



# **MD Series- CAN SERVO**

## **Protocol Manual**

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# 1. Communication Protocol

## 1-1. Transport Layer

### A. Normal Write

1) Data write to SERVO

WRITE HEADER	ID	Address	REG LENGTH	DATA Low	DATA High	CHECK SUM
0x96	0xXX	0xXX	0x02	0xXX	0xXX	0xXX

### B. Normal Read

1) To SERVO

WRITE HEADER	ID	Address	REG LENGTH	CHECK SUM
0x96	0xXX	0xXX	0x00	0xXX

2) From SERVO

RETURN HEADER	ID	Address	REG LENGTH	DATA Low	DATA High	CHECK SUM
0x69	0xXX	0xXX	0x02	0xXX	0xXX	0xXX

	Size [Bytes]	Explanation
<b>Header</b>	1	0x96 – Send (Master -> SERVO) 0x69 – Response (SERVO -> Master)
<b>ID</b>	1	For the Servo. -> Range – 1~254 (0x00 ~ 0xFE) *0x00 – Broadcast *0xFF – Broadcast for Multi-action at the same time.
<b>Address</b>	1	Set the start address of the memory to be changed. (see <a href="#">2.1 Memory Address Table</a> )
<b>Length</b>	1	Length of the Data. (Max. 2 bytes.)  *For write to SERVO, always be wrote 2. *For read to SERVO, always be wrote 0.
<b>Data</b>	2	Little-endian.  Ex) (Dec)9999, (Hex)0x270F -> Data[0] – 0x0F, Data[1] – 0x27  *For write to SERVO, always be wrote 2. *For read to SERVO, always none.
<b>Check Sum</b>	1	Calculation. -> (ID + Address + Length + Data) % 256  Ex) 0x96 0x00 0x1E 0x02 0x88 0x13 0xBB (For write) -> (0x00 + 0x1E + 0x02 + 0x88 + 0x13) & 0xFF = 0xBB

# 1. Communication Protocol

## 1-2. Communication Example

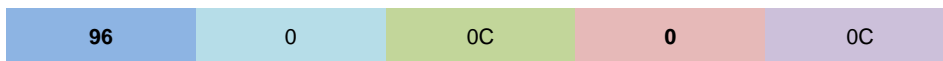
### A. Move to Position.

1) Data write to SERVO [Hex]



### B. Read to Current Position from SERVO

1) To SERVO [Hex]



2) From SERVO [Hex]



\* Return to raw data read from ADC.

### C. How to change SERVO Configuration.

1) For be changed REG\_POSITION\_MIN. [Hex]



2) For be saved configuration, SAVE command write to SERVO. [Hex]



2) For be applied configuration, RESET command write to SERVO. [Hex]



# 2. Memory Address

## 2-1. Memory Address Table

Address	Name	length	RW	Range		Feature			
				min	max				
Status	0x0C	REG_POSITION	2	r	0	16383	Read the Current Position.		
	0x10	REG_TORQUE	2	r	0	4095	Read the Torque.		
	0x12	REG_VOLTAGE	2	r	0	4095	Read the Input Voltage[ X/100 mV].		
	0x14	REG_MCU_TEMP	2	r	0	4095	Read the MCU temperature [ °C ].		
	0xB6	REG_WORKING_TIME_H	2	r	65535	2^31	Read the Accumulated Working time(minute).		
	0xB4	REG_WORKING_TIME_L	2	r	0	65535	Read the Accumulated Working time(minute).		
	0xBA	REG_WORKING_PCB_TIME_H	2	r	65535	2^31	Read the Accumulated Operating time(minute).		
	0xB8	REG_WORKING_PCB_TIME_L	2	r	0	65535	Read the Accumulated Operating time(minute).		
Action	0x1E	REG_POSITION_NEW	2	r/w	0	6000	Set the new Position.		
Config	0x32	REG_ID	2	r/w	0	255	Set the SERVO ID.		
	0x3C	REG_CAN_BUS_ID_H	2	r/w	65535	2^31 (2.0B)	Set the CAN BUS(NODE) ID. '0' is Broadcast. (Unable to UAVCAN)  * Only for UAVCAN ID Range is 1~127.		
	0x3E	REG_CAN_BUS_ID_L	2	r/w	0	65535 (2.0A)			
	0x40	REG_SAMPLE_POINT	2	r/w	0	1	Set the CAN Sample Point. (0 = 50%, 1 = 87.5%)		
	0x38	REG_CAN_BAUDRATE	2	r/w	0	8	Set the baud rate.(Default 16 Quanta) [Kbps].		
							50.00%		87.50%
							0 - 1000		0 - 1000
							1 - 800 (12 Quanta)		1 - 800 (15 Quanta / 86.7%)
							2 - 750		2 - 750
							3 - 500		3 - 500
4 - 400 (12 Quanta)							4 - 400 (8 Quanta)		
5 - 250							5 - 250		
6 - 200							6 - 200		
7 - 150							7 - 150		
8 - 125		8 - 125							
9 - 100		9 - 100							
10 - 80 (12 Quanta)		10 - 80 (12 Quanta)							
11 - 50		11 - 50							
12 - 40		12 - 40							
13 - 25		13 - 25							
14 - 20		14 - 20							
15 - 10		15 - 10							

# 2. Memory Address

## 2-1. Memory Address Table

Address	Name	length	R/W	Range		Feature	
				min	max		
Config	0x3A	REG_NORMAL_RETURN_DELAY	2	r/w	0	65535	Set the delay time until Return-Packet is transmitted.
	0x46	REG_POWER_CONFIG	2	r/w	0	65535	Set the power management method. bit0 : S/W Reset bit9 : Forced Emergency Stop ( 0 = Off, 1 = On) bit15 : BootLoader Mode (For Firmware Upgrade)
	0x48	REG_EMERGENCY_STOP	2	r/w	0	65535	Set the emergency stop control bit bit8 : Position Min Over bit9 : Position Max Over bit10 : Temp. Min Over bit11 : Temp. Max Over bit12 : Torque Over bit13 : Voltage min Over bit14 : Voltage max Over
	0x4E	REG_DEADBAND	2	r/w	0	4095	Set the Dead-band.
	0x50	REG_POSITION_MAX	2	r/w	0	16383	Set the maximum clockwise position.
	0x52	REG_POSITION_MIN	2	r/w	0	16383	Set the maximum counter-clockwise position.
	0xC2	REG_POSITION_MID	2	r/w	1	16382	Set the position when servo takes a values. <b>* It must be set between MIN and MAX.</b>
	0x54	REG_VELOCITY_MAX	2	r/w	0	4095	Set the maximum velocity.
	0x56	REG_TORQUE_MAX	2	r/w	0	4095	Set the maximum torque.
	0x58	REG_VOLTAGE_MAX	2	r/w	0	4095	Set the maximum operating Voltage. (0 = Off)
	0x5A	REG_VOLTAGE_MIN	2	r/w	0	4095	Set the minimum operating Voltage. (0 = Off)
	0x5C	REG_TEMP_MAX	2	r/w	0	4095	Set the maximum operating temperature. (0 = Off)
	0x5C	REG_TEMP_MIN	2	r/w	0	4095	Set the minimum operating temperature. (0 = Off)
	0x94	REG_POS_MAX_LIMIT	2	r/w	0	16383	Set the maximum position limits. (0 = Off)
	0x96	REG_POS_MIN_LIMIT	2	r/w	0	16383	Set the minimum position limits. (0 = Off)
	0x63	REG_FACTORY_DEFAULT	2	w	3855		Restore data to factory default.
	0x70	REG_CONFIG_SAVE	2	w	65535		Save changed data in memory.

# 3. Example for SERVO Control

## 3-1. Control Example

Basic Setting	LEFT	NEUTRAL	RIGHT
Travel Angle	60°	0°	60°
Position Data Value ( 1 = 0.25 usec )	600 ( 900 usec )	3000 ( 1500 usec )	5400 ( 2100 usec )
Command	REG_POSITION_NEW 600	REG_POSITION_NEW 3000	REG_POSITION_NEW 5400

\* Position can be modified by the commands below.

**REG\_POSITION\_MIN // REG\_POSITION\_MID // REG\_POSITION\_MAX**

### A. NEUTRAL 3000

1) Data write to SERVO [Hex]



### B. LEFT 600

1) Data write to SERVO [Hex]



### C. RIGHT 5400

1) Data write to SERVO [Hex]

