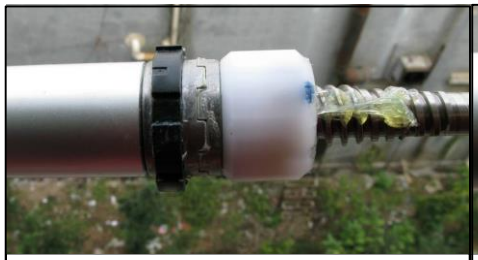


“Push only” is for situations such as these below

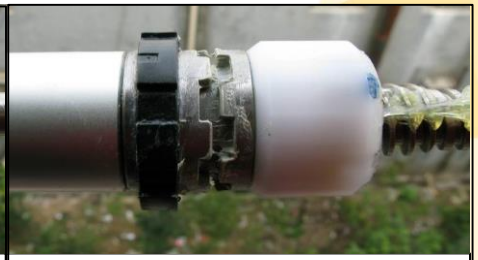
“Free-Wheeling Push Only” Nut

- **Purpose:** The Free-Wheeling Push only nut system is designed for the same reason as the “push only” nut: To prevent obstructions such as animals, people, window sills, other furniture from being damaged by a retracting actuator system.
- **Problem with standard “push only” nut:** The drive nut is not physically fixed to the extension tube. In the case of an obstruction, the nut will continue to spin and slowly move away from the extension tube. If the obstruction is not cleared quickly, there is a risk the extension tube and whatever it’s holding up will crash down.
- The “Free-wheeling Push Only” nut was designed to be fixed onto the extension tube, HOWEVER, it will still allow the nut to spin in place freely if an obstruction is encountered. If an obstruction is encountered, the extension tube will be held up by the obstruction, but the drive nut will not continue to pull the extension tube with it. The nut will spin freely in place. **There is a space for the nut to freely unscrew/spin, however, the drive nut is still firmly fixed to the extension tube so it cannot move away from the nut and possibly crash down later.**





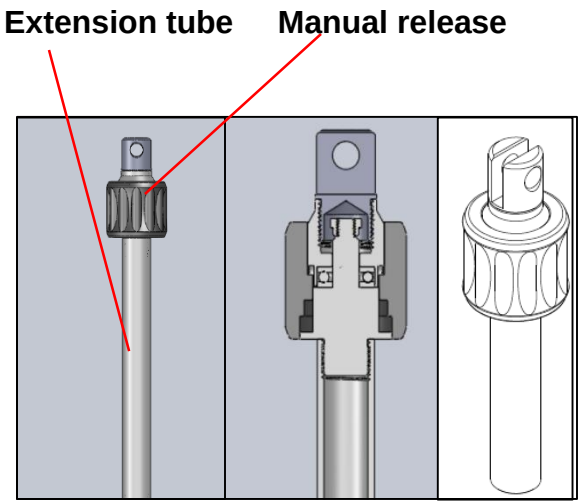
The “free-wheeling push only” nut system when the system is extending

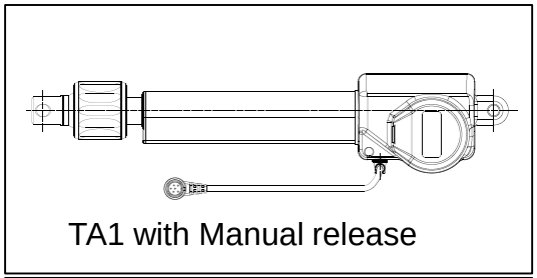


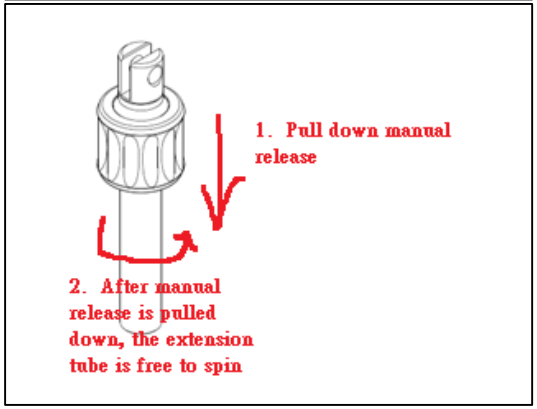
The “free-wheeling push only” nut system when the system is retracting and encounters an obstruction

Manual Release

- **Purpose:** It was originally designed to allow the linear actuator to be easily back-drivable in a medical patient hoist system. In case of power failure or actuator motor failure, the patient should be able to be manually lowered from the patient hoist.
- In order to back drive the linear actuator, the extension tube needs to be able to spin so the drive nut can back-drive down the lead screw.
- **Problem:** If the front attachment is locked in place in the top of the patient hoist, the extension tube cannot spin because the extension tube and front attachment are screwed together. Therefore, the drive nut cannot back-drive down the lead screw and retract the actuator because the extension tube and drive nut are also fixed together (screwed together).
- **Solution:** The manual release allows the extension tube to release from the front attachment and spin freely. This allows the linear actuator to back-drive freely and the patient to be lowered from the patient hoist system.




TA1 with Manual release



Manual Crank

Purpose: To allow the linear actuator to be manually operated (extended/retracted).
Problem: In areas of the world where electric power is not reliable, medical patients are sometimes stuck in an unhealthy position when the care center's power is interrupted since most linear actuators are powered by electricity.
Solution: The manual crank allows the medical practitioner to manually change the bed positions to relieve the patient in case of emergency during power outages or long periods of time without power.

Comparison & Application of

TiMOTION Control System

Control System Composition

TC TiMOTION Control box

TP TiMOTION Power supply

TH TiMOTION Handset

- **TFH** (Furniture Handset)
- **TMH** (Medical Handset)
- **TDH** (Display Handset)
- **TNP** (Nursing Panel)
- **TFS** (Footswitch)

Furniture Control System

Furniture Application

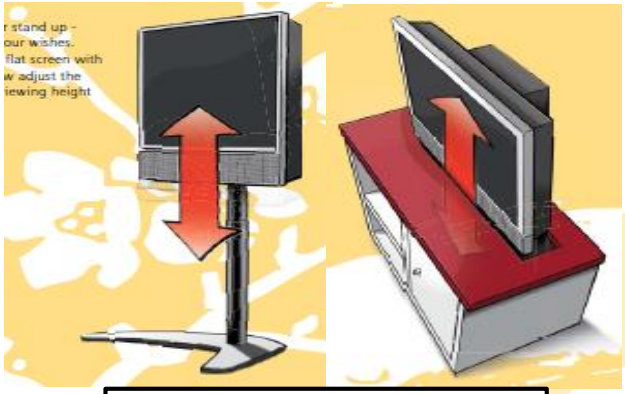
Examples

Recliner

Massage chair

Sofa

Home bed



TV lift

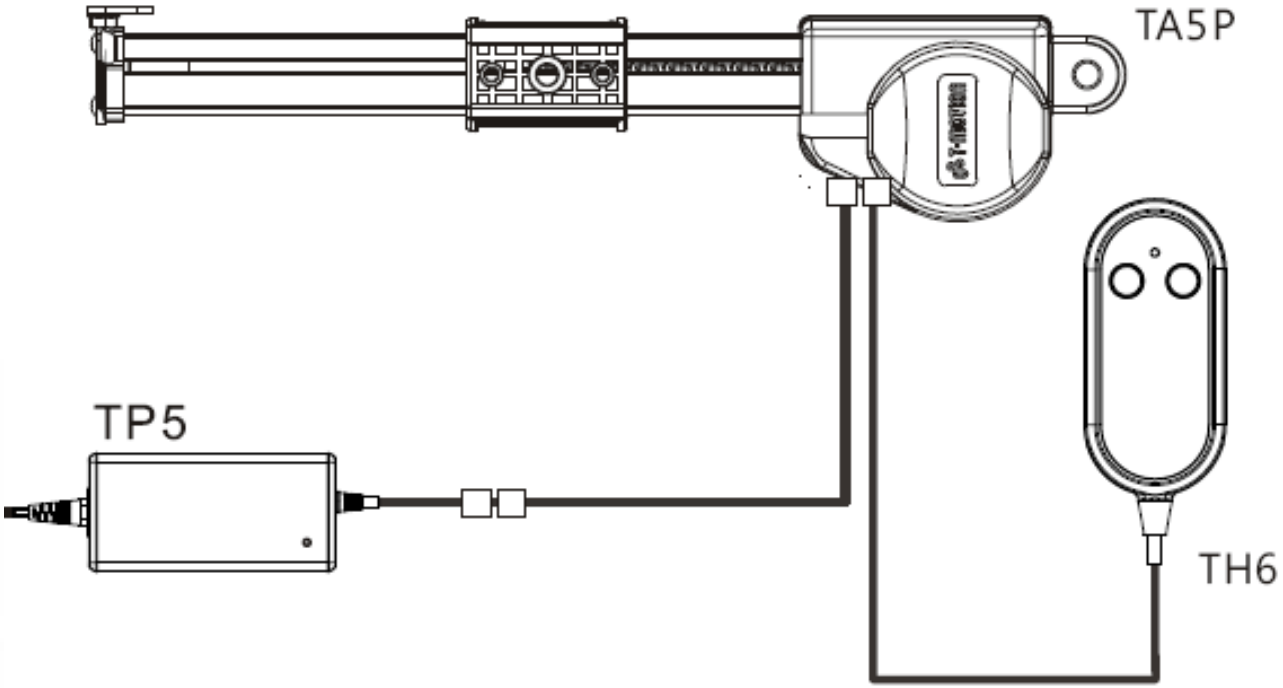
Furniture Application

Introduction

- ✓ Mostly in black
- ✓ Mostly indoor use. No IP requirement.
- ✓ **(CE, UL)** Basic certificate
- ✓ Simple function, less software requirement, easy programming
- ✓ High competition in price. Need to control cost.
- ✓ Handset design is important

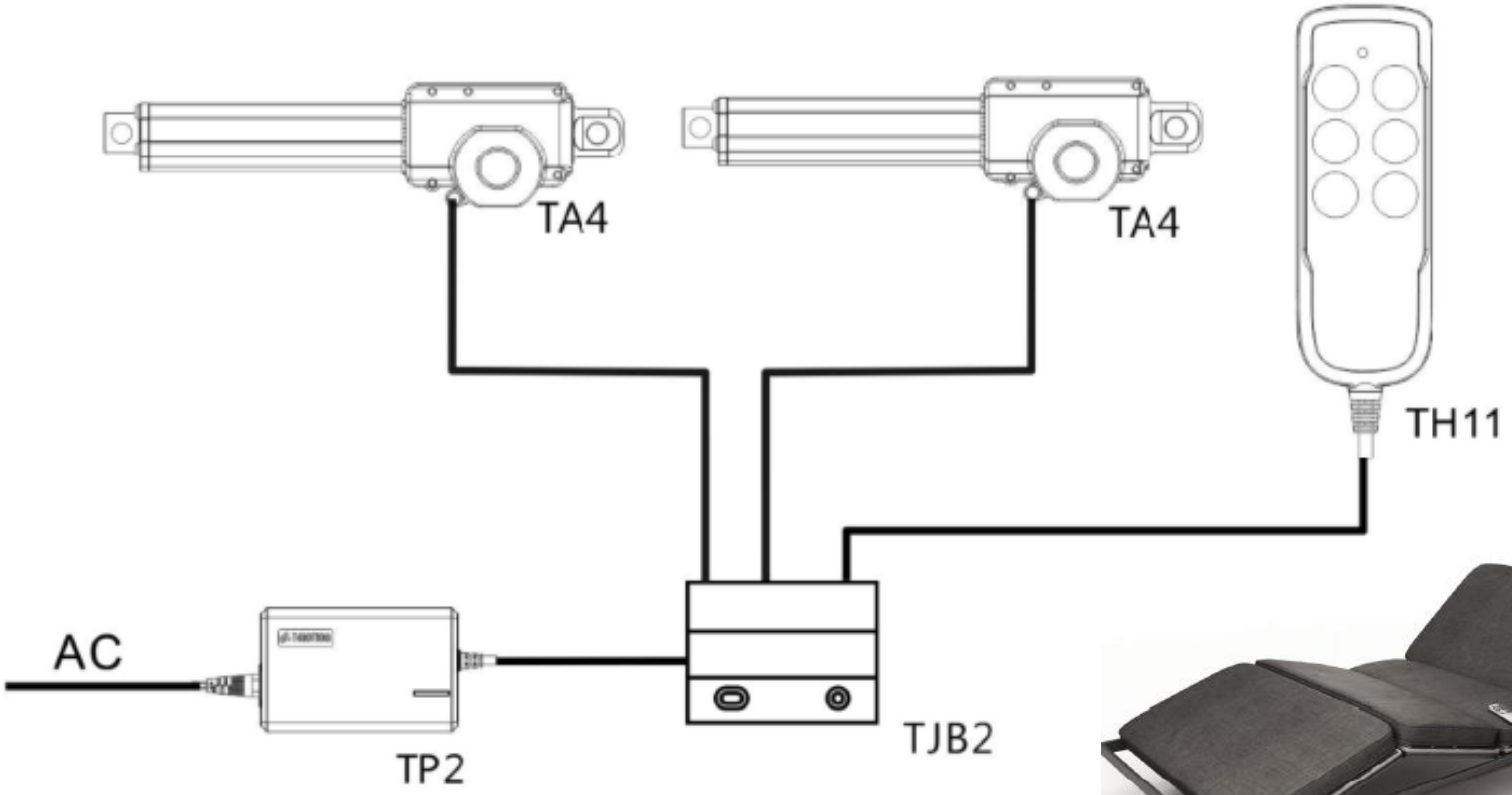
Furniture Application

Direct cut system – One motor



Furniture Application

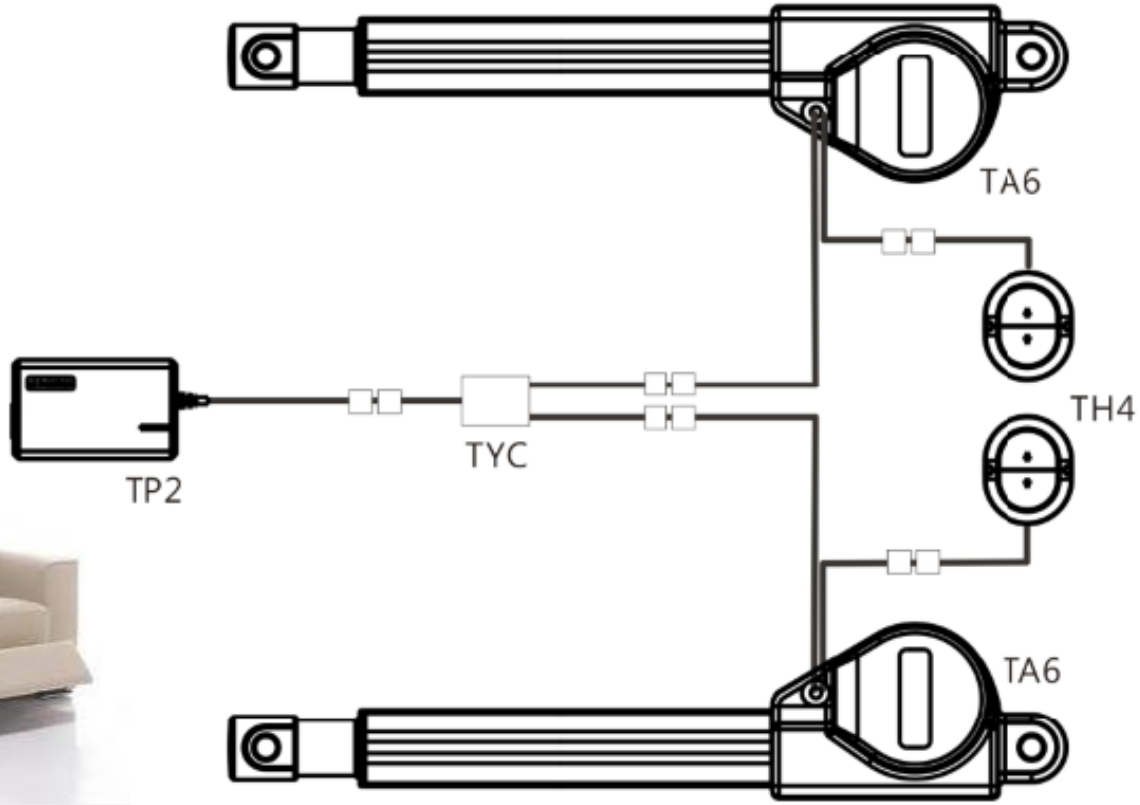
Direct cut system – Two motor one handset



Furniture Application

TP

Direct cut system – two motors two handsets



Furniture Application

furniture direct cut handsets

Embedded type for sofa/chair

TH4 2 or 4 buttons
Backlight available

TH5 2 buttons

TH16 2 or 4 buttons
Backlight available

TH19 2 buttons
Backlight ring

TFH2 2 buttons
Backlight, USB

TFH6 2 buttons
Zinc Alloy Plating

Furniture Application

Furniture direct cut handsets

TH15 2 buttons

TFH4 4 buttons

TFH11 2 buttons
USB

TH23 2 or 4 buttons
Capacitive touch button

TH9 3 buttons
Safe button

Furniture Application

Furniture direct cut handsets

Hand-hold type

TH6 4 buttons

TH11 6 buttons

TH17 8 buttons
Rubber button

TFH3 6 buttons

TFH5 toggle switch

Furniture Application

Control box options

				
	TC2/TC2B	**TC3/TC3B**	**TC6**	**TC7**
Power supply	Built-in EI (2 or 3A) or SMPS (2A)	without	without	without
Motor #	1~3	1~4	1~5	1~2
PWM #	2	2	2	2
Wireless	RF & IR	RF & IR	RF & IR	add TRF
TH plug	DIN 8P	DIN8P or RJ 10P	RJ 10P	DIN 8P
Other feature	Battery options	Support many accessories	Support many accessories	

Furniture Application

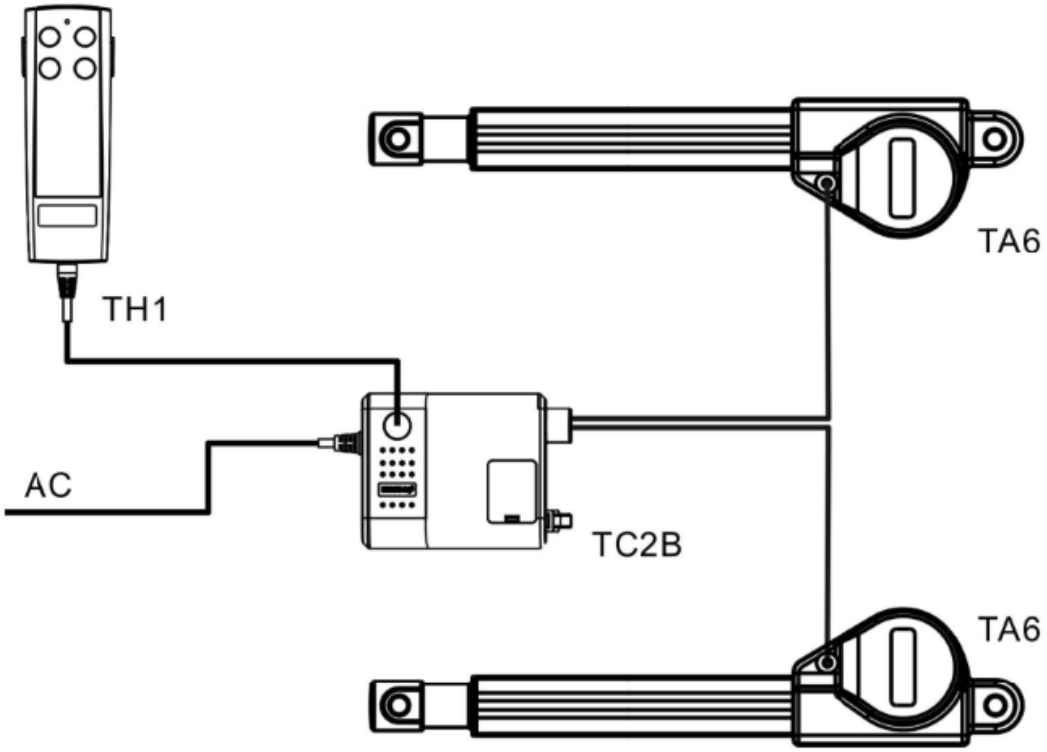
TC2/TC2B battery option

With two 9V battery cable

With TBB battery cable to connect with TBB series

Furniture Application

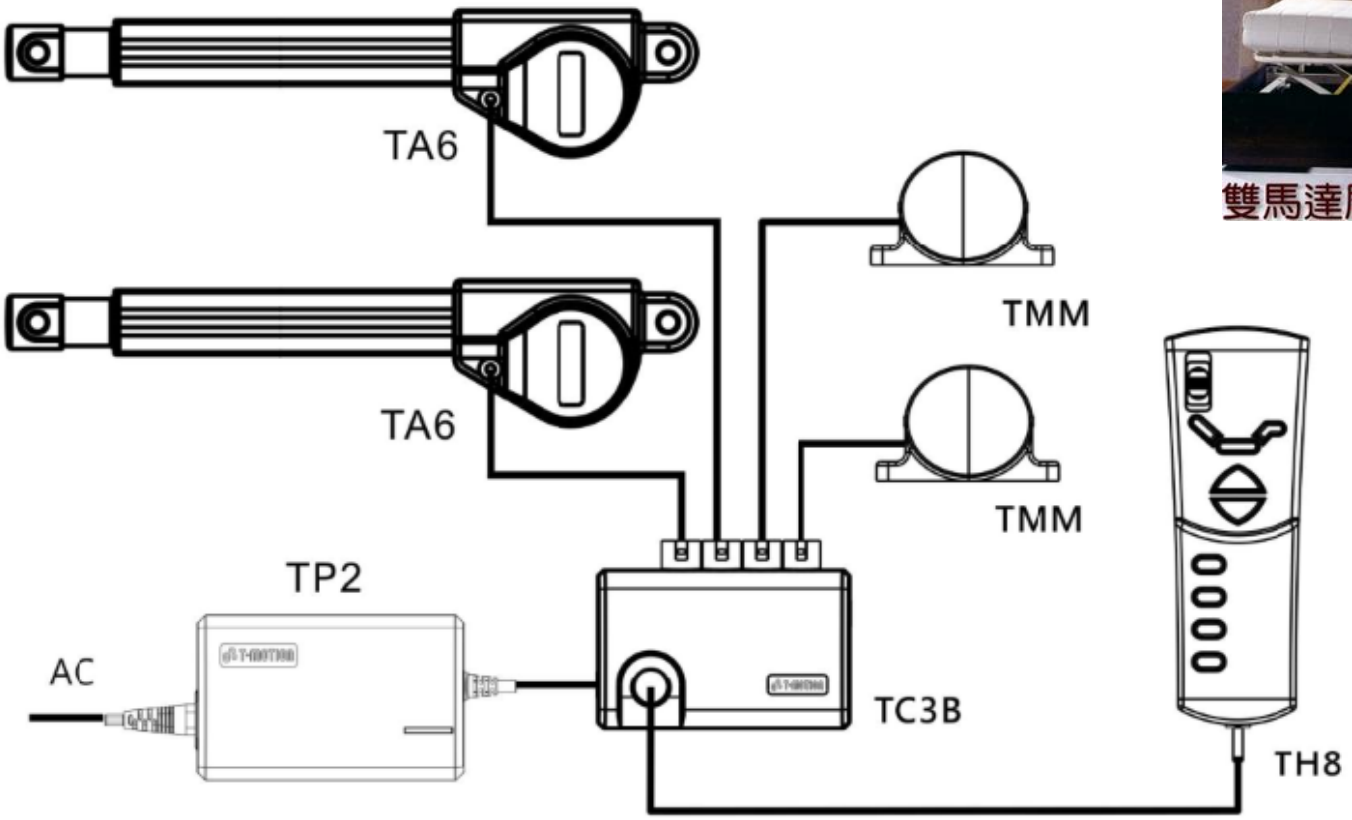
TC2(B) control system example



TC2/TC2B can achieve IP54 but no medical certificate.

Furniture Application

TC3(B) control system example



Furniture Application

Non-direct cut furniture handsets

TH1 10 buttons

TH7 10 buttons

TH17 6 buttons Rubber button

TH13 for massage chair With LCD

TH29 8 buttons

Furniture Application

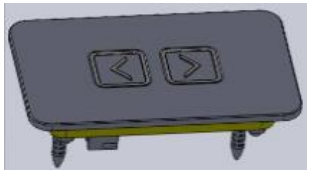
Non-direct cut furniture handsets

High-end embedded type

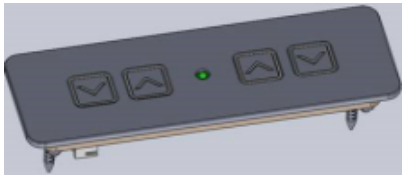
TFH7
2 color LED backlight

TFH7P
2 color LED backlight
3.5mm charging socket

TFH7S
2 color LED backlight
3.5mm charging socket



TFH15
Smaller dimension TFH7



TFH15P
Smaller dimension TFH7P

- With conductive rubber button
- **LED:** with 2-color LED backlight. Normally need to work with MCU control box

Furniture Application
Wireless furniture handsets

Radio frequency handset – RF handset can conduct transmission in all directions of the receiver, and is able to pass through blocks

RF handset has to work with control box built in with RF receiver, or add TRF

TH3

TH8

TH25

TRF
無線接收盒

Furniture Application

Accessories

Massage motors

TMM

TMM2

TMM3

TMM4

Accessories for recliners

TRL
Reading Light

THP
Heating Pad

TAL
Air Lumbar

TSS
Safety Strip

Furniture Application

Accessories

TBB3
1.8Ah
Lithium battery

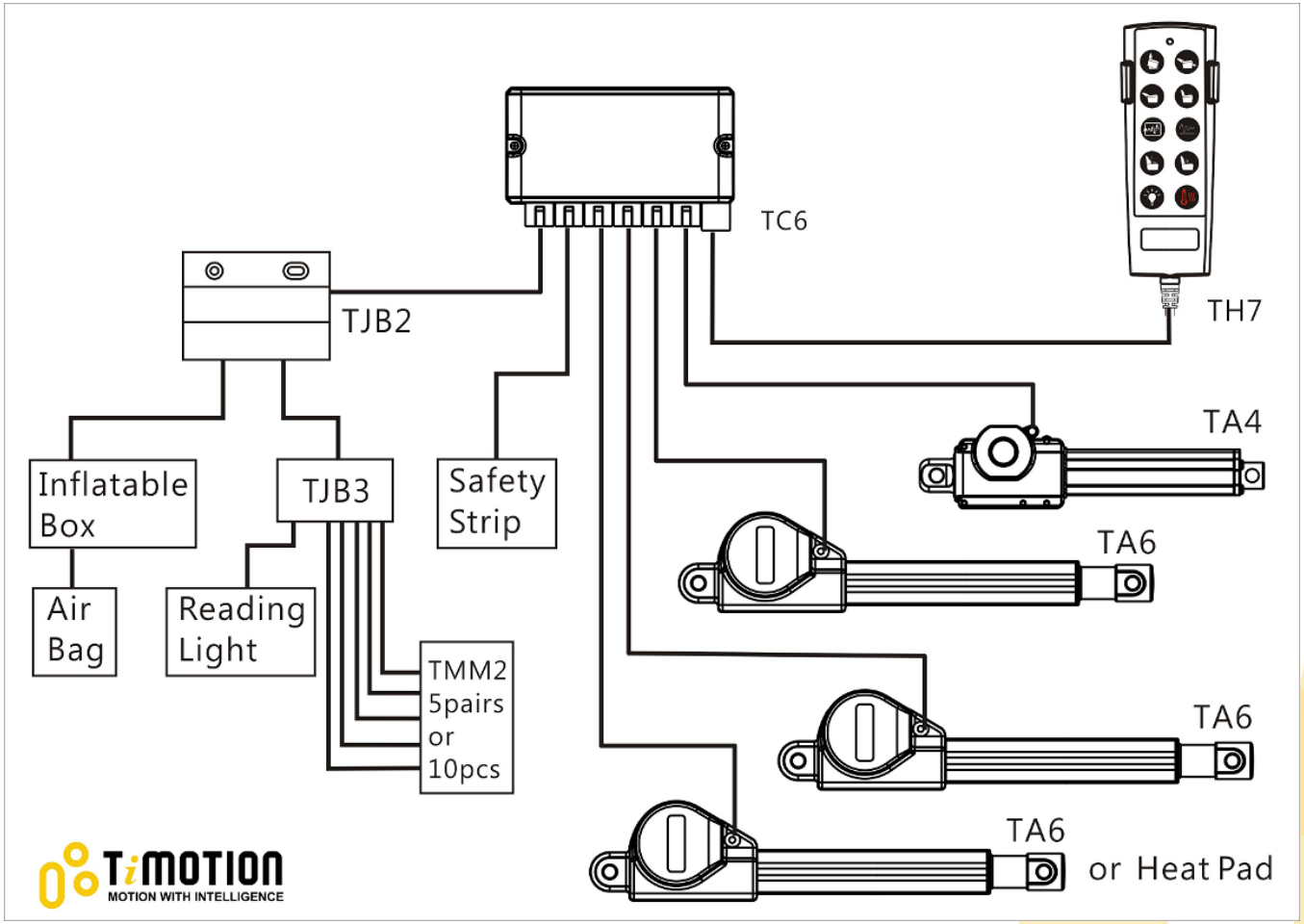
TBC
TBB

TRF
RF receiver

TFA1
USB charger

Furniture Application

TC6 control system example



Medical Control System

Medical Application

Examples

Medical bed

Exam couch

Patient hoist

Power wheel chair

Nurse computer cart

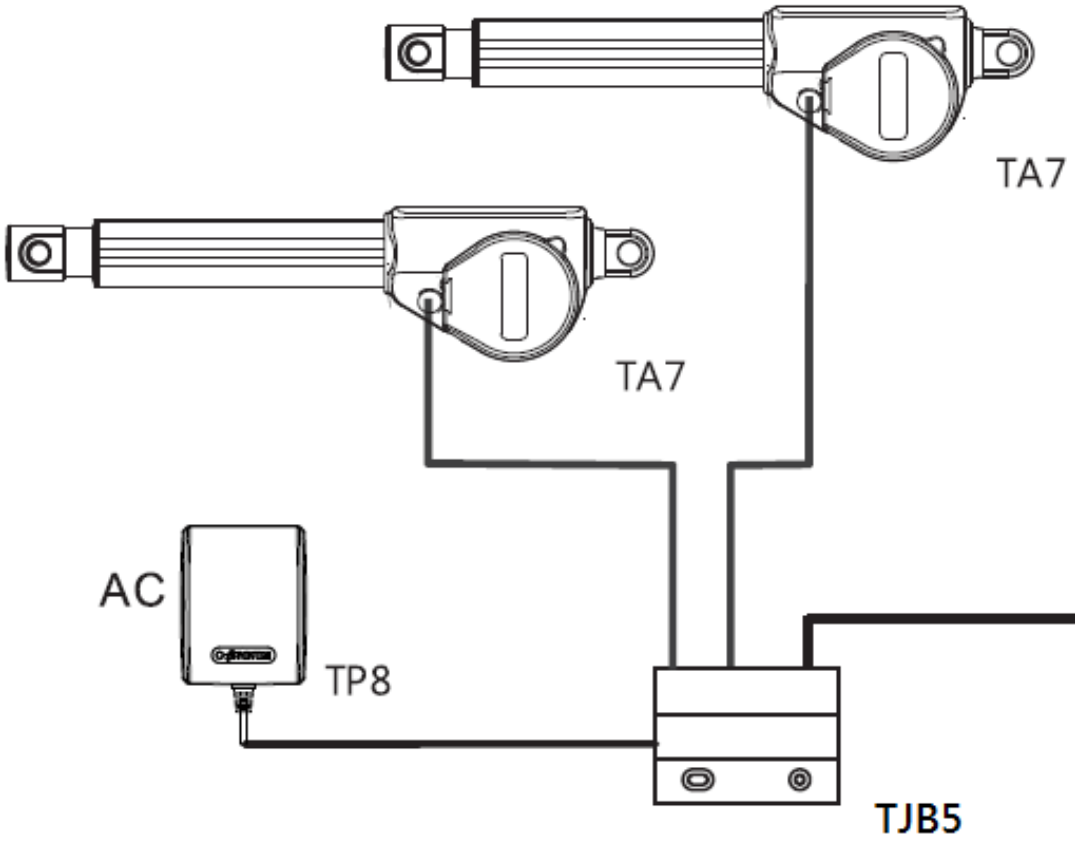
Medical Application

Introduction

- ✓ Mostly in grey
- ✓ **IP54** or above
- ✓ Compliance with medical standard. High safety requirement.
  Ex: safety key, anti-pulling buckles, PTC in transformer
- ✓ More complicated software, such as limited position, synchronization, back-up battery
- ✓ System supports many handsets/accessories, plus motors are with high current, so the electric components are more expensive

Medical Application

Medical direct cut system



Medical Application

Medical direct cut system

TH21	**TFS**	**TFS2**	**TFS3**
10 buttons	2 buttons	6 buttons	2 buttons

Medical Application

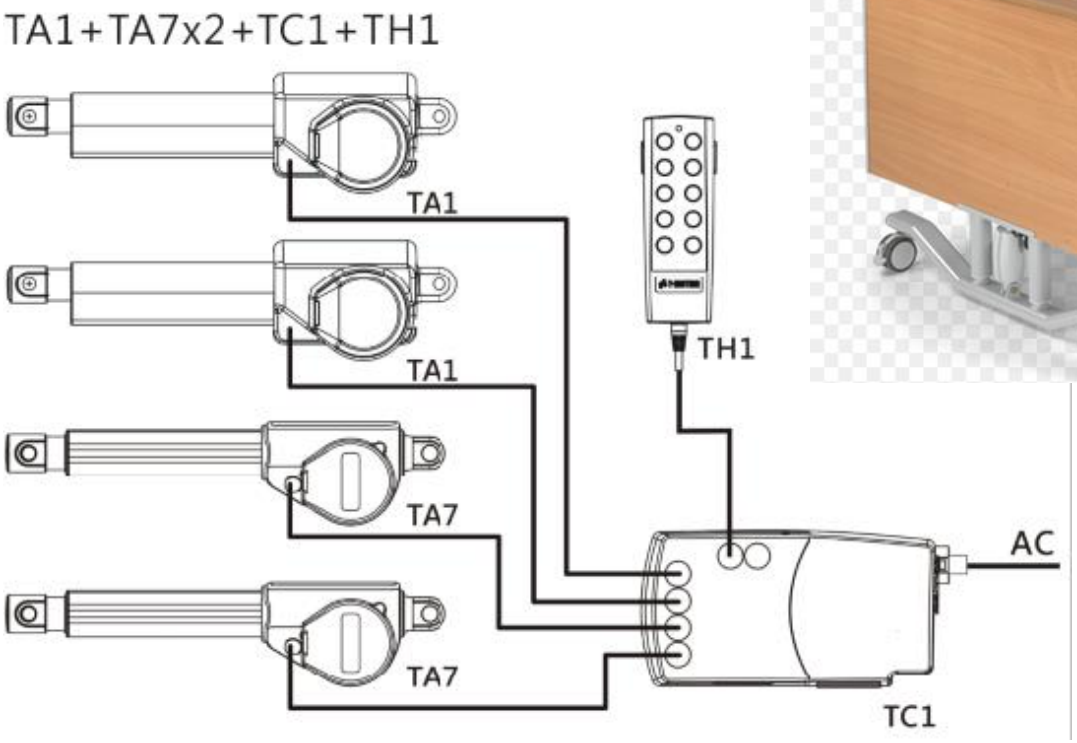
Medical control box options

with built-in transformer

	 **TC1**	 **TC8**	 **TC10**
Power supply	EI (3A) Toroidal (4A, 5A) SMPS (2.5A, 4A)	Carry TP4 or TP6	EI (3A) Toroidal (4A, 5A) SMPS (2.5A, 4A)
Motor #	1~4	1~7	1~5
PWM #	2	6	5
TH plug	Default: RJ 10P		
Medical Certificate	Yes	Yes	Yes
Battery	Battery socket	Carry TBB/TBB2 Battery socket	Built-in TBB2

Medical Application

Control box system example



Medical Application

Medical control box options

No built-in transformer, low voltage solution

TC14

Power supply	Without
Motor #	1~4
PWM #	2
TH plug	RJ 10P
Medical Certificate	Yes
Battery	No battery hole, need to use Y-cable

TP8

TP9

TP4

TP6

Medical Application

Non-direct cut medical handsets

General options

TH1	TH2	TH7	TH10	TH12	TH26
10 buttons	10 buttons	10 buttons	10 buttons	12 buttons	6 buttons

Medical Application

Non-direct cut medical handsets

Special function

TH24 6 buttons	TMH1 10 buttons	TMH5 10 buttons
Rubber cover IP67	With flashlight Patient alarm	LCD

Medical Application

Nursing panel

Normally operated by nurse

TNP1 hook type
27 buttons

TNP2 embedded type
17 buttons

TNP3 embedded type
11 buttons

TNP4 embedded type
15 buttons

TNP5 hook type
25 buttons, With LCD

TNP6 embedded type
or hook type, 17 buttons

Medical Application
Example

A high-end medical bed has many control interface

Medical Application

Other control panel

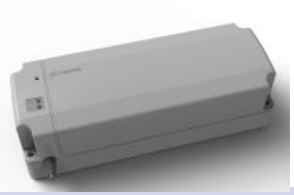
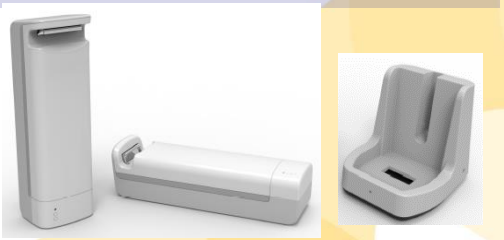
Membrane Switch
(Need to work with TJB3)

TFH

Medical Application

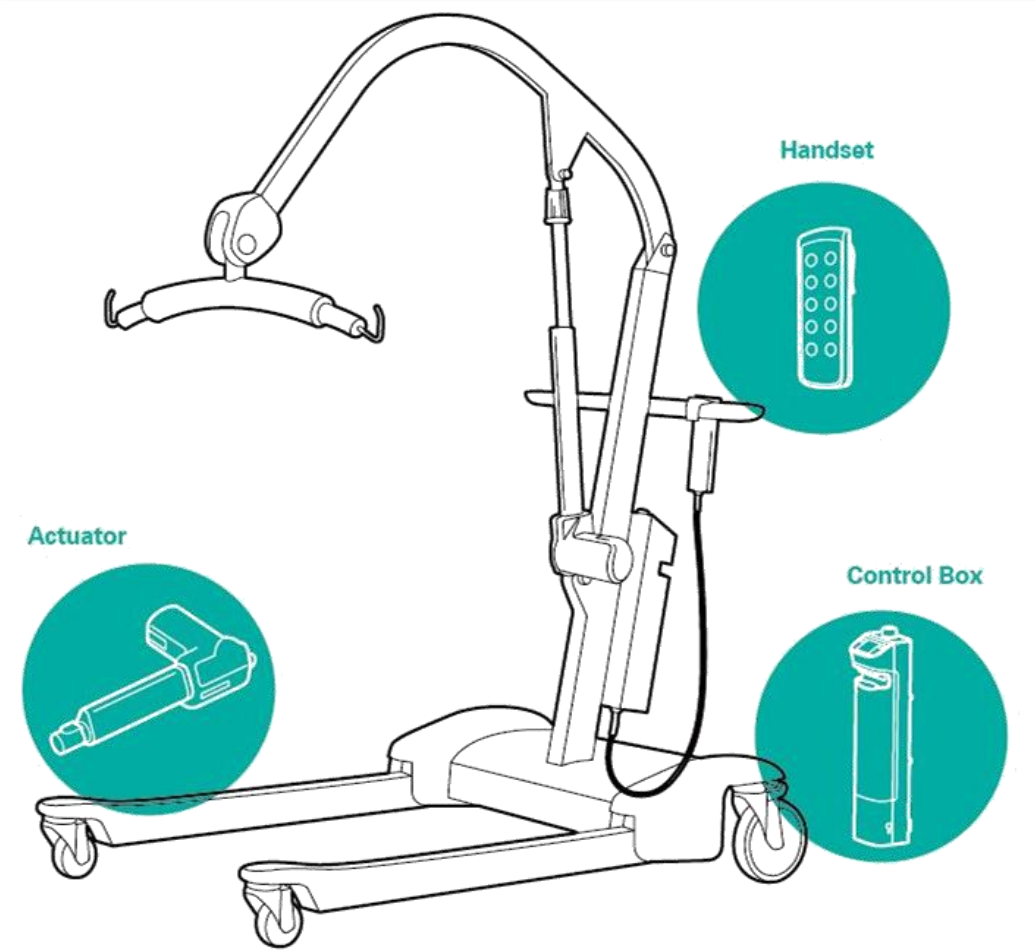
Medical batteries

Mostly lead-acid battery

		
TBB 2.0Ah Lead-acid battery	**TBB2** 1.2Ah Lead-acid battery	**TBB4** 2.0Ah or 1.2Ah Lead-acid battery on/off switch separate battery compart
		
TBB5 (TBD) Fe-Li Ion battery	**TBB6** 2.9Ah or 5.0Ah Lead-acid battery	**TBB7** 2.9Ah or 5.0Ah Lead-acid battery Charged by TBC2 or TP7C

Medical Application

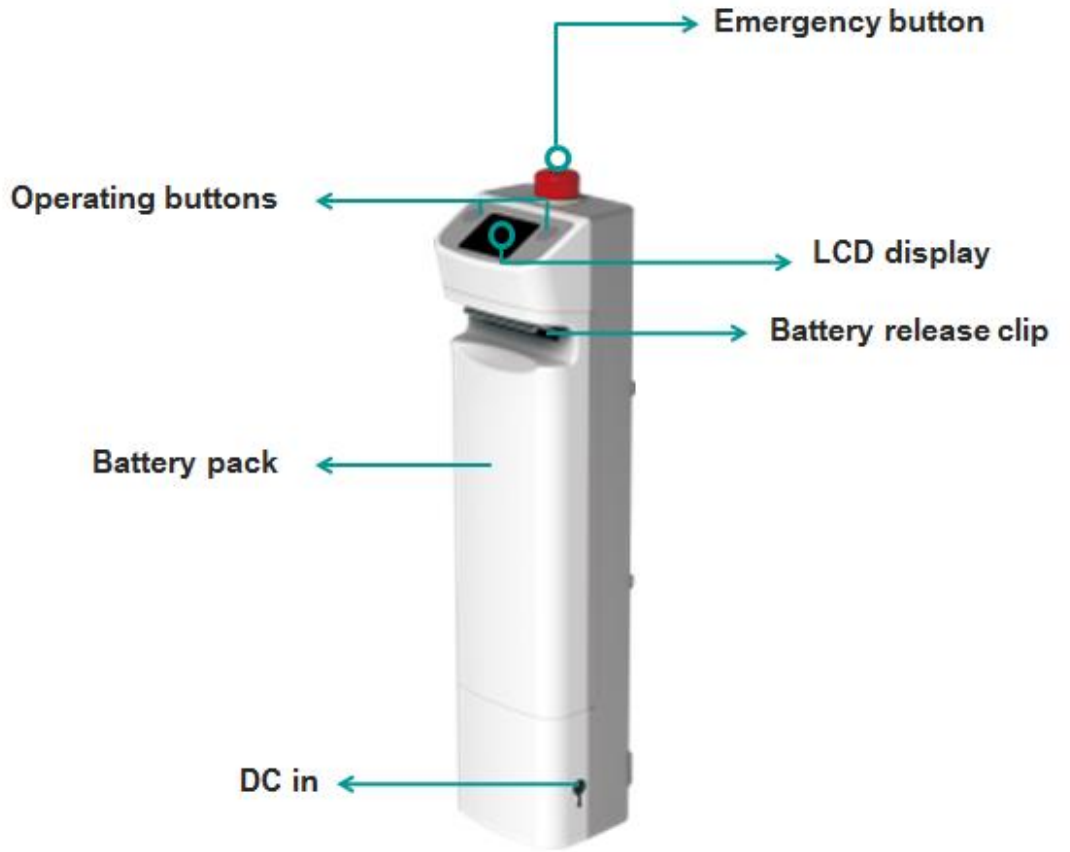
Patient hoist system



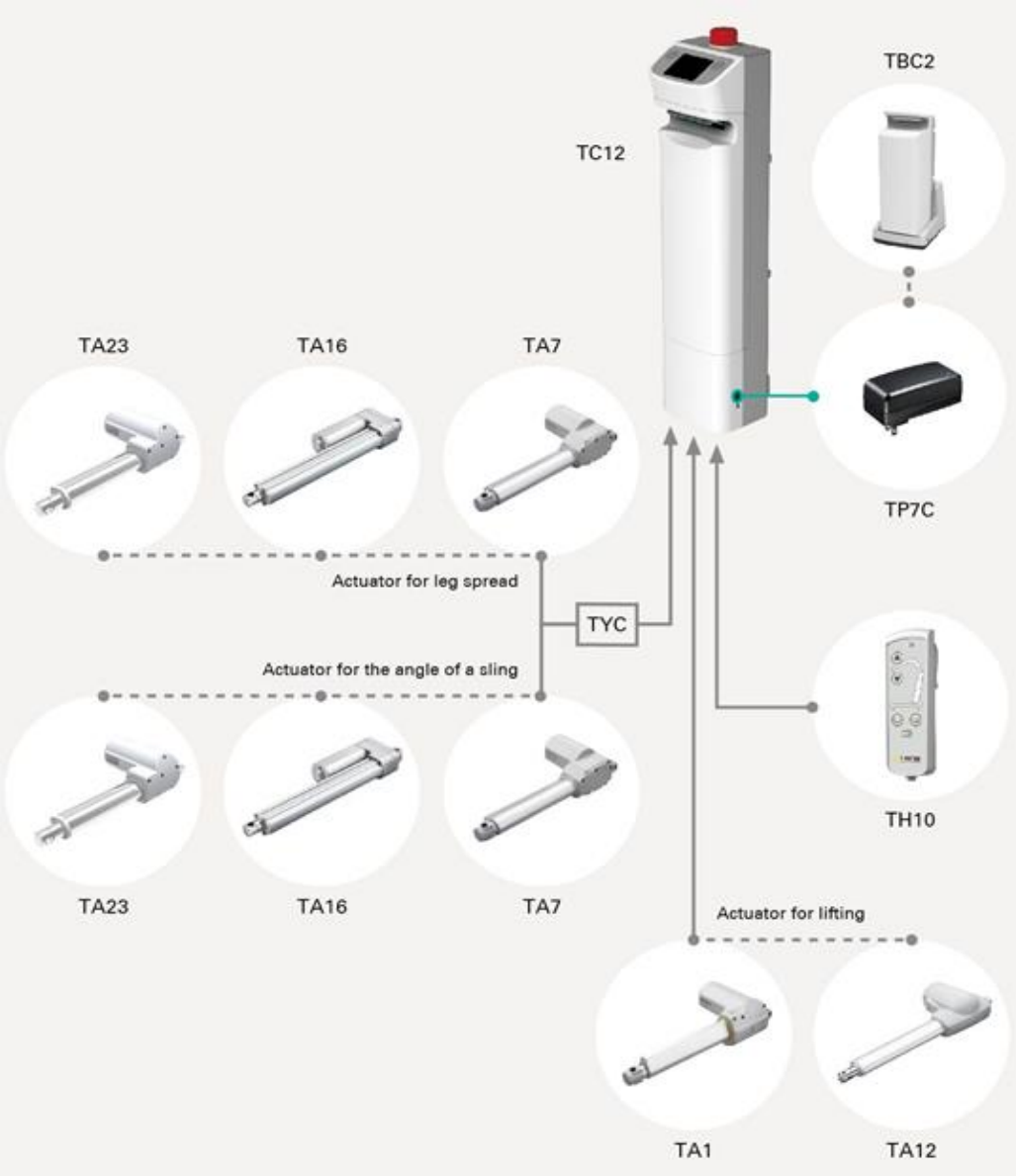
Medical Application

Patient hoist system

Patient hoist control box – TC12



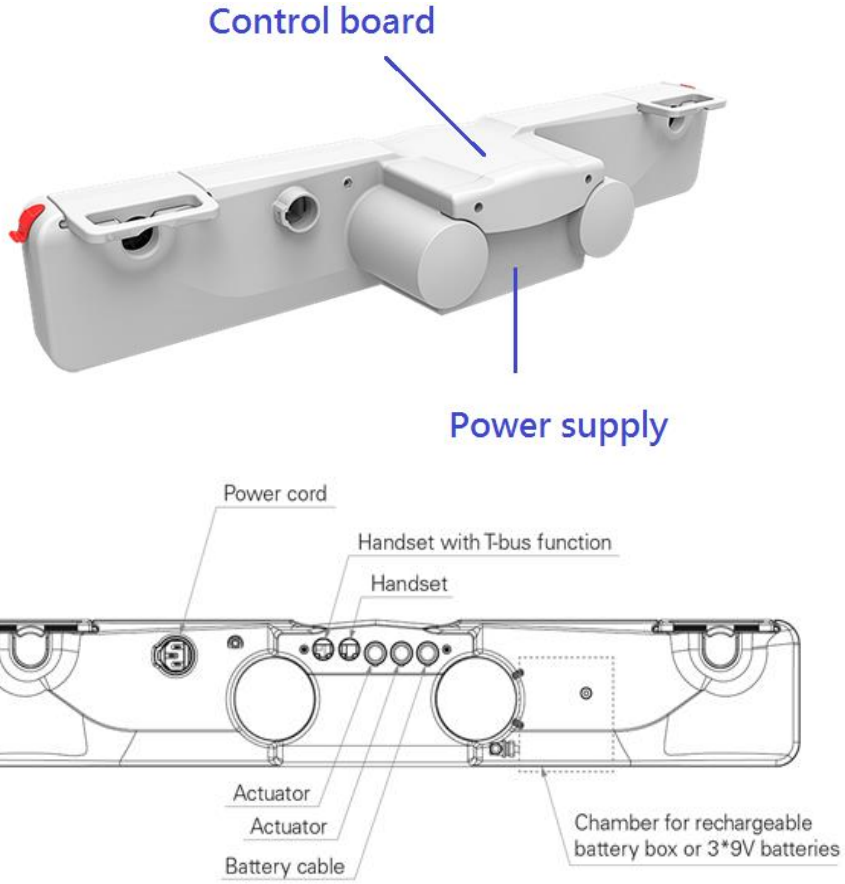
Battery charged by TBC2
Battery option: 2.9Ah, 5Ah

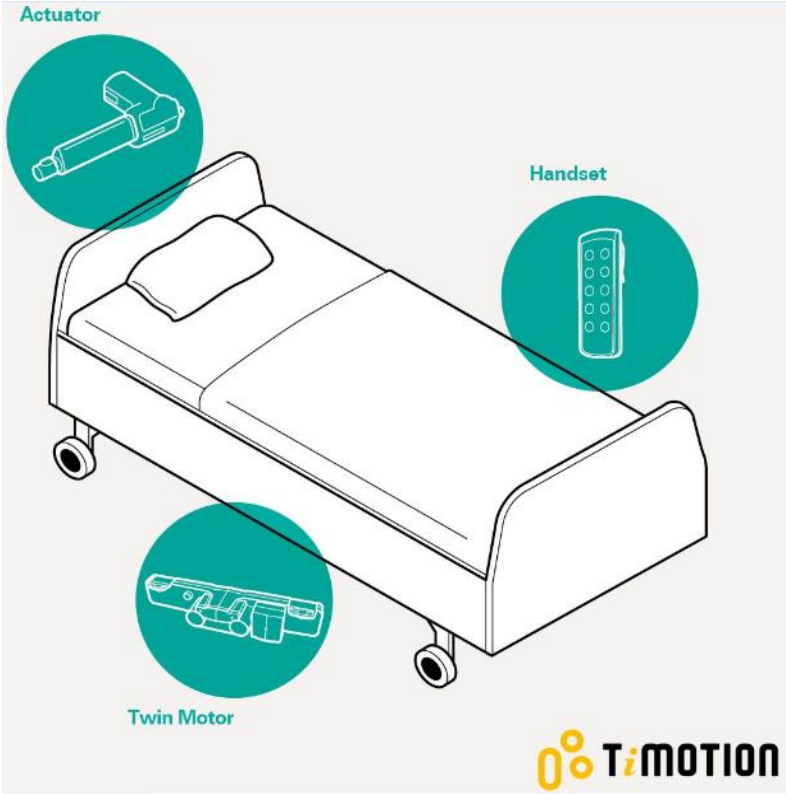

TC12
TBC2
TA23
TA16
TA7
TP7C
Actuator for leg spread
TYC
Actuator for the angle of a sling
TH10
TA23
TA16
TA7
Actuator for lifting
TA1
TA12

TH10

Medical Application

Dual motor control system – TT1





Deskline Control System

Deskline Application

Examples

Height adjustable office desk

Various workstations

Deskline Application

Introduction

- ✓ Same as furniture requirement: black, no IP.
- ✓ Handset design is important.
- ✓ Trend is to minimize the appearance of control box and transformer.
- ✓ Special demand function: low stand-by power, constant speed, anti-collision, memory positions

Deskline Application

Handset options

Simple Up/Down Switch

	TH14	TH37	TFH8	TFH13	TDH1	TDH4
Installation	Front side	Front side	Front side	Embedded	Embedded	Embedded
Color	Black with white arrow sticker	Black with blue or dark grey button	Black	Customized membrane	Black, white, grey	Black
Picture						
Button type	Limit switch	Tact switch	Tact switch	Metal dome	Capacitive touch	Capacitive touch
Display					V	V

Deskline Application

Handset options

with memory positions

	TDH2	TDH3	TDH5	TDH6
Installation	Embedded	Front side	Front side	Front side
Color	Black	Black	Black with blue or dark grey button	Black
Memory Positions	3	3	4	4
Picture				
Button type	Capacitive touch button	Tact switch	Tact switch	Tact switch

How to choose power supply?

Power supply options

What is power supply?

A power supply is an electronic device converting electrical energy to electrical load. It converts the power from AC to DC, and regulates the voltage to an adequate amount, which allows the electrical device to run smoothly.

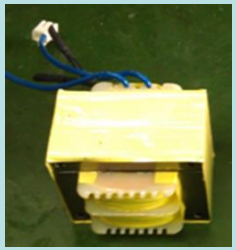
Linear power supply

Use core winding to convert AC to low voltage AC, then rectified into DC power output.

Switching-mode power supply

A switching-mode power supply is an electronic power supply that incorporates a switching regulator to convert electrical power efficiently.

Power supply options



Linear transformer		Switching – mode transformer
EI 2A, 3A	Toroidal 4A, 5A	SMPS 1.5A, 2A, 2.5A, 4A

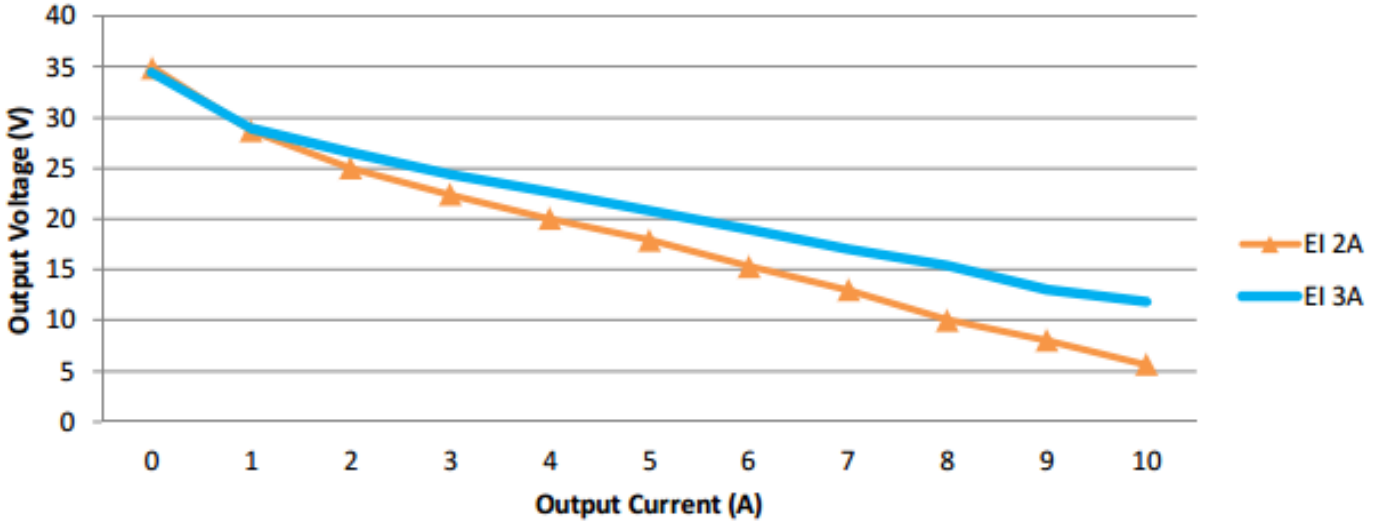
Benefits:
- Simple electrical design, stable
- Voltage drops slowly, can sustain higher current

Drawbacks:
- (±10%) Limited input voltage
- Big, heavy
- (40~50%) Lower efficiency

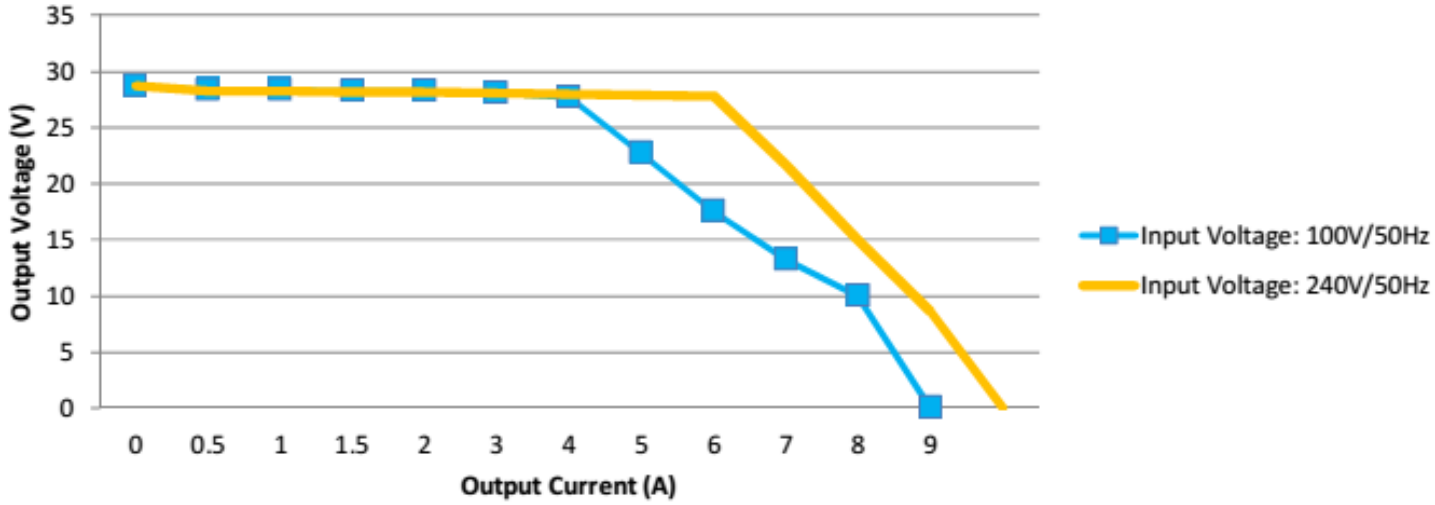
Benefits:
- (100~240V) Wide input voltage
- Small
- (60-90%) Higher efficiency
- Constant voltage output under load

Drawbacks:
- Greater complexity
- Voltage drops quickly

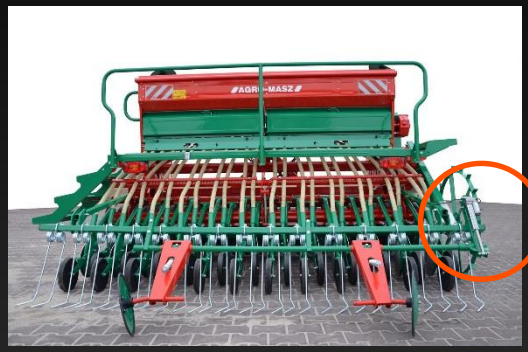
Transformer (230V/50Hz)



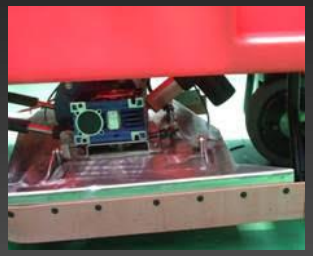
Switching Mode Power Supply (2.5A)



INDUSTRIAL APPLICATION EXAMPLES

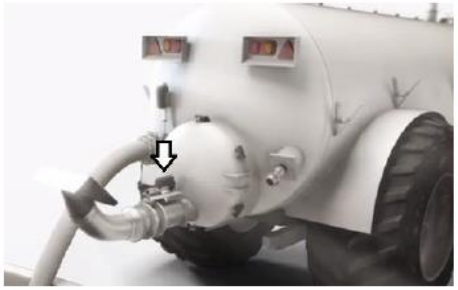
Fertilizer spreaders	Move the rotating disks spreading the fertilizing grains		
Mechanical seed drill	Raise the teeth of the machine during road transport (TA2 actuator)		
Grain feeder	Raise the gasket to adjust the flow of seeds or grain		
Pig barn ventilation flaps	Open air inlets inside pig houses (TA2 with potentiometer)		

Egg incubators	Tilt the trays holding the eggs	
Flat roof windows	Open the windows (TA1 actuators)	
Louver systems	Open the louver system (TA2 actuator)	
Sky dome for EN12101-2 smoke and heat exhaust systems	Open the skydome (TA2P)	

Pergolas	Push to make the slats pivot (TA2)	 
Road traffic signs	Raise the traffic signs	
Scrubbers and sweepers	Lift the brush (TA2P, TA23)	  
Flat touchscreen lifts	Adjust the height of the screen (TA4, columns)	  

Industrial application examples

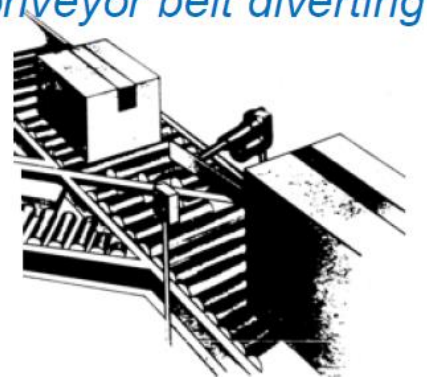
泥漿車 *Slurry Tanker*



水閥器 *Pipe Valve*

風力渦輪機
Wind Turbine

輸送帶改道
Conveyor belt diverting



太陽能板 *Solar Panel*

Thank you for your attention

Questions?