Servo Comparison

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Purpose of Documentation:

Direct comparison of the servo motors to find out its suitability for the project.

General Servo specifications:

Item	AX-12A(OLD) CORED	XM540-W150-T/R (NEW) COREDLESS	MX-64T (IN LAB) COREDLESS (IN LAB)
Baud Rate	7,843 [bps] ~ 1 [Mbps]	9,600 [bps] ~ 4.5 [Mbps]	8,000 [bps] ~ 4.5 [Mbps]
Resolution	0.29 [°]	4096 [pulse/rev]	4096 [pulse/rev]
Motor	Cored	Coreless	Coreless
Operating Modes	0 ~ 300 [°] Endless Turn	Current Control Mode Velocity Control Mode Position Control Mode (0 ~ 360 [°]) Extended Position Control Mode (Multi-turn) Current-based Position Control Mode PWM Control Mode (Voltage Control Mode)	Wheel Mode (Endless Turn) Joint Mode (0 ~ 360 [°]) Multi-turn Mode
Gear Ratio	254 : 1	152.3 : 1	200 : 1
Stall Torque	1.5 [N.m] (at 12 [V], 1.5 [A])	6.9 [N.m] (at 11.1 [V] 4.2 [A]) 7.3 [N.m] (at 12.0 [V], 4.4 [A]) 8.9 [N.m] (at 14.8 [V], 5.5 [A])	5.5 [N.m] (at 11.1 [V], 3.9 [A]) 6.0 [N.m] (at 12 [V], 4.1 [A])] 7.3 [N.m] (at 14.8 [V], 5.2 [A])
No Load Speed	59 [rev/min] (at 12V)	50 [rev/min] (at 11.1 [V]) 53 [rev/min] (at 12.0 [V]) 66 [rev/min] (at 14.8)	58 [rev/min] (at 11.1 [V]) 63 [rev/min] (at 12 [V]) 78 [rev/min] (at 14.8 [V])
Input Voltage	9.0 ~ 12.0 [V] (**Recommended : 11.1V**)	10.0 ~ 14.8 [V] (**Recommended : 12.0 [V]**)	10.0 ~ 14.8 [V] (Recommended : 12.0 [V])
Physical Connection	TTL Level Multi Drop Bus Half Duplex Asynchronous Serial Communication (8bit, 1stop, No Parity)	RS485 / TTL Multidrop Bus TTL Half Duplex Asynchronous Serial Communication with 8bit, 1stop, No Parity RS485 Asynchronous Serial Communication with 8bit, 1stop, No Parity	RS485 / TTL Multidrop Bus TTL Half Duplex Asynchronous Serial Communication with 8bit, 1stop, No Parity RS485 Asynchronous Serial Communication with 8bit, 1stop, No Parity
Feedback	Position, Temperature, Load, Input Voltage, etc	Position, Velocity, Current, Realtime tick, Trajectory, Temperature, Input Voltage, etc	Position, Temperature, Load, Input Voltage, etc

Relevant Servo specifications:

	AX-12A(OLD)	XM540-W150-T/R (NEW)	MX-64T (IN LAB)
Weight	54.6 [g]	165 [g]	MX-64AR/AT: 135 [g] MX-64R/T: 126 [g]
RPM	0 ~ 1,023(0x3FF) 1,023 X 0.111 = 113.553 (Join Mode)	0 ~ 1,023(0x3FF) 1,023 X 0.229 = 234.267 (Velocity Limit)	0~1023 (0X3FF) 1023 x 0.114 = 116.62 (Join Mode)
Operating Voltage	(**Recommended : 11.1V**) max is 12v	(**Recommended : 12.0 [V]**)	(**Recommended : 12.0 [V]**)
Torque	1.5 [N.m] / 9.81 = 0.15 kgf	6.9[N.m] / 9.81 = 0.703kgf 7.3 [N.m] / 9.81 = 0.744kgf 8.9 [N.m] 8.9 / 9.81 = 0.907kgf	5.5 [N.m] /9.81 = 0.5606kgf 6.0 [N.m] /9.81 = 0.6116kgf 7.3 [N.m] /9.81 = 0.7441kgf
No-load	59 [rev/min] (at 12V)	50 [rev/min] (at 11.1 [V]) 53 [rev/min] (at 12.0 [V]) 66 [rev/min] (at 14.8)	58 [rev/min] (at 11.1 [V]) 63 [rev/min] (at 12 [V]) 78 [rev/min] (at 14.8 [V])
Total Torque(Max Torque)	There are 4 legs with 3 motors each, totaling to 12 motors 0.15kgf x 12= 1.8kgf max for stall Torque	There are 4 legs with 3 motors each, totaling to 12 motors 0.703kgf x 12 = 8.436 kgf max for stall Torque 0.744kgf x 12 = 8.928kgf max for stall Torque 0.907kgf x 12 = 10.884kgf max for stall Torque	There are 4 legs with 3 motors each, totaling to 12 motors 0.5606kgf x 12 =6.072kgf max for stall Torque 0.6116kgf x 12 =7.3392kgf max for stall Torque 0.7441kgf x12 = 8.9292kgf max for stall Torque

References from :

Calculation of torque and max load:
https://robotics.stackexchange.com/questions/14943/how-much-weight-can-dc-motor-carry

Unit of calculated load:
https://en.wikipedia.org/wiki/Kilogram-force