

Crustcrawler Pro-Series Robotic Builders Guide

VERSION 3.0



Robotic
CrustCrawler
Design & Development

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WARRANTY

CrustCrawler warrants its products against defects in materials and workmanship for a period of 30 days. If you discover a defect, CrustCrawler will, at its option, repair, replace, or refund the purchase price. Simply call for a Return Merchandise Authorization (RMA) number, write the number on the outside of the box and send it back to CrustCrawler. Please include your name, telephone number, shipping address, and a description of the problem. We will return your product, or its replacement, using the same shipping method used to ship the product to CrustCrawler. This warranty does not cover the Robotis servos. Robotis servos are covered under the Robotis warranty and require a Return Merchandise Authorization (RMA) number authorized by Robotis only. Crustcrawler does not have the authority to replace or repair the Robotis line of servos as all repair/ replacement authority is determined and completed by Robotis.

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Support

Crustcrawler wants to ensure your success, so if you ever need support you can contact us at:

Phone: - 480-577-5557

E-mail – support@crustcrawler.com

CrustCrawler Forum - <http://forum.crustcrawler.com/phpBB3/index.php>

Robotis Support Site: <http://support.robotis.com>

The Robotis support site is loaded with free software downloads including a complete Software Development Kit (SDK) for both multiple controllers. Detailed specifications for the complete line of Robotis Servos can also be found here. Visit this site often as it is updated on a daily basis.

REQUIRED TOOLS

The following tools will be required to build the Crustcrawler Pro-Series of components:

- Small head, 6 in.(15.24cm) or longer Phillips screwdriver
- Needle nose pliers
- Optional thread locker

Note: CrustCrawler provides the Allen wrenches with all kit components.

Compatibility

The Crustcrawler Pro-Series of robotic arm components are compatible with the following Robotis servos:

- AX-12A / AX-18A (wrist rotate component only)
- MX-28T / MX-28R / RX-28 (HN07-N101 Type only)
- MX-64T / MX-64R / RX-64 (HN05-N101 Type only)
- MX-106T / MX-106R

Note #1:

The “HN05-N101 Type and HN07-N101 Type” designations indicates the type of servo horn hole pattern that comes standard with the servo. HN05-N101 and HN07-N101 type servos have the same servo horn hole patterns as the MX servo series and will work with the Crustcrawler Pro-Series of robotic arm components.

Note #2:

The MX-28T, MX-64T and the MX-106T type servos are 3-pin serial and the MX28R, MX-64R, MX-106R use 4-pin RS-485 communication protocols. Please keep this in mind when selecting the type of servo you are going to use on the CrustCrawler Pro-Series Robotic arm.

Note #3:

Since the connections between servos are to be connected to each other (daisy chained) when building the robotic arm, it is a best practice to use servos of the same type of communication protocol but is not necessarily required.

CRUSTCRAWLER PRO-SERIES COMPONENTS


The Crustcrawler Pro-Series of arm components are made to connect in any number of different ways using simple hand tools. The following is a list of Pro-Series Arm components with a complete listing of hardware parts contained within each kit.

GIRDERS / ADAPTERS

	DESCRIPTION	HARDWARE
	<p>2.5in (6.35cm) Girder</p> <p>Weight - .8oz.</p>	<p>(12) #4 Lock nuts (4) #4 - 1/4" screws (8) #4- .31in. Countersink Screws</p>
	<p>5 in. (12.7cm) Girder</p> <p>Weight - 1.3oz.</p>	<p>(12) #4 Lock nuts (4) #4 - 1/4" screws (8) #4- .31in. Countersink Screws</p>
	<p>Adjustable 8.31in. (21.11cm) to 13.21 in. (33.81cm) Girder</p> <p>Weight - 3.9oz.</p>	<p>(12) #4 Lock nuts (4) #4 - 1/4" screws (8) #4 - .31in. Countersink Screws</p>
	<p>Single Axis Adapter Plate</p> <p>This plate is required any time a single axis is going to be connected to one end of the girder.</p> <p>Weight - .6oz.</p>	<p>(4) #4 - .31in. Countersink Screws</p>


SINGLE AND DUAL AXIS KITS

	DESCRIPTION	HARDWARE
	<p><u>MX/RX-28 Single Axis Kit</u></p> <p>Height = 2.91in.(7.39cm)</p> <p>Width = 1.89in(4.8cm)</p> <p>Weight = 3.4 oz.</p>	<p>(4) #4 Lock nuts</p> <p>(4) #4- 1/4in. Screws</p> <p>(4) M2.5 – 8mm screws/ nuts</p> <p>(4) #4 .31in countersink screws</p>
	<p><u>MX/RX-64 Single Axis Kit</u></p> <p>Height = 3.50in.(8.89cm)</p> <p>Width = 2.21in.(5.6cm)</p> <p>Weight = 6 oz.</p>	<p>(4) #4 Lock nuts</p> <p>(4) #4- 1/4in. Screws</p> <p>(4) M2.5 – 8mm screws / nuts</p> <p>(4) #4 .31in countersink screws</p>
	<p><u>MX-106 Single Axis Kit</u></p> <p>Height = 3.6in (9.14cm)</p> <p>Width = 2.45in. (6.22cm)</p> <p>Weight = 6.9oz.</p>	<p>(4) #4 Lock nuts</p> <p>(4) #4- 1/4in. Screws</p> <p>(4) M2.5 – 8mm screws/ nuts</p> <p>(4) #4 .31in countersink screws</p>
	<p><u>MX/RX-28 Dual Axis Kit</u></p> <p>Height = 3.10in.(7.87cm)</p> <p>Width = 4.94in.(12.54cm)</p> <p>Weight = 8.10oz.</p>	<p>(16) #4- .31” countersink screws</p> <p>(4) #4-1/4” screws</p> <p>(8) #4- Lock Nuts</p> <p>(8) M2.5 – 8mm screws / nuts</p>
	<p><u>MX/RX-64 Dual Axis Kit</u></p> <p>Height = 3.68in.(9.34cm)</p> <p>Width = 5.10in.(12.95cm)</p> <p>Weight = 13.2oz.</p>	<p>(16) #4- .31” countersink screws</p> <p>(4) #4-1/4” screws</p> <p>(8) #4- Lock Nuts</p> <p>(8) M2.5 – 8mm screws/ nuts</p>

	<p><u>MX-106 Dual Axis Kit</u></p> <p>Height = 3.79in. (9.62cm)</p> <p>Width = 5.32in (13.51cm)</p> <p>Weight = 15oz.</p>	<p>(16) #4- .31” countersink screws (4) #4-1/4” screws (8) #4- Lock Nuts (4) M2.5 – 8mm screws/nuts</p>
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WRIST ROTATE KITS

	<p><u>AX12A / AX-18A Wrist Rotate</u></p> <p>Weight = 3.5oz.</p>	<p>(4) M2 – 14mm screws (12) #4 – 1/4” screws (4) #4 lock nuts (2) AX Side brackets (2) RX/MX-28 angle brackets (1) .394” (9.93mm) Axis Spacer</p>
	<p><u>MX-28 Wrist Rotate</u></p> <p>Weight = 4.5oz.</p>	<p>(4) M2 – 14mm screws (8) M2.5 – 8mm screws (12) #4 – 1/4” screws (4) #4 lock nuts (2) MX Side brackets (2) RX/MX-28 angle brackets (1) .394” (9.93mm) Axis Spacer</p>
	<p><u>MX-64 Wrist Rotate</u></p> <p>Weight =6.6oz.</p>	<p>(4) M2 – 14mm screws (8) M2.5 – 8mm screws (12) #4 – 1/4” screws (4) #4 lock nuts (2) MX Side brackets (2) RX/MX-64 angle brackets (1) .394” (9.93mm) Axis Spacer</p>

 <p>The image shows a black and red MX-106 Wrist Rotate motor assembly. It is a compact, rectangular device with a circular output shaft on the left side. The top and right sides are red, while the front and bottom are black. A small white label on the front face reads "MX-106".</p>	<p><u>MX-106 Wrist Rotate</u></p> <p>Weight =7.5oz.</p>	<p>4) M2 – 14mm screws (8) M2.5 – 8mm screws (12) #4 – ¼” screws (4) #4 lock nuts (2) MX Side brackets (2) RX/MX-64 angle brackets (1) .394” (9.93mm) Axis Spacer</p>
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TURNTABLES

PART #	DESCRIPTION	HARDWARE
	<p>MX/RX-28 Turntable</p> <p>Dimensions - 4.5" X 4.5" (11.43cm X 11.43cm)</p> <p>Mounting Tabs - 5.25" (13.33cm) center to center</p>	<p>(4) M2 8mm countersink screws</p> <p>(4) M2 10mm screws</p> <p>(1) Turntable spacer</p> <p>(1) Turntable bearings set</p>
	<p>MX/RX-64 Turntable</p> <p>Dimensions - 4.5" X 4.5" (11.43cm X 11.43cm)</p> <p>Mounting Tabs - 5.25" (13.33cm) center to center</p>	<p>(4) M2.5 8mm countersink screws</p> <p>(4) M2.5 10mm screws</p> <p>(1) Turntable spacer</p> <p>(1) Turntable bearing set</p>
	<p>MX-106 Turntable</p> <p>Dimensions - 4.5" X 4.5" (11.43cm X 11.43cm)</p> <p>Mounting Tabs - 5.25" (13.33cm) center to center</p>	<p>(4) M2.5 8mm countersink screws</p> <p>(4) M2.5 - 10mm screws</p> <p>(1) Turntable spacer</p> <p>(1) Turntable bearing set</p>

BUILDING YOUR CRUSTCRAWLER PRO-SERIES ROBOTIC ARM

The Crustcrawler Pro-Series Robot Arm can be built from the turntable upwards in the following configurations:

- **Turntable to Dual Axis**
- **Turntable to Single Axis**
- **Turntable to Girder**
- **Dual Axis to Girder**
- **Single Axis to Girder**
- **Axis to Axis**
- **Axis to Girder**
- **Girder to Axis**
- **Axis to Wrist Rotate**

End effectors, such as Crustcrawler's line of grippers can be attached to the Pro-Series of components in several ways as well:

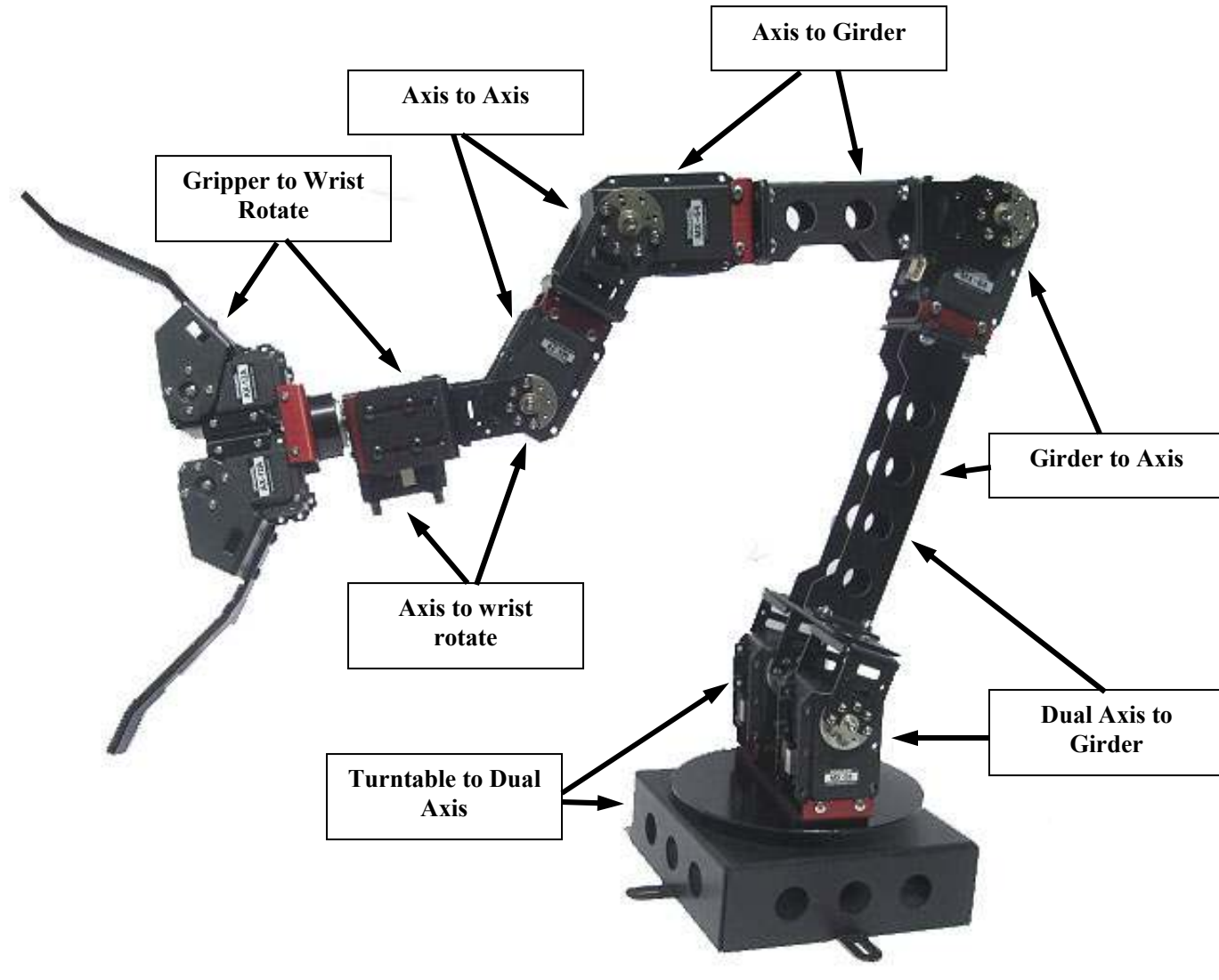
- **End effector to servo**
- **End effector to wrist rotate kit**
- **End effector to girder (Crustcrawler Dual Gripper and Big Gripper kits only)**

This technical guide will illustrate the most common and useful build configurations for the Crustcrawler Pro-Series Robotic Arm components but not necessarily all of the combinations that can be attained with the Pro-Series interchangeable components. We encourage you, our customer, to explore the various ways that to build your robotic arm using the flexible Crustcrawler Pro-Series of components.

CRUSTCRAWLER PRO-SERIES SAMPLE CONFIGURATIONS

Illustrated below are just a few example configurations of how the CrustCrawler Pro-Series Robotic Arm components can be put together to make a custom robotic arm. All Crustcrawler Pro-Series Arm components can be placed in any order.

EXAMPLE #1



Example #1 Parts List

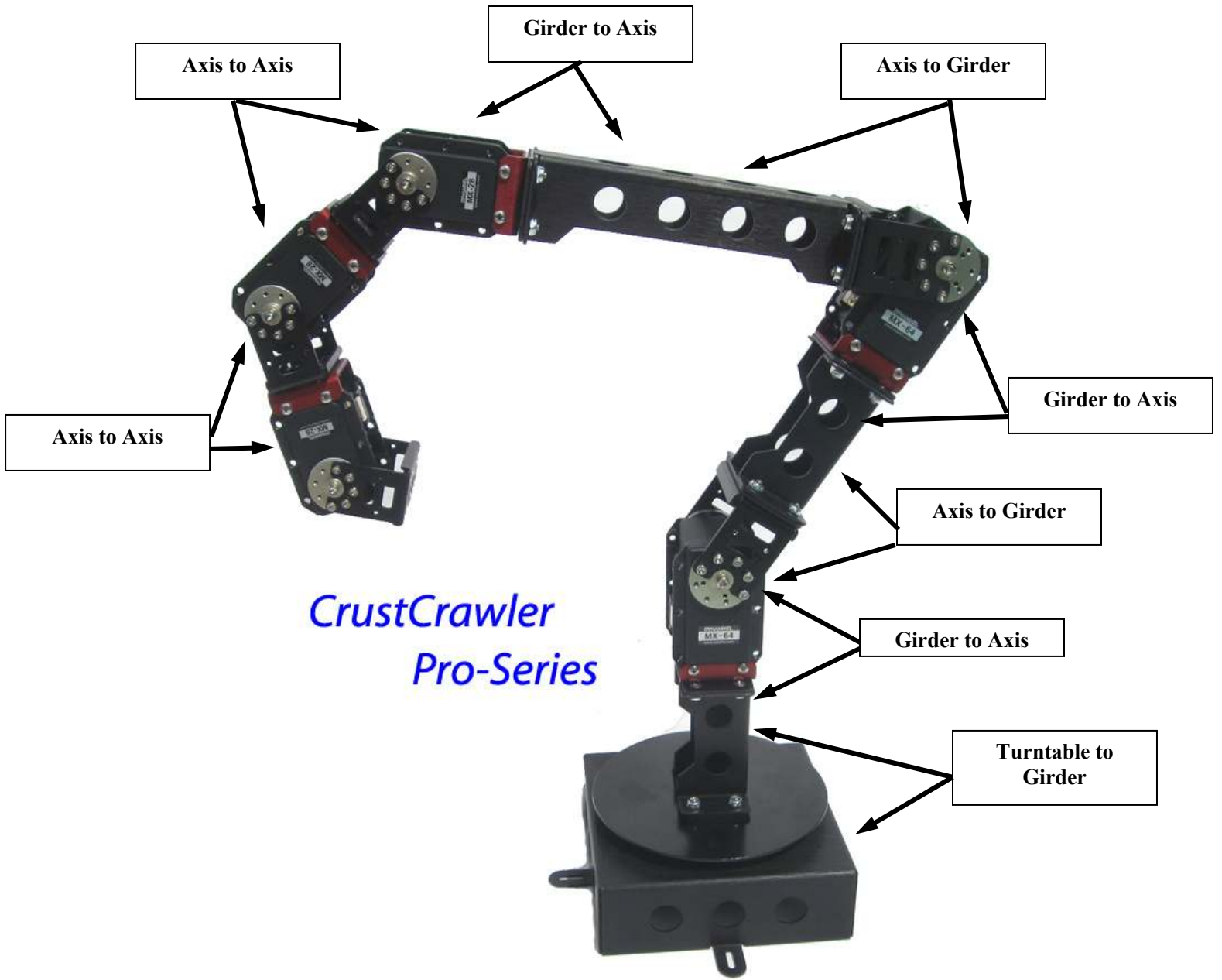
- (1) MX-64T Pro-Series Turntable
- (1) MX-106T Pro-Series Dual Axis kit
- (3) Pro-Series Single Axis Mounting Plates
- (1) 5 inch (12.7cm) Pro-Series girder
- (1) MX-106T Pro Series Single Axis Kit
- (1) 2.5 inch (6.35cm) Pro Series Girder
- (1) MX-64T Pro-Series Single Axis kit
- (1) MX-28T Pro-Series Single Axis kit
- (1) MX-28T Pro-Series Wrist Rotate kit
- (1) Pro-Series Wrist to Dual Gripper Adapter
- (1) Dual gripper kit with (2) AX-18A Servos
- (2) 12 inch (30.48cm) 3-pin wire extensions

Note 1:

The parts list above reflects the use of the MX-106T, MX-64T and MX-28T actuators. If you have selected the MX-106R, MX-64R and MX-28R actuators, then substitute the 12inch (30.48cm) 3-pin wire extension with the 12inch (30.48cm) 4-pin version.

Note 2:

The servo types selected above are only used as an example illustration. Any combination of servo types (MX-28, MX-64 and MX-106) can be substituted.



EXAMPLE #2

Example #2 Parts List

- (1) MX-28T Pro-Series Turntable
- (2) 2.5 inch (6.35cm) Pro Series Girder
- (2) MX-64T Pro-Series Single Axis kit
- (6) Pro-Series Single Axis Mounting Plates
- (1) 5 inch (12.7cm) Pro-Series girder
- (3) MX-28T Pro Series Single Axis Kits
- (3) 12 inch (30.48cm) 3-pin wire extensions

Note 1:

The parts list above reflects the use of the MX-106T, MX-64T and MX-28T actuators. If you have selected the MX-106R, MX-64R and MX-28R actuators, then substitute the 12inch (30.48cm) 3-pin wire extension with the 12inch (30.48cm) 4-pin version .

Note 2:

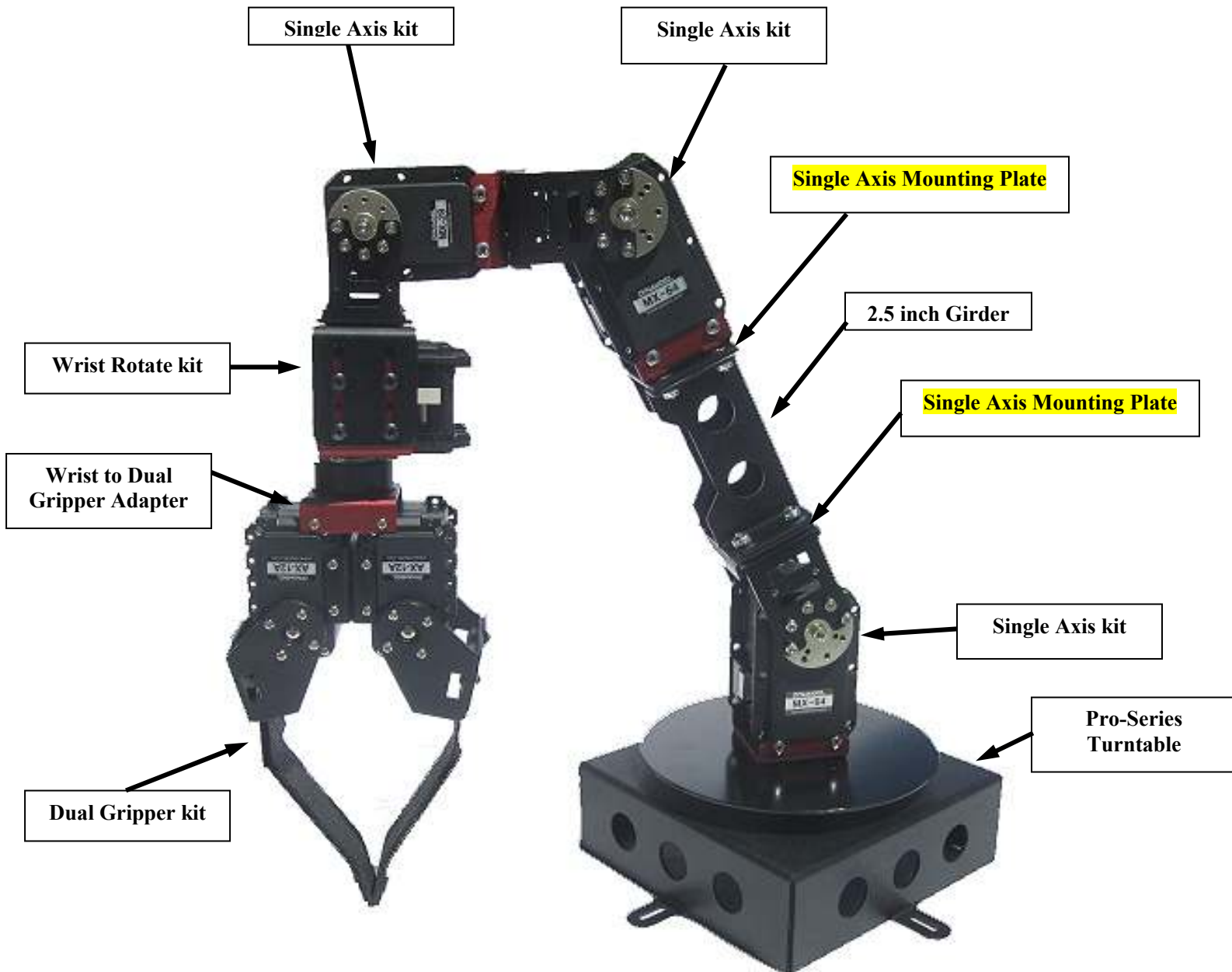
The servo types selected above are only used as an example illustration. Any combination of servo types (MX-28, MX-64 and MX-106) can be substituted.

CRUSTCRAWLER PRO-SERIES PARTS GUIDE

The illustration below provides an example of the most common parts that are required to build a custom robotic arm using Crustcrawler's Pro-Series of modular components.

Note 1: When transitioning from a single axis to a girder and/or a girder to a single axis, a “**Single Axis Mounting Plate**” is needed for each transition.

Note 2: When transitioning from an MX-64 or MX-106 Single Axis to an MX-28 Wrist Rotate assembly, the **MX-64/106 Axis to MX-28 Wrist Rotate Adapter** is required.



Example #3 Parts List

- (1) MX-28T Pro-Series Turntable
- (2) MX-64T Pro-Series Single Axis kits
- (2) Pro-Series Single Axis Mounting Plates
- (1) 2.5 inch (6.35cm) Pro Series Girder
- (1) MX-28T Pro-Series Single Axis kit
- (1) MX-28T Pro-Series Wrist Rotate kit
- (1) Pro-Series Wrist to Dual Gripper Adapter
- (1) Dual gripper kit with (2) AX-12A Servos
- (2) 12 inch (30.48cm) 3-pin wire extensions

Note 1:

The parts list above reflects the use of the MX-106T, MX-64T and MX-28T actuators. If you have selected the MX-106R, MX-64R and MX-28R actuators, then substitute the 12inch (30.48cm) 3-pin wire extension with the 12inch (30.48cm) 4-pin version.

Note 2:

The servo types selected above are only used as an example illustration. Any combination of servo types (MX-28, MX-64 and MX-106) can be substituted.

MX-Series Servo Technical Data

MX-28T

Description		Qty
DYNAMIXEL	MX-28T	1
HORN	RX28 HN07-N101	1
WASHER	Thrust Washer	1
CABLE	3P Cable 200mm	1
BOLT/NUT	Wrench Bolt M2.5*6	16pcs
	Wrench Bolt M2.5*8	1
	Wrench Bolt M2*3	10pcs
	Nut M2.5	18pcs

SPECIFICATIONS:

Product name	DYNAMIXEL MX-28T		
Weight	72g		
Dimension	35.6mm x 50.6mm x 35.5mm		
Gear Ratio	193 : 1		
Operation Voltage (V)	10	12	14.8
Stall Torque (N.m)	2.3	2.5	3.1
Stall Current (A)	1.3	1.4	1.7
No Load Speed (RPM)	50	55	67
Motor	Maxon Motor		
Minimum Control Angle	About 0.088 degrees x 4,096		
Operating Range	Actuator Mode : 360 degrees Wheel Mode : Endless turn		
Operating Voltage	10~14.8V (Recommended voltage : 12V)		
Operating Temperature	-5C ~ 80C		
Command Signal	Digital Packet		
Protocol	Half duplex Asynchronous Serial Communication (8 bit, 1 stop, No Parity)		
Link (physical)	TTL Multi Drop Bus (daisy chain type connector)		
ID	254 ID (0~253)		
Baud Rate	8000bps ~ 4.5Mbps		
Feedback Functions	Position, Temperature, Load, Input Voltage, etc.		
Material	Case : Engineering Plastic Gear : Full Metal		
Position Sensor	Contactless absolute encoder		
Default	ID #1 - 57600bps		
Compatible Product	Click : Compatibility Chart		
Drawings	Click : 2D and 3D		
e-Manual	Click : http://support.robotis.com		

MX-28R

Description		Qty
DYNAMIXEL	MX-28R	1
HORN	RX28 HN07-N101	1
WASHER	Thrust Washer	1
CABLE	4P Cable 200mm	1
BOLT/NUT	Wrench Bolt M2.5*6	16pcs
	Wrench Bolt M2.5*8	1
	Wrench Bolt M2*3	10pcs
	Nut M2.5	18pcs

SPECIFICATIONS:

Product name	DYNAMIXEL MX-28R		
Weight	72g		
Dimension	35.6mm x 50.6mm x 35.5mm		
Gear Ratio	193 : 1		
Operation Voltage (V)	10	12	14.8
Stall Torque (N.m)	2.3	2.5	3.1
Stall Current (A)	1.3	1.4	1.7
No Load Speed (RPM)	50	55	67
Motor	Maxon Motor		
Minimum Control Angle	About 0.088 degrees x 4,096		
Operating Range	Actuator Mode : 360 degrees Wheel Mode : Endless turn		
Operating Voltage	10~14.8V (Recommended voltage : 12V)		
Operating Temperature	-5C ~ 80C		
Command Signal	Digital Packet		
Protocol	Half duplex Asynchronous Serial Communication (8 bit, 1 stop, No Parity)		
Link (physical)	RS-485 Multi Drop Bus (daisy chain type connector)		
ID	254 ID (0~253)		
Baud Rate	8000bps ~ 4.5Mbps		
Feedback Functions	Position, Temperature, Load, Input Voltage, etc.		
Material	Case : Engineering Plastic Gear : Full Metal		
Position Sensor	Contactless absolute encoder		
Default	ID #1 - 57600bps		
Compatible Product	Click : Compatibility Chart		
Drawings	Click : 2D and 3D		
e-Manual	Click : http://support.robotis.com		

MX-64T

Description		Qty
DYNAMIXEL	MX-64T	1
HORN	HN05-N102 (MX Exclusive)	1
WASHER	Thrust Washer	1
CABLE	3P Cable 200mm	1
BOLT/NUT	Wrench Bolt M2.5*4	16pcs
	Wrench Bolt M3*8	1pcs
	Nut M2.5	18pcs

SPECIFICATIONS:

Product Name	MX-64T		
Weight	126g		
Dimension	40.2mm x 61.1mm x 41mm		
Gear Ratio	200 : 1		
Operation Voltage (V)	10	12	14.8
Stall Torque (N.m)	5.5	6	7.3
Stall Current (A)	3.9	4.1	5.2
No Load Speed (RPM)	58	63	78
Motor	Maxon Motor		
Minimum Control Angle	About 0.088 degrees x 4,096		
Operating Range	Actuator Mode : 360 degrees Wheel Mode : Endless turn		
Operating Voltage	10~14.8V (Recommended voltage : 12V)		
Operating Temperature	-5C ~ 80C		
Command Signal	Digital Packet		
Protocol	Half duplex Asynchronous Serial Communication (8bit,1 stop, No Parity)		
Link (physical)	TTL Multi Drop (daisy chain type connector)		
ID	254 ID (0~253)		
Baud Rate	8000bps ~ 4.5Mbps		
Feedback Functions	Position, Temperature, Load, Input Voltage, Current , etc.		
Material	Case : Engineering Plastic Gear : Full Metal		
Position Sensor	Contactless, absolute encoder		
Default	ID #1 – 57600bps		
Compatible Product	Click : Compatibility Chart		
Drawings	Click : 2D and 3D		
e-Manual	Click : http://support.robotis.com		

MX-64R

Description		Qty
DYNAMIXEL	MX-64R	1
HORN	HN05-N102 (MX Exclusive)	1
WASHER	Thrust Washer	1
CABLE	4P Cable 200mm	1
BOLT/NUT	Wrench Bolt M2.5*4	16pcs
	Wrench Bolt M3*8	1pcs
	Nut M2.5	18pcs

SPECIFICATIONS:

Product Name	MX-64R		
Weight	126g		
Dimension	40.2mm x 61.1mm x 41mm		
Gear Ratio	200 : 1		
Operation Voltage (V)	10	12	14.8
Stall Torque (N.m)	5.5	6	7.3
Stall Current (A)	3.9	4.1	5.2
No Load Speed (RPM)	58	63	78
Motor	Maxon Motor		
Minimum Control Angle	About 0.088 degrees x 4,096		
Operating Range	Actuator Mode : 360 degrees Wheel Mode : Endless turn		
Operating Voltage	10~14.8V (Recommended voltage : 12V)		
Operating Temperature	-5C ~ 80C		
Command Signal	Digital Packet		
Protocol	Half duplex Asynchronous Serial Communication (8bit,1 stop, No Parity)		
Link (physical)	RS-485 Multi Drop Bus (daisy chain type connector)		
ID	254 ID (0~253)		
Baud Rate	8000bps ~ 4.5Mbps		
Feedback Functions	Position, Temperature, Load, Input Voltage, Current , etc.		
Material	Case : Engineering Plastic Gear : Full Metal		
Position Sensor	Contactless absolute encoder		
Default	ID #1 – 57600bps		
Compatible Product	Click : Compatibility Chart		
Drawings	Click : 2D and 3D		
e-Manual	Click : http://support.robotis.com		

MX-106T

Description		Qty
DYNAMIXEL	MX-106T	1
HORN	HN05-N102 (MX Exclusive)	1
WASHER	Thrust Washer	1
CABLE	3P Cable 200mm	1
BOLT/NUT	Wrench Bolt M2.5*4	16pcs
	Wrench Bolt M3*8	1pcs
	Nut M2.5	18pcs

SPECIFICATIONS:

Product Name	MX-106T		
Weight	153g		
Dimension	40.2mm x 65.1mm x 46mm		
Gear Ratio	225 : 1		
Operation Voltage (V)	10	12	14.8
Stall Torque (N.m)	8.0	8.4	10.0
Stall Current (A)	4.8	5.2	6.3
No Load Speed (RPM)	41	45	55
Motor	Maxon Motor		
Minimum Control Angle	About 0.088 degrees x 4,096		
Operating Range	Actuator Mode : 360 degrees Wheel Mode : Endless turn (Position Control)		
Operating Voltage	10~14.8V (Recommended voltage : 12V)		
Operating Temperature	-5C ~ 80C		
Command Signal	Digital Packet		
Protocol	Half duplex Asynchronous Serial Communication (8bit,1 stop, No Parity)		
Link (physical)	TTL Multi Drop Bus (daisy chain type connector)		
ID	254 ID (0~253)		
Baud Rate	8000bps ~ 4.5Mbps		
Feedback Functions	Position, Temperature, Load, Input Voltage, Current , etc.		
Material	Case : Engineering Plastic Gear : Full Metal		
Position Sensor	Contactless absolute encoder		
Default	ID #1 – 57600bps		
Compatible Product	Click : Compatibility Chart		
Drawings	Click : 2D and 3D		
e-Manual	Click : http://support.robotis.com		

MX-106R

Description		Qty
DYNAMIXEL	MX-106R	1
HORN	HN05-N102 (MX Exclusive)	1
WASHER	Thrust Washer	1
CABLE	4P Cable 200mm	1
BOLT/NUT	Wrench Bolt M2.5*4	16pcs
	Wrench Bolt M3*8	1pcs
	Nut M2.5	18pcs

SPECIFICATIONS:

Product Name	MX-106R		
Weight	153g		
Dimension	40.2mm x 65.1mm x 46mm		
Gear Ratio	225 : 1		
Operation Voltage (V)	10	12	14.8
Stall Torque (N.m)	8.0	8.4	10.0
Stall Current (A)	4.8	5.2	6.3
No Load Speed (RPM)	41	45	55
Motor	Maxon Motor		
Minimum Control Angle	About 0.088 degrees x 4,096		
Operating Range	Actuator Mode : 360 degrees Wheel Mode : Endless turn (Position Control)		
Operating Voltage	10~14.8V (Recommended voltage : 12V)		
Operating Temperature	-5C ~ 80C		
Command Signal	Digital Packet		
Protocol	RS485 Asynchronous Serial Communication (8bit,1stop, No Parity)		
Link (physical)	RS485 Multi Drop Bus (daisy chain type connector)		
ID	254 ID (0~253)		
Baud Rate	8000bps ~ 4.5Mbps		
Feedback Functions	Position, Temperature, Load, Input Voltage, Current, etc.		
Material	Case : Engineering Plastic Gear : Full Metal		
Position Sensor	Contactless absolute encoder		
Default	ID#:1 – 57600bps		
Compatible Product	Click : Compatibility Chart		
Drawings	Click : 2D and 3D		
e-Manual	Click : http://support.robotis.com		