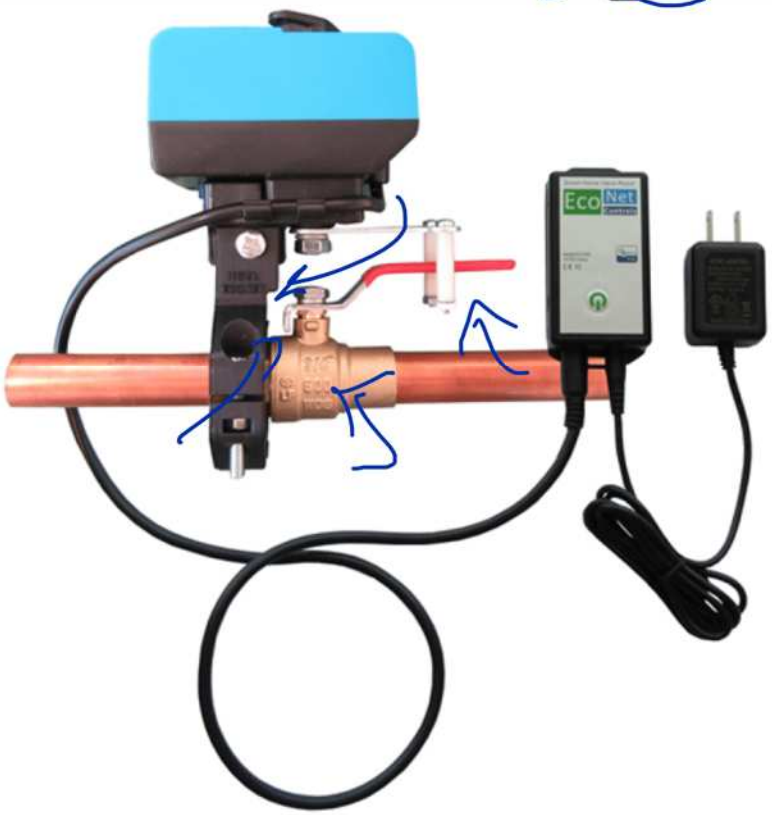
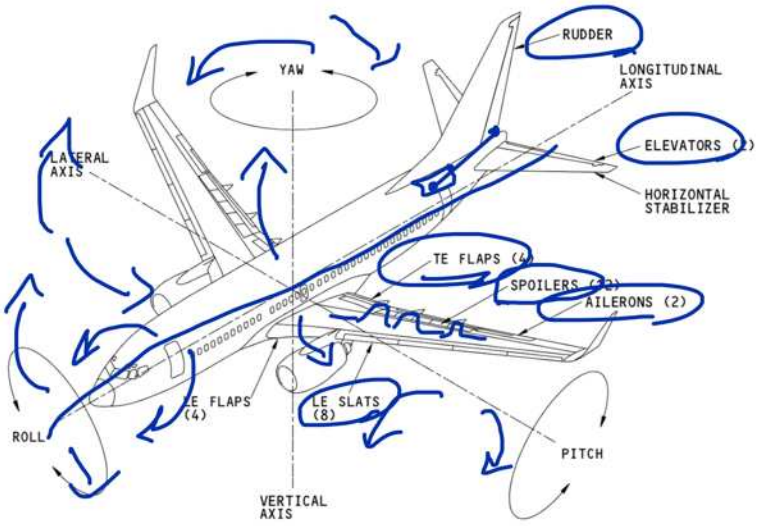
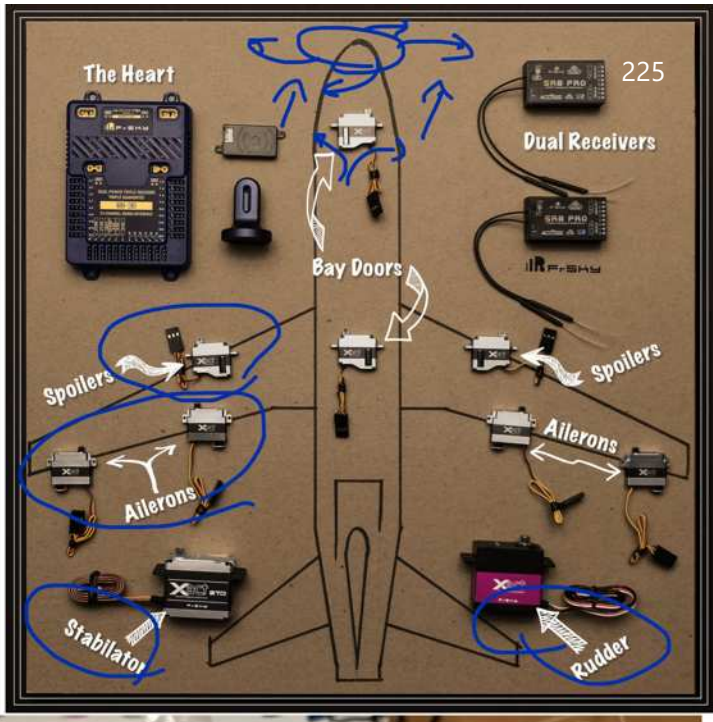
DC

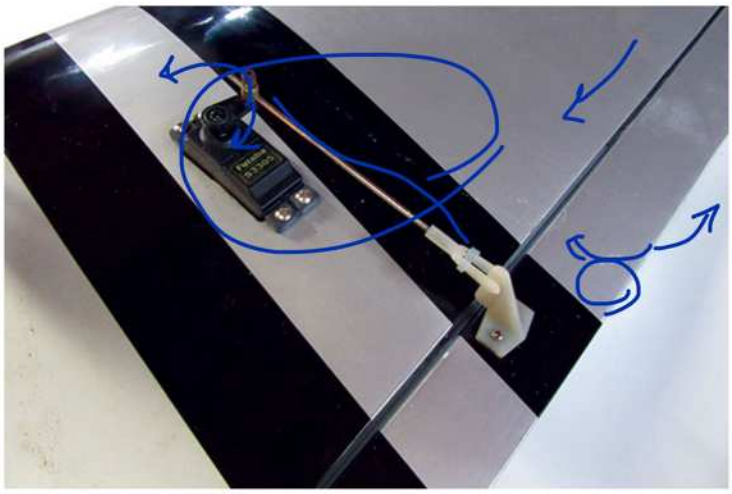
AC

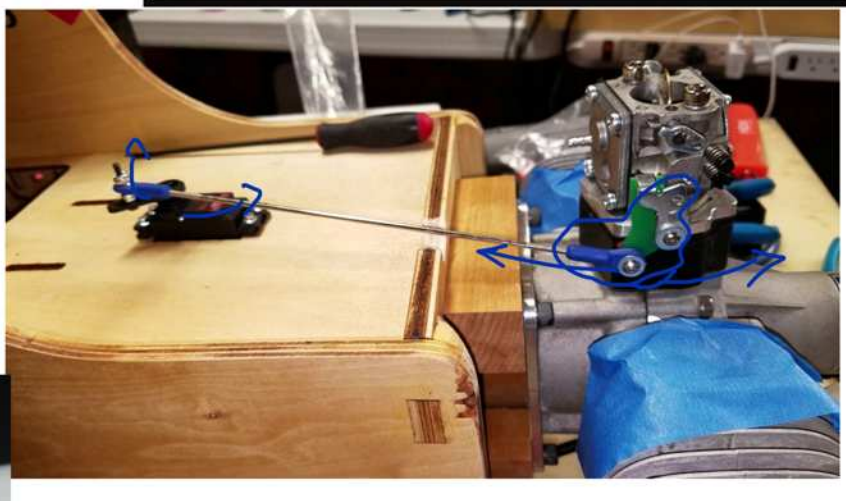
Servo motor

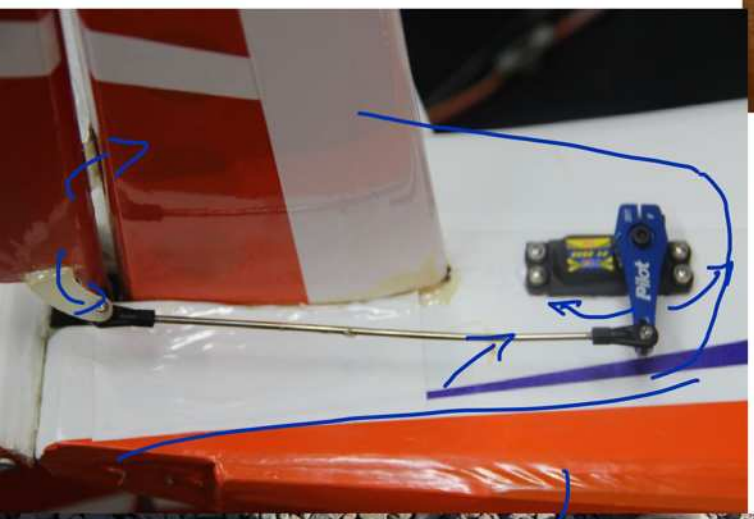


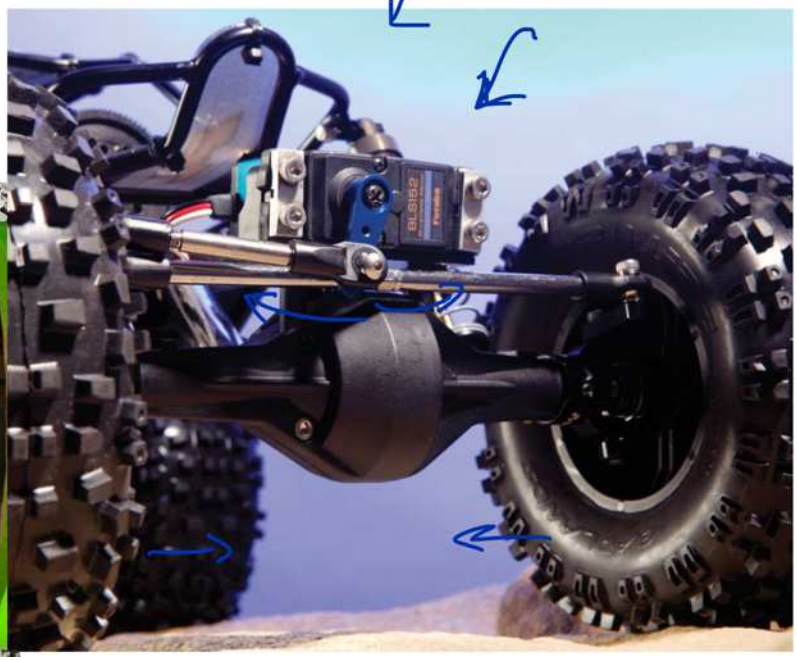

RUDDER
YAW
LONGITUDINAL AXIS
LATERAL AXIS
ELEVATORS (2)
HORIZONTAL STABILIZER
TE FLAPS (4)
SPOILERS (2)
AILERONS (2)
LE FLAPS (4)
LE SLATS (8)
ROLL
PITCH
VERTICAL AXIS

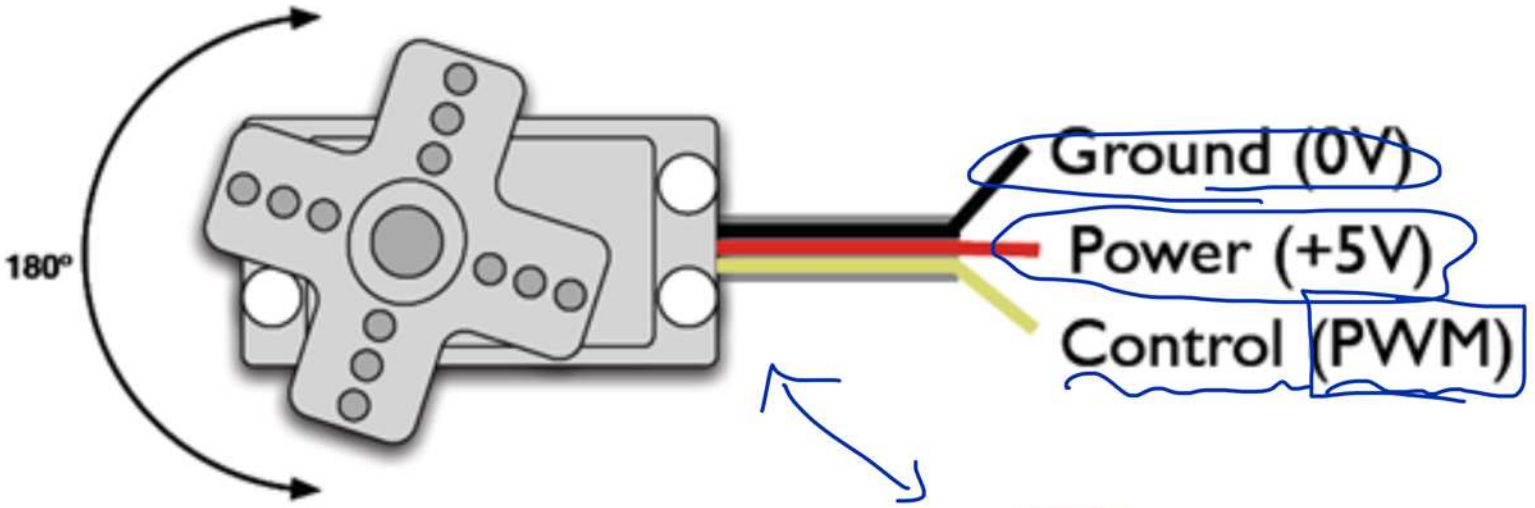

The Heart
Dual Receivers
Bay Doors
Spoilers
Spoilers
Ailerons
Ailerons
Stabilator
Rudder

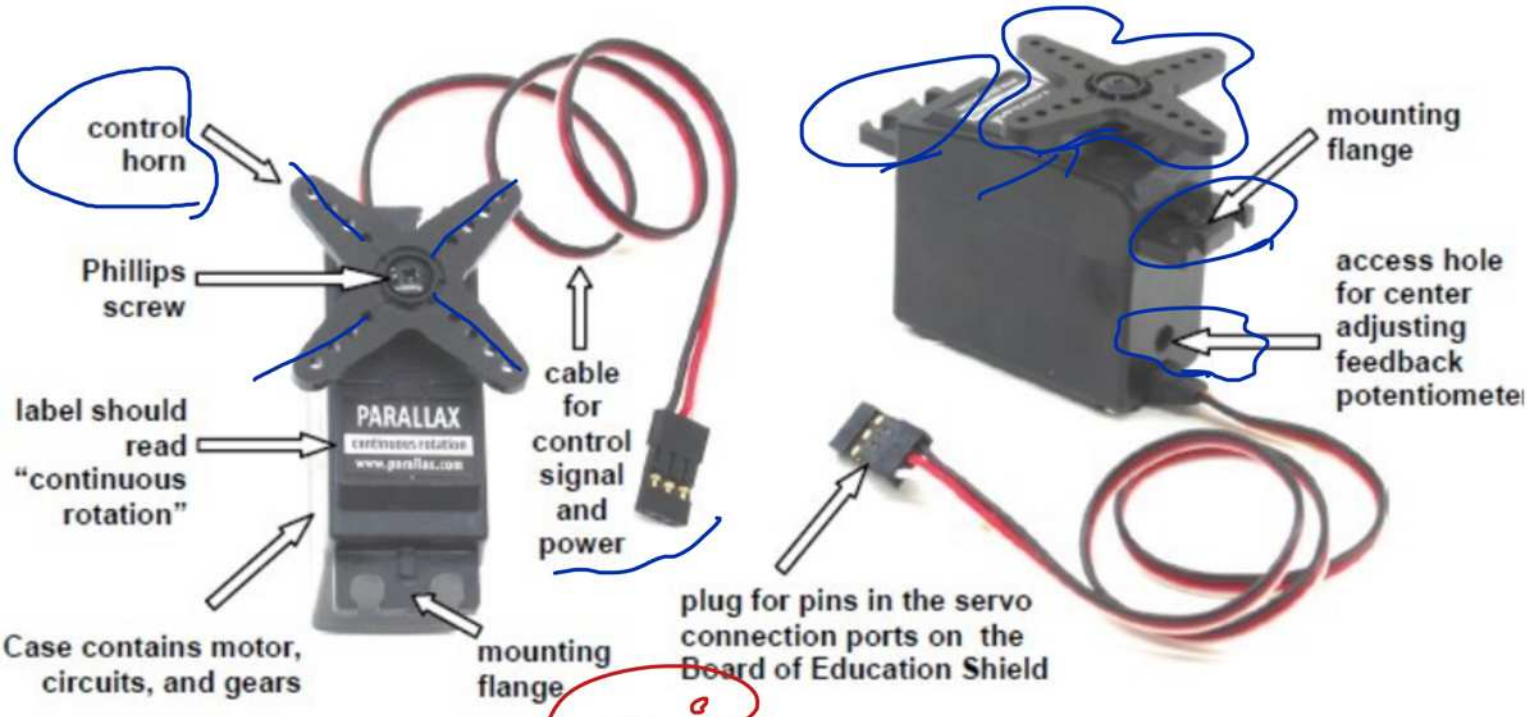


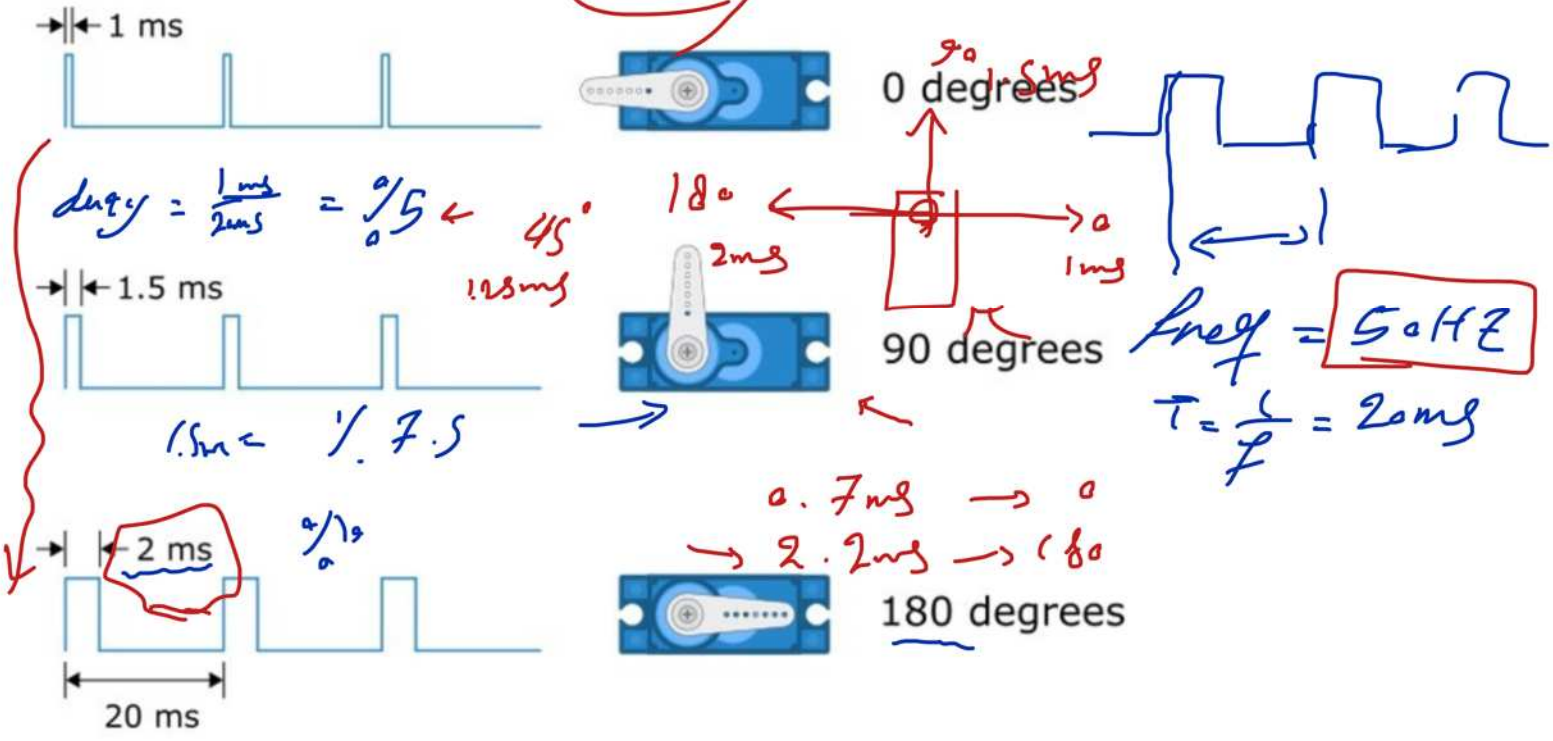


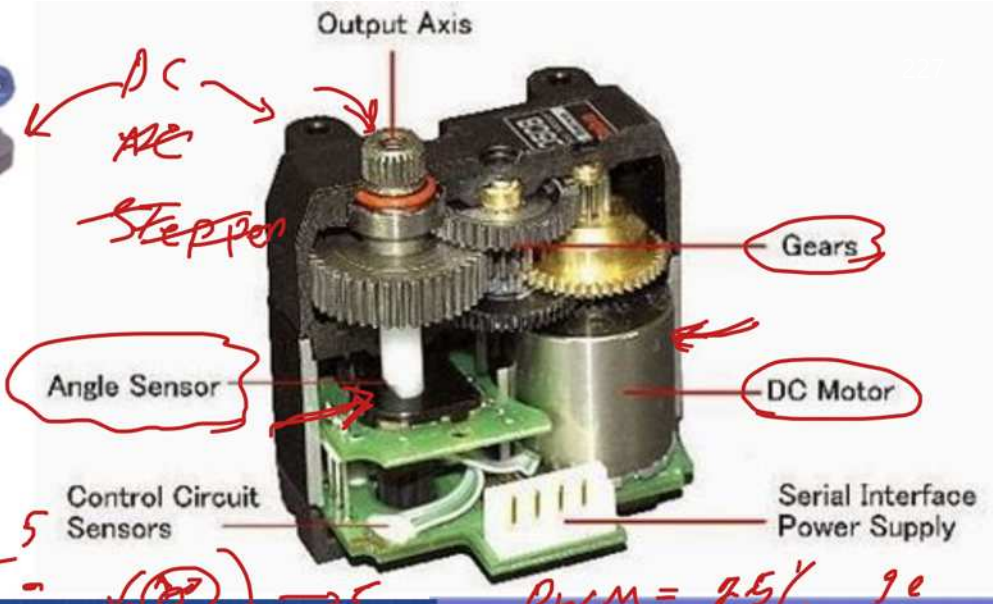

Pilot

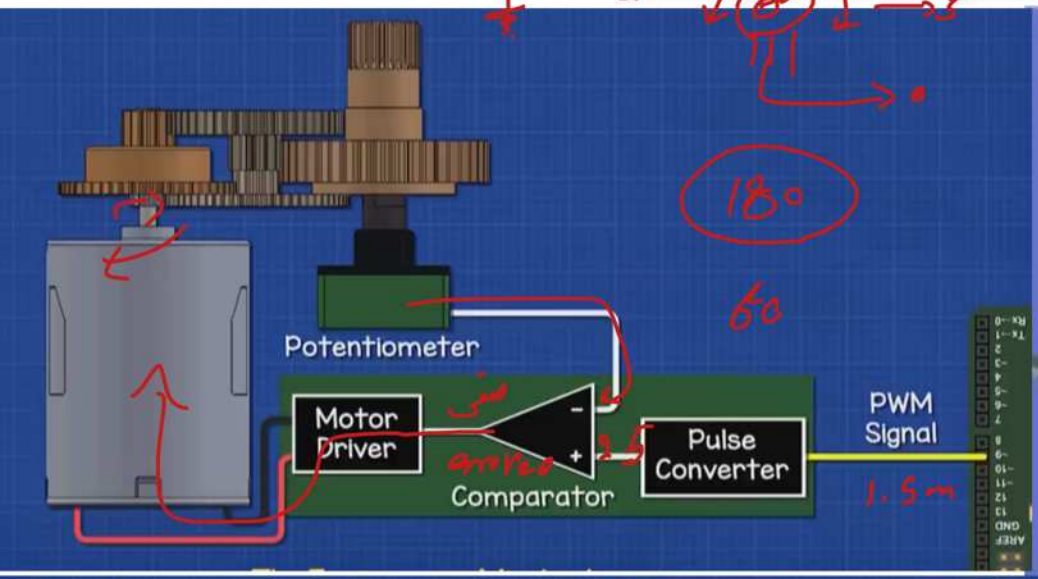


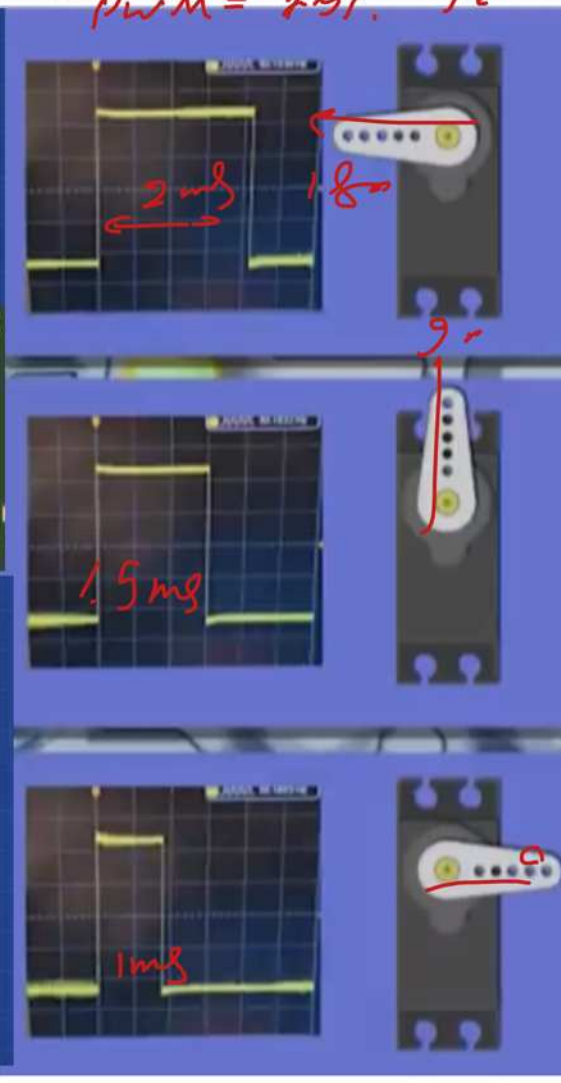

180°
Ground (0V)
Power (+5V)
Control (PWM)

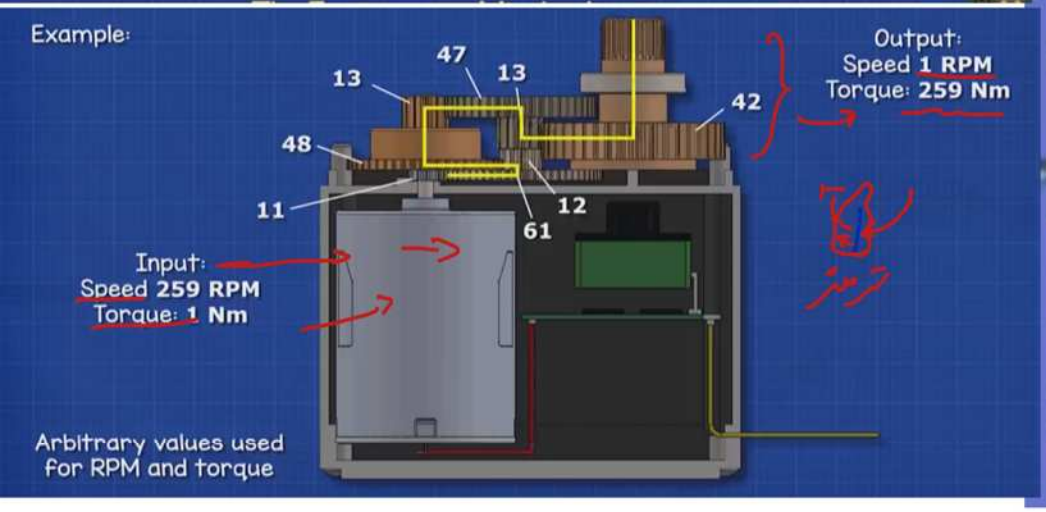

control horn
Phillips screw
label should read "continuous rotation"
Case contains motor, circuits, and gears
PARALLAX
cable for control signal and power
mounting flange
plug for pins in the servo connection ports on the Board of Education Shield
mounting flange
access hole for center adjusting feedback potentiometer


1 ms
0 degrees
1.5 ms
90 degrees
2 ms
180 degrees
20 ms



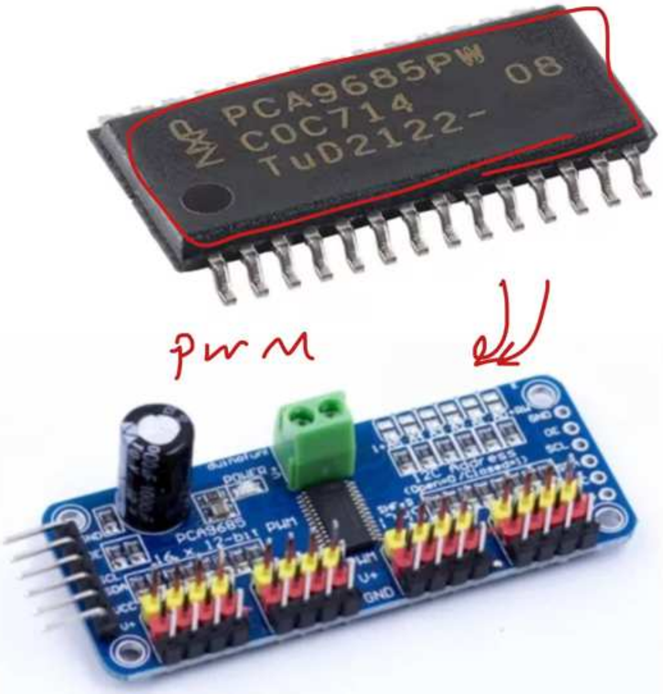




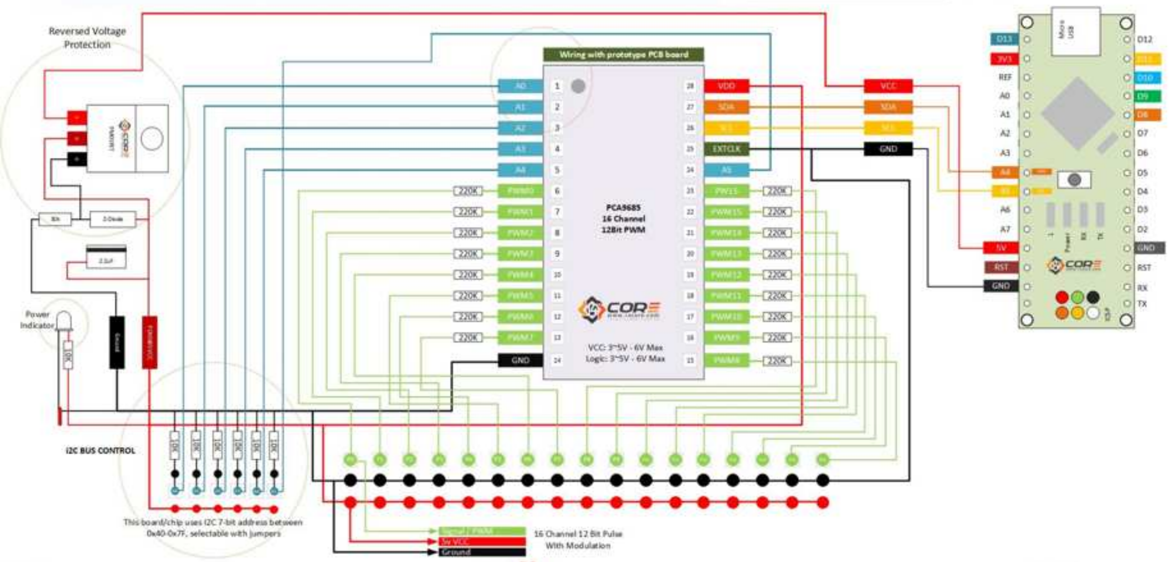


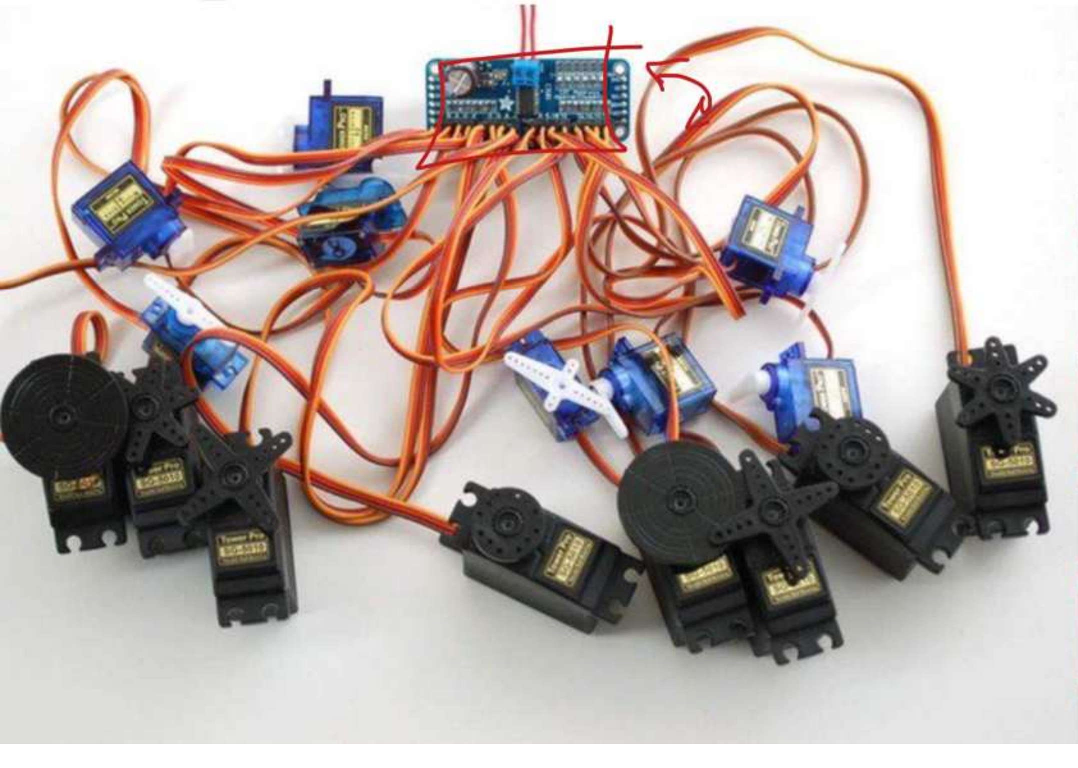
AVR
ATmega328
6ch

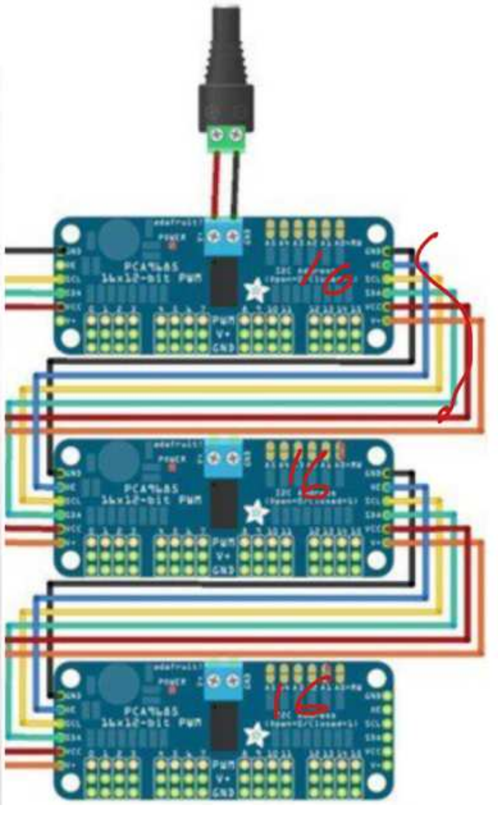
STM

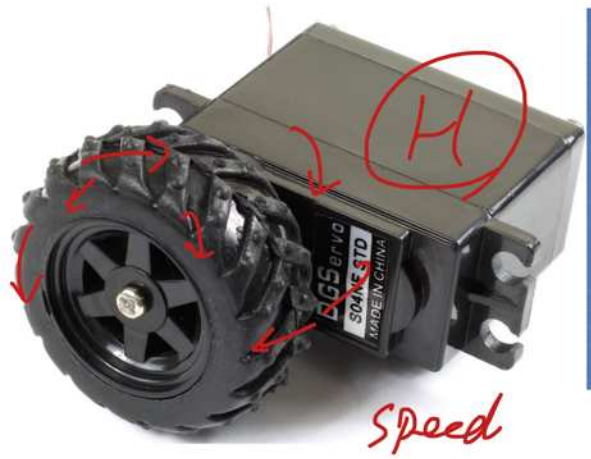

PCA9685PW 08
C0C714
TuD2122-
pwm

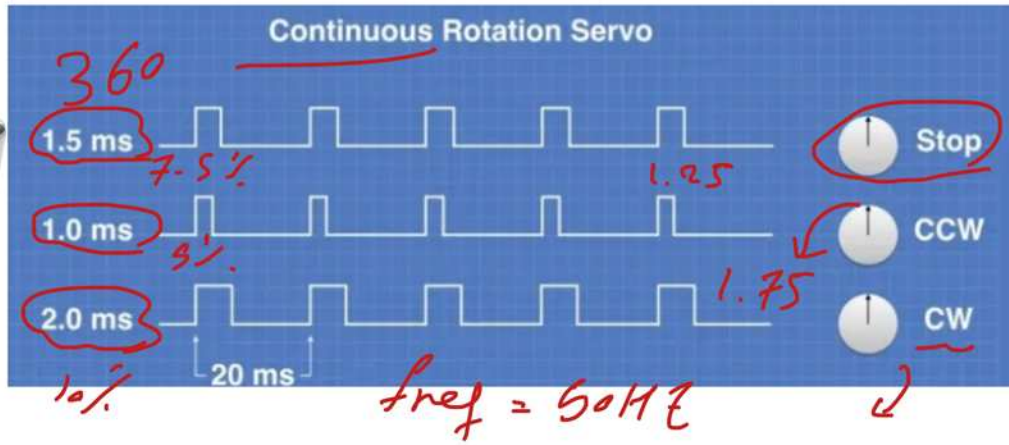

Address Input 0
Address Input 1
Address Input 2
Address Input 3
Address Input 4
LED driver 0
LED driver 1
LED driver 2
LED driver 3
LED driver 4
LED driver 5
LED driver 6
LED driver 7
Supply Ground
Supply Voltage
Serial Data Line
Serial Clock Line
External Clock Input
Address Input 5
Active LOW Output
LED driver 15
LED driver 14
LED driver 13
LED driver 12
LED driver 11
LED driver 10
LED driver 9
LED driver 8
I2C
16ch
PCA9685
www.components101.com

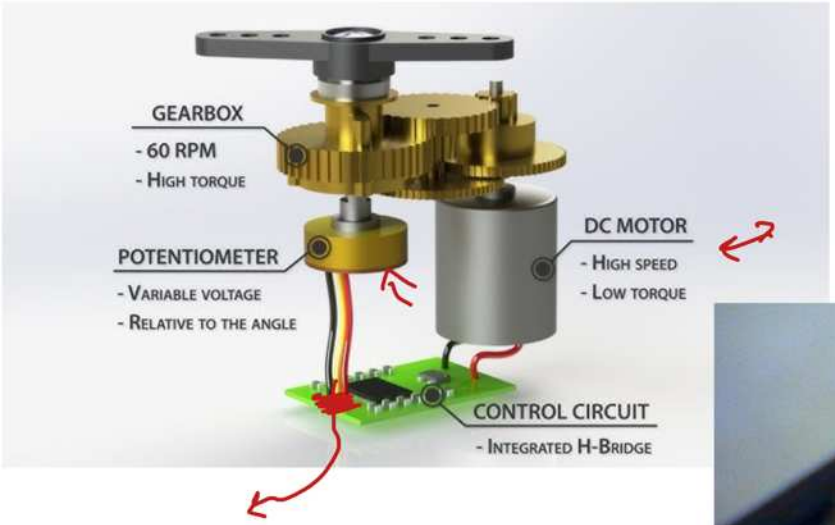

Reversed Voltage Protection
Wiring with prototype PCB board
PCA9685
16 Channel
12Bit PWM
VCC: 3~5V - 6V Max
Logic: 3~5V - 6V Max
I2C BUS CONTROL
This board/chip uses I2C 7-bit address between 0x40-0x7F, selectable with jumpers
16 Channel 12 Bit Pulse With Modulation

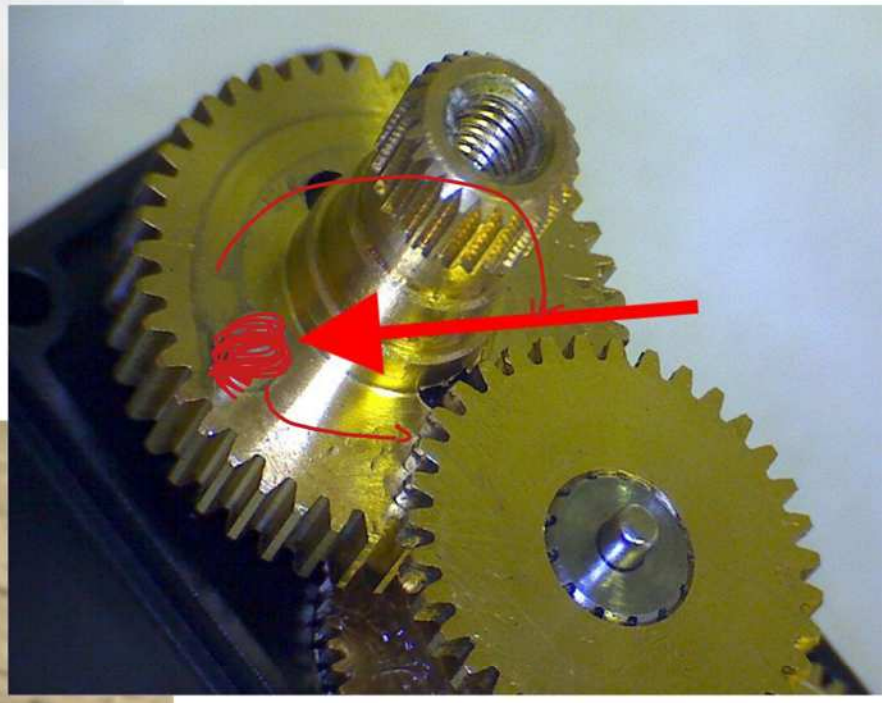


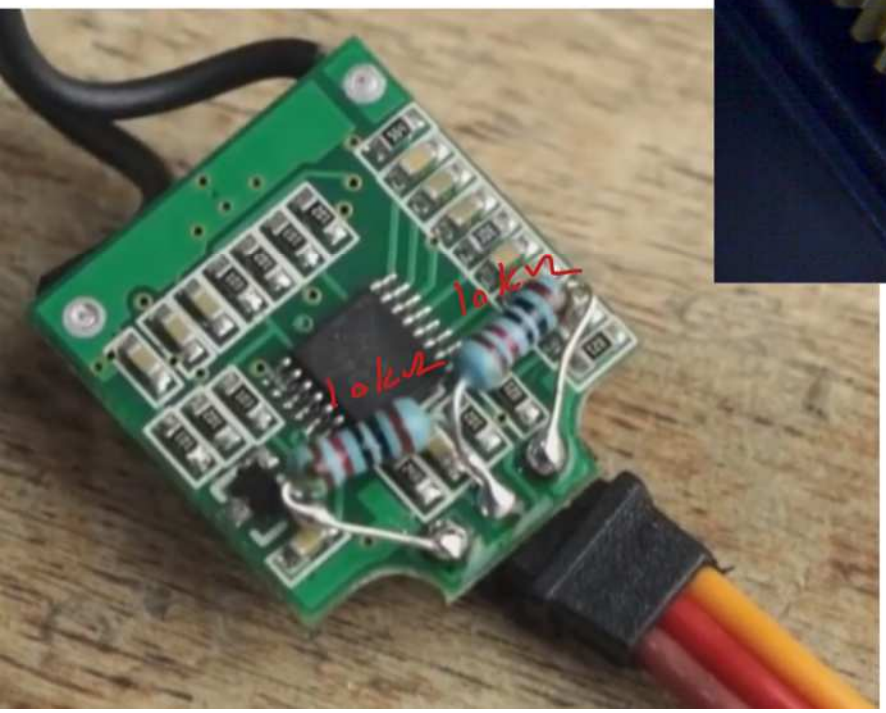

16
16
16


H
Speed

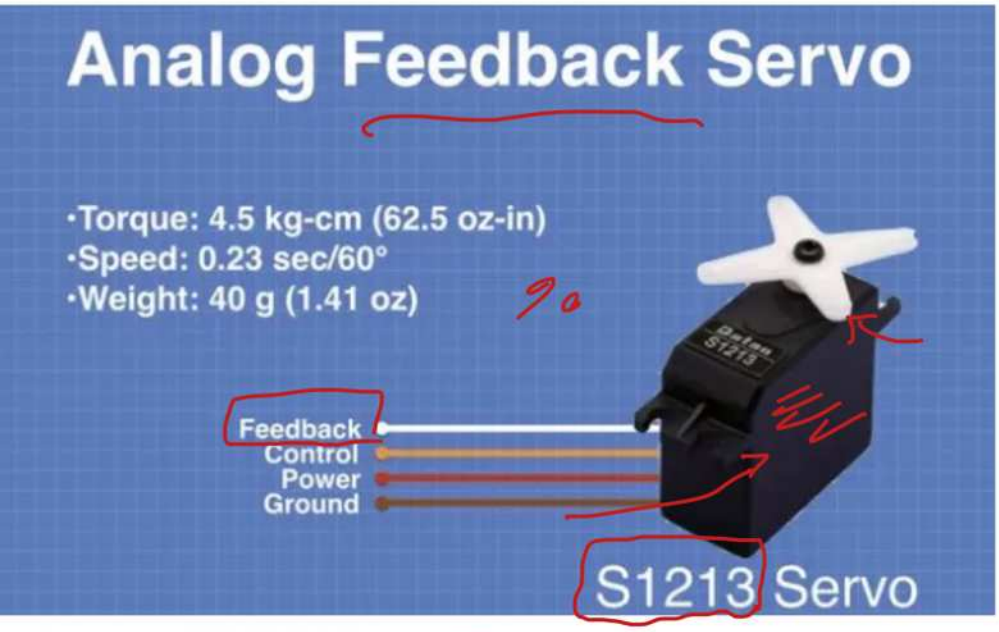

Continuous Rotation Servo
360
1.5 ms
7.5%
1.25
Stop
1.0 ms
9%
1.75
CCW
2.0 ms
10%
20 ms
CW
freq = 50Hz

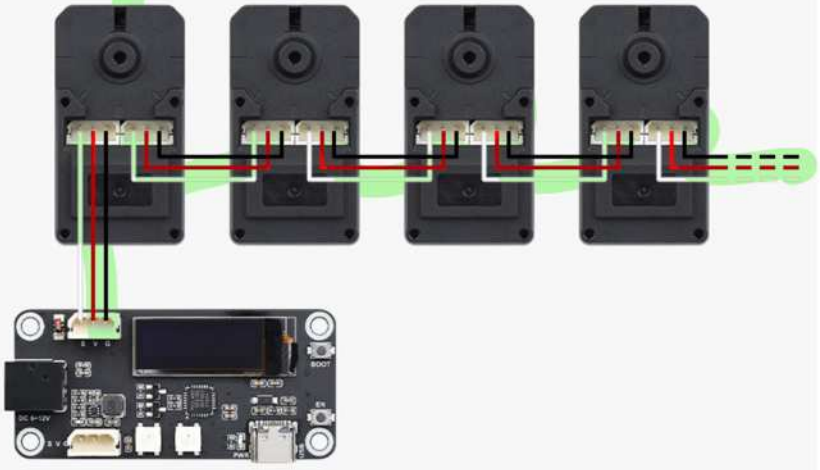

GEARBOX
- 60 RPM
- High torque
POTENTIOMETER
- Variable voltage
- Relative to the angle
DC MOTOR
- High speed
- Low torque
CONTROL CIRCUIT
- Integrated H-Bridge




10kΩ
10kΩ

180 → 360





Specification/Feature	Description
Brand	Robotis
Control Mechanism	Closed-Loop (feedback-based)
Feedback Options	Position, Speed, Torque, Voltage, Temperature
Communication Protocol	TTL or RS-485
Operating Modes	Position Control, Velocity Control, Torque Control, PWM Control
Power Supply Voltage	Typically 6V - 24V (varies by model)
Torque Output	Model-dependent (ranges from 1.5 kg·cm to 400 kg·cm for different models)
Resolution	High-resolution encoders (depends on the model)
Gear Type	Plastic or Metal (varies by series)
Connectivity	Daisy-chain network capability
Protection Mechanisms	Overheat protection, Overvoltage detection, Load detection
Supported Models	AX, MX, RX, EX, XL, XM, Pro series
Durability	Designed for industrial and heavy-duty applications
Application Areas	Robotics, Industrial Automation, Educational Projects, Research Applications
Temperature Range	Typically -5°C to 80°C
Dimensions	Varies by model (compact to large industrial sizes)
Weight	Model-specific (from lightweight to heavy-duty designs)
Mounting Options	Multiple mounting brackets and adapters available
Programming Interface	Compatible with Robotis software and open-source platforms

Address	Item	Access	Initial Value
0(0X00)	Model Number(L)	RD	12(0x0C)
1(0X01)	Model Number(H)	RD	0(0x00)
2(0X02)	Version of Firmware	RD	?
3(0X03)	ID	RD,WR	1(0x01)
4(0X04)	Baud Rate	RD,WR	1(0x01)
5(0X05)	Return Delay Time	RD,WR	250(0xFA)
6(0X06)	CW Angle Limit(L)	RD,WR	0(0x00)
7(0X07)	CW Angle Limit(H)	RD,WR	0(0x00)
8(0X08)	CCW Angle Limit(L)	RD,WR	255(0xFF)
9(0X09)	CCW Angle Limit(H)	RD,WR	3(0x03)
10(0x0A)	(Reserved)	-	0(0x00)
11(0X0B)	the Highest Limit Temperature	RD,WR	85(0x55)
12(0X0C)	the Lowest Limit Voltage	RD,WR	60(0X3C)
13(0X0D)	the Highest Limit Voltage	RD,WR	190(0xBE)
14(0X0E)	Max Torque(L)	RD,WR	255(0XFF)
15(0X0F)	Max Torque(H)	RD,WR	3(0x03)
16(0X10)	Status Return Level	RD,WR	2(0x02)
17(0X11)	Alarm LED	RD,WR	4(0x04)
18(0X12)	Alarm Shutdown	RD,WR	4(0x04)
19(0X13)	(Reserved)	RD,WR	0(0x00)
20(0X14)	Down Calibration(L)	RD	?
21(0X15)	Down Calibration(H)	RD	?
22(0X16)	Up Calibration(L)	RD	?
23(0X17)	Up Calibration(H)	RD	?

24(0X18)	Torque Enable	RD,WR	0(0x00)
25(0X19)	LED	RD,WR	0(0x00)
26(0X1A)	CW Compliance Margin	RD,WR	0(0x00)
27(0X1B)	CCW Compliance Margin	RD,WR	0(0x00)
28(0X1C)	CW Compliance Slope	RD,WR	32(0x20)
29(0X1D)	CCW Compliance Slope	RD,WR	32(0x20)
30(0X1E)	Goal Position(L)	RD,WR	[Addr36]value
31(0X1F)	Goal Position(H)	RD,WR	[Addr37]value
32(0X20)	Moving Speed(L)	RD,WR	0
33(0X21)	Moving Speed(H)	RD,WR	0
34(0X22)	Torque Limit(L)	RD,WR	[Addr14] value
35(0X23)	Torque Limit(H)	RD,WR	[Addr15] value
36(0X24)	Present Position(L)	RD	?
37(0X25)	Present Position(H)	RD	?
38(0X26)	Present Speed(L)	RD	?
39(0X27)	Present Speed(H)	RD	?
40(0X28)	Present Load(L)	RD	?
41(0X29)	Present Load(H)	RD	?
42(0X2A)	Present Voltage	RD	?
43(0X2B)	Present Temperature	RD	?
44(0X2C)	Registered Instruction	RD,WR	0(0x00)
45(0X2D)	(Reserved)	-	0(0x00)
46[0x2E)	Moving	RD	0(0x00)
47[0x2F)	Lock	RD,WR	0(0x00)
48[0x30)	Punch(L)	RD,WR	32(0x20)
49[0x31)	Punch(H)	RD,WR	0(0x00)

MG-995

PWM

0 → 180

1ms 2ms

deg	Ton	duty
0	0.6ms	3%
90	1.25ms	6.25%
180	2.05ms	10.25%