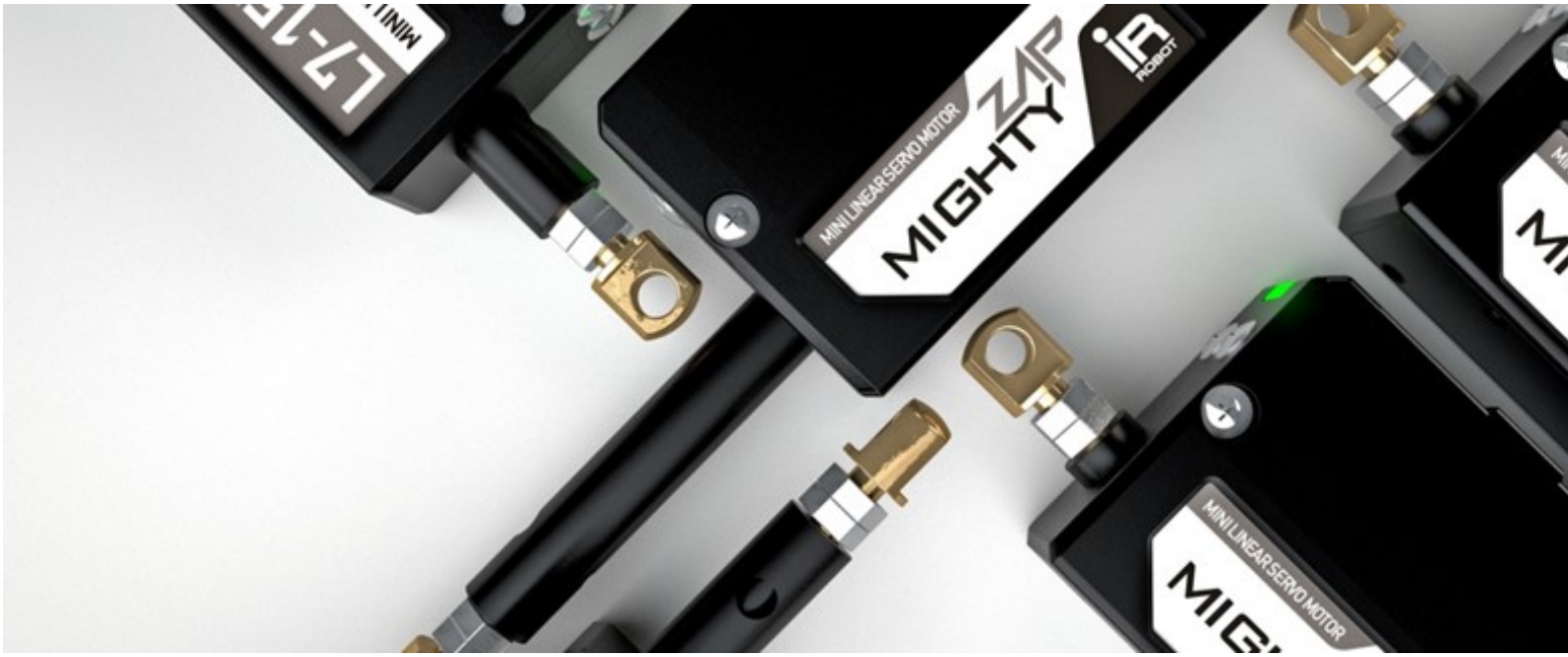
Robust Mini Linear Servo Motor

mightyZAP

User Manual



IR ROBOT

Imagination to Realization

INDEX

1 Before Use

1.1. Introduction

Thank you for purchasing mightyZAP mini Linear servo motors! Please peruse this manual before use to prevent any unexpected damage of product or serious injury of users.

mightyZAP mini Linear servo motors have been developed to provide reliable, high quality linear solution in compact space. mightyZAP mini Linear servo motors can be applied in various fields such as factory automation, medical devices, robotics, professional UAV and radio control hobby.

[Features]

- Position Control (Positional Accuracy 100um)
- Embedded Drive circuit
- 4096 Step High Resolution
- High Performance Coreless Motor
- Minimized Mechanical Backlash (50um)
- Excellent Substitute for pneumatic cylinder which does not support position control
- Reasonable Cost

1.2. For Safety

- Do not disassemble servo motor at user's discretion. Maintenance should be done by authorized engineer.
- Use designated input power to prevent damage of product.
- Use within the force at rated power(Peak Efficiency Point) for better lifespan & proper performance.
- Be careful to touch the servo case right after operation. It may be hot.
- Be sure to keep servo motor away from water, dust, sand, oil.
- This product is designed for indoor use. Do not use it outdoor condition.
- Do not push / pull the servo rod by excessive force.
- Keep out of reach of Children.

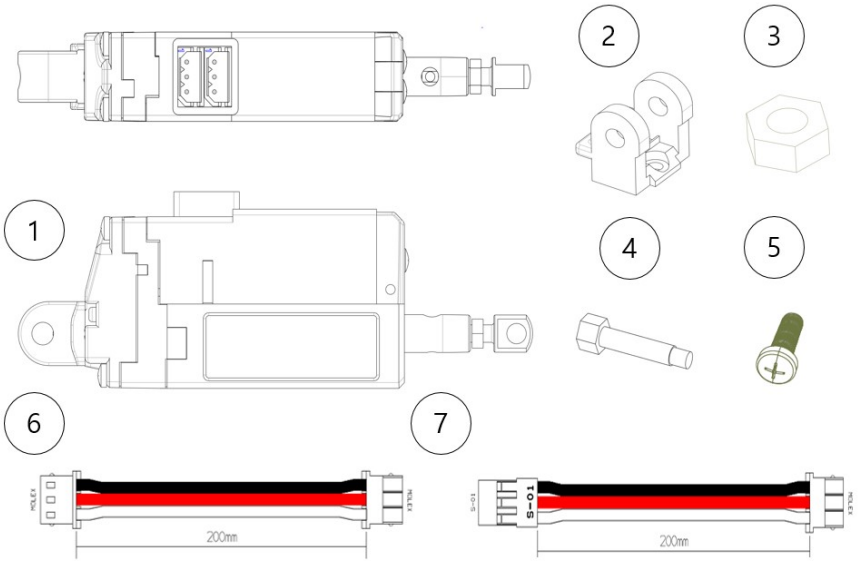
1.3. For Storage

Do NOT store/use servo motor under below extreme condition. It may cause malfunction or damage of product.

- Direct light and High temperature more than 60 °C or Low temperature lower than minus 20°C.
- Highly Humid space
- Space having Vibrating condition
- Space having Dust
- Space causing Electrostatic

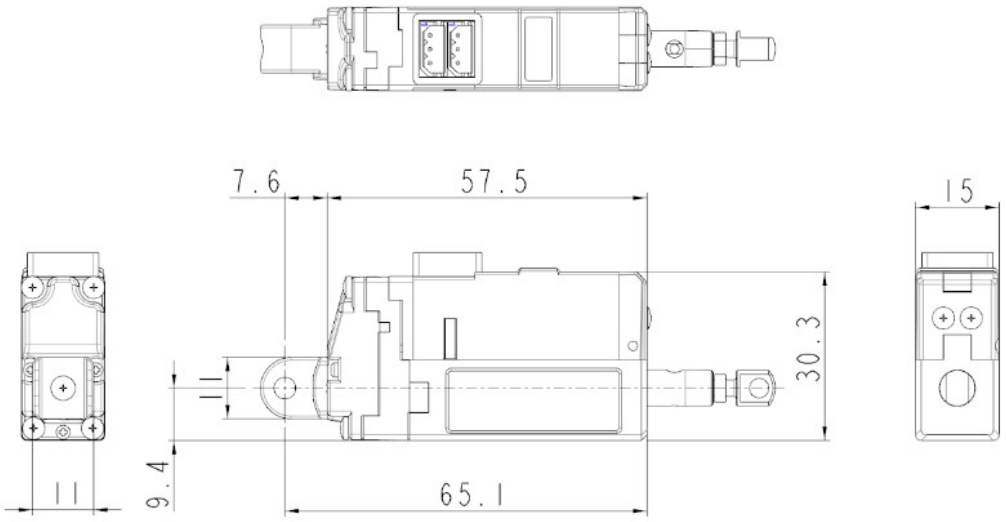
2 Basic Information

2.1. Component



① mightyZAP Linear servo motor
② Hinge Base 1pc
③ M3 NUT
④ Hinge Shaft
⑤ M2.5x6
⑥ 200mm Molex to Molex Wire
⑦ 200mm S-01 to Molex Wire

2.2. Dimension



2.3. Specification

Stock Item	L(7)12-20PT-3	L(7)12-40PT-3
	High Speed	High Force
Peak Power Point	40N@55mm/s	80N@16mm/s
Peak Efficiency Point	**20N@90mm/s**	**40N@28mm/s**
Max. Speed(no load)	110mm/s	37mm/s
Gear Type	Super Engineering Plastic	

Order Made Item	L(7)12-13PT-3	L(7)12-64PT-3	L(7)12-100PT-3
	Ultra Speed	High Force	Ultra Force
Peak Power Point	26N@70mm/s	128N@6mm/s	200N@3.7mm/s
Peak Efficiency Point	**13N@112mm/s**	**64N@10mm/s**	**100N@6mm/s**
Max. Speed(no load)	149mm/s	12.4mm/s	7.46mm/s
Gear Type	Super Engineering Plastic	2 Metal & 4 Super Engineering Plastic	4 Metal & 2 Super Engineering Plastic

Common Specification	
Motor Type	High Performance Coreless motor
Gear Type	Super Engineering Plastic
Stroke	**30mm**
Positional Accuracy	Under 0.1mm (100㎛)
Electric al Stroke	30mm
Feedback Potentiometer	10KΩ /mm +/- 1% linearity
Input Voltage	Optional - 7.4V or 12.1V (Rated)
Stall Current	3.4A at 7.4V / 2.3A at 12.1V (Premium line)
Operating Temperature	-10℃ ~ 50℃
Mechanical Backlash	0.05mm (50㎛)
Control System	TTL Half Duplex (Daisy Chain) and PWM with Position Feedback
Microcontroller	32bit ARM Core, 4096 Resolution (AC/DC converter)
Pulse Range	900 ㎲(Retracted)~1500 ㎲(Center)~2100 ㎲(Extended)
Parameter Setting	Programmable
Ingress Protection	IP-54 (Dust & Water Tight)
Dimension / Weight	57.5(L)x29.9(W)x15(H)mm / 45g
LED Indication	7 Errors Indication (Overload, Checksum, Range, Overheat, Stroke Limit, Input voltage, Instruction Error)
Standard Accessory	1 Mounting Bracket, 2 types Rod end (Detachable linkage and Metal nut(M2.5) type)
Wire/Connector	Molex to S-01(Hitec and Futaba compatible) and Molex to Molex Type(Molex 50-37-5033) / 200mm length, 0.08x60(22AWG)

Caution Use within Rated Force

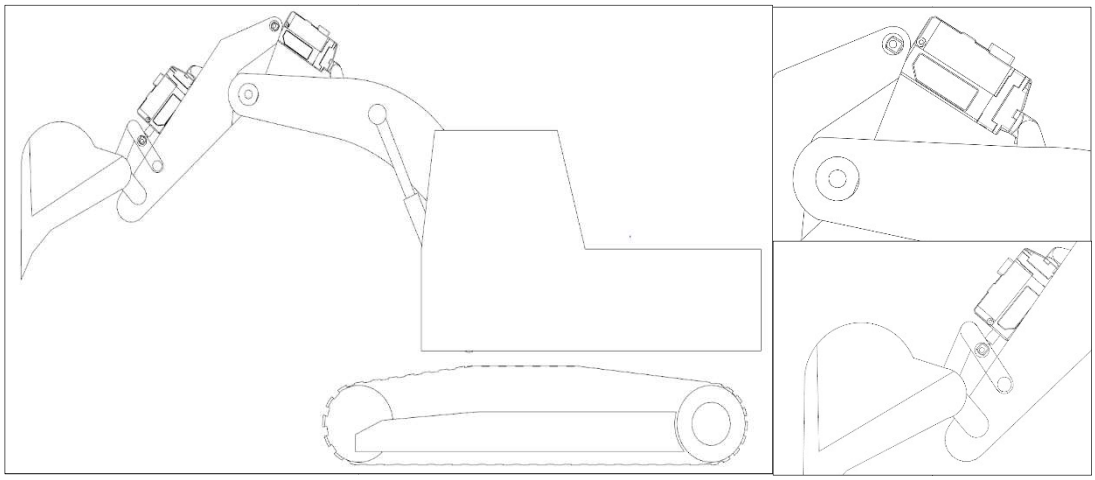
For proper performance and better lifespan of mightZAP, it is stronlgy requested to use it within the rated force range(Rated Force = Peak Efficiency Point).

3 Application

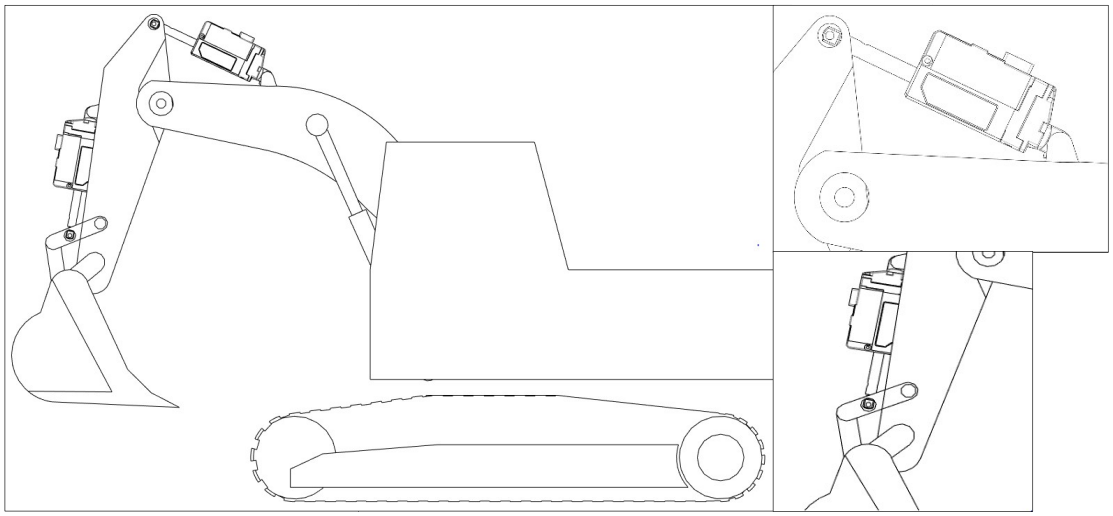
3.1. Manipulator

Blow picture shows excavator arm using mightyZAP.

4 joint link structure and 2 joint structure are simplified. Based on basic link structure, you can refer to below picture to make a rotating movement.

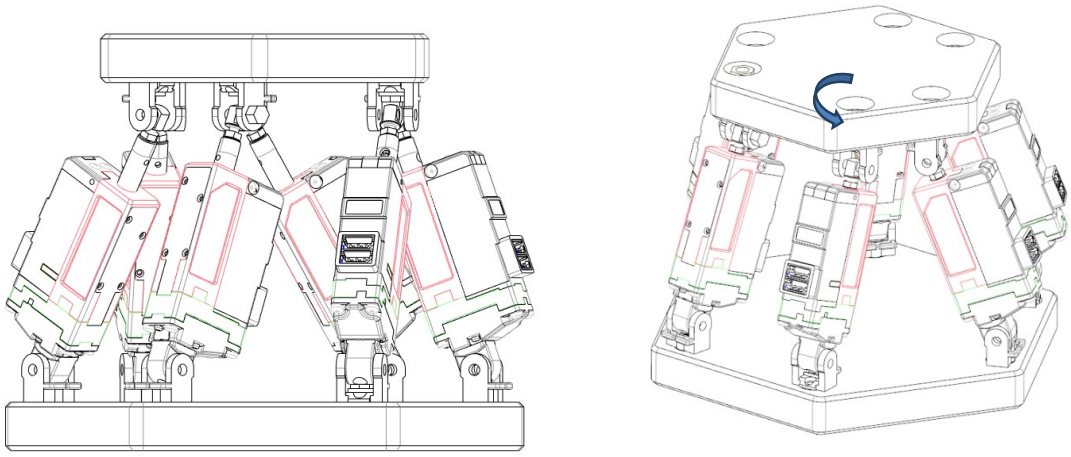


[In case servo position at 0 - fully retracted position]

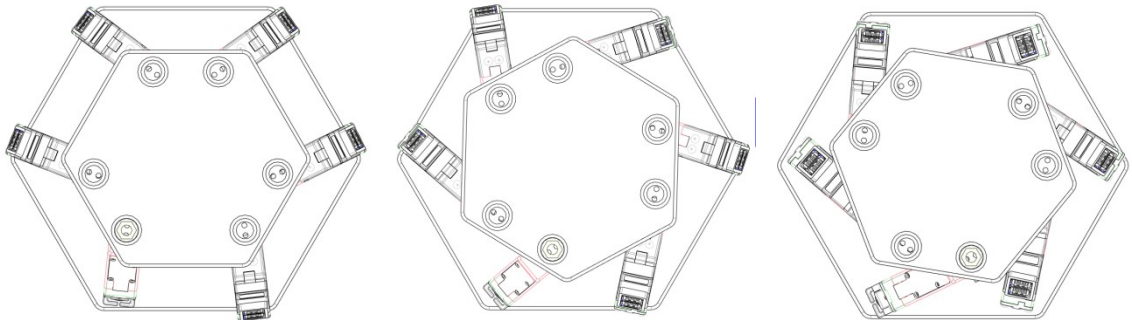


[In case servo position at 30mm - fully extended position]

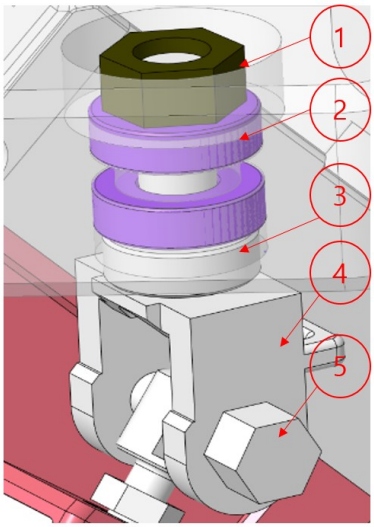
3.2. Stewart Platform



Stewart Platform having 6 rotating axis on both upper and lower panel. You can make X, Y, Z movements and plus, Z axis rotating movement.



Above shows how to make rotating movement of upper panel.



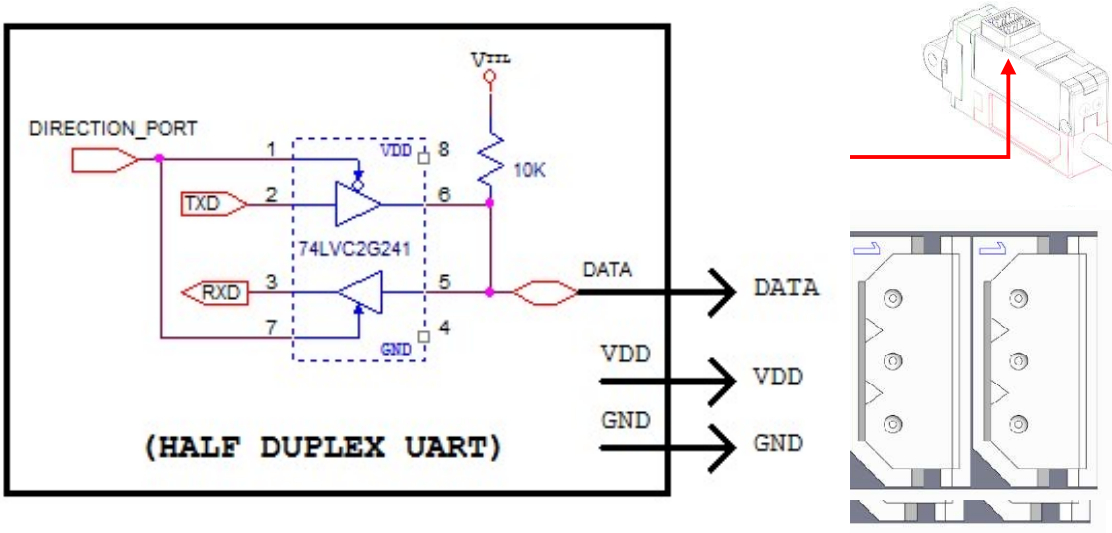
①Nut
②Bearing
③Rotating Shaft
④Linkage Base
⑤Linkage Shaft

4 Servo Control

4.1. Circuit Connection

mightyZAP supports both data communication(Half Duplux TTL) as well as simple pulse(PWM) control. For the control under data communication, UART signal of main board should be converted into Half Duplex Type signal.

Conversion circuit will be as below.

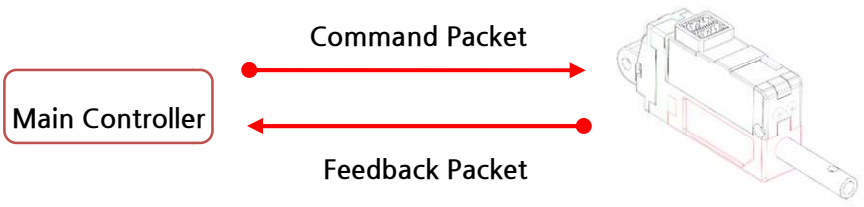


The direction of data signal for TxD and RxD of TTL level will be determined according to the level of direction_port as below.

- The level of "direction_port" is LOW : TxD signal will be outputted as Data.
- The level of "direction_port" is HIGH :: Data signal will be inputted to RxD.

4.2. Communication

mightyZAP and your main controller will communicate by exchanging data packet. The sorts of packet are Command packet (Main controller to mightyZAP) and Feedback packet(mightZAP to your main controller)



(1) Specification

① Communication specification

- **2 Mode in One** (Pulse / Data Mode Auto-Switching)

  mightyZAP will automatically recognize the input signal between data mode and pulse mode.

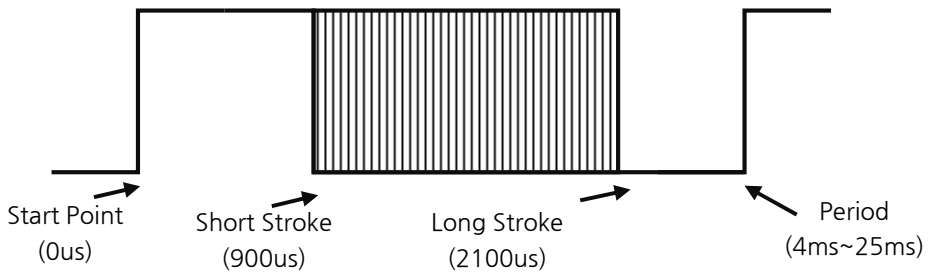
- **Data Mode**

  Asynchronous Serial communication (8 bit, 1 Stop bit, None Parity)

Item	Spec
Structure	Half-duplex UART
Baud Rate	57600bps(default)
Data Size	8bit
Parity	non-parity
Stop Bit	One bit

- **Pulse Mode**

  PPM(Pulse Position Modulation) Compatible [Radio-Control Servo Pulse Mode]
  (500us(Retracted)~1500 us(Center)~2500 us(Fully Extended)



※ Short stroke : Retract stroke / Long stroke : Extend stroke

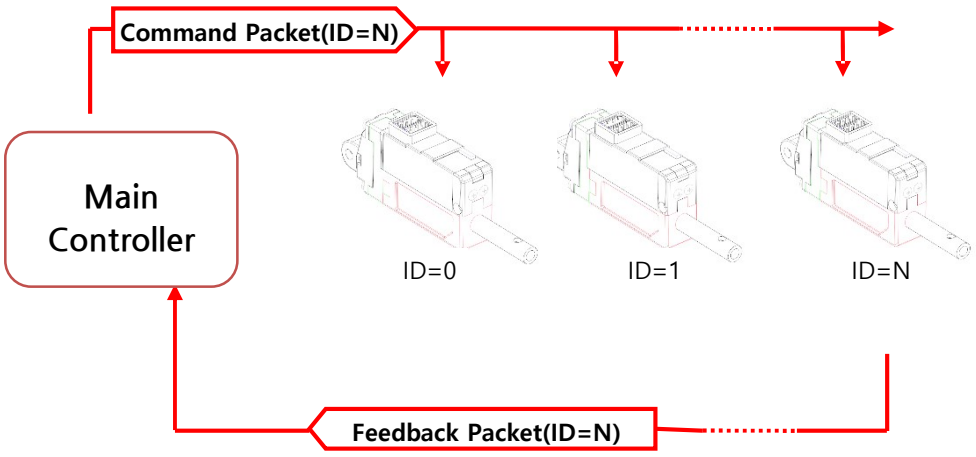
② Data specification

Data range is basically determined as below in both Data and Pulse modes. All factors are changeable & programmable.

Rod Stroke	Data Mode	Pulse Mode
Short Stroke	0	900us
Half Stroke	2047	1500us
Long Stroke	4095	2100us

③ Daisy-Chain Connection

After receiving Command Packet at multiple qty of mightZAPs, the servo whose ID is N will be operated only. (Only N ID servo will send Feedback packet and execute Command.)



Caution Unique ID

Each mightZAP servo must have an individual ID to prevent interference between same IDs.
Therefore, you need to set individual IDs for each servo in the network node.
As factory default ID is 0, so please assign different, individual IDs for each servo. It will be easier if you assign each ID when you connect each servo in Daisy-chain network one by one.

(2) Packet Description

① Command Packet

It is command packets for servo operation. Its structure and elements are as below.

■ Structure

■ Element

Index	Data	Description
0	Start Byte 1	Start Byte 1 (0xFF)
1	Start Byte 2	Start Byte 2 (0xFF)
2	Start Byte 3	Start Byte 3 (0xFF)
3	ID	Servo ID (Range: 1 ~ 253, Broadcast ID: 254, Stand-alone ID: 0)
4	SIZE	Packet Size (COMMAND+FACTOR+CHECKSUM)
5	COMMAND	Instruction
5+1	FACTOR #1	First Parameter
5+m	FACTOR #m	"m"th Parameter
5+N	FACTOR #N	Last Parameter
5+N+1	Check Sum	Check Sum = BinaryInvert(LOWER_BYTE(ID + SIZE + COMMAND + FACTOR#1 + … + FACTOR#N))

■ Element Description

1. HEADER (3Byte)

- Code to recognize Packet start : 0xFFFFFF

2. ID (1Byte)

- The ID is an unique number of each servo to support Daisy Chain connection.
- Factory default value(ID) is 0.
- In case of ID = 0, it will be deemed as stand-alone(single) connection and communicate regardless of ID. (except for Echo, Load Data)
- In case of ID = 1 ~253, ID "N" which is stored in the servo will be operated.
- In case of ID = 254 (0xFE), it is operated under "Broadcasting Mode (move all servos)" and Feedback Packet does not work.

3. SIZE (1Byte)

- Packet length in Byte unit
- Data counting value after "Size" data (COMMAND+FACTOR+CHECKSUM)
- That is, Size value = Number of byte of "Factor" + 2

4. COMMAND (1Byte)

- Command codes defining the purpose of Packet

Function	CODE	Description
Echo	0xF1	Feedback Packet Reception
Load Data	0xF2	Send "Address" and get feedback of Data
Store Data	0xF3	Send "Address" and "Data". Then Save.
Send Data	0xF4	Send "Address" and "Data" for temporary storage
Execution	0xF5	Execute temporarily stored data that is made by SendData.
Factory Reset	0xF6	Reset to Factory default parameter value
Restart	0xF8	Restart servo system
Symmetric Store	0x73	Store data in the same address of multiple qty servos.

5. FACTOR

- Additional Packet factor according to Command

6. CHECKSUM

Verification data to check omission and any changes of Packet data. The interaction formula will be as below.

- Checksum = BinaryInvert(LOWER_BYTE(ID + SIZE + COMMAND + FACTOR#1 + ⋯ + FACTOR#N))

② Feedback Packet

After reception of command packet, servo sends Feedback packet including requested information. Its structure and factors are as below.

■ Structure

■ Element

Index	Data	Description
0	**Start Byte 1**	Start Byte 1 (0xFF)
1	**Start Byte 2**	Start Byte 2 (0xFF)
2	**Start Byte 3**	Start Byte 3 (0xFF)
3	**ID**	Servo ID (Range: 1 ~ 253, Broadcast ID: 254, Stand-alone ID: 0)
4	**SIZE**	Packet Size (COMMAND+FACTOR+CHECKSUM)
5	**ERROR**	Error Code
5+1	**FACTOR #1**	First Parameter
5+m	**FACTOR #m**	"m"th Parameter
5+N	**FACTOR #N**	Last Parameter
5+N+1	**Check Sum**	Check Sum = BinaryInvert(LOWER_BYTE(ID + SIZE + ERROR + FACTOR#1 + ⋯ + FACTOR#N))

■ Element Description

1. HEADER (3Byte)

- Recognizing "Packet start" code. 0xFFFFFF

2. ID (1Byte)

- Individual ID number for each servo (1 ~253)

3. SIZE (1Byte)

- Packet length in Byte unit
- Data counting value after "Size" data (ERROR+FACTOR+CHECKSUM)
- That is, Size value = Number of byte of "Factor" + 2

4. ERROR (1Byte)

- Error status during operation for each bit

Error	bit	Description	LED
RESERVED	7	TBD	LED Off
Instruction Error	6	In case that undefined instruction is sent, or Execution command is sent without Send Data command, it will be set as "1".	White
Overload Error	5	In case that current load cannot be controlled with the designated maximum force, it will be set as "1".	Cyan
Checksum Error	4	In case that transferred Checksum packet value is not correct, it will be set as "1".	Magenta
Range Error	3	In case that the command is out of Data Map address range, it will be set as "1".	Blue
Overheating Error	2	In case that the inner temperature is out of operating temperature range which is designated in the Control table, it will be set as "1".	Yellow
Stroke Limit Error	1	In case that the goal position is written out of range between PULL Stroke Limit and PUSH Stroke Limit, it will be set as "1".	Green
Input Voltage Error	0	In case that the input voltage is out of operating voltage range designated in the Control table, it will be set as "1".	Red

5. FACTOR

- Additional Packet factor according to Feedback data.

6. CHECKSUM

Verification data to check omission and any changes of Packet data. The interaction formula will be as below.

- Checksum = BinaryInvert(LOWER_BYTE(ID + SIZE + ERROR + FACTOR#1 + ··· + FACTOR#N))

(3) Data Map

① Data Memory Map

■ Memory using data (Non-volatile)

- Data to be saved in non-volatile memory which maintain data even after power OFF/ON.
- All data will be reset to default value when Factory Reset command is executed.

Address	Name	Description	Access	Default
0 (0x00)	Model Number(L)	Low byte of model number	R	
1 (0x01)	Model Number(H)	High byte of model number	R	
2 (0x02)	Version of Firmware	Firmware version info.	R	-
3 (0x03)	ID	Servo ID	RW	0 (0x00)
4 (0x04)	Baud Rate	Servo communication speed	RW	32 (0x20)
5 (0x05)	Return Delay Time	Return delay time	RW	250 (0xFA)
6 (0x06)	Short Stroke Limit(L)	Low byte of Retract direction limit value.	RW	0 (0x00)
7 (0x07)	Short Stroke Limit(H)	High byte of Retract direction limit value.	RW	0 (0x00)
8 (0x08)	Long Stroke Limit(L)	Low byte of Extension direction limit value.	RW	255 (0xFF)
9 (0x09)	Long Stroke Limit(H)	High byte of Extension direction limit value.	RW	15 (0x0F)
11 (0x0B)	the Highest Limit Temperature	High temp limit	RW	80 (0x50)
12 (0x0C)	the Lowest Limit Voltage	Low temp limit	RW	individual SPEC
13 (0x0D)	the Highest Limit Voltage	Highest limit of voltage	RW	individual SPEC
14 (0x0E)	Max Force(L)	Low byte of max force	RW	255 (0xFF)
15 (0x0F)	Max Force(H)	High byte of max force	RW	3 (0x03)
16 (0x10)	Feedback Return Mode	Feedback return mode	RW	2 (0x02)
17 (0x11)	Alarm LED	Alarm LED function	RW	36 (0x24)
18 (0x12)	Alarm Shutdown	Alarm Shut Down function	RW	36 (0x24)
22 (0x16)	Resolution Factor	Resolution setting factor	RW	1 (0x01)
30 (0x1E)	Third-party Program Interface (L)	Low byte of third party program compatibility interface	RW	54 (0x36)
31 (0x1F)	Third-party Program Interface (H)	High byte of third party program compatibility interface	RW	1 (0x01)
32 (0x20)	Third-party Program Firmware Version	Firmware version of third party program compatibility software	RW	37(0x25)
37 (0x25)	D Gain	Derivative Gain	RW	individual SPEC

38 (0x26)	I Gain	Integral Gain	RW	individual SPEC
39 (0x27)	P Gain	Proportional Gain	RW	individual SPEC
40 (0x28)	Short Stroke Pulse Width (L)	Low byte of Retract direction pulse width	RW	132 (0x84)
41 (0x29)	Short Stroke Pulse Width (H)	High byte of Retract direction pulse width	RW	3 (0x03)
42 (0x2A)	Long Stroke Pulse Width (L)	Low byte of Extension direction pulse width	RW	52 (0x34)
43 (0x2B)	Long Stroke Pulse Width (H)	High byte of Extension direction pulse width	RW	8 (0x08)
44 (0x2C)	Middle Stroke Pulse Width (L)	Low byte of middle stroke pulse width	RW	220 (0xDC)
45 (0x2D)	Middle Stroke Pulse Width (H)	High byte of middle stroke pulse width	RW	5 (0x05)
50 (0x32)	Center Difference (L)	Low byte of Zero point adjustment value	RW	255 (0xFF)
51 (0x33)	Center Difference (H)	High byte of Zero point adjustment value	RW	7 (0x07)
52 (0x34)	Punch Initial Value(L)	Low byte of Punch initial value	RW	individual SPEC
53 (0x35)	Punch Initial Value(H)	High byte of Punch initial value	RW	individual SPEC

② Parameter Map

■ Parameter Using Data (Volatile)

- All data to be reset to default value whenever power is On.

Address	Name	Description	Access	Default
0 (0x80)	Force ON/OFF	Force On/ Off	RW	0 (0x00)
1 (0x81)	LED	LED On/Off	RW	0 (0x00)
2 (0x82)	Short Stroke Compliance Margin	Compliance margin of Retract direction	RW	4 (0x04)
3 (0x83)	Long Stroke Compliance Margin	Compliance margin of Extension direction	RW	4 (0x04)
6 (0x86)	Goal Position(L)	Low byte of Goal position value	RW	-
7 (0x87)	Goal Position(H)	High byte of Goal position value	RW	-
8 (0x88)	Moving Speed(L)	Low byte of Moving speed value	RW	-
9 (0x89)	Moving Speed(H)	High byte of Moving speed value	RW	-
10 (0x8A)	Force Limit(L)	Low byte of max force limit	RW	Max Force(L)
11 (0x8B)	Force Limit(H)	High byte of max force limit	RW	Max Force(H)
12 (0x8C)	Present Position(L)	Low byte of present position value	R	-

13 (0x8D)	Present Position(H)	High byte of present position value	R	-
14 (0x8E)	Present Speed(L)	Low byte of present speed value	R	-
15 (0x8F)	Present Speed(H)	High byte of present speed value	R	-
16 (0x90)	Present Load(L)	Low byte of present load value	R	-
17 (0x91)	Present Load(H)	High byte of present load value	R	-
18 (0x92)	Present Voltage	Current voltage	R	-
19 (0x93)	Present Temperature	Current temperature	R	-
20 (0x94)	Received Data	Reception status for "Send Data"	R	0 (0x00)
22 (0x96)	Moving	Moving status	R	0 (0x00)
23 (0x97)	Lock	Lock for Non-volatile Memory	RW	0 (0x00)
24 (0x98)	Punch(L)	Low byte of Punch value	RW	Punch Initial Value(L)
25 (0x99)	Punch(H)	High byte of Punch value	RW	Punch Initial Value(H)

(4) Command Example Packet

1) Echo Receiving Feedback Packet

Command Packet

HEADER	ID	Size	Command	Checksum
0xFFFFFF	0x00	0x02	0xF1	0x0C

- Command packet to recognize status of servo connection.

Feedback Packet

HEADER	ID	Size	Error	Checksum
0xFFFFFF	0x00	0x02	0x00	0xFD

- Feedback packet to inform status of servo connection. (including Error information)

2) Load Data Sending Address and receiving data feedback

Command Packet

HEADER	ID	Size	Command	Factor #1	Factor #2	Checksum
				Address	Length	
0xFFFFFF	0x00	0x04	0xF2	0x8C	0x02	0x7B

- Command packet to read current position value of servo

Feedback Packet

HEADER	ID	Size	Error	Factor #1	Factor #2	Checksum
0xFFFFFF	0x00	0x04	0x00	0xFF	0x07	0xF5

- Feedback packet to inform current servo position value 2047(0x07FF).

3) Store Data Store data after sending Address and Data

Command Packet (ID Change)

HEADER	ID	Size	Command	Factor #1	Factor #2	Checksum
				Address	Data	
0xFFFFFF	0x00	0x04	0xF3	0x03	0x01	0x04

- Command packet designating Servo ID as '1'(0x01).

Feedback Packet

HEADER	ID	Size	Error	Checksum
0xFFFFFF	0x01	0x02	0x00	0xFC

- Feedback packet informing Servo ID is changed.

Command Packet (Goal Position)

HEADER	ID	Size	Command	Factor #1	Factor #2	Factor #3	Checksum
				Address	Data #1	Data #2	
0xFFFFFF	0x01	0x05	0xF3	0x86	0xFF	0x07	0x7A

- Command packet designating Servo goal position as 2047(0x07FF).

Feedback Packet

HEADER	ID	Size	Error	Checksum
0xFFFFFF	0x01	0x02	0x00	0xFC

- Feedback packet informing receipt of servo's goal position command.

4) Send Data Send "Address" and "Data", Then temporarily store it.

Command Packet

HEADER	ID	Size	Command	Factor #1	Factor #2	Factor #3	Checksum
				Address	Data #1	Data #2	
0xFFFFFF	0x01	0x05	0xF4	0x86	0xFF	0x07	0x79

- Command packet for temporary store of goal position as 2047(0x07FF).

Feedback Packet

HEADER	ID	Size	Error	Checksum
0xFFFFFF	0x01	0x02	0x00	0xFC

- Feedback packet informing receipt of temporary store for servo goal position.

5) Execution Execute temporarily stored data that is made by Send Data.

Command Packet

HEADER	ID	Size	Command	Checksum
0xFFFFFF	0x01	0x02	0xF5	0x07

- Command packet to execute all temporarily stored data at the same time.

Feedback Packet

HEADER	ID	Size	Error	Checksum
0xFFFFFF	0x01	0x02	0x00	0xFC

- Feedback packet informing receipt of execution command for temporarily stored data.

6) Factory Reset Reset to factory default parameter value.

Command Packet

HEADER	ID	Size	Command	Factor	Checksum
				Option	
0xFFFFFF	0x01	0x03	0xF6	0x01	0x04

- Basic parameter (Memory & Parameter) to be reset to Default value. Additional Reset to be determined according to options.
- Servo ID to be reset to 0(ID Default) and Baud Rate to be maintained current status.
- If concerned bit is "1", it means Reset. If it is "0", it means Hold.

Option	bit	Description
Servo ID	0	Reset servo ID to 0
Baud Rate	1	Reset to 32 (57600 bps)

Feedback Packet

HEADER	ID	Size	Error	Checksum
0xFFFFFF	0x01	0x02	0x00	0xFC

- Feedback packet informing receipt of Factory reset.

7) Restart Servo system Restart

Command Packet

HEADER	ID	Size	Command	Checksum
0xFFFFFF	0x00	0x02	0xF8	0x05

- Command packet to reboot servo system.

Feedback Packet

HEADER	ID	Size	Error	Checksum
0xFFFFFF	0x00	0x02	0x00	0xFD

- Feedback packet informing receipt of Restart command of servo system

8) Symmetric Store Save data in the same address of multiple servos.

Command Packet (Goal Position)

HEADER	ID	Size	Command	Factor #1	Factor #2
				Address	Length
0xFFFFFF	0xFE	0x0A	0x73	0x86	0x02

Factor #3	Factor #4	Factor #5	Factor #6	Factor #7	Factor #8	Checksum
1〉ID	1〉Data #1	1〉Data #2	2〉ID	2〉Data #1	2〉Data #2	
0x01	0xFF	0x03	0x02	0xFF	0x07	0xF1

- Command packet to designate goal positions of multiple servos at the same time.
- Synchronization for multiple servos without delay comparing to designating goal position to each individual servo.
- Length (L) : The number of Data(Excluding ID of each servo) for factors of each servo.
- Size : (Factor+2) or 4+(L+1) X N (N:number of servo)
- Feedback Packet : No Feedback

ID	Goal position
1 (0x01)	1023 (0x03FF)
2 (0x02)	2047 (0x07FF)

(5) Data Description

1) Model Number

- The model number of MightyZAP
- "Read" only to discriminate & recognize concerned model

2) Version of Firmware

Check if current firmware is the latest version.

3) ID

ID to discriminate each servo. Different IDs should be assigned in Daisy-Chain system.

- In case of ID = 0, it will be deemed as stand-alone(single) connection and communicate regardless of ID. (except for Echo, Load Data)
- In case of ID = 1 ~253, ID "N" which is stored in the servo will be operated.
- In case of ID = 254 (0xFE), it is operated under "Broadcasting Mode (move all servos)" and Feedback Packet does not work.

4) Baud Rate

- Determining communication speed. Default value is 57600bps
- Servo system should be rebooted to apply changed baud rate to the servo.

[Setting Value]

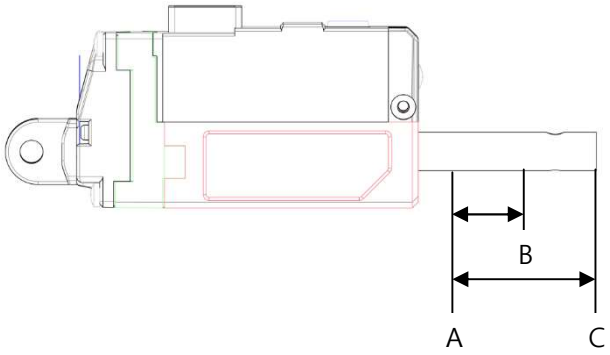
Value	Baud Rate(bps)
2 (0x02)	400000
4 (0x04)	250000
8 (0x08)	200000
16 (0x10)	115200
32 (0x20)	57600
64 (0x40)	19200
128 (0x80)	9600

■ **Return Delay Time**

Delay time to receive feedback packet after sending Command packet. (Unit : μs)

5) Stroke Limit

Stroke limit between Short Stroke (A) and Long Stroke (C) which is the max/min. value of Goal Position. (Range: 0 ~ 4095)



6) The Highest Limit Temperature

Temperature limitation of servo inner space. (Based on the Temp sensor on Micom)

■ The Highest / Lowest Limit Voltage

Max/Min. value of input voltage (unit : 0.1V)

For the servo with 7.4V input voltage :, 6V ~ 8.6V

For the servo with 12V input voltage : 9V ~ 13V

7) Max Force

- Maximum force value.
- 0 manes force OFF and 1023 is max force.
- When power is ON, it will be copied to Force Limit(ADDR: 0x8A|0x8B) and will be used as initial value.

8) Feedback Return Mode

Feedback packet return mode after receipt of Command Packet

Mode	Feedback Packet Return or NOT
0	Do NOT sending Feedback packet for all Commands. (Except for Echo command)
1	Sending Feedback packet only for Load Data Command.
2	Sending Feedback packet for all Commands.

※ Under Broadcast ID(0xFE) mode, feedback packet will NOT be sent regardless values of Feedback Return Mode.

9) Alarm LED

If concerned bit is set as "1" when error occurs, LED indication will be activated.

Error	bit	LED Indicate
RESERVED	7	LED Off
Instruction Error	6	White
Overload Error	5	Cyan
Checksum Error	4	Magenta
Range Error	3	Blue
Overheating Error	2	Yellow
Stroke Limit Error	1	Green
Input Voltage Error	0	Red

In case that different errors are made at the same time, lower bit has a priority.

If Error is resolved, alarm will be deactivated after 2 sec and turns to previous status.

10) Alarm Shutdown

Force will be OFF if concerned bit is set as "1" when error occurs.

Error	bit
RESERVED	7
Instruction Error	6
Overload Error	5
Checksum Error	4
Range Error	3
Overheating Error	2
Stroke Limit Error	1
Input Voltage Error	0

11) Resolution Factor

Changing motor resolution

Factor	Resolution
1	4096
2	2048
3	1024
4	512

12) Calibration Stroke

- Calibration Short Stroke : Short Stroke calibration value, Short Stroke Calibration value which is set at the factory will be saved.
- Calibration Long Stroke : Long Stroke calibration value, Long Stroke Calibration value which is set at the factory will be saved.
- Calibration Center Stroke : Half Stroke calibration value, Half Stroke Calibration value which is set at the factory will be saved.

13) Third-Party Program Interface / Firmware Version

Program interface format setting factor for 3rd party program
Set as below according to 3rd party program's Resolution factor.

Resolution	Resolution Factor	Program Interface	Firmware Version
4096	1	310	37 or higher
1024	3	12	25 or higher

14) Short / Long Stroke Pulse Width

Pulse width setting for retract / extend position(Unit : μs). Setting Range is 900us ~ 2100us.

Rod Stroke	Goal Position (Based on Resolution 4096)	Default Setting
Short Stroke	0	900us
Half Stroke	2047	1500us
Long Stroke	4095	2100us

15) Center Difference

Zero point adjusting value of the center point. Setting range is within the Stroke Limit.

16) Force ON/OFF

Setting for Force On and OFF (0 : OFF, 1 : ON)

value	Description
0	Cut off power to the motor and Force is OFF.
1	Power to be supplied to the motor and Force is ON.

17) LED

Control LED when there is no Error indication.

bit	Description
0	LED Disable (All LEDs will be Off when it is 1.)
1	RED LED Control
2	GREEN LED Control
3	BLUE LED Control

18) Stroke Compliance Margin

Setting for flexibility of motor control. It is the difference between a goal position and a present position. If it is too big, Dead Band will get bigger which means positional accuracy will be bad. If it is too small, servo will trembles.

19) Goal Position

Goal position value which is desired position value to move.

Rod Stroke	Resolution		
	4096	2048	1024
Short Stroke	0	0	0

Half Stroke	2047	1023	511
Long Stroke	4095	2047	1023

Resolution can be adjusted according to Resolution Factor setting.

20) Moving Speed

- Moving speed setting.
- Range is between 0~1023. The higher value, the faster speed.
  (But, 0 means the Maximum speed.)
- When power is ON, it will be initialized to "0".

21) Force Limit

- Force limit setting.
- Range is between 0~1023. The higher value, the higher force.
- When power is ON, it will be initialized to Max Force(ADDR: 0x0E|0x0F)..

22) Present Position

- Current Position value of stroke.
- Range is between 0~4095 and the value will be varied according to Resolution Factor setting.

23) Present Speed

- Current proportional speed.
- Range is between 0~2047.
- Between 0~1023, The speed is on Short Stroke direction (retract direction).
  Between 1024~2047, The speed is on Long Stroke direction (extend direction).

24) Present Load

- Current load value
- To be shown in the range of 0~2047
- Between 0~1023: Load is on short stoke direction(retract direction).
  Between 1024~2047: Load is on long stoke direction(extend direction).

25) Present Voltage

- Current input voltage. The unit is 0.1V
- For instance, 74 means 7.4V

26) Present Temperature

- Current temperature of servo inner space. The unit is 1 ℃.
- For instance, 85 means 85℃.

27) Received Data

Send Data command reception status for Execution command.

Value	Description
0	Send Data command is NOT received.
1	Send Data command is received.

28) Moving

Moving status

Value	Description
0	Goal Position command execution is completed.
1	Goal Position command execution is under operation.

29) Lock

Value	Description
0	Non-volatile Memory Modification available
1	Non-volatile Memory Modification Unavailable

30) Punch

- Minimum current to the motor during the operation.
- Higher Punch value increase stall torque, but chattering can be made if punch value is too high.

5 Warranty Service

5.1. Warranty & Service

The warranty period of mightZAP is 1 year from the date of purchasing the goods. Please prepare some evidence showing the date of purchase and contact your product supplier or IR Robot.

Warranty service will not cover the malfunctions of product which are derived from customer's abuse, mistake, or carelessness (including normal wearing of gear train, tear of wire harness and motor burnt-out). Please kindly note that all service should be processed by designated engineers and voluntary disassembly or maintenance may void warranty.

IR Robot Customer Service Team :

- Tel : +82- 070-7600-9466
- Address : (ZIP 14502) 1303, Bucheon Techno Park 401, Pyeongcheon-Ro 655, Wonmi-Gu, Gyeonggi-Do, Korea.
- E-mail : enigma@irrobot.com

Thank you.