Series 1780 Dynamometer User Manual V2.2

Manual SKU#: PHAX

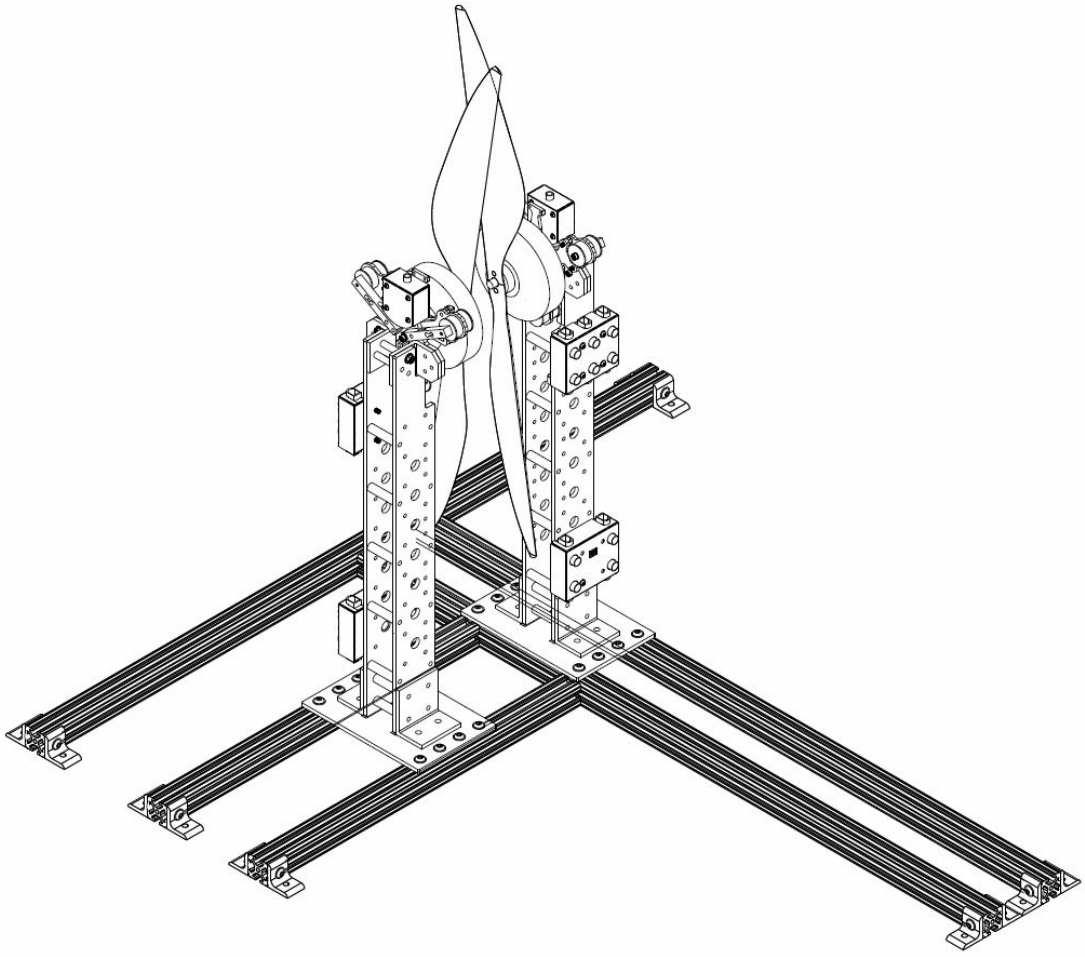

Image above shows the Series 1780 V2 coaxial version, with the optional no-solder board and two-axis ground railing system sold separately.

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Chapter 1: Introduction

This is a user manual for the customers who purchased the **Series 1780 Dynamometer V2**, in order to demonstrate all important information about preparing, assembling and using this dynamometer. If you need the user manual for the original Series 1780 Dynamometer V1, please contact us.

The user manual of the Series 1780 is regularly updated. To ensure you have accurate information and to ensure you have the latest version of the manual, we ask you to download the latest PDF copy from our website:

https://rcbenchmark.gitlab.io/docs/en/

IMPORTANT!

We highly recommend that all operators who will be working with this machine carefully read this user manual in its entirety, before carrying out any operation on the Series 1780.

Please notice that not following the instructions in this user manual may result in testing errors, malfunction of the dynamometer, serious injuries, or death of the operator.

In this manual, any text following a # represents the RCbenchmark SKU# for this item. You may refer to this number to order spare parts.

The Series 1780 dynamometer contains several major units: the load measurement units, the power measurement unit, the main board, and the fixtures. Every box may contain one or multiple bags of fasteners. Please keep them in the boxes until you need to use them.

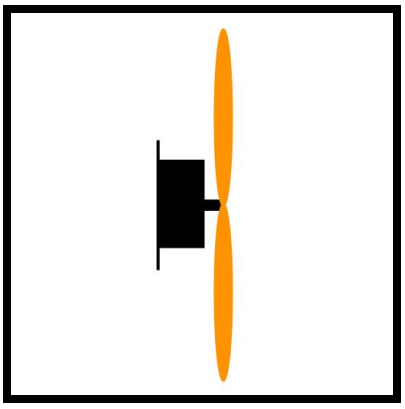
All load measurement units, the 25kgf-12Nm version A side (#TRAK) & B side (#GDBA), and the 40kgf-18Nm version A side (#GYJT) & B side (#EPDY) are extremely sensitive to any external forces. All the load measurement units come with a protective shell, within their own boxes. Do not take it out until you need to mount it onto the support. And when you unmount the load measurement unit from the support, please place it back into the protective casing. For further information about how to store and keep a valid warranty on this unit, please refer to section 4.2.1 of this manual.

1.1 Determine your configuration

Currently, the Series 1780 Dynamometer offers the following configurations:

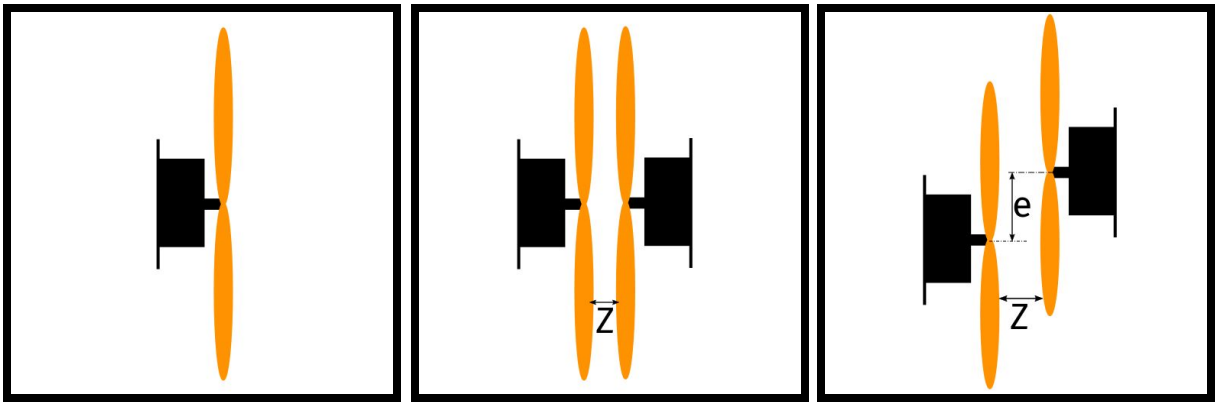
Series 1780 Dynamometer: Single-motor
25kgf-100A (#KHYER) and 40kgf-150A (#KTBKA)

- For characterizing one brushless motor
- Voltage, current, thrust, torque and RPM measurement
- Upgradable to any coaxial version (purchase necessary)



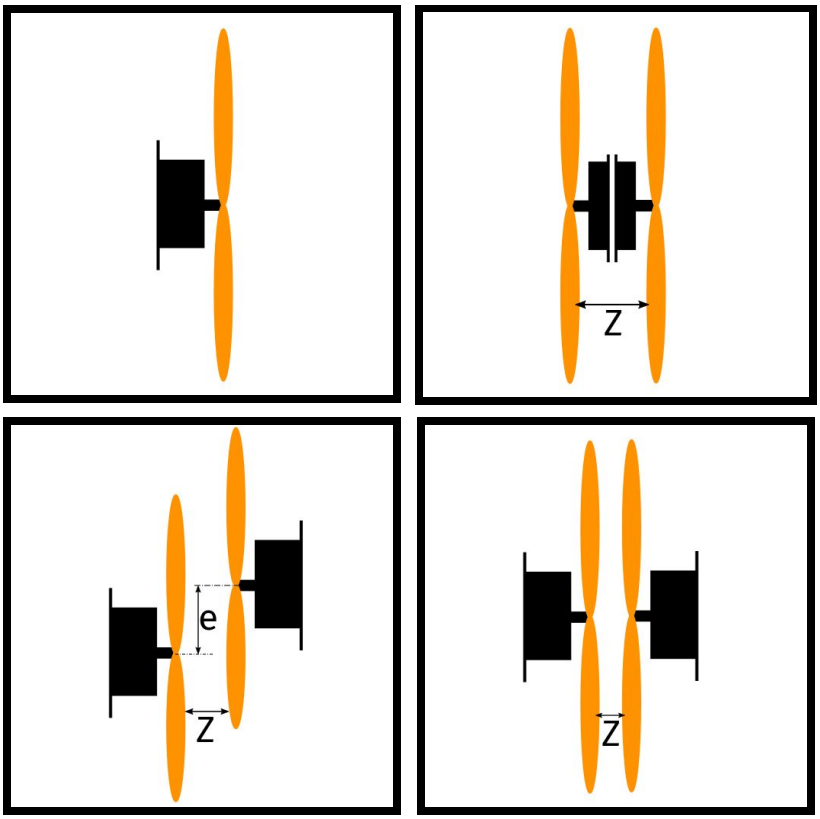
Series 1780 Dynamometer: Basic coaxial
25kgf-100A (#KYQXD) and 40kgf-150A (#KDAPQ)

- For characterizing one and two brushless motors
- Voltage, current, thrust, torque and RPM measurements for each motor
- Adjustable axial and radial distance (with railing system)
- Simultaneous control on both motors
- Individual and global data for the propulsion system
- Support the following setups:



Series 1780 Dynamometer: Ultimate coaxial
25kgf-100A (#KCHQB) and 40kgf-150A (#KDRHP)

- For characterizing two brushless motors
- Voltage, current, thrust, torque and RPM measurements for each motor
- Minimum axial distance for a back-to-back setup: 100mm
- Adjustable axial and radial distance (with railing system)
- Simultaneous control on both motors
- Individual and global data for the propulsion system
- Support the following setups:



Please verify your order and invoice about which configuration you purchased from us.

1.2 Item checklists for your dynamometer

Before you use these checklists, please check which configuration you purchased from us. If unsure please contact us.

1.2.1 Series 1780 Dynamometer 25kgf-100A: Single-motor (SKU#:KHYER)

Please check the following items are in the carton:

- Load measurement unit 25kgf-12Nm: A side (SKU#: TRAK) x1
- Mono main board V2 (SKU#: RHGQ) x1
- Main board power adapter (SKU#: PGAC) x1
- Power & control console 100A: A side (SKU#: AQJT) x1
- Fixture brackets and fasteners box (SKU#: XJEA) x1
- Support plates in wrap (SKU#: YREP) x1
- Motor mount V2 (SKU#: ETHR) x1
- Hand tools kit V2 (SKU#: DBHQ) x1
- General user manual (SKU#: PHAX) x1
- Mechanical safety stop (SKU#: UTPF) x1

1.2.2 Series 1780 Dynamometer 40kgf-150A: Single-motor (SKU#:KTBKA)

Please check the following items are in the carton:

- Load measurement unit 40kgf-18Nm: A side (SKU#: GYJT) x1
- Mono main board V2 (SKU#: RHGQ) x1
- Main board power adapter (SKU#: PGAC) x1
- Power & control console 150A: A side (SKU#: RBEP) x1
- Fixture brackets and fasteners box (SKU#: XJEA) x1
- Support plates in wrap (SKU#: YREP) x1
- Motor mount V2 (SKU#: ETHR) x1
- Hand tools kit V2 (SKU#: DBHQ) x1
- General user manual (SKU#: PHAX) x1
- Mechanical safety stop (SKU#: UTPF) x1

1.2.3 Series 1780 Dynamometer 25kgf-100A: Basic coaxial (SKU#:KYQXD)

Please check the following items are in the carton:

- Load measurement unit 25kgf-12Nm: A side (SKU#: TRAK) x1
- Load measurement unit 25kgf-12Nm: B side (SKU#: GDBA) x1
- Dual main board V2 (SKU#: GPDE) x1
- Main board power adapter (SKU#: PGAC) x1
- Power & control console 100A: A side (SKU#: AQJT) x1
- Power & control console 100A: B side (SKU#: YGKE) x1
- Fixture brackets and fasteners box (SKU#: XJEA) x2
- Support plates in wrap (SKU#: YREP) x2
- Motor mount V2 (SKU#: ETHR) x2
- Hand tools kit V2 (SKU#: DBHQ) x1
- General user manual (SKU#: PHAX) x1
- Mechanical safety stop (SKU#: UTPF) x2

1.2.4 Series 1780 Dynamometer 40kgf-150A: Basic coaxial (SKU#:KDAPQ)

Please check the following items are in the carton:

- Load measurement unit 40kgf-18Nm: A side (SKU#: GYJT) x1
- Load measurement unit 40kgf-18Nm: B side (SKU#: EPDY) x1
- Dual main board V2 (SKU#: GPDE) x1
- Main board power adapter (SKU#: PGAC) x1
- Power & control console 150A: A side (SKU#: RBEP) x1
- Power & control console 150A: B side (SKU#: GAPD) x1
- Fixture brackets and fasteners box (SKU#: XJEA) x2
- Support plates in wrap (SKU#: YREP) x2
- Motor mount V2 (SKU#: ETHR) x2
- Hand tools kit V2 (SKU#: DBHQ) x1
- General user manual (SKU#: PHAX) x1
- Mechanical safety stop (SKU#: UTPF) x2

1.2.5 Series 1780 Dynamometer 25kgf-100A: Ultimate coaxial (SKU#:KCHQB)

Please check the following items are in the carton:

- Load measurement unit 25kgf-12Nm: A side (SKU#: TRAK) x1
- Load measurement unit 25kgf-12Nm: B side (SKU#: GDBA) x1
- Coaxial Back-to-back Special Mounting (SKU#: JCTX) x1
- Dual main board V2 (SKU#: GPDE) x1
- Main board power adapter (SKU#: PGAC) x1
- Power & control console 100A: A side (SKU#: AQJT) x1
- Power & control console 100A: B side (SKU#: YGKE) x1
- Fixture brackets and fasteners box (SKU#: XJEA) x2
- Support plates in wrap (SKU#: YREP) x2
- Motor mount V2 (SKU#: ETHR) x2
- Hand tools kit V2 (SKU#: DBHQ) x1
- General user manual (SKU#: PHAX) x1
- Mechanical safety stop (SKU#: UTPF) x2

1.2.6 Series 1780 Dynamometer 40kgf-150A: Ultimate coaxial (SKU#:KDRHP)

Please check the following items are in the carton:

- Load measurement unit 40kgf-18Nm: A side (SKU#: GYJT) x1
- Load measurement unit 40kgf-18Nm: B side (SKU#: EPDY) x1
- Coaxial Back-to-back Special Mounting (SKU#: JCTX) x1
- Dual main board V2 (SKU#: GPDE) x1
- Main board power adapter (SKU#: PGAC) x1
- Power & control console 150A: A side (SKU#: RBEP) x1
- Power & control console 150A: B side (SKU#: GAPD) x1
- Fixture brackets and fasteners box (SKU#: XJEA) x2
- Support plates in wrap (SKU#: YREP) x2
- Motor mount V2 (SKU#: ETHR) x2
- Hand tools kit V2 (SKU#: DBHQ) x1
- General user manual (SKU#: PHAX) x1
- Mechanical safety stop (SKU#: UTPF) x2

1.2.7 Accessories

If you purchased any of these accessories, you can find them in the carton that comes with your Series 1780 Dynamometer (any configuration):

- Series 1780 temperature probe (SKU#: JTKB)
- Series 1780 no-solder board V2 (SKU#: HABT)
- Series 1780 air-speed probe (SKU#: BJPK)
- Series 1780 XLCH motor mount (SKU#: LXMF)

If you purchased any railing systems or enclosures, most of the items will come in a separate carton. However, the fasteners and the fixture plates for the ground railing systems may be within the same carton of your Series 1780 Dynamometer. Please follow the detailed checklist in Chapter 3 in order to locate these items.

Chapter 2: General safety rules

Always put safety first! It is your responsibility!

It is extremely important to stay alert and to know how each item works. Read this part for yourself, and make sure all your colleagues who will be potentially working on the Series 1780 have carefully read this guide before using the dynamometer.

This part will not cover details about how to assemble the Series 1780 Dynamometer, neither about how to connect the electrical components. For these operations, please refer to their proper chapters within this manual. However, you should still read through this chapter before moving on to the next steps.

The following instructions apply on both operating and maintenance personnel and must be followed during all phases of operations, service, testing and repair of this instrument.

To ensure safety, please follow these instructions:

1. Before construction make sure all your tools are in good condition and don't need to be replaced. Learn the tools application, limitations, and possible hazards.
2. Inspect all fasteners before every experiment and as often as possible.
3. Make sure to use properly rated cables for the power.
4. Do not use power tools in the presence of flammable liquids or gases.
5. Always keep your work area clean, do not work on surfaces that are dirty with oil. Small metal chips may be blown up and hit the propeller by accident. Clean your testing room before every test.
6. Respect the Murphy's law. If you think something might go wrong, it will.
7. Make sure you are dressed for safety. The load cell parts may be sharp, wear gloves all along the assembly. Do not wear jewelry or inappropriate clothing when operating the tool.
8. Do not let children around the Series 1780 dynamometer.
9. Never force the tool to do a job for which it was not designed or outside its specifications. Using the tool outside of its official specifications will void the warranty and is at your own risk.
10. Do not use or assemble the tool alone.

11. Do not substitute parts or modify the instrument.
12. Always disconnect the power source before making adjustments, changing parts, cleaning or working on the tool.
13. Do not store anything near or above the tool, especially in function.
14. Always keep your tools clean, in good working order.
15. Do not operate the tool if you are under the influence of drugs, alcohol, or medication that may affect your ability to properly use the tool.
16. Do not open and touch the electrical circuits inside the enclosures (No-solder Board, Power & control control, Main board, Force sensor circuit). Do not change or modify the electrical circuit.
17. Respect the working conditions concerning the power, voltage and current of the motors that you use on the Series 1780 Dynamometer.
18. Make sure you are running all your tests in a safe space. You should have some protection. Such as an enclosure or a safety cage, in order to shield and protect when the propeller breaks apart on its spinning surface.
19. The safety cage or the enclosure should be suitably rated for containing a propeller failure. It should also protect in case the Series 1780 comes apart (loose screw or mechanical failure).
20. Make sure nobody is in the room or near the propeller in function.
21. Wait for the propeller to stop spinning before accessing the testing area.
22. Make sure all the parts have time to cool down after any test. The motor, ESC, batteries and wires may be hot. Please keep a fire extinguisher available in the proximity.
23. Make sure a protective surface is between you and the propeller in function. Wear protective glasses at all times while in the same room.
24. For the installation of the components in the Series 1780, please always refer to the proper chapter in this manual. Always use the given fasteners, following their proper instructions to make sure the proper fasteners are used and are well tightened. Confirm the structure’s rigidity every time before any tests.
25. Unbalanced propellers and extreme vibrations can lead to fatigue failure of some aluminum components and/or the load cells. Please ensure the unit is completely enclosed in the safety area and inspect all parts before performing a test.

26. Note that unbalanced propellers may cause resonances and powerful vibrations. It may result in structure failure, and can endanger someone. If you find your structure vibrating due to resonances, stop the test as soon as possible.

27. If you are using your own built fixtures, make sure they are rigid enough to support your loads.

28. Ground railing systems and the enclosures must be fixed on the ground properly. They cannot be left free on the ground.

29. Do not approach the Series 1780 before cutting off the power

30. If using ground rails, after each adjustment of position, ensure the fasteners between the fixture plate and the rail are properly tightened.

31. Never forget about the lock washers, they are important to resist high vibration from the propulsion system.

Chapter 3: Ground fixations and enclosure

IMPORTANT!

You should prepare the ground fixtures before assembling the Series 1780 Dynamometer. This applies both for your own mounting methods, or if using our ground railing system.

The Series 1780 Dynamometer offers an option to purchase the ground railing system and the enclosure as accessories with your Series 1780 Dynamometer order. If you wish to add this to your dynamometer, please visit our online store or contact us at info@rcbenchmark.com

The ground rails assist you to fix the whole Series 1780 Dynamometer on the ground. For the customers who purchased the Series 1780 single-motor configuration, these rails function as a fixture jig. For the customers who purchased the Series 1780 coaxial configurations, these rails will allow 1-axis or 2-axis linear movements, in order to adjust the axial and/or radial distances between two propellers.

The Series 1780 enclosures contain several T-slotted beams. It provides ground fixing and some protections for the Series 1780. You may need to add the metal meshes and the Plexiglas accordingly. Currently, we cannot fully guarantee the safety as the mesh was not designed to fully stop the debris from flying out of the enclosure. No matter if you have this type of enclosure or not, any personnel should never stay near the spinning propellers, especially on their rotation surfaces.

You can also build your own ground fixtures, enclosures or safety cages for the Series 1780. We will present some ideas and examples about how to build these in the following sections.

Always remember, you are responsible for the safety of using the Series 1780 Dynamometer.

3.1 Mounting options

IMPORTANT!

Using no fixture, or leaving the Series 1780 improperly secured may cause permanent damage to the load measurement unit, or cause damage to your facility, or even cause casualties. Check the safety guide for more information.

In this section, we will present several possibilities to fix the Series 1780 on the ground. You have several methods at your disposal, depending on your available resources and depending on the components you purchased (railing system and/or enclosure).

The base of the Series 1780 is made of two corner brackets, which together form the following hole pattern:

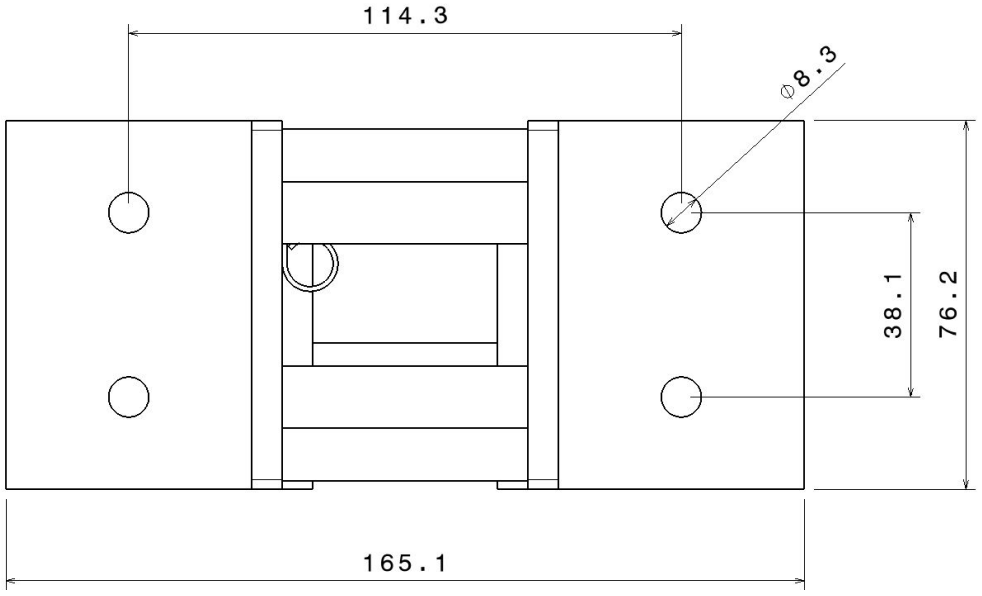


Fig. 3.1: Hole pattern for fixing the Series 1780 to a structure. All annotations in mm. Four holes available for M8 or 5/16” bolt, X distance at 114.3 mm, Y distance at 38.1 mm.

If you purchased any of our railing system accessories, you will also have a fixture base plate (#KGTP) as shown in Fig. 3.2. Even if you don’t use the railing system, you may find this fixture plate helpful in attaching your Series 1780 to your own structure.

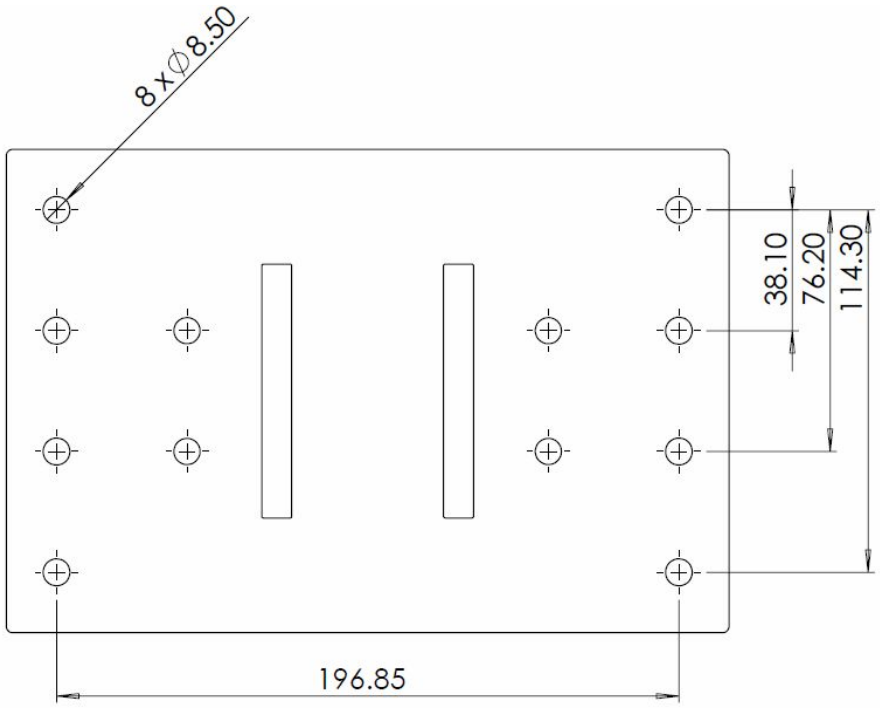


Fig. 3.2: Fixture base plate (#KGTP): adapter to place and hold the S1780 on the rails. This part comes with the railing system accessory, or can be purchased separately.

In summary here are some available mounting options:

- RCbenchmark railing system without enclosure
- RCbenchmark railing system with enclosure
- Directly bolted to the floor
- Bolted to your own structure
- Bolted to Plywood and weights

3.1.2 Floor bolts

If you have not purchased our railing system, please follow the instructions in this section (floor bolts) or the next section (floor plywood) to fix your Series 1780 on the floor. In order to use floor bolts, you must drill the floor or have a structure available.

When drilling holes in the ground, please use caution and follow the instructions from the bolts suppliers to properly insert adapters and the bolt cover inside the concrete. We recommend to have a technician in civil engineering to examine your building's security and to assist you for the installation of the floor bolts. You should also get the approval from your building manager.

3.1.3 Plywood on the floor

If your facility does not allow to drill into the concrete flooring, you may use a large piece of plywood and place heavy weights in each corner of the plywood, along with rubber pads to increase friction between the plywood and the floor. There is a high bending moment at the base of the tool, make sure to use washers and a sufficiently thick plywood to handle it. Using the fixture plate shown in Fig. 3.2 may help in securing the tool (separate purchase required). The screw heads can easily break through the plywood under heavy load. It is your responsibility to make the base of your structure suitable for supporting the Series 1780.

3.1.4 Accessory: RCbenchmark railing system

If you have purchased one of our Series 1780 ground railing systems, this section will present you how to securely install the rails and the fixture plate.

We currently offer three configurations of railing system:

- Single-motor ground railing system shown in Fig. 3.3 (SKU#: KADXH)
- One-axis ground railing system shown in Fig. 3.4 (SKU#: KBHED)
- Two-axis ground railing system shown in Fig. 3.5 (SKU#: KBJRA)

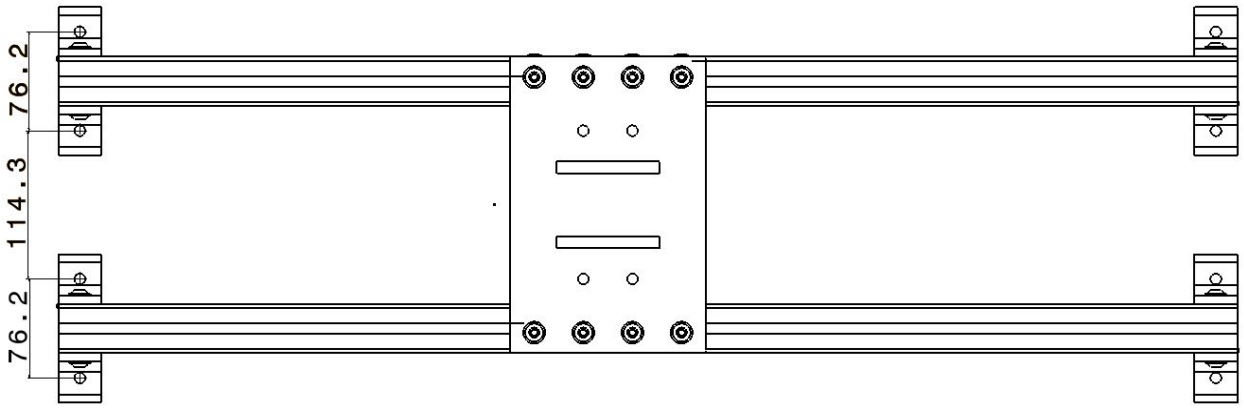


Fig. 3.3: Single-motor railing system (SKU#: KADXH)

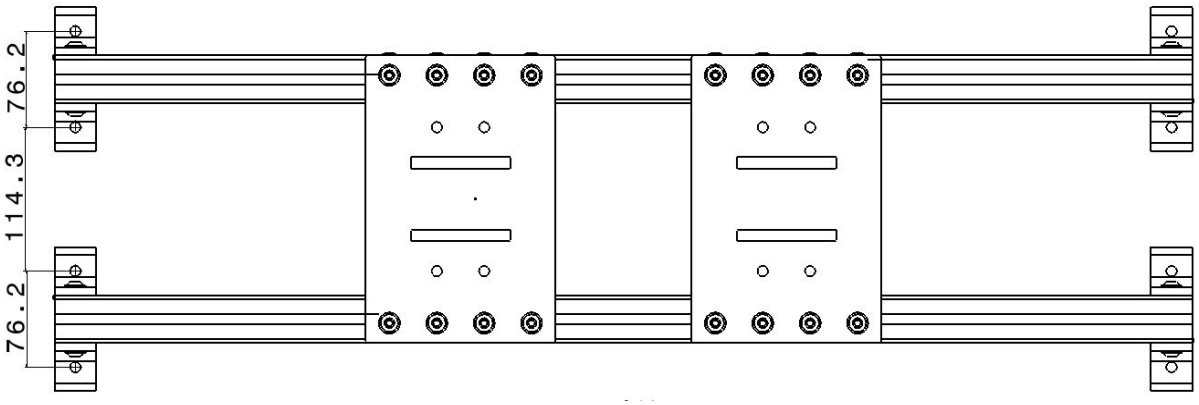


Fig. 3.4: One-axis railing system

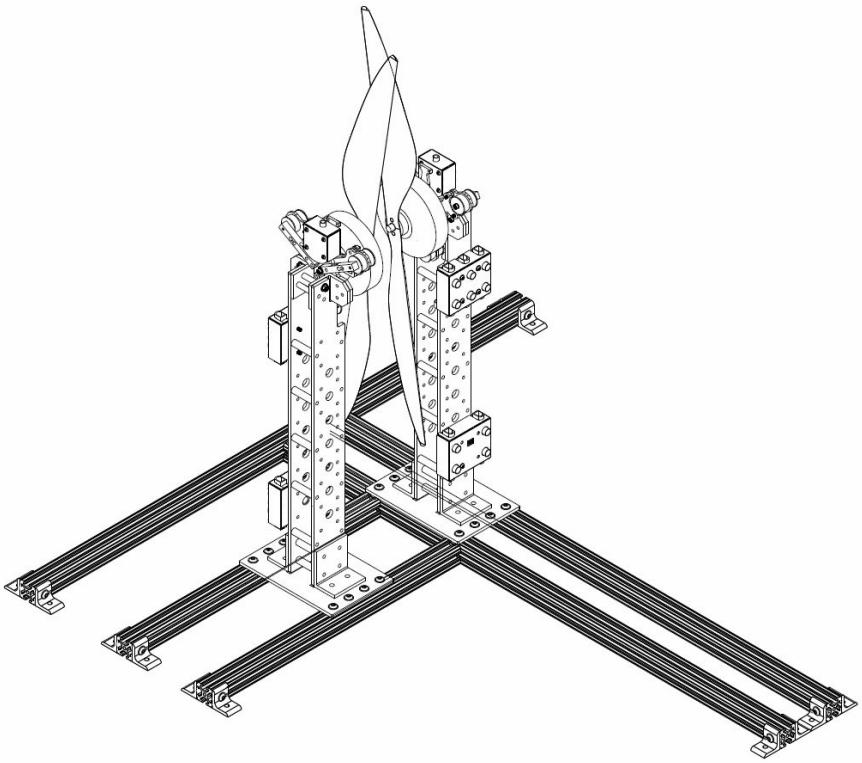


Fig. 3.5: The two-axis ground railing system (SKU#: KBJRA) with the Series 1780 coaxial version installed on the rails. Allows adjusting the radial offset to perform partial propeller overlapping tests.

3.1.4.1 Single-motor railing system: installation

Please unpack the following items before the installation:

Item name	Item SKU	Qty	Located in (SKU# if exist)
Single Rail 1-1/2"x1-1/2" 4ft long	HJXQ	2	Railing system shipping box (#KADXH)
Fixture base plate	KGTP	1	#RTQB
End-feed fastener female part	YREC	8	#TEBK
End-feed fastener screw part	KEDB	8	#TEBK
Corner bracket with fixture screws and fasteners	REGC	8	#QKET
5/16"-18 socket screw - 7/8" length	QPJX	4	#PCDK
5/16"-18 serrated lock nut	JDKA	4	#PCDK
1/2" open end wrench	CEXH	1	#PCDK

Please follow these instructions to install the single-motor railing system:

- ❏ Open two end-feed fasteners for fixture plate bag (#TEBK) and take the female end-feed fastener parts (#YREC)
- ❏ Take two 4 feet T-slotted beams (#HJXQ)
- ❏ Insert four female parts of the end-feed fasteners (#YREC) on the groove into the slot of one beam (#HJXQ). You may insert into any side of the beam, but must keep all four in the same side. Once inserted, turn the beam and make the side with the end-feed fastener parts facing up. As shown in Fig. 3.6.

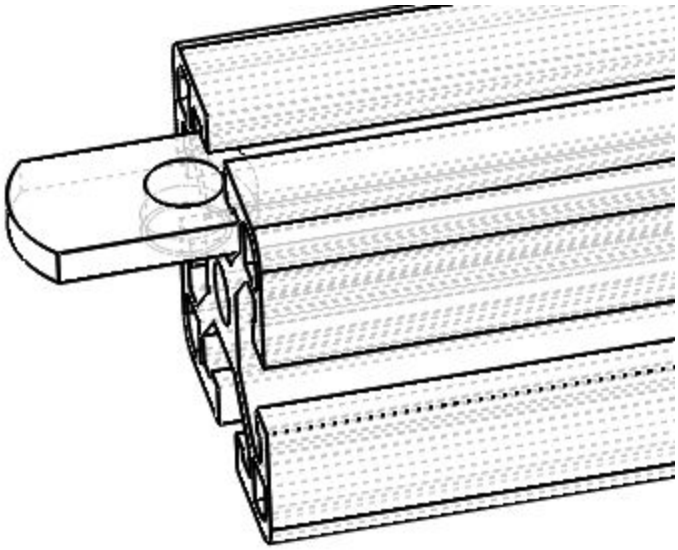


Fig. 3.6: Female part end fastener (#YREC) in the 4ft Single rail (#HJXK)

- ❏ Repeat the previous step for another beam to make two beams with four end-feed fastener female part each.
- ❏ Place the fixture plate (#KGTP) shown in Fig. 3.2 on the top of the two beam and align the eight Diameter 8.50mm holes of the plate with all eight female end-feed fastener parts (#YREC) holes.
- ❏ Take the end-feed fastener screw (#KEDB) out from the fastener bag (#TEBK)

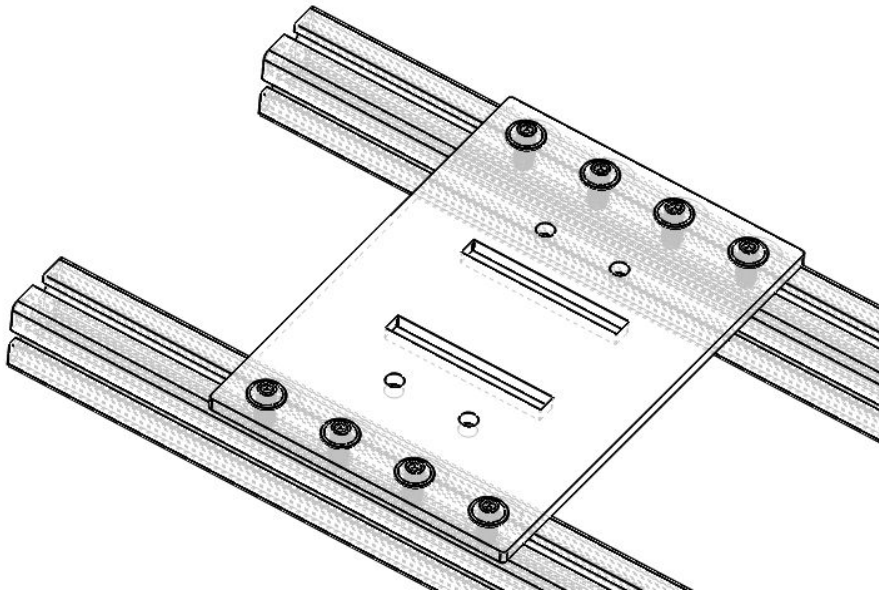


Fig. 3.7: Fixture base plate (#KGTP) fixed on the two beam (#HJXQ) with end feed fasteners

- ❏ Insert the screws to connect the fixture base plate (#KGTP) with the end-feed fasteners (#YREC) in the slotted beam.
- ❏ Adjust the position of the fixture plate on the two rails. Once finished, tighten all eight screws (#KEDB) to firmly fix the plate on the beams.
- ❏ Take one corner brackets (#REGC) to connect with one end-feed fastener in each corner bracket (They are packaged together already). Repeat this step for other seven (a total of eight) corner brackets with fastener assembly.
- ❏ Don't fully tighten the screw into the end-feed fastener in order to allow the corner brackets slide in the groove.
- ❏ Insert the brackets with end-feed fastener into the rail, as shown in Fig. 3.8. Insert two into the left side, two into the right side of each beam.

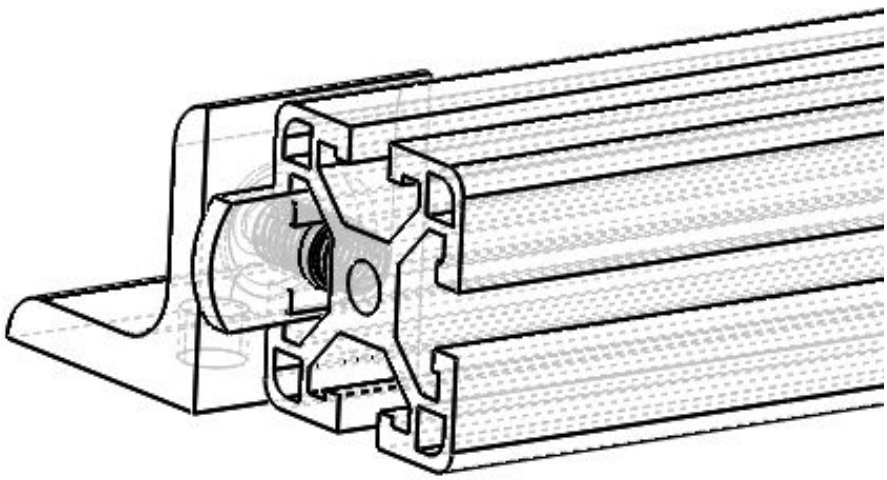


Fig. 3.8: Corner bracket with end-feed fastener (#RGEC) sliding in the beam groove

- ❏ Repeat the last step for another beam.
- ❏ Once inserted, the assembled railing system will look similar to Fig. 3.3.
- ❏ In Fig. 3.3 dimensions are just nominal. You can put this railing system on the floor and fix it with the your own holes on the floor or the plywood.
- ❏ You will have to fully tighten the rails into the floor or the plywood.
- ❏ Double-check all fasteners if they are well fastened.

3.1.4.2 One-axis railing system: installation and linear movement

Please unpack the following items before the installation:

Item name	Item SKU	Qty	Located in (SKU# if exist)
Single Rail 1-1/2"x1-1/2" 4ft long	HJXQ	2	Railing system shipping box (#KBHED)
Fixture base plate	KGTP	2	#RTQB
End-feed fastener female part	YREC	16	#TEBK
End-feed fastener screw part	KEDB	16	#TEBK
5/16"-18 socket screw - 7/8" length	QPJX	8	#DRTQ
5/16"-18 serrated lock nut	JDKA	8	#DRTQ
1/2" open end wrench	CEXH	1	#DRTQ
Corner bracket with fixture screws and fasteners	REGC	8	#PCDK

Please follow this instruction to install the one-axis railing system:

- ❏ Open two end-feed fasteners for fixture plate bag (#TEBK) and take the female end-feed fastener parts (#YREC)
- ❏ Take two 4 feet T-slotted beams (#HJXQ)
- ❏ Insert eight female end-feed fastener parts (#YREC) on the groove of the slot in each beam (#HJXQ), the side of beam with fastener parts should facing up. (See Fig. 3.6)
- ❏ Repeat the last step for another T-slotted beam (#HJXQ)
- ❏ Put two fixture plates (#KGTP) on the top of the two beams and align them with eight 8.50mm holes of each plate with the end-feed fastener parts holes. (See Fig. 3.7)
- ❏ Rotate the end-feed fastener screws (#KEDB) into the female end-feed fastener part through the fixture base plate. Adjust to an appropriate position for two plates, and then tighten all 16 screws, as shown in Fig. 3.9.

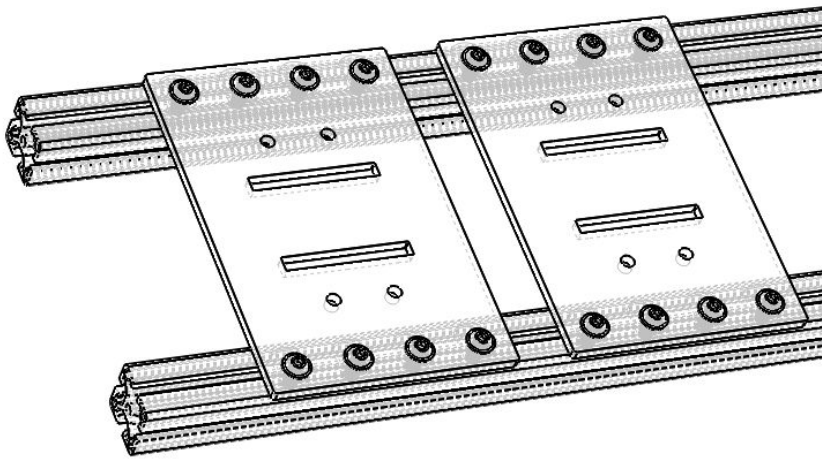


Fig. 3.9: Two Fixture base plates (#KGTP) fixed on the two beams (#HJXQ) with end feed fasteners (#TEBK)

- ❏ Take one corner bracket (#REGC) to connect with one end-feed fastener in each corner bracket. Repeat this step for other seven (a total of eight) corner brackets with fastener assembly.
- ❏ Don't fully tighten the screw into the end-feed fastener in order to allow the corner brackets slide in the groove.
- ❏ Insert the brackets with end-feed fastener into the rail, as shown in Fig. 3.8. Insert two into the left side, two into the right side of each beam. (See Fig. 3.8)
- ❏ Values are just nominal. You can put this railing system on the floor and fix it with the holes on the floor or on the plywood.
- ❏ If you want to move the plates just untighten a little bit the screws (#EKDB) and drag the plates on the beam.
- ❏ Repeat the last step for another beam.
- ❏ Once inserted, the assembled railing system will look similar to Fig. 3.4.

3.1.4.3 Two-axis railing system: installation and linear movements

Please unpack the following items before the installation:

Item name	Item SKU	Qty	Located in (SKU# if exist)
Single Rail 1-1/2"x1-1/2" 4ft long	HJXQ	3	Railing system shipping box (#KBJRA)
Single Rail 1-1/2"x1-1/2" 2ft long	QDXE	2	
Fixture base plate	KGTP	2	#RTQB
End-feed fastener female part	YREC	12	#TEBK
End-feed fastener screw part	KEDB	12	#TEBK
Corner bracket with fixture screws and fasteners	REGC	18	#ATGX
5/16"-18 socket screw - 7/8" length	QPJX	8	#DRTQ
5/16"-18 serrated lock nut	JDKA	8	#DRTQ
1/2" open end wrench	CEXH	1	#DRTQ

Please follow this instruction to assemble the two-axis railing system

- ❏ Take the three 4 feet beams (#HJXQ)
- ❏ We will first start with the radial axis unit.
- ❏ Take the four L corner brackets (#REGC) out. And then for each L corner bracket, insert one end-feed fastener in each side, to make both sides of the L bracket have the end-feed fastener female part (#YREC).
- ❏ Insert the corner brackets into the slots on the left and right side the two **4 feet** beams (#HJXQ), as shown in Fig. 3.11. Don't tighten the screw with the end-feed fastener completely in order to allow the corner brackets slide in the groove.

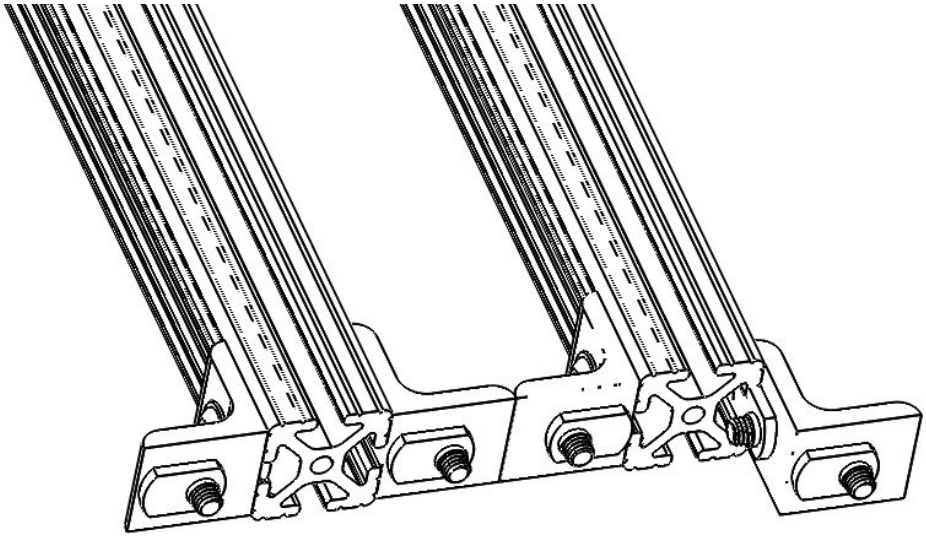


Fig. 3.11: Four corner brackets (#REGC) with end-feed fastener on 4ft beam (#HJXQ)

- ❏ Repeat the previous step to place corner brackets on another beam (#HJXQ), as shown in Fig. 3.11.
- ❏ Take the extra 4 feet beam (#HJXQ), and slide it through the end feed fasteners that are free on the other side of four L corner brackets from the two beams assembled in the previous step, as shown in Fig. 3.12.

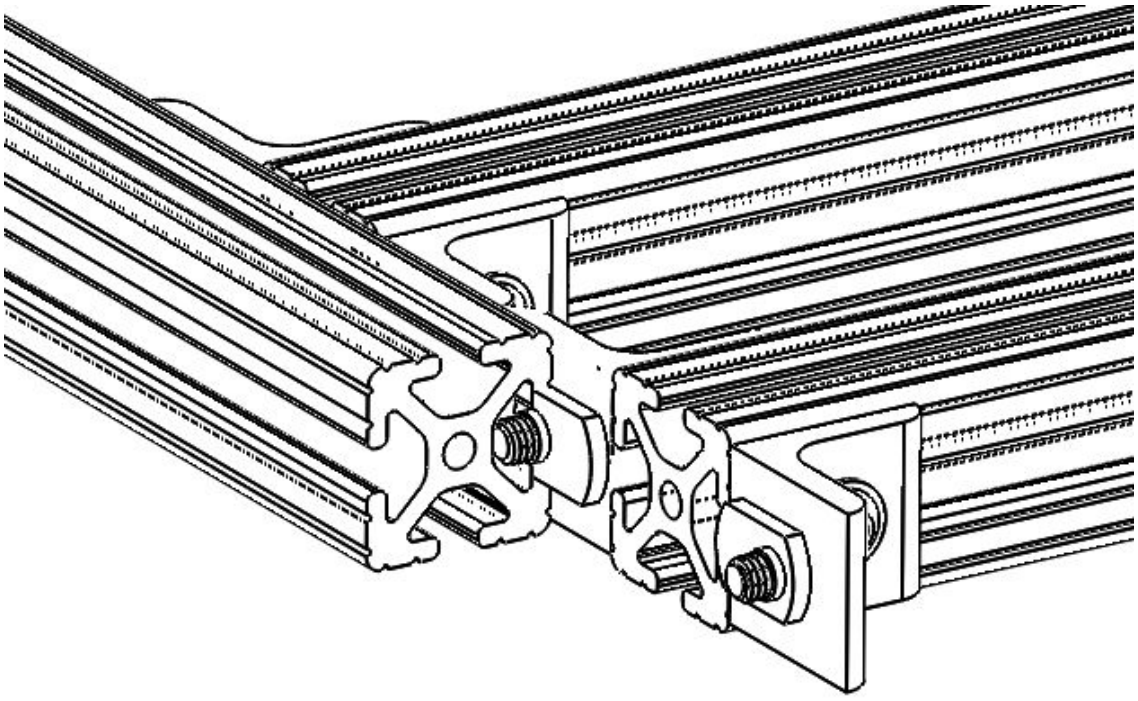


Fig. 3.12: 4ft beam(#HJXQ) through the end feed fasteners four corner brackets (#REGC)

- ❏ Open an end-feed fasteners for fixture plate bag (#TEBK).
- ❏ Insert **two** female parts of the end-feed fasteners (#YREC) on the groove into the slot of one beam (#HJXQ). You may insert into any side of the beam, but must keep all four in the same side. Once inserted, turn the beam and make the side with the end-feed fastener parts facing up. As shown in Fig. 3.6.
- ❏ Repeat the previous step for another beam to make two beams with **two** end-feed fastener female part each.
- ❏ Place the fixture plate (#KGTP) on the top of the two beam and align the four Diameter 8.50mm holes of the plate with all eight female end-feed fastener parts (#YREC) holes.
- ❏ Take the end-feed fastener screw (#KEDB) out from the fastener bag. Insert the screws to connect the fixture base plate (#KGTP) with the end-feed fasteners (#YREC) in the slotted beam.
- ❏ Adjust the position of the fixture plate on the two rails. Once finished, tighten all eight screws (#KEDB) to firmly fix the plate on the beams.

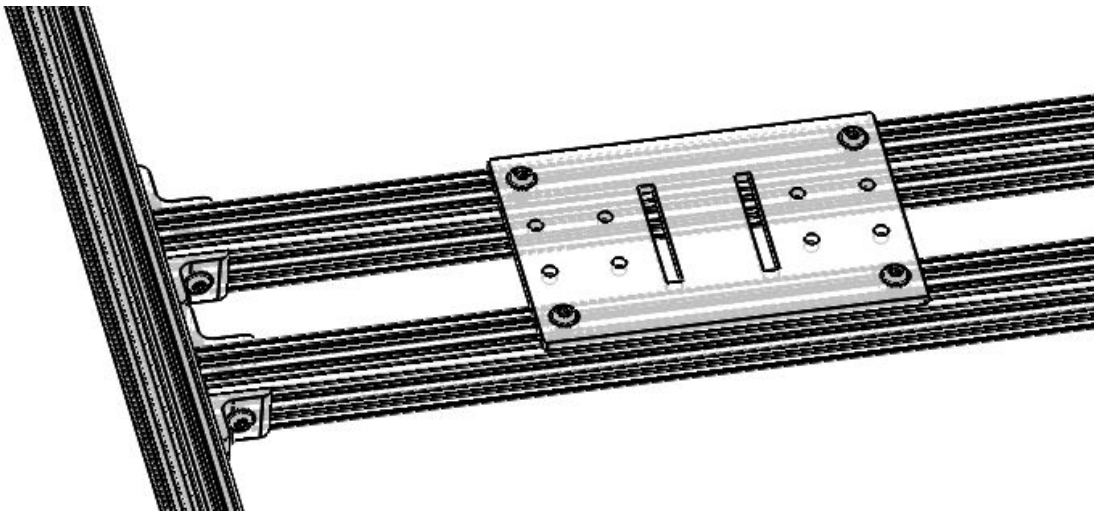


Fig. 3.13: Fixture base plate (#KGT) fixed on the two beam (#HJXQ) with end feed fasteners (#TEBK)

- ❏ You can now move on to assemble the axial axis unit
- ❏ Take two corner brackets (#REGC) and attach it with two end-feed fasteners, one on each side of the L bracket.
- ❏ Take two **2 feet rails** (#QDXE) and insert one corner bracket, only on the left side of the one beam and the right side of another beam, see Fig. 3.14.

- ❏ Slide one **4 feet** beam (#HJXQ) to insert into the end-feed fasteners on the L brackets of these two **2 feet** beam (#QDXE), see Fig. 3.14.

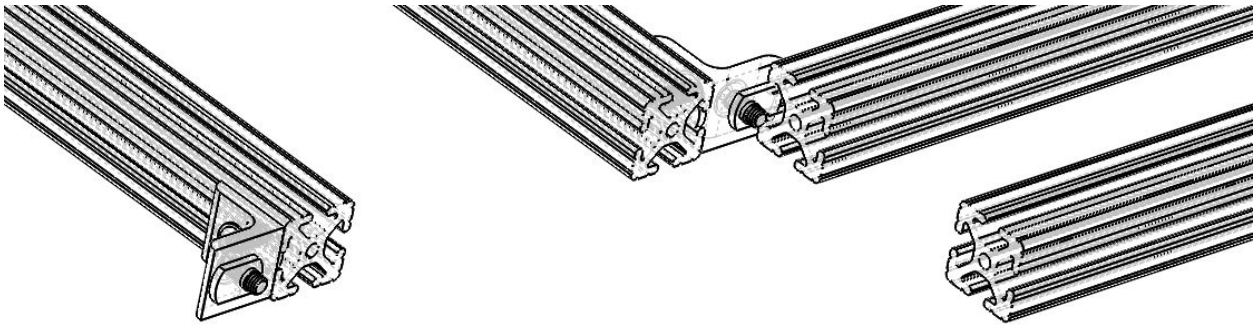


Fig. 3.14: 2ft beam (#QDXE) with corner brackets sliding in one 4ft beam (#HJXQ).

- ❏ Open the two others end-feed fasteners for fixture plate bag (#TEBK).
- ❏ Insert four female parts of the end-feed fasteners (#YREC) on the groove into the slot of one of the beam (#QDXE). You may insert into any side of the beam, but must keep all four in the same side. Once inserted, turn the beam and make the side with the end-feed fastener parts facing up. As shown in Fig. 3.15.
- ❏ Repeat the previous step for another **2 feet beam** to make both beams with four end-feed fastener female part each.
- ❏ Place the fixture plate (#KGTP) on the top of the two beam and align the eight Diameter 8.50mm holes of the plate with all eight female end-feed fastener parts (#YREC) holes.
- ❏ Take the 5/16”-18 ⅞” length screw (#KEDB) out from the fastener bag (#TEBK). Insert the screws to connect the fixture base plate (#KGTP) with the end-feed fasteners (#YREC) in the slotted beam.
- ❏ Adjust the position of the fixture plate on the two rails. Once finished, tighten all eight screws (#KEDB) to firmly fix the plate on the beams.

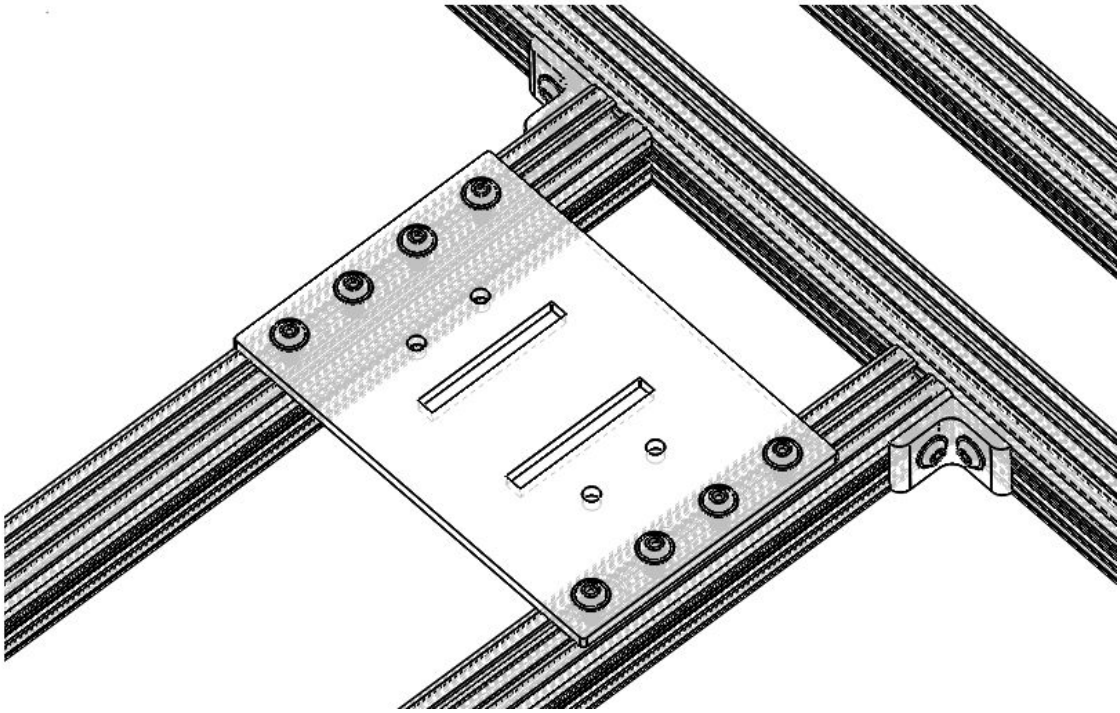


Fig. 3.15 : Fixture base plate (#KGT) fixed on the two 2ft beam (#QDXE) with end feed fasteners (#TEBK)

- ❏ Take one corner bracket (#REGC) to connect with one end-feed fastener in each corner bracket. Repeat this step for other eleven (a total of twelve) corner brackets with fastener assembly.
- ❏ Don't fully tighten the screw into the end-feed fastener in order to allow the corner brackets slide in the groove.
- ❏ Insert the brackets with end-feed fastener into the rail, as shown in Fig. 3.8. Insert two into the left side, two into the right side of each beam.
- ❏ Repeat the last step for another beam.
- ❏ Once inserted, the assembled railing system will look similar to Fig. 3.16.
- ❏ If you want to move the plates (#KGTP) just untighten a little bit the screws (#EKDB) and drag the plates on the beam.

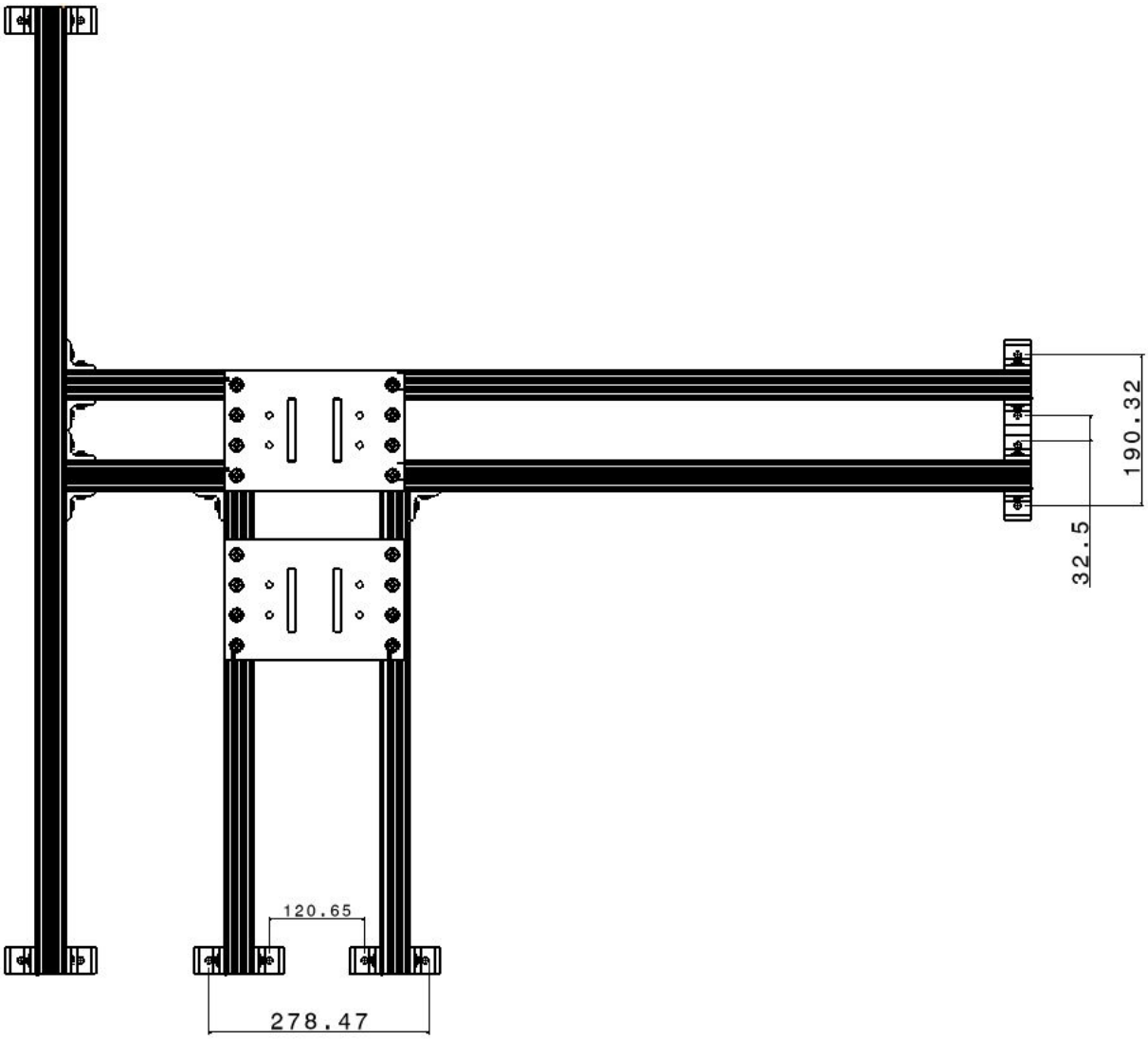


Fig. 3.16: Assembled two-axis railing system

- ❏ In Fig. 3.16 dimensions are just nominal. You can put this railing system on the floor and fix it with the your own holes on the floor or the plywood.
- ❏ You will have to fully tighten the rails into the floor or the plywood.

3.2 Design your own railing system

We proposed several solutions in section 3.1 of this chapter, using plywood or ground bolts to fix the Series 1780 Dynamometer on the floor. We usually recommend our customers to purchase our ground railing systems, as a turn-key solution, where you obtain all components and they have been tested in our facility. Alternatively you can build your own railing system.

When you decide to design and build your own ground fixtures, please be aware that RCbenchmark does not guarantee the functionality of your own design fixtures. You must be cautious about the dimension of the frames, the profiles and the length of these slotted frames. Besides, You must have proper fasteners and corner brackets to support these frames and to hold the Series 1780 Dynamometer in place.

RCbenchmark is not responsible for any damage caused by your custom ground fixture.

3.3 Accessory: RCbenchmark enclosure (available soon)

If you purchased the RCbenchmark enclosure, this part will guide you to securely install the enclosure.

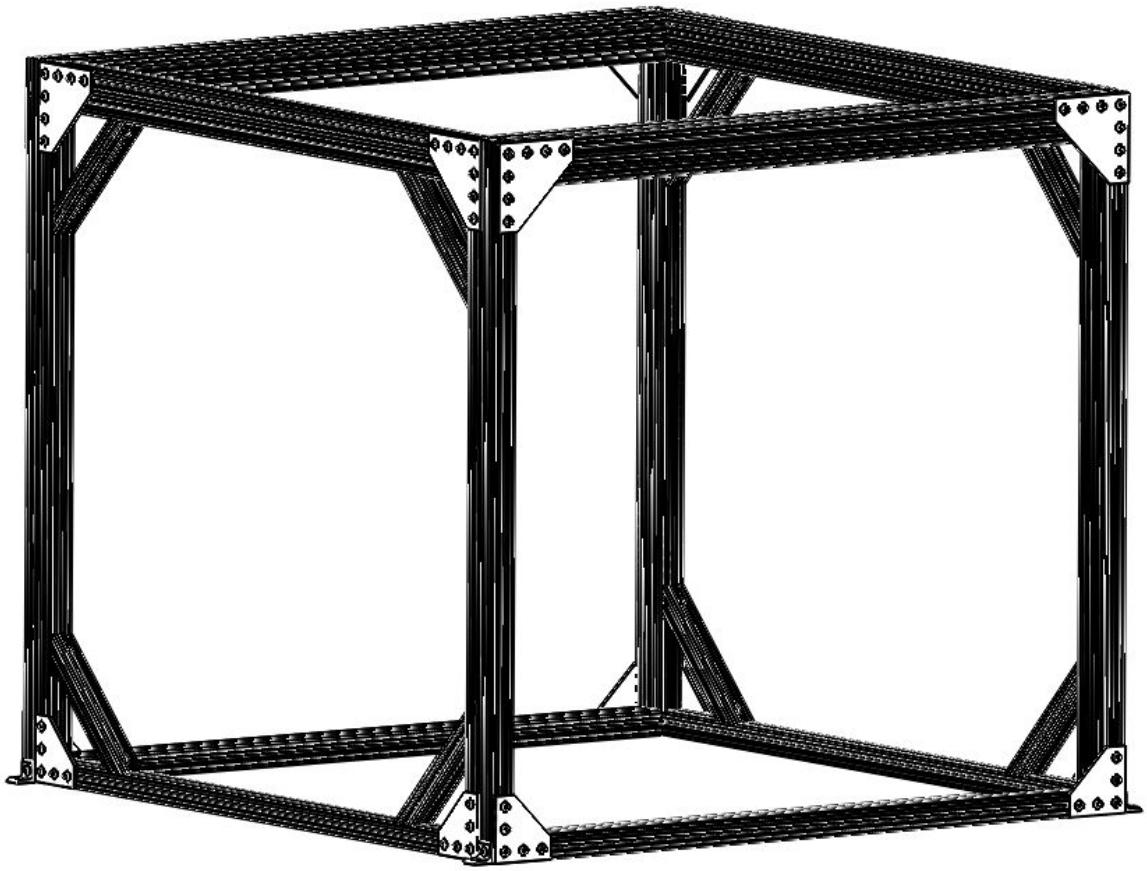


Fig. 3.17: RCbenchmark enclosure. The 4'x4'x4' configuration (SKU#: KXAEC) is shown here.

3.3.1 Additional safety aspects - specific to enclosure

Before installing and using the Series 1780 enclosure, please keep in mind:

1. The enclosure cannot fully protect high-speed debris coming out, always stay far away from the the spinning propeller.
2. The enclosure does not have any mesh in the front and in the back, keep away from those area.
3. Never approach the enclosure until the propeller fully stops.

4. Never enter the enclosure without first disconnecting the power source.
5. If possible, place the whole enclosure in an isolated room.
6. Install the enclosure with the proper fasteners and given tools.
7. Reinforce the structure with the proper corner brackets.
8. To reduce tripping hazards, manage the cables using the given cable tie-wraps.
9. Never work alone to install the enclosure.
10. When you need to move the enclosure, please make sure you have companion to help.

3.3.2 What's included in the enclosure

Before using the bill of material to check the items, please verify your invoice in order to confirm which size of enclosure you purchased:

- Small enclosure 4' Width x 4' Depth x4' Height shown in Fig. 3.17 (SKU#: KXAEC)
- Medium enclosure 4' Width x 4' Depth x 6' Height (SKU#: KYPEX)
- Large enclosure 6' Width x 4' Depth x 6' Height (SKU#: KARXT)

Small enclosure 4'x4'x4' package content (SKU#: KXAEC):

- 1-½" x 1-½" T-slotted frame 4' long (#YJTA) x2
- 1-½" x 3" T-slotted frame 4' long (#CXQK) x8
- 3" x 3" T-slotted frame 4' long (#YTDK) x2
- Diagonal beam 12" long (#JTKA) x8
- Surface corner bracket 5 holes (#XRPJ) x8
- Corner bracket (#REGC) x4
- Surface corner bracket 7 holes (#YTPX) x8
- Bag end-feed fasteners (#TEBK) x2

Medium enclosure 4'x4'x6' package content (SKU#: KYPEX):

- 1-½" x 1-½" T-slotted frame 4' long (#YJTA) x2
- 1-½" x 3" T-slotted frame 4' long (#CXQK) x4
- 1-½" x 3" T-slotted frame 6' long (#XGEH) x4
- 3" x 3" T-slotted frame 4' long (#YTDK) x2
- Diagonal beam 12" long (#JTKA) x8
- Surface corner bracket 5 holes (#XRPJ) x8
- Corner bracket (#REGC) x4
- Surface corner bracket 7 holes (#YTPX) x8

- Bag end-feed fasteners (#TEBK) x2

Large enclosure 6'x4'x6' package content (SKU#: KARXT):

- 1-½" x 1-½" T-slotted frame 6' long (#AGHK) x2
- 1-½" x 3" T-slotted frame 4' long (#CXQK) x2
- 1-½" x 3" T-slotted frame 6' long (#XGEH) x6
- 3" x 3" T-slotted frame 4' long (#YTDK) x2
- Diagonal beam 12" long (#JTKA) x8
- Surface corner bracket 5 holes (#XRPJ) x8
- Corner bracket (#REGC) x4
- Bag end-feed fasteners (#TEBK) x2
- Surface corner bracket 7 holes (#YTPX) x8

Before you work on the enclosure, please ensure you have the proper hand tools. These tools are packed in a transparent reclosable bag inside the carton of the Series 1780 Dynamometer:

- ¼" drive hex allen key (SKU#: QYHR) x1
- 3/16" drive hex allen key (SKU#: TRHE) x1
- 7/16" wrench (SKU#: DBTQ) x1

3.3.3 Enclosure installation steps

In this part, we will present you the instruction to unpack the package, to prepare the components, to securely install the enclosure and tighten all necessary fasteners.

IMPORTANT!

Assemble in the place where you want to use the enclosure. Once fully assembled, the enclosure weighs at least 80kg (175 lbs) and its minimum size is 4'x4'x4' (1.21mx1.21mx1.21m).

There are multiple enclosure configurations, however the methodology to assemble all the components is always the same.

- ❑ Take one 1-½" x 3" T-slotted frame 4' long (#CXQK)
- ❑ Take two 5 holes corner bracket (#XRPJ).
- ❑ In each hole put an end feed fastener as seen in Fig. 3.18

- ❏ Drag the 5 holes in each side of the 1-½" x 3" T-slotted frame 4' long in the one groove side (Fig. 3.20).

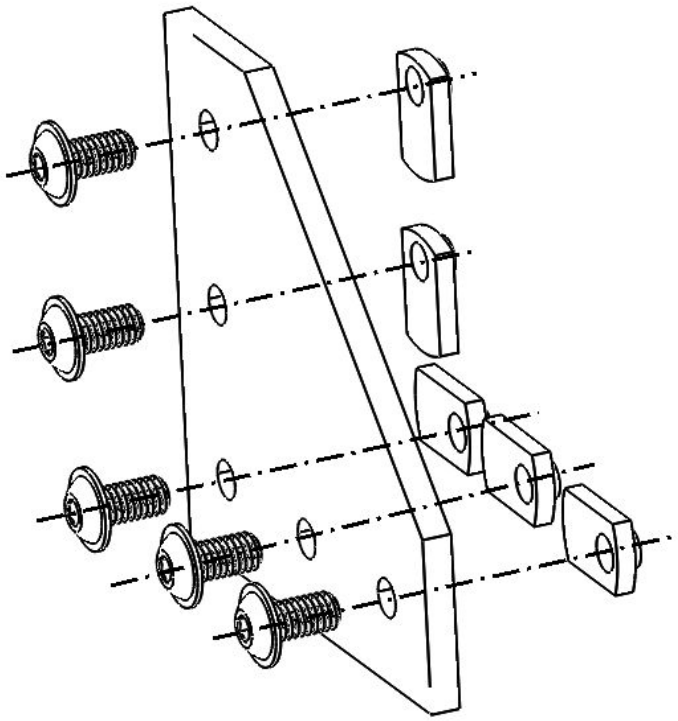


Fig. 3.18: 5 holes corner bracket with end feed fasteners

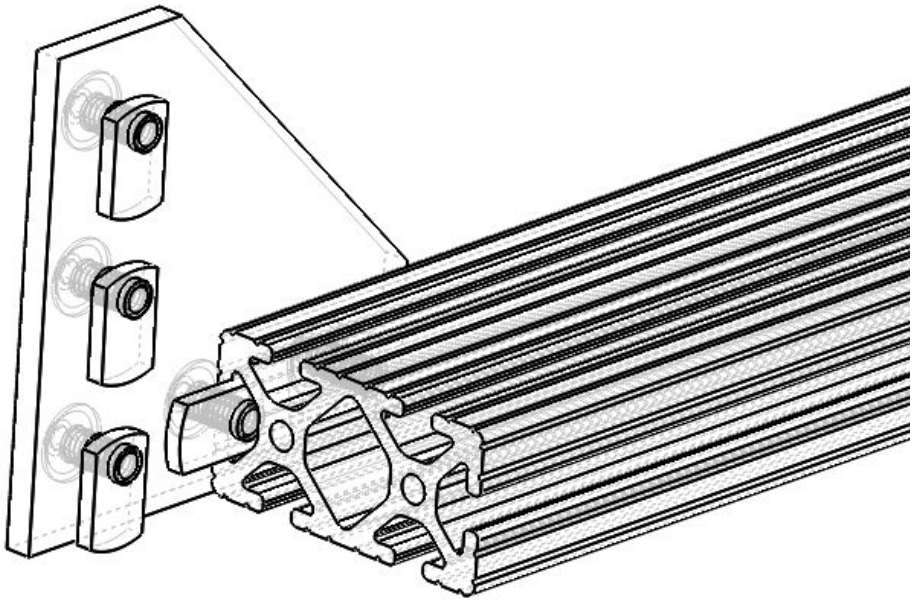


Fig. 3.19: Five holes corner bracket on 1-½" x 3" T-slotted frame

- ❏ Take a 1-½" x 3" T-slotted frame (can be a 4' or 6' beam).
- ❏ In the one groove side insert a diagonal beam 12" long (#JTKA), as shown in Fig. 3.20.

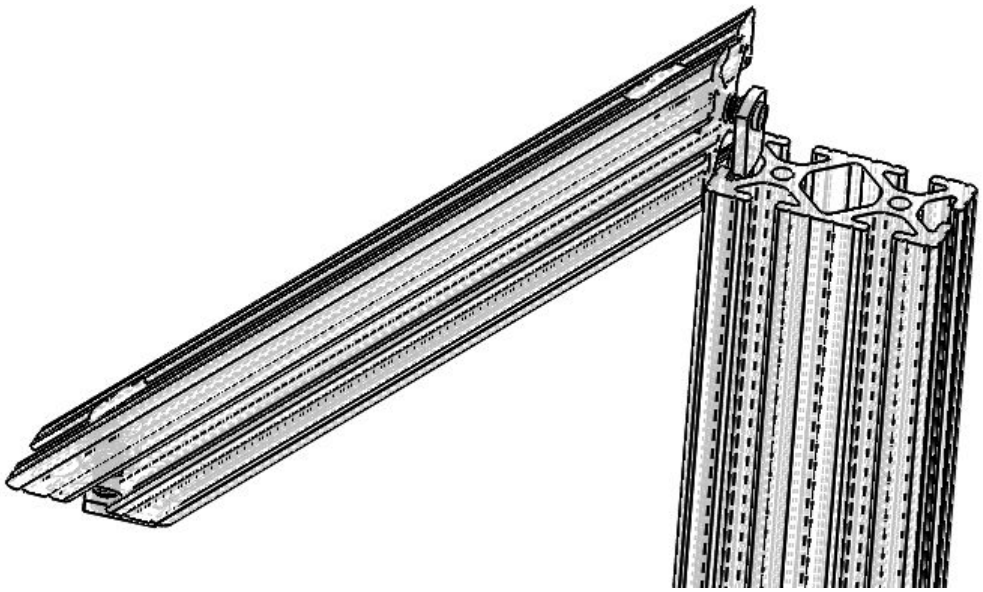


Fig. 3.20: Diagonal beam through the 1-½" x 3" T-slotted frame

- ❏ Take one corner bracket (#REGC) and put one end feed fastener on this.
- ❏ In the two groove side insert another 5 holes corner bracket (#XRPJ) in one groove and one corner bracket in the other groove as shown in Fig. 3.21.

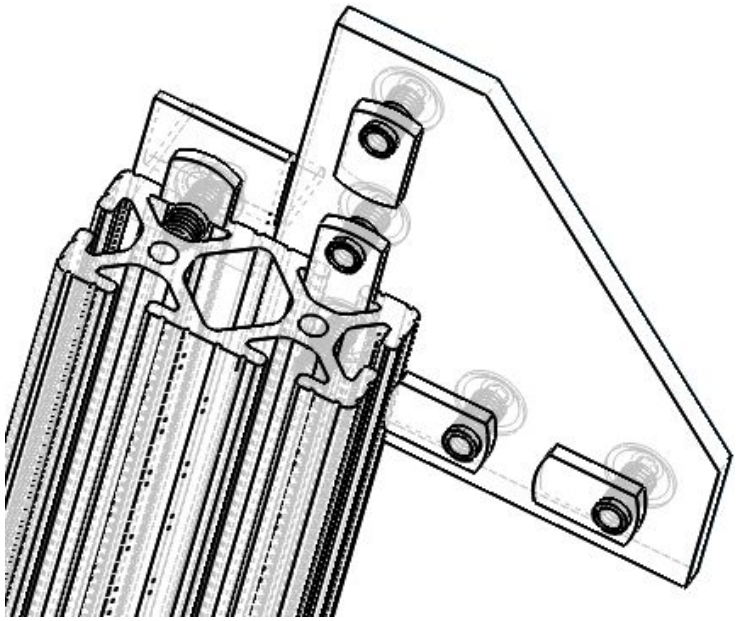


Fig. 3.21: Corner bracket and 5 holes corner bracket on the 1-½" x 3" T-slotted frame.

- ❏ Pass this beam through the 5 holes corner bracket and the end fastener and tighten.
- ❏ Do the same thing for the other side.

Fig. 3.22: 1-½" x 3" T-slotted frame with two vertical beams (can be 4' or 6' beams)

- ❏ Repeat these steps in order to make the other part of the enclosure.
- ❏ In each vertical beam (can be 4' or 6' beam) insert a diagonal beam 12" long (#JTKA).

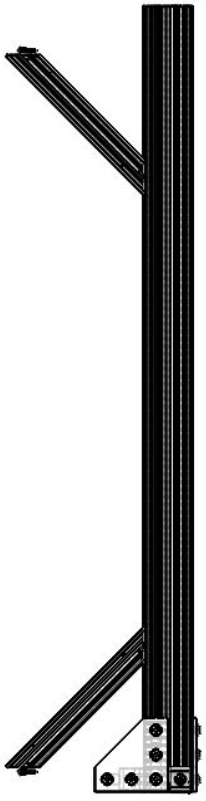


Fig. 3.24: Vertical beam with diagonal beams

- ❏ Take four 7 holes corners brackets (#YTPX)
- ❏ In each hole put an end feed fastener
- ❏ Put the 7 holes corner bracket in each vertical beam on the two groove side.

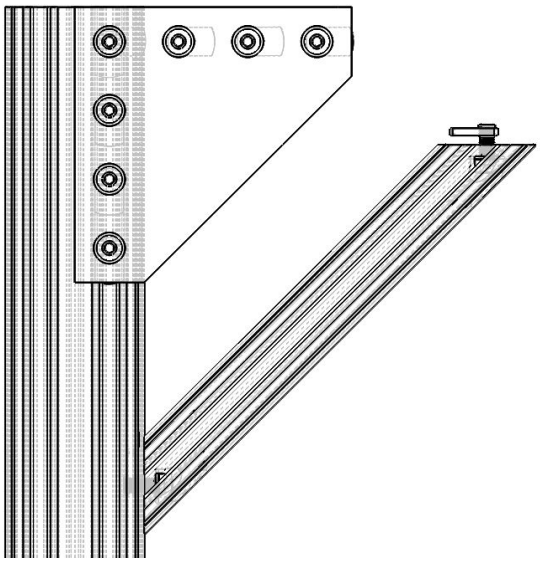


Fig. 3.23: Vertical beam with diagonal beam and 7 holes corner bracket.

- ❏ Take two 7 holes corner bracket (#YTPX) and put in each hole one end feed fastener.
- ❏ Take one 3" x 3" T-slotted frame 4' long (#YTDK) and insert in each side one 7 holes corner bracket (#YTPX). (insert up to the 3rd hole and tighten).

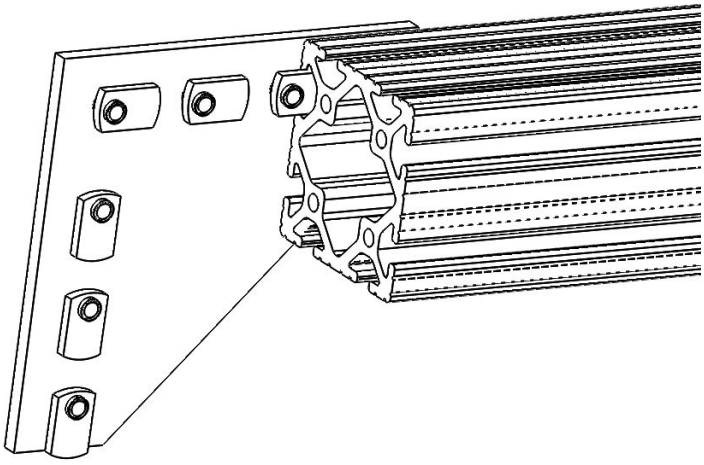


Fig. 3.24: Seven holes corner bracket on 3" x 3" T-slotted frame 4' long

- ❏ Put the beam with the corner brackets through the extension and the vertical beam (can be 4’ or 6’ beam) and tighten.

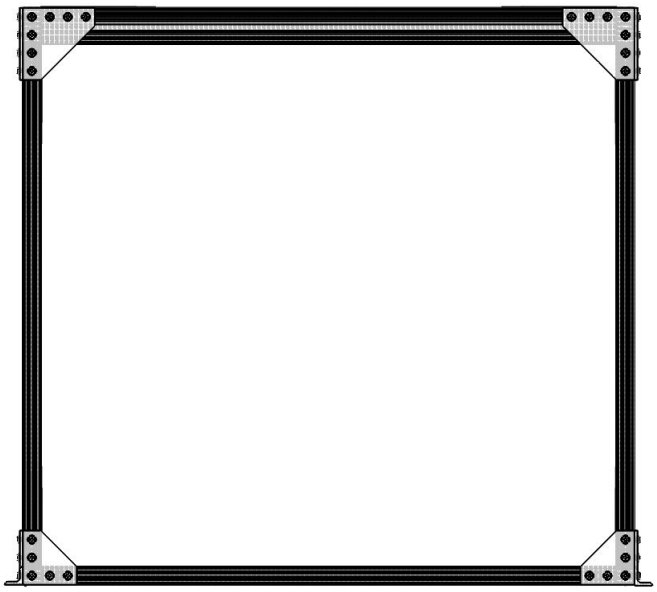


Fig. 3.25: Assembly of one face of the enclosure

- ❏ Do the same thing for the other side
- ❏ Take two 1-½” x 1-½” T-slotted frame 4’ long (can be a 6’ long) and insert them through the 5 holes corner brackets (#XRPJ) and the diagonal beam(#JTKA) and tighten.

Fig. 3.26: Enclosure with the bottom

- ❏ Take two 1-½" x 3" T-slotted frame 4' long (can be a 6' long) and insert them through the 7 holes corner brackets (#YTPX) and the diagonal beam (#JTKA) and tighten.

IMPORTANT!

If you purchased the ground railing system, you should install it now, and continue these steps after. You will need a partially assembled enclosure to fix the ground rails to the enclosure. Follow the ground rail instructions contained in this manual to prepare the ground rails and follow section 3.3.4 to integrate the rails with the enclosure.

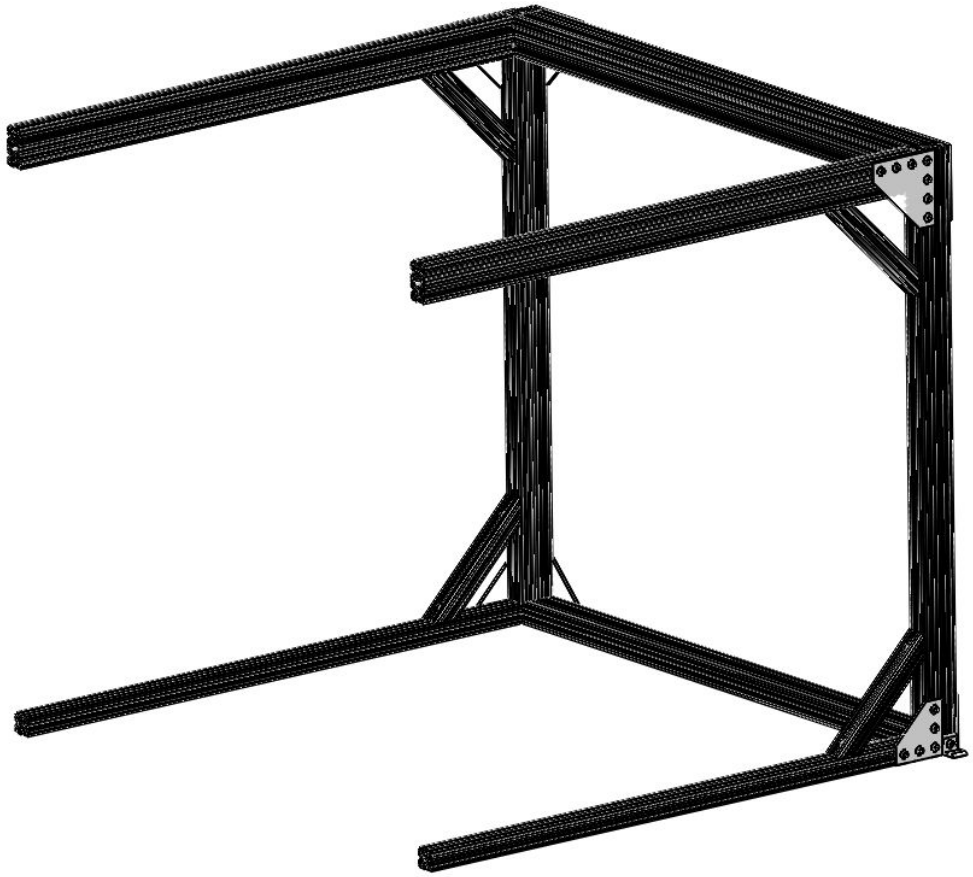


Fig. 3.27: Enclosure with the top and the bottom.

- ❏ Take the last side and insert it through the four beams and tighten.
- ❏ Double check if all the fixations are strongly tightened.
- ❏ The final assembly should look like the finished enclosure in Fig. 3.19

3.3.4 Integrate the ground railing system into the enclosure

If you purchased both the RCbenchmark railing system and the RCbenchmark enclosure, you can integrate the railing system directly onto the enclosure.

In this application, you do not need to use the L corner brackets to fix the ground rails on the floor, but to use them to connect to the base of the enclosure. Here is a more detailed guide about how to carry out the integration:

Unfortunately, you may have to disassemble a part of the enclosure to slide the end feed fasteners in the rail grooves. For the Single-motor and 1-axis ground railing system :

- ❏ Put one end feed fastener in each corner bracket and turn all the corner bracket of 90 degrees.
- ❏ Insert the rails between the bottom beam in the enclosure.

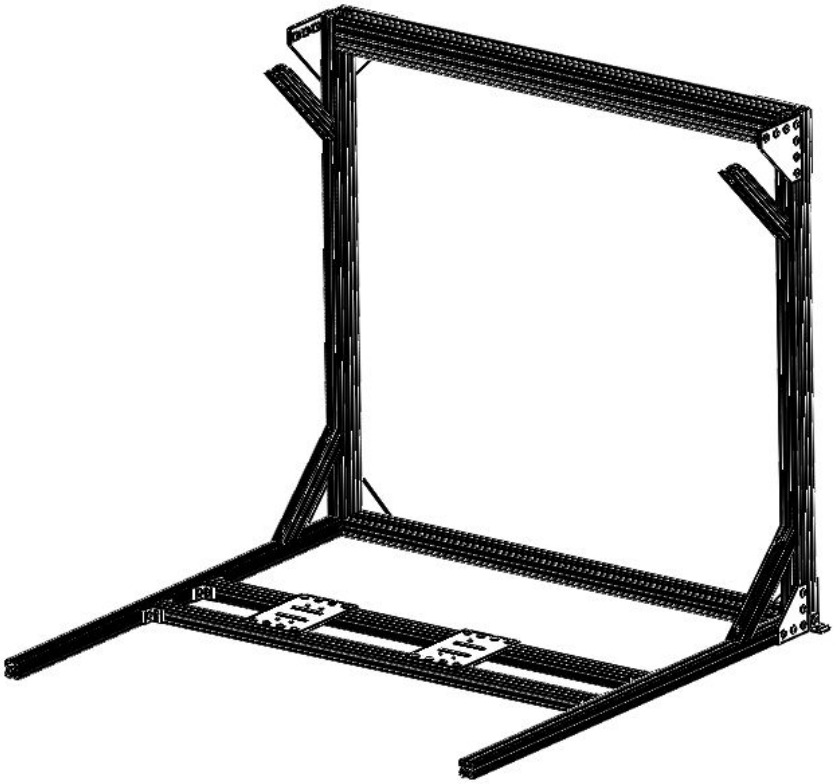


Fig. 3.28: 1-axis railing system setup on the bottom beams

- ❏ Close the enclosure as explained above and tighten all the screw.

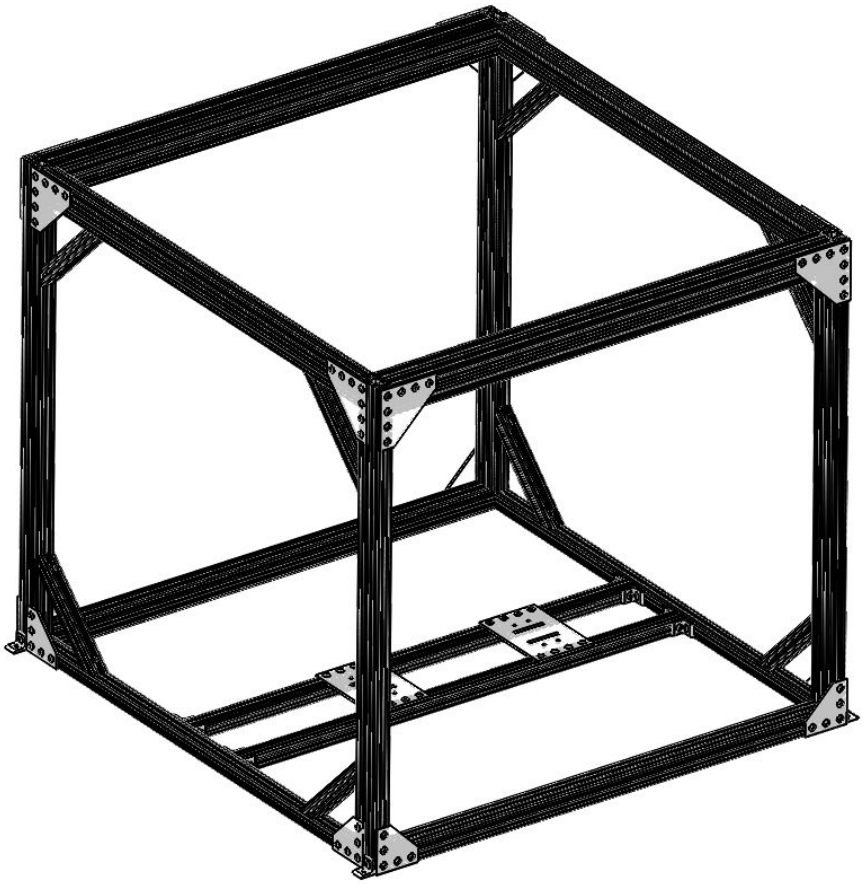


Fig. 3.29: 1-axis railing system in the small size enclosure.

For the 2-axis ground railing system :

Before you start the assembly of the enclosure put 2 end feed fastener female part on the one groove side of the 1-½" x 3" T-slotted frame 4' long (#CXQK) as you can see on Fig. 3.30.

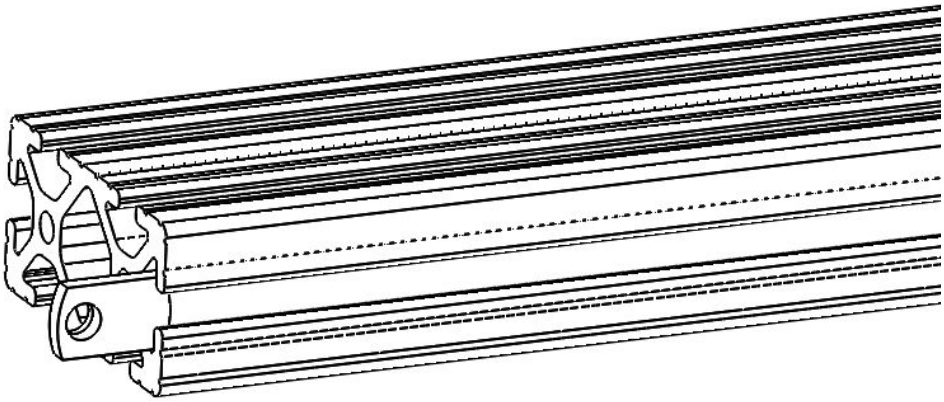


Fig. 3.30: Female part end feed fastener in the 1-½" x 3" T-slotted frame 4' long

- ❏ Assemble the bottom of the enclosure.
- ❏ Take your 2-axis railing system (#KBJRA).
- ❏ Insert one end feed fastener in each corner bracket and turn all the corner bracket of 90 degree.
- ❏ Make the two axis system slide through the beam on the bottom.

Fig. 3.31: 2-axis railing system setup on the bottom beam

- ❏ Close the enclosure as explained above and tighten all the screws. The whole system is shown as Fig 3.32.

Fig. 3.32: Enclosure with 2-axis railing system inside

3.4 Build you own enclosure

IMPORTANT!

Having the propeller spinning in an opened area, and running tests without proper casing, duct, cage or enclosure can be extremely dangerous to the operators and the facility.

You must have strong enough material for the safety cage, especially on the spinning surface of the propellers. The material should be capable in absorbing the energy from debris of propellers.

3.4.1 Design and build your own enclosure

For security reasons, it is important:

- Your enclosure is large enough to hold your propellers
- The panel wall can absorb energy from debris
- The structure is strong enough to hold the thrust and vibration

Before starting design the enclosure, please know what size of propellers you are planning to test. Generally speaking, you should leave at least 4" (100mm) distance from the propeller's blade tips to the panel wall, and even more to reduce airflow interactions.

For example, if you are planning to test a 40" propeller, you should design your safety cage at least 48" wide and 48" high. Remember, always take your future tests into account if you are planning to have larger propellers.

3.4.2 Integrate the RCbenchmark railing system into your own cage

If you purchased the RCbenchmark ground railing system, but not the enclosure, you may need to integrate the railing system onto your own safety cage. With the supplied end-feed fasteners and the L corner brackets, you can easily fix the rails on top of your base panel.

To ensure smooth rails movement, we always recommend to start assembling first the whole ground railing system in order to guarantee the functionality of the linear movement(s), and drill the holes on your base panel for the L bracket fixtures at the end.

You may also build your own safety cage using T-slotted frames similar to the RCbenchmark enclosure. When you integrate our railing system into your own frames, please make sure that your frames' profile are fully compatible with our rails. The RCbenchmark railings system uses 1-½"x1-½" profile rails, and mostly 5/16"-18 fasteners. You may refer to section 3.3.4 in this chapter for more details about how to connect the rails with the frames. RCbenchmark is not responsible for your own designed enclosure and we cannot guarantee the alignment between our rails and your own frames.

Chapter 4: Series 1780 Installation

We always suggest to first build the ground fixtures and the safety enclosure prior to any Series 1780 assembly and installation. If you have not yet prepared the fixtures, please first read Chapter 3 in this user manual.

In this chapter, we will present you a guide to install the Series 1780 Dynamometer. Every section in this chapter represents the suggested procedure to assemble and to install the Series 1780, please follow the sequence accordingly and do not bypass any operation.

There are three configurations and two rating versions for the Series 1780 Dynamometer, they share most of the components and the mechanical parts. If you find repeated items (SKU#) in your package, it means that this component can be used for Single-motor, Basic coaxial and Ultimate coaxial versions, you will just need to simply follow the same guide to build or assemble your second one.

When you are ready to start with the Series 1780 installation, please first prepare the correct tools for the operations. You can find inside the package a bag of hand-tool (SKU#: DBHQ), which includes several sizes of allens keys and wrenches. If you are using your own tools please make sure to have the proper drive sizes.

Fig. 4.1: Allen keys

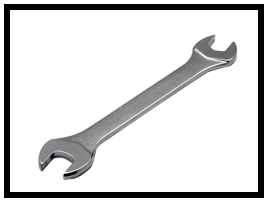


Fig. 4.2: Wrench

Please follow this procedure sequence to install the Series 1780:

1. Two-plate support and L brackets (2 for coaxial)
2. Load measurement unit (A and B side)
3. Motor, motor mount and optical RPM probe
4. ESC, power and control console, no-solder-board
5. Main board
6. Coaxial back-to-back special mount

4.1 Two-plate support and L brackets

The two-plate support is the major mechanical structure for the Series 1780. It was designed to connect the load measurement unit to the ground fixture. You can also fix most of the electrical components on either side of it.

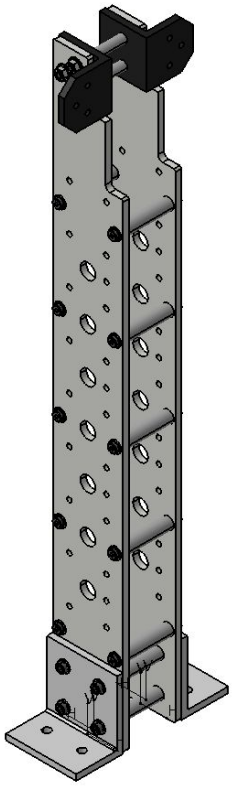


Fig. 4.3: Two-plate support schematic drawing

If you have purchased any of the coaxial configurations, no matter that is the 25kgf-100A or the 40kgf-150A version, you will receive material to build two supports in the package. Each support is designed to mount only one load measurement unit.

IMPORTANT!

This structure is designed to hold loads and vibrations from one propeller, you must follow the instruction to properly assemble the structure and firmly tighten all the supplied fasteners. Insufficient strength may impose extreme danger during tests.

4.1.1 What's included and where to find the parts

Item name	Item SKU	Qty	Located in (SKU# if exist)
Support Plate	PJBC	2	Main Carton Box
L Bracket upper mount (black)	EPJT	2	Bracket and fastener box (#XJEA)
L Bracket lower mount (silver)	XABY	2	Bracket and fastener box (#XJEA)
Upper fixture fasteners bag	KQHD	1	Bracket and fastener box (#XJEA)
Upper L bracket fastener bag	EJKT	1	Bracket and fastener box (#XJEA)
Lower L bracket fastener bag	RCQT	1	Bracket and fastener box (#XJEA)
Two plate connection fastener bag	GCYR	1	Bracket and fastener box (#XJEA)

For each fasteners bags, you will find these items:

Upper fixture fasteners bag (SKU#: KQHD)

Item name	Item SKU	Qty
M6 x 70mm socket head screw	BPRA	3
M6 serrated flange lock nut	PKQD	3
9.53OD 38.1mm long spacer	HYAR	3

Upper L bracket fastener bag (SKU#: EJKT)

Item name	Item SKU	Qty
M5 x 20mm socket head screw	YBJA	6
M5 serrated flange lock nut	BAKT	6

Lower L bracket fastener bag (SKU#: RCQT)

Item name	Item SKU	Qty
1/2"OD 2" long F-F standoff	EKDR	4
1/4"-20 1" long socket head screw	QJRC	8
1/4" split lock washer	CQAK	8

Two plate connection fastener bag (SKU#: GCYR)

Item name	Item SKU	Qty
1/2"OD 2" long F-F standoff	EKDR	10
1/4"-20 3/4" long low profile socket head screw	HQRK	20
1/4" split lock washer	CQAK	20

To avoid mistakes on using wrong screws in the Series 1780 assembly, please keep the fasteners in the bags until you need to use them. We did not prepare any spare fasteners in the bags. Keep the fastener bags. In case that you need to unmount the structure, place the fasteners back to those bags.

4.1.2 Assembly of the support

Please follow these instructions to assemble the two-plate support:

- ❏ Unpack the wrapped item (#YREP), and get two support plates (#PJBC).
- ❏ Place these two support plates (#PJBC) on a working table.

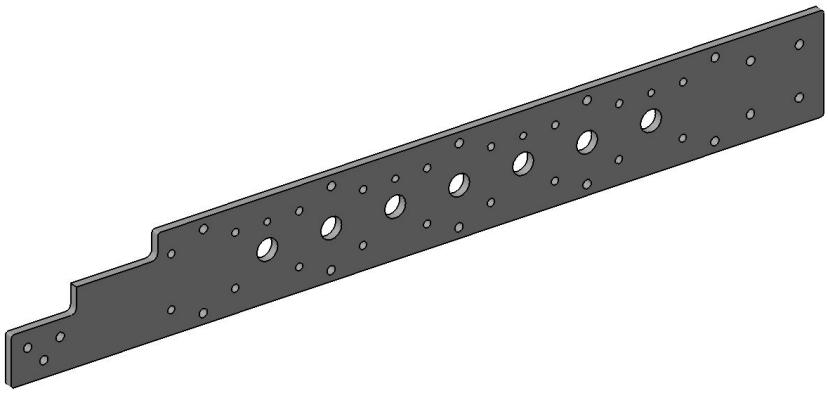


Fig. 4.4: Support plate (#PJBC)

- ❏ Open the L bracket and fastener box (#XJEA), take the two plate connection fastener bag (#GCYR) out of the box.
- ❏ Open the two plate connection fastener bag (#GCYR) and take out all the 10 pieces of 2” long female-female standoffs (#EKDR), 20 pieces of ¼”-20 ¾” long low profile

socket head screws (#HQRK) and 20 pieces of ¼" split lock washers (#CQAK) out of the bag.

❏ Hook one split lock washer (#CQAK) onto one ¼"-20 ¾" long low profile socket head screw (#HQRK), as image shown:

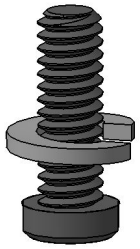


Fig. 4.5: Insert ¼" split lock washer (#CQAK) onto ¼"-20 screw (#HQRK)

❏ Repeat the same operation for the other 19 screws and lock washers.

❏ Take one 2" long F-F standoff (#EKDR) out of the bag.

❏ Insert the screw (#HQRK) with the split lock washer (#CQAK), into one of the ten highlighted holes into the support plate (#PJBC). These holes are located the closest to the long edge of the plate. You can start with any of these holes on the plate.

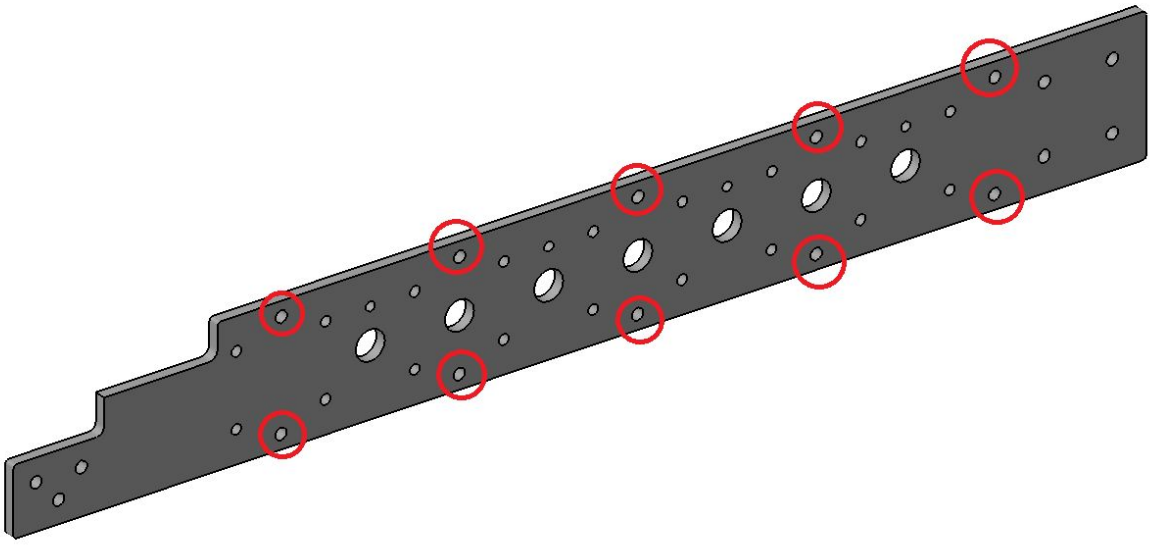


Fig. 4.6: Highlighted hole on the support plate (#PJBC) to insert the screw (#HQRK)

❏ Place the standoff (#EKDR) on the other side of the plate (#PJBC), and then turn the screw (#HQRK) into the standoff. Don't tighten the screw completely yet.

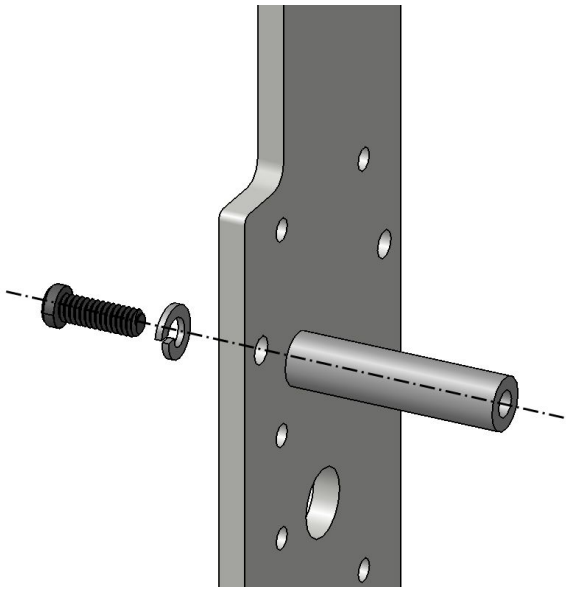


Fig. 4.7: Insert screw (#HQRK) into standoff (#EKDR)

❏ Repeat the last step for the other 9 holes on the plate. Make sure that the support plate (#PJBC) and the split lock washer (#CQAK) are in between the screw (#HQRK) and the standoff (#EKDR).

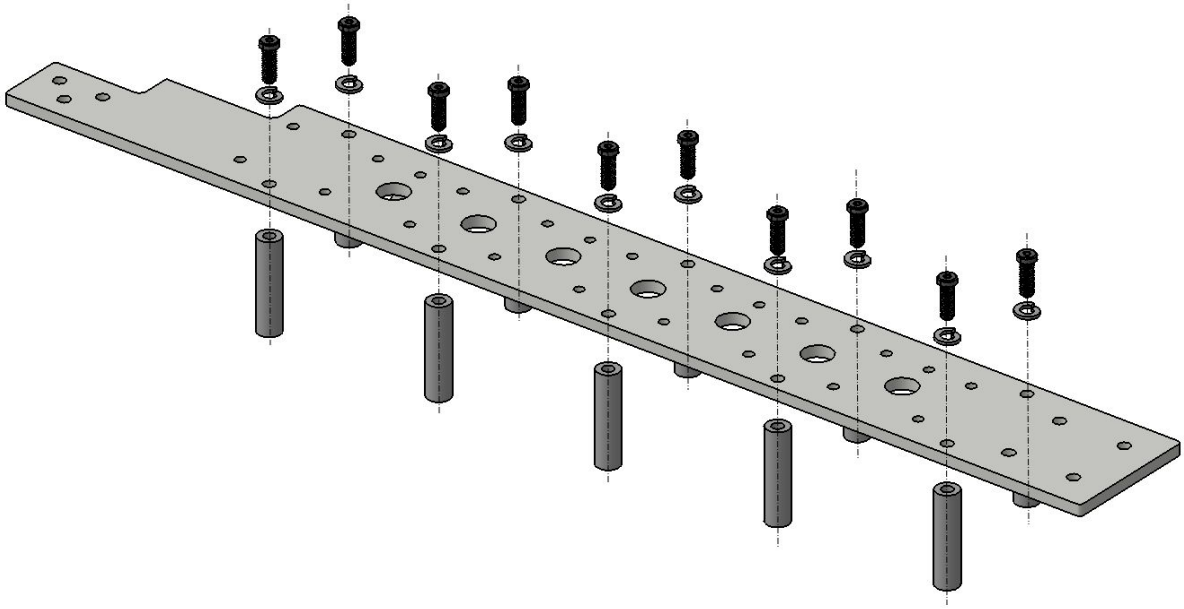


Fig. 4.8: Fix all 10 standoffs (#EKDR) on one plate (#PJBC)

❏ Take the second support plate out of the wrap (#PJBC)

- ❏ Align the second plate according to the same hole feature, on another side of the standoffs (#EKDR)
- ❏ Insert the screw (#HQRK) and the split lock washer (#CQAK) into the standoff, the same way as you have done previously, to connect the two support plates (#PJBC) together with the standoffs.
- ❏ Screw in but do not fasten completely.

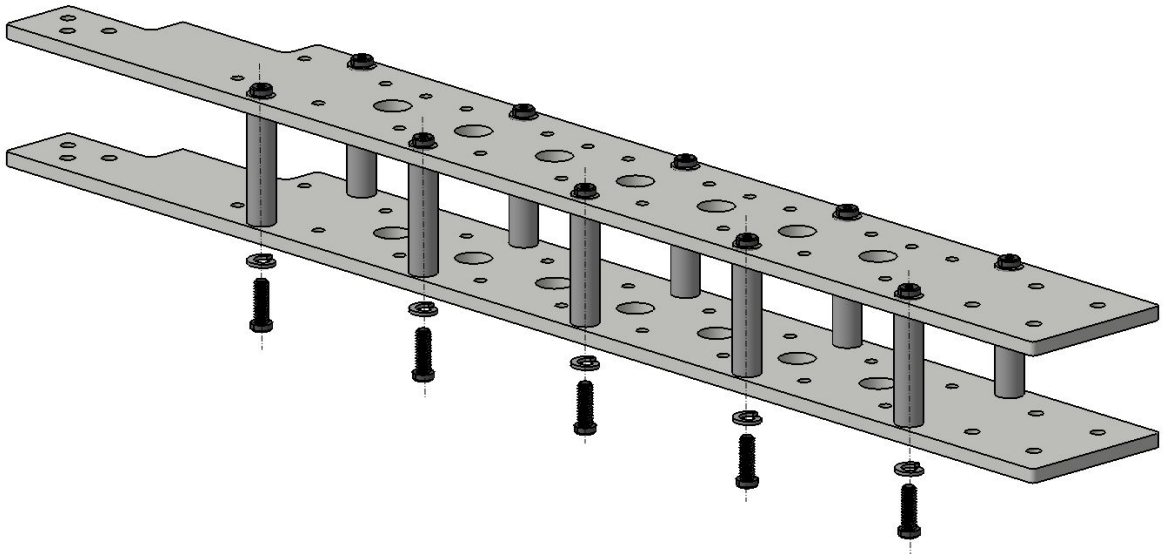


Fig. 4.9 Insert screws (#HQRK) and lock washers (#CQAK) into the other plate

- ❏ Finish the all the 10 screws on the other side, keep all the screws not fully tightened.
- ❏ Take both of the silver L brackets lower mount (#XABY) and the Lower L bracket fastener bag (#RCQT) out of the box (#XJEA)
- ❏ Place the L bracket lower mount (#XABY) on the outer side of the two-plate support, aligning the four holes in the bottom of the support (shown as the lowest holes in fig. 4.10).
- ❏ Take out four 2” long F-F standoffs (#EKDR) out of the bag, and slide them in between the two plates, aligning the same four holes in the bottom of the support.
- ❏ Take out all four ¼”-20 1” long socket head screw (#QJRC) and hook them up with four ¼” split lock washers (#CQAK).
- ❏ Insert the screws (#QJRC) and the split lock washers (#CQAK) into the standoffs, connecting one side of the support plate (#PJBC) and the L bracket lower mount (#XABY) together.

- ❏ Repeat last step for the rest seven holes (four per side, thus eight in total), as image shown below:

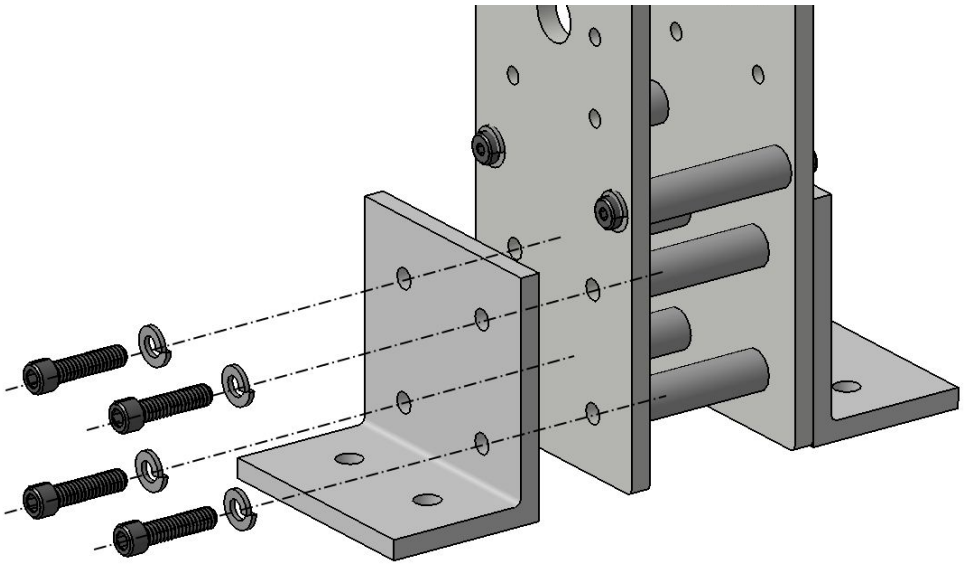


Fig. 4.10: Connect the L brackets lower mount (#XABY) with the support

- ❏ Take both of the black anodized L bracket upper mounts (#EPJT) out from the bracket and fastener box (#XJEA).
- ❏ Take out the upper fixture bag (#KQHD) out from the box (#XJEA), open the bag and place all three M6 x 70mm bolts (#BPRA), three M6 serrated lock nut (#PKQD) and three 38.1mm long spacers (#HYAR) on the working table
- ❏ Place the L bracket upper mount (#EPJT) on the cut edge of the support plate (#PJBC), and repeat the step for the other side of the plate
- ❏ Insert the spacers (#HYAR) in between two L brackets (#EPJT)
- ❏ Insert the M6 x 70mm socket head screws (#BPRA) through the support plate (#PJBC), then the L bracket (#EPJT), then the spacer (#HYAR), again L bracket and come out on the other plate, shown as Fig 4.11.
- ❏ Rotate the M6 serrated lock nut (#PKQD) into the M6 x 70mm screw as shown in Fig. 4.11.
- ❏ Tighten all three serrated lock nut with wrench and allen key
- ❏ Tighten all twenty ¼”-20 ¾” low profile screws into the standoffs
- ❏ Tighten all eight ¼”-20 1” socket head screws into the standoffs

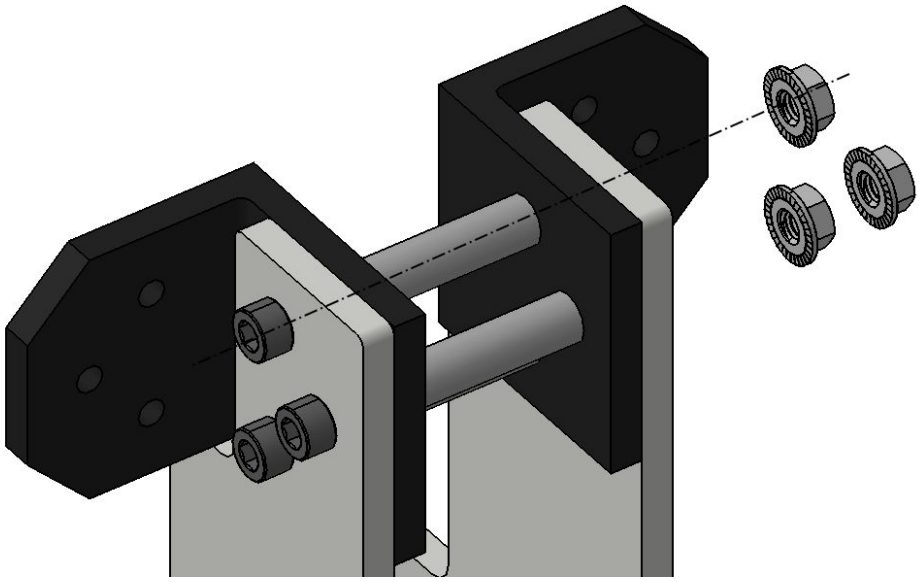


Fig. 4.11: Connect the upper mount

- ❏ Double-check if all the fasteners are mounted on the support, and if they were well tightened.
- ❏ Place the finalized two-plate support on the working table.

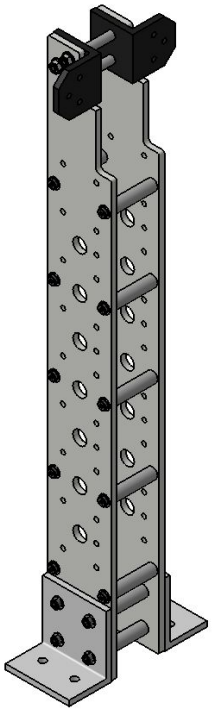


Fig. 4.12: Assembled two-plate support

- ❏ If you purchased the coaxial configuration of the Series 1780 (Basic coaxial or Ultimate coaxial), you will need to build the second two-plate support. Simply repeat all the previous steps.

IMPORTANT!

High load structure, please make sure that all fasteners are properly tightened when finalizing the assembly.

4.1.3 Integrate the support into the railing system

If you purchased the RCbenchmark railing system, you may now place the two-plate support onto the railing system's base fixture plate. If you did not purchase the railing system, you can skip this step of installation and use your own fixation methods.

You will need the following material to mount the support onto the fixture plate:

Item name	Item SKU	Qty	Located in (SKU# if exist)
Assembled two-plate support	N/A	1	Assembled by you
Fixture base plate	KGTP	1	Assembled ground railing system
5/16"-18 socket head screw - 7/8" length	QPJX	4	Railing fasteners and tools bag (#TKYH)
5/16"-18 serrated lock nut	JDKA	4	Railing fasteners and tools bag (#TKYH)
1/2" open end wrench	CEXH	1	Railing fasteners and tools bag (#TKYH)
¼" drive hex allen key	QYHR	1	Railing fasteners and tools bag (#TKYH)

To install the two-plate support onto the railing system, follow this instruction:

- ❏ Take four 5/16"-18 socket head screw - 7/8" length (#QPJX)
- ❏ Take four 5/16"-18 serrated lock nut (#JDKA)
- ❏ If you have already assembled fixture base plate (#KGTP) onto the rails, now you can place the assembled two-plate support on the base plate, and finish the whole assembly on the rails.

- ❏ If you have not yet assembled the fixture base plate (#KGTP) onto the rails, you can instead take up the base plate (#KGTP) and work anywhere you desire.
- ❏ Align four holes on the L brackets of the assembled two-plate support with the fixture base plate (#KGTP)
- ❏ Insert the 5/16”-18 socket head screw (#QPJX) into the 4 holes

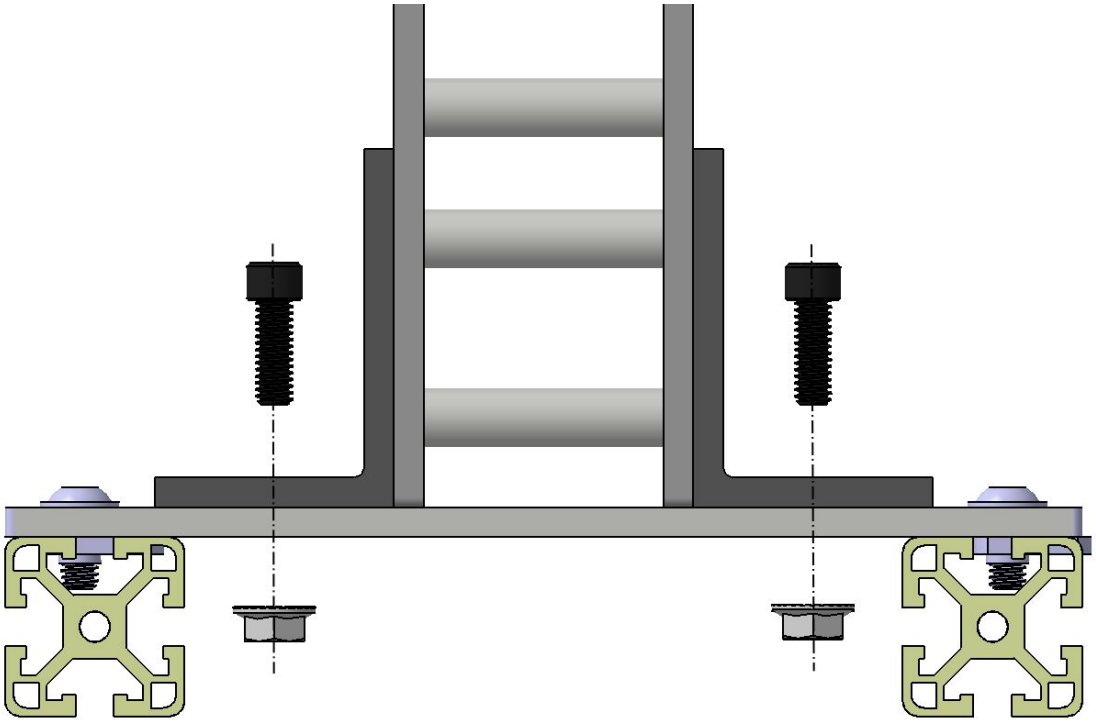


Fig 4.13: Assembly of the two-plate support onto the fixture base plate

- ❏ Insert the 5/16”-18 serrated flange nut (#JDKA) on the other side of the fixture base plate (#KGTP).
- ❏ Tighten the screws with the nuts, following a diagonal sequence.
- ❏ Double-check to see if the two-plate support is well fastened to the base plate.

4.2 Load measurement unit

The load measurement unit is the key component of the Series 1780. It measures thrust and torque for your motors and propellers. It is extremely sensitive to light impacts and overload.

Fig 4.14: Load measurement unit assembly

The unit provides mounting points to connect with the two-plate support, and to fix the motor mount plate. It also has two cables: one for the load measurement and the other for the optical RPM sensor.

4.2.1 Storage, calibration and warranty

IMPORTANT!

The load cell is a precision instrument and is very delicate. Impact and excessive force applied on the load measurement unit will cause permanent damage to the load sensors!

The Series 1780 load sensor comes in a protective case to protect the unit from impacts during shipping and while not in use. We recommend to keep the load measurement unit inside the package until you need to mount it onto the two-plate support.

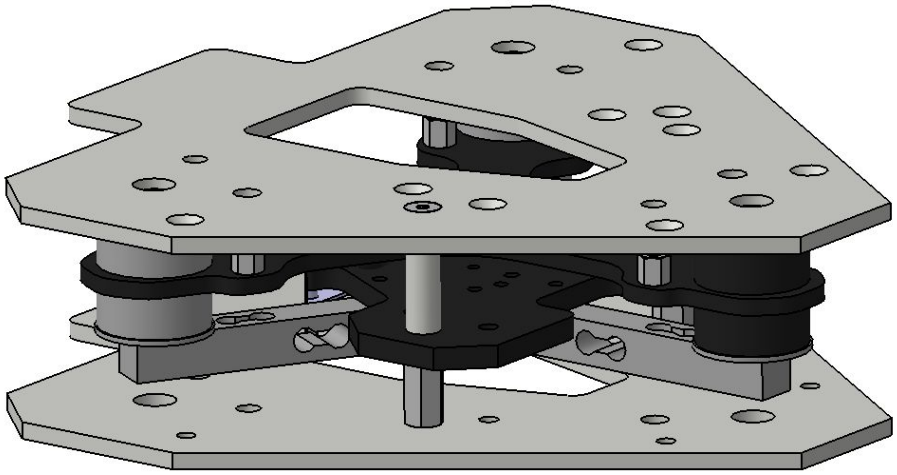


Fig 4.15: Load measurement unit inside the protective case

Please keep all the components of the protective case together, if repair is necessary ship the unit back with the casing. If you are not able to ship the load measurement unit back with the protective casing for repair or recalibration, we will return the unit back with a new protective casing but a USD$120 charge will be applied.

IMPORTANT!

Do not unfasten any torx screws on the load measurement unit, as a recalibration of the whole unit will be needed upon reassembly. Your test results will be affected if the calibration data is not valid. Currently the load measurement unit can only be re-calibrated in RCbenchmark facility, please contact us for a quote if a recalibration is needed.

4.2.2 What's included

If you purchased the Series 1780 Dynamometer 25kgf-100A: single motor configuration (SKU#: KHYER), you will receive one 25kgf-12Nm load measurement unit in the carton box:

Item name	Item SKU	Qty
Series 1780 load measurement unit 25kgf-12Nm: A side	TRAK	1

If you purchased the Series 1780 Dynamometer 25kgf-100A: Ultimate coaxial (SKU#: KCHQB) or Basic coaxial (SKU#: KYQXD) which allow two motors measurement, you will receive two 25kgf-12Nm load measurement units in the carton box:

Item name	Item SKU	Qty
Series 1780 load measurement unit 25kgf-12Nm: A side	TRAK	1
Series 1780 load measurement unit 25kgf-12Nm: B side	GDBA	1

If you purchased the Series 1780 Dynamometer 40kgf-150A: single motor configuration (SKU#: KTBKA), you will receive one 40kgf-18Nm load measurement unit in the carton box:

Item name	Item SKU	Qty
Series 1780 load measurement unit 40kgf-18Nm: A side	GYJT	1

If you purchased the Series 1780 Dynamometer 40kgf-150A: Ultimate coaxial (SKU#: KDRHP) or Basic coaxial (SKU#: KDAPQ) which allow two motors measurement, you will receive two 40kgf-18Nm load measurement units in the carton box:

Item name	Item SKU	Qty
Series 1780 load measurement unit 40kgf-18Nm: A side	GYJT	1
Series 1780 load measurement unit 40kgf-18Nm: B side	EPDY	1

For each package (#TRAK, #GDBA, #GYJT, #EPDY), you can find the calibrated load measurement unit in a protection case.

4.2.3 Mount load measurement unit to the support

IMPORTANT!

Do not start this step until you have assembled the two-plate support and installed the ground fixture that can firmly hold the Series 1780 dynamometer.

This section is not applicable to the customers who are planning to setup two motors in back-to-back with the special mounting. Refer to section 4.6 for that setup.

You will need to find the following material in order to start the operation:

Item name	Item SKU	Qty	Located in (SKU# if exist)
Assembled two-plate support	N/A	1	Assembled by you
Load measurement unit: A side or Load measurement unit: B side (25kgf-12Nm or 40kgf-18Nm)	XBKH RJGT QEAT HDKJ	1	Packed load measurement unit box (#TRAK, #GDBA, #GYJT, #EPDY)
Upper L bracket fastener bag	EJKT	1	Bracket and fastener box (#XJEA)

Inside the upper L bracket fastener bag (#EJKT), you will find:

Item name	Item SKU	Qty
M5 x 20mm socket head screw	YBJA	4
M5 serrated flange lock nut	BAKT	4

- ❏ Take out four M5 screws (#YBJA) from the fastener bag (#EJKT).
- ❏ Take out four M5 serrated nuts (#BAKT) from the fastener bag (#EJKT).
- ❏ Open the packed load measurement unit box (#TRAK, #GDBA, #GYJT or #EPDY).
- ❏ Take the whole casing including the load measurement unit out from the box.
- ❏ Remove the flat head screws from the round spacer side, and then lift up the package protective plate.
- ❏ Take out all the spacers

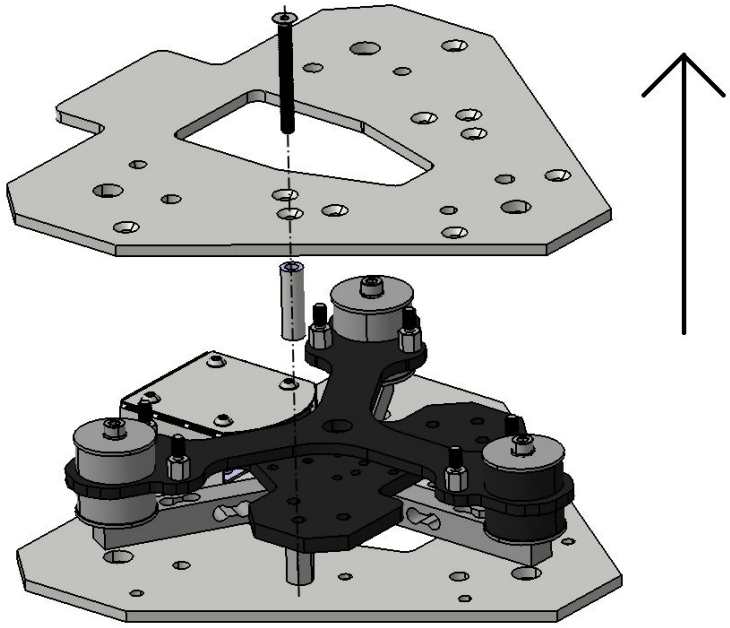


Fig. 4.16: Removal of the protective metal plate

- ❏ Now you can lift up the load measurement unit.
- ❏ You will need to use the following hole features align the load measurement unit with the two-plate support: upper L brackets. Please spare the outer two holes to install the mechanical safety stop.

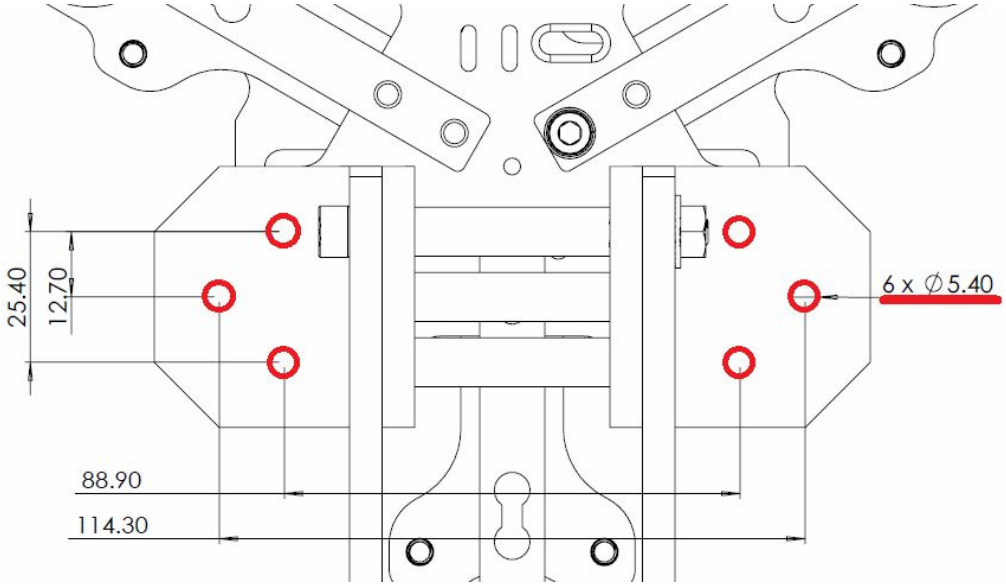


Fig. 4.17: Align the load measurement unit with the upper L brackets with the highlighted hole features

❏ Place the load measurement unit (#XBKH, #RJGT, #QEAT or #HDKJ) onto the support, aligning these upper and lower holes shown in Fig. 4.18.

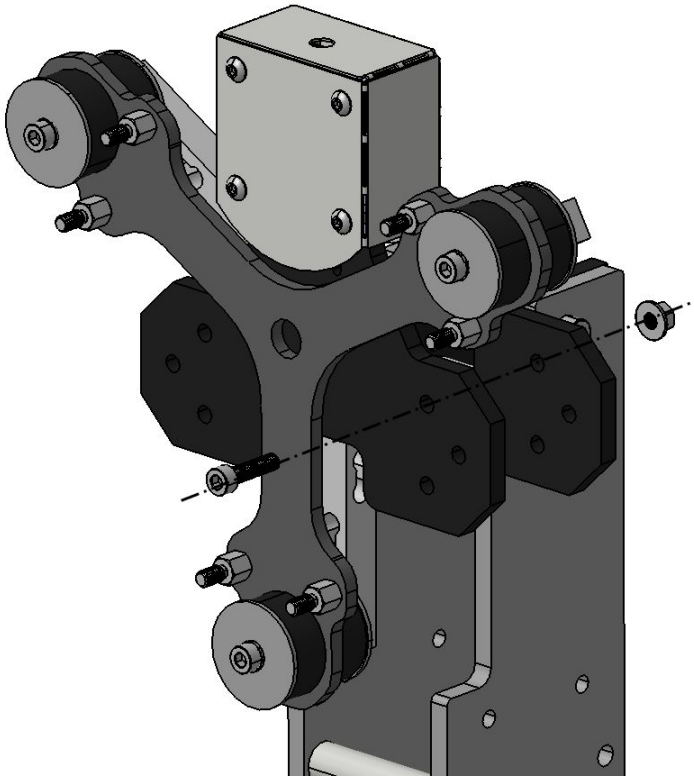


Fig 4.18: Fasten the load measurement unit on the support

❏ Insert four M5x20 socket head screw (#YBJA) into the upper and lower holes, from the load measurement unit side.

❏ Rotate in the M5 serrated flange nut (#BAKT) from the upper L bracket side to connect the load measurement unit (#XBKH, #RJGT, #QEAT or #HDKJ) with the black upper L brackets.

❏ Repeat the operation for the remaining three screws and nuts, not tighten them.

❏ If you have purchased any coaxial configuration, where you receive two load measurement units, repeat these steps to mount your second load measurement unit onto another support. Please also pay attention to orientation: you must decide face-to-face or back-to-back if you are planning to test coaxial.

❏ See Section 6 in this chapter for details about the coaxial back-to-back mounting.

4.2.4 Installation of the mechanical safety stop

Please retrieve the mechanical safety stop bag (#UTPF) from the carton box:

Item name	Item SKU	Qty
Mechanical stop metal strip	PGQY	1
M5 x 35 mm socket head screw	LPWW	2
14 mm long spacer	PDSW	2
M5 flange lock nut	YTEX	2

- ❏ From the previous operation 4.2.3, you shall only have installed four screws in the upper and lower position to connect the load measurement unit and the L corner bracket.
- ❏ Pass the M5 x 35 mm socket head screws through the outer holes on the metal strip
- ❏ Align the 14 mm spacers on the other side of the strip, install it onto the lower plate
- ❏ Turn in the M5 flange nut on the side of the L corner bracket
- ❏ Now you can fasten all six screws and nuts.

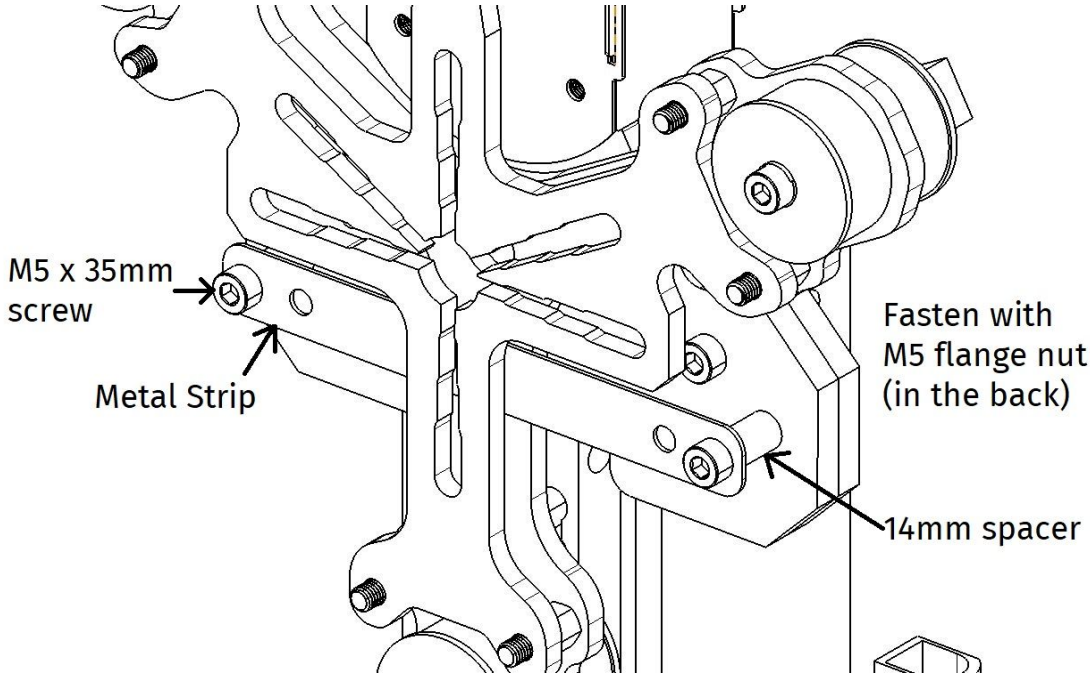


Fig 4.19 Installation of the mechanical safety stop

4.2.5 Dismounting the load measurement unit from support

The load measurement using will need to be put back in the protective casing if you need to:

- Change setup
- Move the dynamometer to another location
- Stop using the Series 1780 for a long time (to avoid damaging the load cell by mistake)
- Return the unit for repair, recalibration or upgrade

In case that you need to dismount the load measurement unit, please first find the protective casing (see section 4.2.1) from the initial package. Build it back with the metal plates and the standoffs.

Use caution when you remove the fasteners, as the load measurement unit is sensitive and any sudden impacts can damage the load sensor. Untighten the M5 x 20mm socket head screws and M5 serrated flange nuts only when it is safe.

After removing the load measurement unit from the support, place it back onto the protective case, aligning with the hex standoffs. Close the casing with the spacers and the second metal plate, and fasten the M5 flat head screws properly to make sure that the load measurement unit is being well protected inside.

Keep the unit inside the casing until you need it.

4.3. Motor, motor mount and optical RPM probe

The motor mount plate is an important component for the Series 1780 Dynamometer. It is a connection between the motor and the load measurement unit. It transfers thrust and torque, and provides a multi-adaptive mounting points to fix your motors and your optical RPM probe.

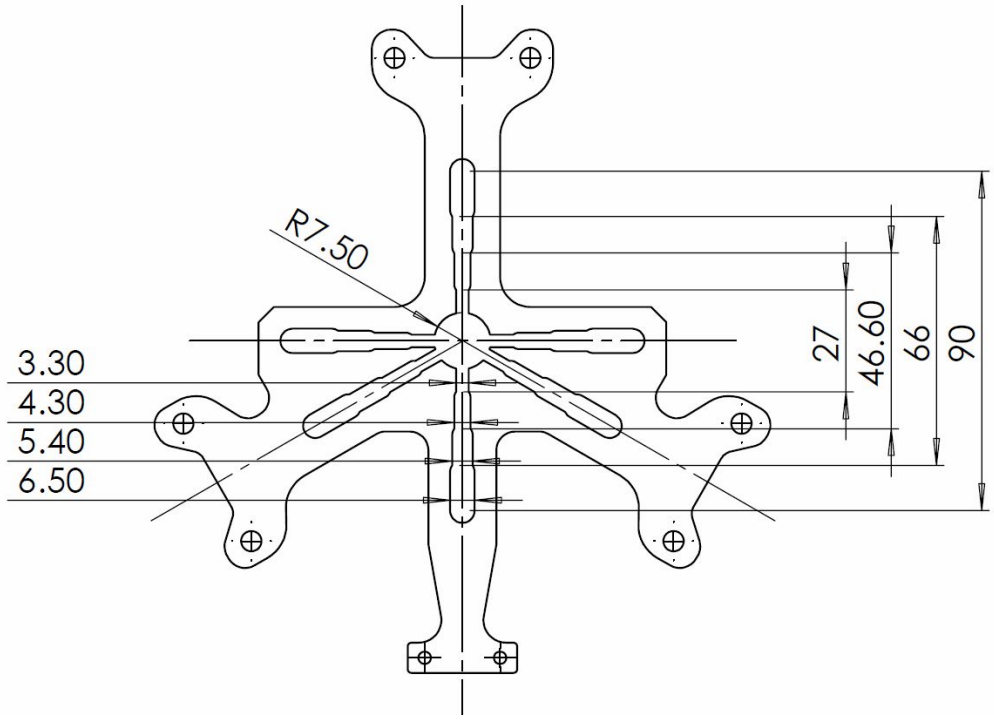


Fig. 4.20: General purpose motor mount slot features (all annotations in mm)

You may also purchase the extra large center hole XLCH motor mount which provides a larger center hole at up to 30mm in diameter. It fits certain types of motor that have back-shaft, such as Xoar TA-130 and KDE 7215. This special version of motor mount is NOT included in the Series 1780 and require separate purchase. Please visit our online store for more details.

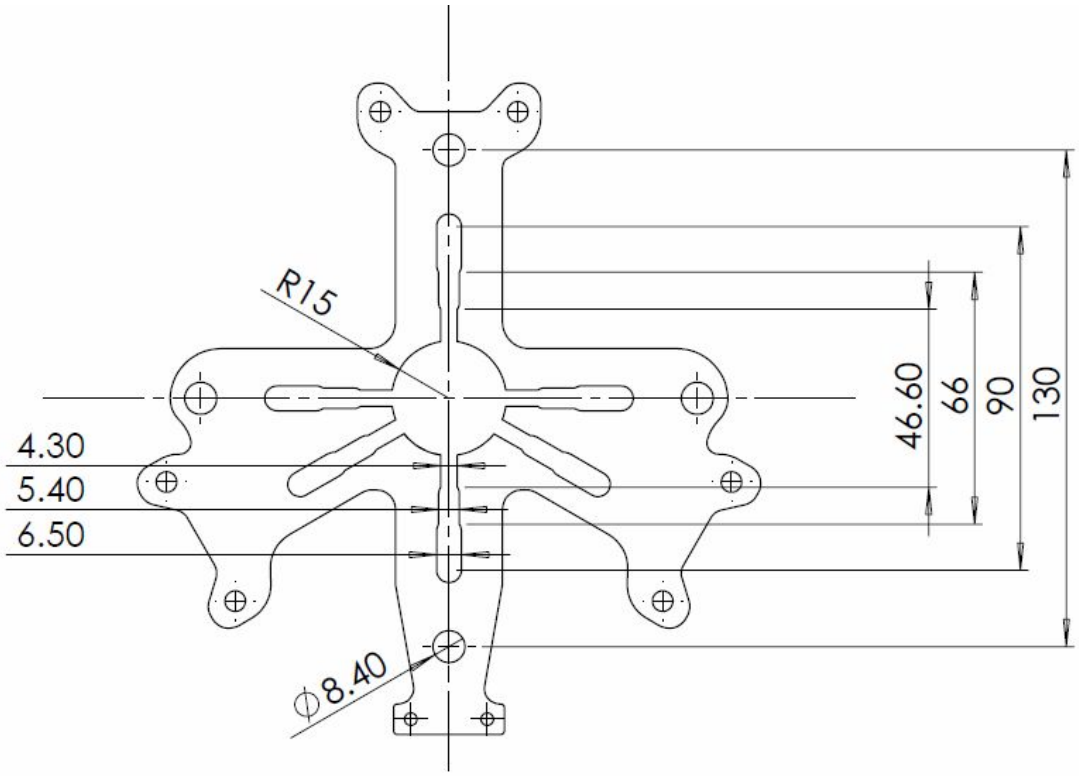


Fig 4.21: XLCH motor mount with D=30mm center hole

Please make sure to first fix the motor and the optical RPM probe on the motor mount before installing the whole structure onto the load measurement unit.

4.3.1 What's included

If you purchased the Series 1780: Single-motor configuration (SKU#: KHYER or KTBKA), you will receive one motor mount plate and one optical RPM probe:

Item name	Item SKU	Qty	Located in (SKU# if exist)
Motor mount V2	ETHR	1	Main Carton Box
Optical RPM Probe V2: A	RTJK	1	Mono Main Board Box (#RHGQ)
Optical Probe Fasteners and Spacers Kit	JRXA	1	Mono Main Board Box (#RHGQ)

If you purchased any of the Series 1780: Basic coaxial or Ultimate coaxial (SKU#: KYQXD, KCHQB, KDAPQ, KDRHP), you will receive two motor mount plates and two optical RPM probes:

Item name	Item SKU	Qty	Located in (SKU# if exist)
Motor mount V2	ETHR	2	Main Carton Box
Optical RPM Probe V2: A	RTJK	1	Dual Main Board Box (#GPDE)
Optical RPM Probe V2: B	QCPT	1	Dual Main Board Box (#GPDE)
Optical Probe Fasteners and Spacers Kit	JRXA	2	Dual Main Board Box (#GPDE)

Both the 25kgf-100A and the 40kgf-150A ratings use the same motor mount plate.

Both types of motor mounts share the same mounting features. The following instructions and figures were made using the general motor mount (#ETHR). If you are building the Series 1780 with the XLCH motor mount, please simply follow the same steps to install the components.

4.3.2 Install your motor onto the motor mount

You will have to prepare your own motor to be tested. Also, you will also need to prepare your own fasteners to fix the motor with the motor mount.

The motor mount plate shown in Fig. 4.20 features several width of slots for M3, M4, M5 and M6 screws at a 0, 90, 120, 180, 240 and 270 degree in a circular pattern:

If your motor supports more than one type of mounting points, we always recommend using the largest possible. For example, your motor has M4 holes at diameter 40mm and M5 holes at diameter 50mm, it is suggested to use the M5 features at diameter 50mm.

We highly recommend adding washers between the motor plate and the screw heads used to install your motor.

IMPORTANT!

Tighten all screws for your motor at the time you mount it on the metal plate. You **CANNOT** reach these screws while the motor plate is mounted on the load measurement unit.

4.3.3 Install the optical RPM probe on the motor mount

The optical RPM probe reads the rotation speed of your motor. You will need to prepare the following material to install the optical RPM probe:

Item name	Item SKU	Qty
General motor mount XLCH motor mount	ETHR or LXMF	1
Optical RPM Probe V2: A or Optical RPM Probe B2: B	RTJK or QCPT	1
Optical Probe Fasteners and Spacers Kit	JRXA	1

Within each bag of optical probe fasteners and spacers kit (SKU#: JRXA), you can find:

Item name	Item SKU	Qty
Spacer 4.76mm long	GFRE	2
Spacer 12.70mm long	9R8L	2
Spacer 22.23mm long	PD8E	2
Spacer 33.34mm long	YE4H	2
Spacer 38.10mm long	TFQM	2
M4 x 12mm socket head screw	QTBR	2
M4 x 20mm socket head screw	QCBP	2
M4 x 30mm socket head screw	RKJC	2
M4 x 40mm socket head screw	YJKT	2
M4 x 50mm socket head screw	FL9D	2
M4 black plastic washer	7EB9	2

It is not necessary to use all the fasteners and spacers indicated above to install the optical RPM probe. You will only need to choose one format of spacer and one length of M4 screw, which can provide the perfect height of the optical probe to approach the motor.

Choose from one of the pairs below according to your motor's height:

- 4.76mm spacer - M4 x 12mm screw
- 12.70mm spacer - M4 x 20mm screw
- 22.23mm spacer - M4 x 30mm screw
- 33.34mm spacer - M4 x 40mm screw
- 38.10mm spacer - M4 x 50mm screw

Follow these instructions to install the optical probe onto the motor mount:

❏ Apply black electrical tape (prepared by you) to seal the logo on the rotor of your motor to be tested.

❏ Apply the supplied reflective tape on any part of the rotor of your motor. The length of the reflective tape should be wider than 10mm.

❏ Select a pair of spacers and screws that correspond to the height from the motor mount to the reflective tape.

❏ Place the M4 screw, the M4 black plastic washer through the slots on the optical RPM probe. Then put the aluminum spacers on the other side of the circuit. Slightly fasten the screws into the tapped holes on the motor mount.

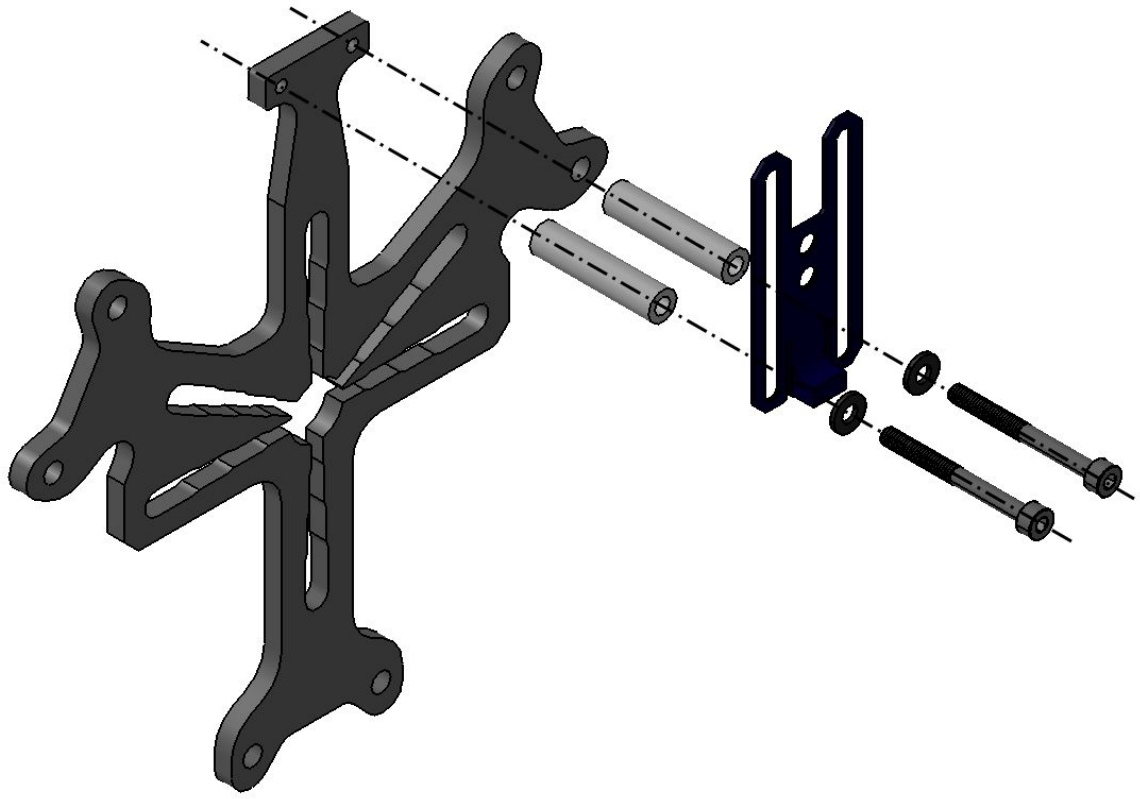


Fig. 4.21: Connection of the screw, washer, spacers and the optical probe to the motor mount

❏ Adjust the radial distance between the sensor head of the probe and the rotor edge, using the slots on the circuit. Make sure the gap between the optical sensor and the motor shown as e in Fig 4.22, to respect the specifications.

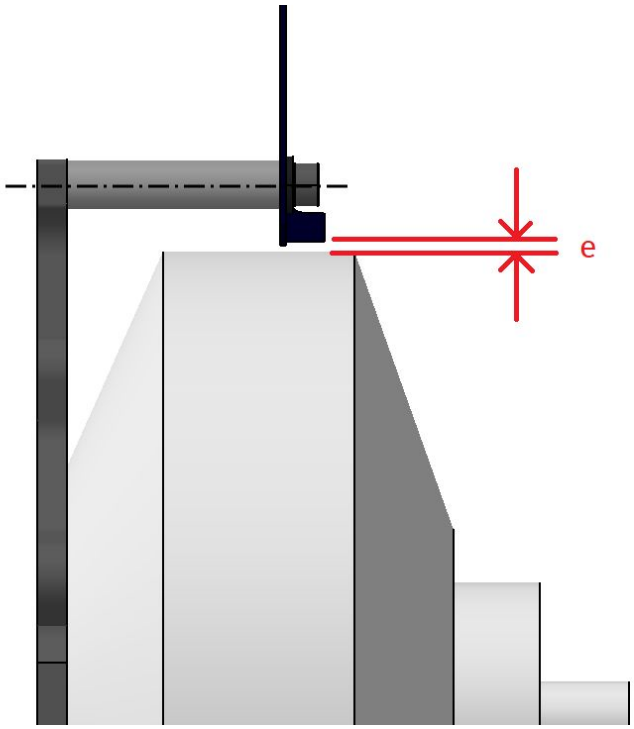


Fig. 4.22: Gap control between the probe and the motor

❏ The recommended “e” gap distance between the motor and the probe is:
- 2~4mm for Optical RPM probe V2.0
- <10mm for Optical RPM probe V2.1

❏ Once the probe reaches the appropriate distance from the motor, fully tighten all the screws with an allen key.

❏ Repeat the same steps if you have purchased the dual motors configurations.

IMPORTANT!

The distance between the motor and the head of the optical sensor is important. It must be kept under certain distance for the optical sensor to work effectively.

The optical probe is very close to spinning parts. Check fasteners are tight before every test in order to prevent the optical probe slipping and colliding with the rotor.

4.3.4 Install the motor mount assembly on the load measurement unit

Once you finish putting the motor and the optical probe on the motor mount, you can now install the whole assembly onto your load measurement unit.

IMPORTANT!

It is recommended to mount your propeller after the motor is fixed onto the load measurement unit.

Check the motor screws if they have been well fastened before this operation. You will no longer be able to reach them after the assembly was put onto the load measurement unit.

You will need to prepare the following material in order to carry out this operation:

Item name	Item SKU	Qty	Located in (SKU# if exist)
Motor mount assembly with motor, optical RPM probe	N/A	1	Assembled in previous steps
Load measurement unit assembly, installed on the support	N/A	1	Assembled in previous steps
Motor mount fasteners bag	HAQY	1	Bracket and fastener box (#XJEA)

Within the motor mount fastener bag (SKU#: HAQY), you can find:

Item name	Item SKU	Qty
M5 serrated flange nut	YTEX	6
M5 hex nut	EX8B	6
M5 split lock washer	T9DQ	6

To start the installation, follow this instruction:

- ❏ Take out all the assembly of the motor mount, with the motor and optical RPM probe.
- ❏ Take out the nuts from the motor mount fastener bag (#HAQY).

❏ Use the six M5 holes on the motor mount to align with the M5 male-female standoffs on the load measurement unit.

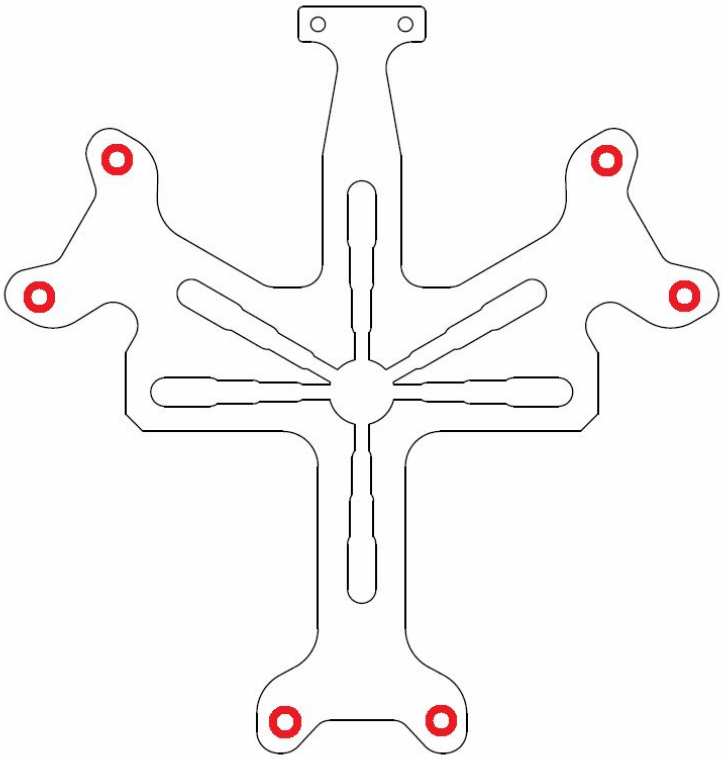


Fig. 4.23: Use the highlighted 6 holes feature to align with the load measurement unit

❏ Rotate the M5 flange nuts (#YTEX) into the male threaded standoffs to fasten the motor mount onto the load measurement unit, as the image shows below:

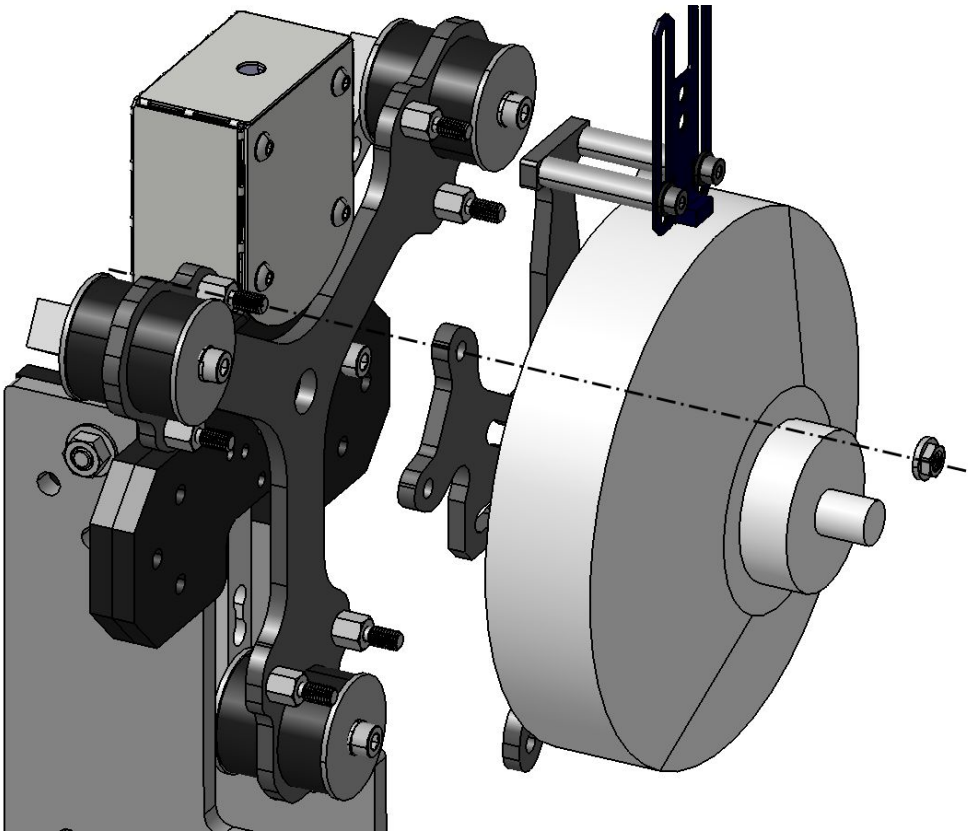


Fig. 4.24: Connection of load measurement unit with motor mount assembly using M5 nuts

- ❏ Repeat the previous step before tightening all the nuts.
- ❏ If your motor is too large and doesn't allow to use the M5 flange nuts (#YTEX), you can replace these nuts with a combination of M5 normal hex nuts (#EX8B) plus M5 split lock washers (#T9DQ). Please always place the lock washer between the nuts and the motor mount plate.
- ❏ Tighten all the nuts with the wrench, following a diagonal sequence.
- ❏ If you have a coaxial configuration, repeat all these steps for the other side load measurement unit.

IMPORTANT!

Every time before you start a test, it is highly recommended to check the tightness of the fasteners on the motor mount, for safety.

4.4 Power and control console, ESC and no-solder board

In the Series 1780 Dynamometer V2, the power sensor and control boards are integrated into one unit, called power and control console. This unit measures the voltage and current from the ESC, as well as signal control to your ESC.

The Series 1780 no-solder board is an optional accessory for the customers who need to frequently change their motors or ESCs. And similar to all our dynamometer products, you will still need to supply your own ESC for all the tests.

In this section, we will only present the hardware installation of all these electrical components. Regarding to the cable connection of these components, please refer to Chapter V. in this user manual.

It is recommended to use the supplied two-plate supports to mount the electrical components. As shown in Fig. 4.25 there are mounting holes on the two-plate supports to hold the electrical components. You may attach the components on the side of you choice.

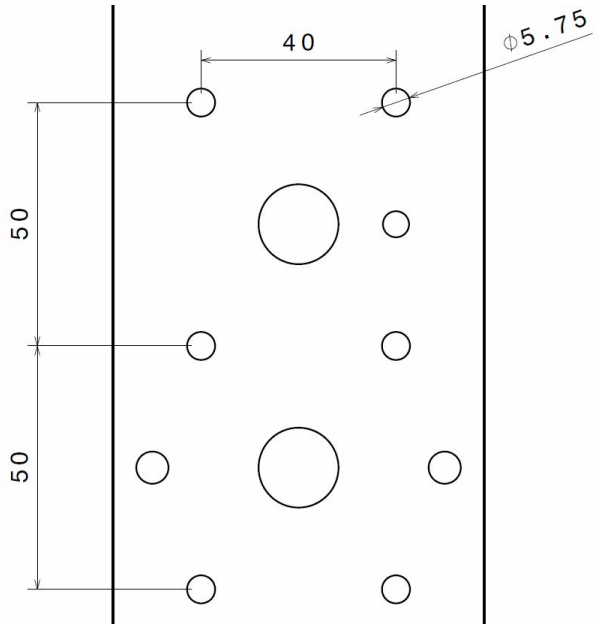


Fig. 4.25: Hole features on the support plate to mount the electrical components

You may use different mounting holes according to the wire length of your motor, wire length of your ESC, as well as the dimension of the ESC.

If you are building your own support, please make sure that the structure has the proper mounting points for these components.

4.4.1 What's included and where to locate the components

If you purchased the Series 1780 Dynamometer 25kgf-100A: single motor version, you will receive one Power and control console 100A: Side A (SKU#: AQJT) packed in white box, this item is located in the main shipping carton. You may find these items in the box:

Item name	Item SKU	Qty	Located in (SKU# if exist)
Series 1780 Power and control console 100A: Side A	KCBP	1	#AQJT
Electrical board fasteners bag	PRXQ	1	#AQJT or #RBEP

If you purchased the Series 1780 Dynamometer 40kgf-150A: single motor version, you will receive one Power and control console 150A: Side A (SKU#: RBEP) packed in white box, this item is located in the main shipping carton. You may find these items in the box:

Item name	Item SKU	Qty	Located in (SKU# if exist)
Series 1780 Power and control console 150A: Side A	PERC	1	#RBEP
Electrical board fasteners bag	PRXQ	1	#AQJT or #RBEP

If you purchased the Series 1780 Dynamometer 25kgf-100A: Basic coaxial or Ultimate coaxial, there are two Power and control consoles 100A: Side A (SKU#:AQJT) and Side B (SKU#: YGKE). You will find these items in two different boxes:

Item name	Item SKU	Qty	Located in (SKU# if exist)
Series 1780 Power and control console 100A: Side A	KCBP	1	#AQJT
Series 1780 Power and control console 100A: Side B	EGTR	1	#YGKE
Electrical board fasteners bag	PRXQ	2	#AQJT & #YGKE

If you purchased the Series 1780 Dynamometer 40kgf-150A: Basic coaxial or Ultimate coaxial, there are two Power and control console 150A: Side A (SKU#:RBEP) and Side B (SKU#:GADP). You will find these items in two different boxes:

Item name	Item SKU	Qty	Located in (SKU# if exist)
Series 1780 Power and control console 150A: Side A	PERC	1	#RBEP
Series 1780 Power and control console 150A: Side B	HAYQ	1	#GADP
Electrical board fasteners bag	PRXQ	2	#RBEP & #GADO

The Series 1780 No-solder-board is an optional accessory. There will be no need to distinguish from A to B side for coaxial configurations. For each no-solder board that you ordered (SKU#: HABT), you can find these items in each box:

Item name	Item SKU	Qty	Located in (SKU# if exist)
Series 1780 no-solder board V2	KPAD	1	#HABT
Electrical board fasteners bag	PRXQ	1	#HABT

All five electrical components: the Series 1780 no-solder board, the Series 1780 power and control console: 100A Side A, 150A Side A, 100A Side B and 150A Side B share the same mounting features, and they all use the same fasteners. All the fasteners are included inside the electrical board fasteners bag (SKU#: PRXQ), located in each identical package of the circuit. You can find the following items in the bag:

Item name	Item SKU	Qty
M5 serrated flange nut	YTEX	4

These tie-wraps can be used to help you to better manage the cables as well as aid in the installation of your ESC. For the single motor configuration:

Item name	Item SKU	Qty	Located in (SKU# if exist)
Tie-wrap 0.1" width, 8" long	YCRH	20	Mono main board box (#RHGQ)

For the dual motor configurations:

Item name	Item SKU	Qty	Located in (SKU# if exist)
Tie-wrap 0.1" width, 8" long	YCRH	40	Dual main board box (#GPDE)

4.4.2 Fixing the no-solder board on the support plate

This part is only applicable to customers who purchased the Series 1780 no-solder board. You can skip this part if you have not purchased this component.

You need to prepare the following material:

Item name	Item SKU	Qty	Located in (SKU# if exist)
Two-plate support	N/A	1	Assembled by you
Series 1780 no-solder board V2	KPAD	1	No-solder board box (#HABT)
M5 serrated flange nut	YTEX	4	Electrical board fasteners bag (#PRXQ)

❑ Place the no-solder board (#KPAD) on any side of the support plate, aligning with the any of the four-hole feature indicated in fig. 4.26. However, it is recommended putting it as close to the motor as possible:

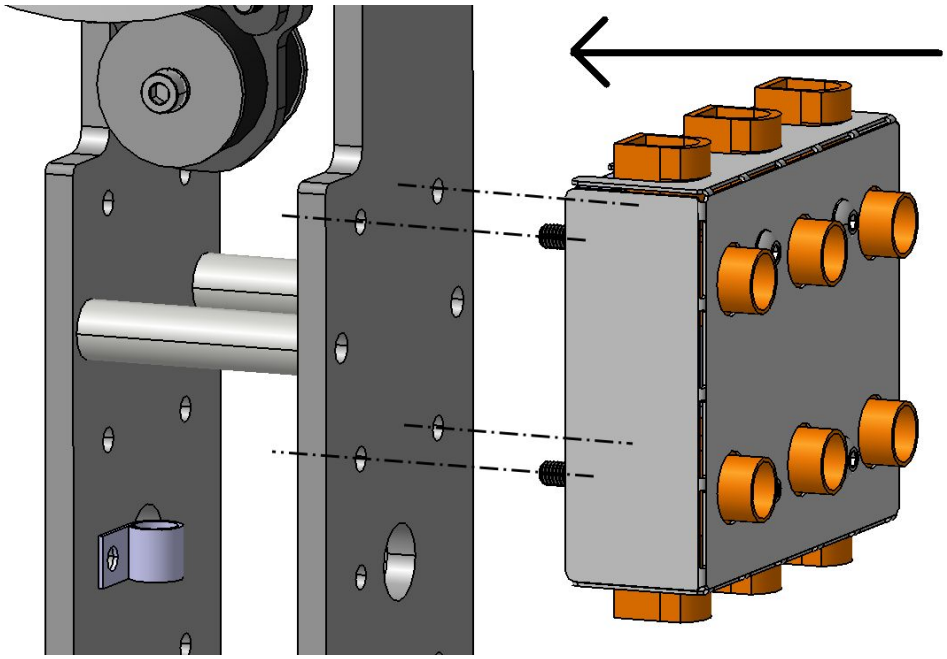


Fig 4.26: Insert the no-solder board on the support plate

- ❏ Insert the no-solder board completely on the support, until the pre-assembled M5 high nuts touches the support plate.
- ❏ Rotate the M5 serrated flange nut (#YTEX) in to the M5 screw head that extends past the casing (see Fig. 4.27).

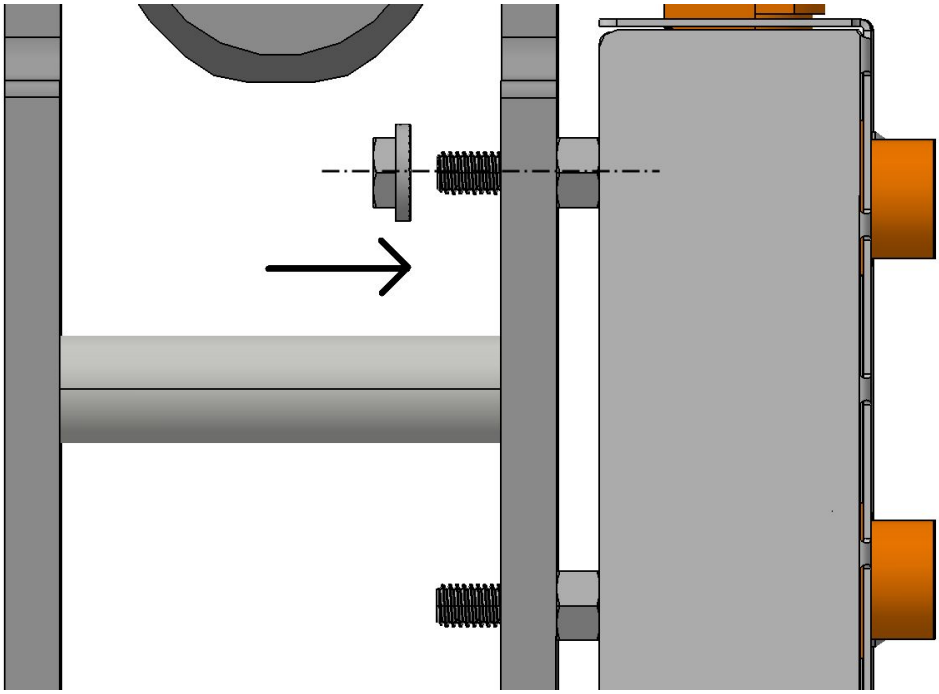


Fig. 4.27: Insert the nuts to fix the no-solder board onto the support plate

- ❏ Repeat the previous step for the other 3 nuts.
- ❏ Use the supplied wrench to fasten all four nuts, in a diagonal sequence.
- ❏ Check the tightness of the fasteners every time before you run any tests.

IMPORTANT!

Under no circumstance should you remove the M5 torx screw nor remove the M5 high nut sealed to the casing. Always keep them on the no-solder board and mount the circuit only with the separated M5 serrated flange nuts!

4.4.3 Fixing the ESC on the support plate

Depending on the size of the ESC, and the fixture pattern on the ESC, you may have lots of different options to fix the ESC on the support plate. Therefore, it is always your own decision on how to fix the ESC on the support or choose to fix it elsewhere.

Here we will show you an example. Inside the package of the main board, you can find tie-wraps. On the support plate, there are also extra hole features and the standoffs which can be used for tie-wrap fixing.

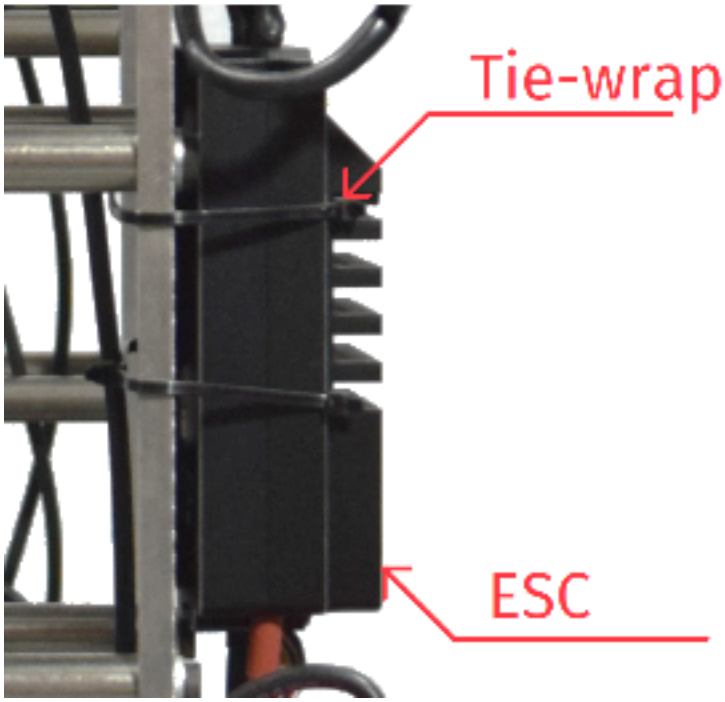


Fig. 4.28: Example on fixing ESC on the support plate using tie-wraps

If one tie-wrap is not long enough, you may use two in-line in order to extend the total length. You will need to apply tie-wraps in several positions to assure enough strength in holding the ESC on the support plate. Any loose object may cause damage to your propeller and/or cause casualty.

When you install the ESC on the support plate, please pay extra attention to the cable length of your ESC. If you are using the RCbenchmark Series 1780 no-solder board, make sure the output cable can reach the no-solder board and can be inserted into the lug; if you are not using the Series 1780 no-solder board, please make sure that the cable from the motor and output from the ESC can be connected together.

4.4.4 Fixing the power and control console on the support plate

IMPORTANT!

All power and control consoles (Side A or B, 100A or 150A) were tested and calibrated at our facility. Please do not remove the M5 high nuts nor the M5 torx screw on the top and the bottom to open the casing. Unauthorized opening will void the warranty.

If you purchased any dual motor configurations, please pay extra attention to where you will install the power and control console: make sure that the side A power and control console will be mounted with the support that holds the side A load measurement unit. Any unmatched side may affect the testing results.

You need to prepare the following material:

Item name	Item SKU	Qty	Located in (SKU# if exist)
Two-plate support	N/A	1	Assembled by you
Power and control console 100A Side A or Side B or Power and control console 150A Side A or Side B	KCBP EGTR PERC HAYQ	1	Power and control console package (#AQJT, #YGKE, #RBEP or #GADP)
M5 serrated flange nut	YTEX	4	Electrical board fasteners bag (#PRXQ)

Operations on the power and control console Side A and Side B, or 100A and 150A are similar. The following instruction is using the SKU# of the Power and control console 100A: Side A. When you are about to install other unit or other rating, simply follow the same steps:

- ❏ Take out the Power and control console Side A (#KCBP) and remove the cable twist tie from the two COM cables in the back of the unit.
- ❏ Pass the two COM cables, with the connector, through one of the center hole on the support plate. There are seven large center holes on the support plate, decide which one to use according to the dimension and the space left for the circuit. Approach the power and control console to your ESC as much as possible.

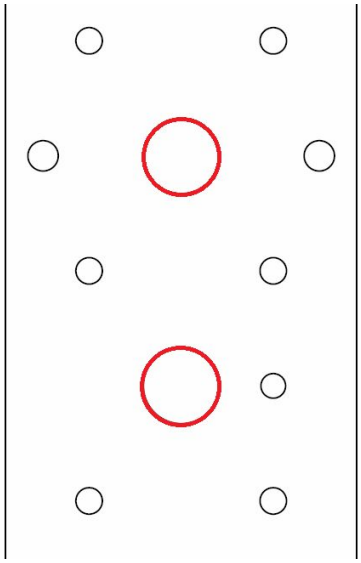


Fig. 4.29: Highlighted hole features for cable passing through

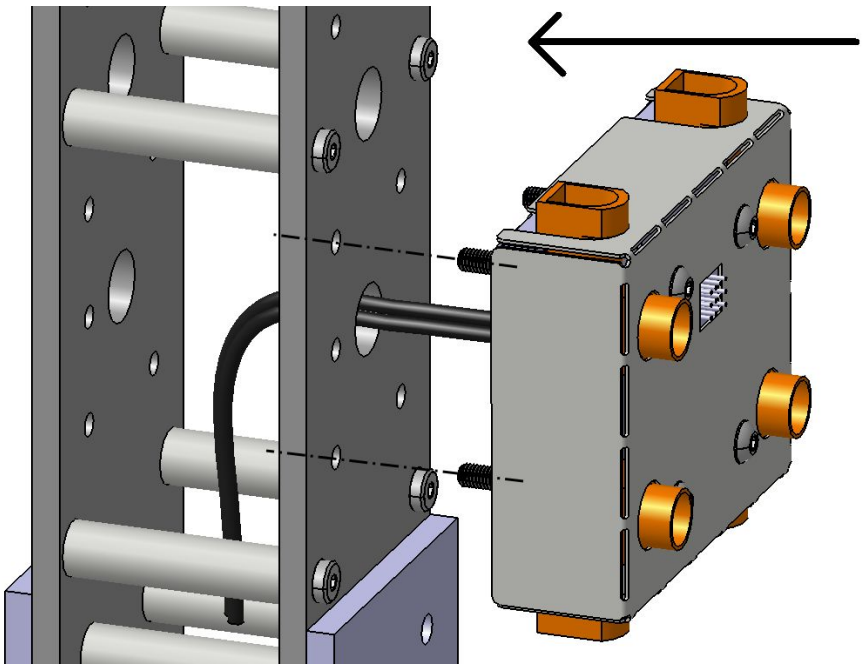


Fig. 4.30: Insert the power and control console onto the support plate

- ❏ Align the four M5 screws as well as the grommet in the back of the console with the mounting points (four D5.75mm holes) on the support plate
- ❏ Insert the screw features on the power and control console (#KCBP) into the support plate. In the meantime, pull those two COM cables until the M5 high nuts on the back of the console reaches the support plate.
- ❏ Make sure that the cable does not touch any sharp edge of the center hole.

- ❏ Take the M5 serrated flange nut (#YTEX) and rotate them onto the M5 screw on the other side of the support plate

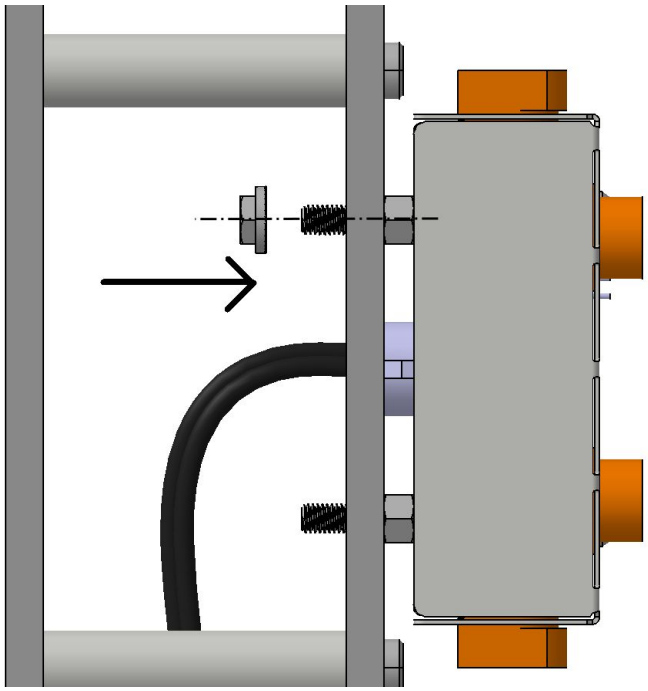


Fig. 4.31: Insert the M5 flange nuts onto the screw

- ❏ Repeat the previous step for the other 3 nuts.
- ❏ Use the supplied wrench to fasten all the four nuts, in a diagonal sequence.
- ❏ If you have purchased any coaxial configurations, repeat all the steps above to install the Power and control console: Side B.
- ❏ Check the tightness of the fasteners every time before you run any tests.

4.5 Main board

Main board is the core component of the Series 1780 Dynamometer. It performs data processing from all the sensors, signal processing for the output PWM to ESC, as well as connection to a workstation for the GUI control.

There are two different versions of the main boards:

- Mono main board (SKU#: RHGQ): for one motor control and measurement
- Dual main board (SKU#: GPDE): for two motors control and measurement

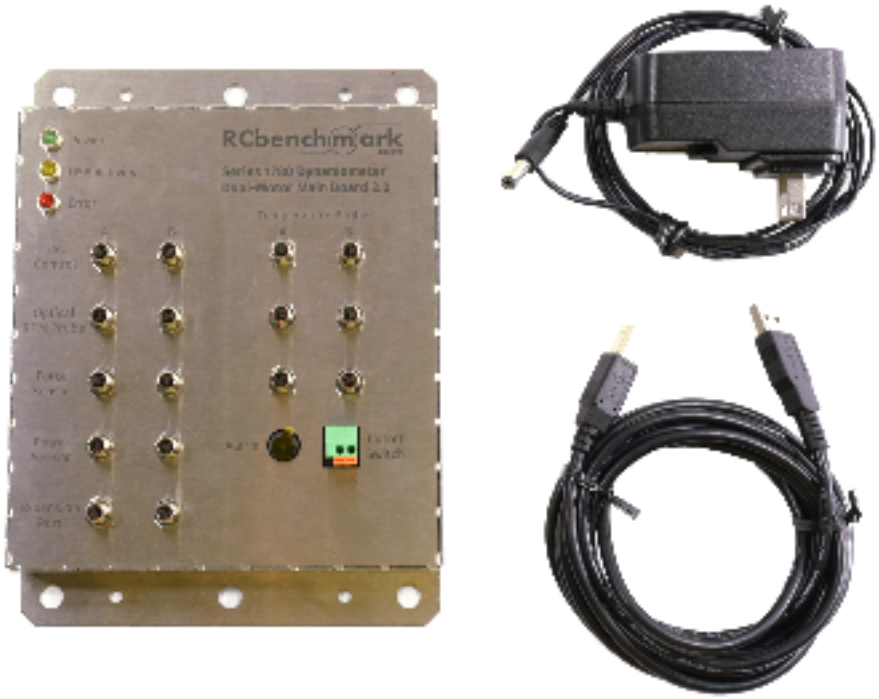


Fig. 4.33: Photo of dual main board with USB cable and power adapter

The difference between the mono and dual main board is the number of connectors supported. Please keep in mind that the mono main board and dual main board share the same power supply and USB connector, as well as the same mounting features.

All Series 1780 main boards provide high quality connectors for connecting the power sensor, force sensor, control unit and other accessories. They also feature buzzer for overload alert, safety cutoff switch, LED indicators, etc.

In this part, we will only present the installation of the main board. For the cable connection of the main board, as well as the use of the buzzer and safety cut-off switch, please refer to Chapter 5.

4.5.1 What's included

If you received the mono main board (SKU#: RHGQ) in the carton, you can check these items inside the package. If you are following the correct procedure of assembly, the optical RPM sensor inside the package should have already been taken out and installed on the motor mount in the previous operation (marked grey in the table):

Item name	Item SKU	Qty
Series 1780 complete mono main board V2	BJXT	1
USB cable	JG3F	1
Optical RPM Probe V2: A	RTJK	1
Optical probe fasteners and spacers kit	JRXA	1
Tie-wrap 0.1" width, 8" long	YCRH	20

If you received the dual main board (SKU#: GPDE) in the carton, you can check these items inside the package. If you are following the correct procedure of assembly, both optical RPM sensors for A and B side inside the package should have been taken out and installed on the motor mount in the previous operation (marked grey in the table):

Item name	Item SKU	Qty
Series 1780 complete dual main board V2	JAGY	1
USB cable	JG3F	1
Optical RPM probe V2: A	RTJK	1
Optical RPM probe V2: B	QCPT	1
Optical probe fasteners and spacers kit	JRXA	2
Tie-wrap 0.1" width, 8" long	YCRH	40

The USB cable is used to connect the main board with your PC, in order to allow communication and data processing on the RCbenchmark software. The tie-wraps can be used to tie all the loose cables

The power adapter is located in the main shipping carton box. The power adapter features several plugs commonly used in the world.

Item name	Item SKU	Qty
Main board power adapter	PGAC	1

4.5.2 How to install the main board on your structure

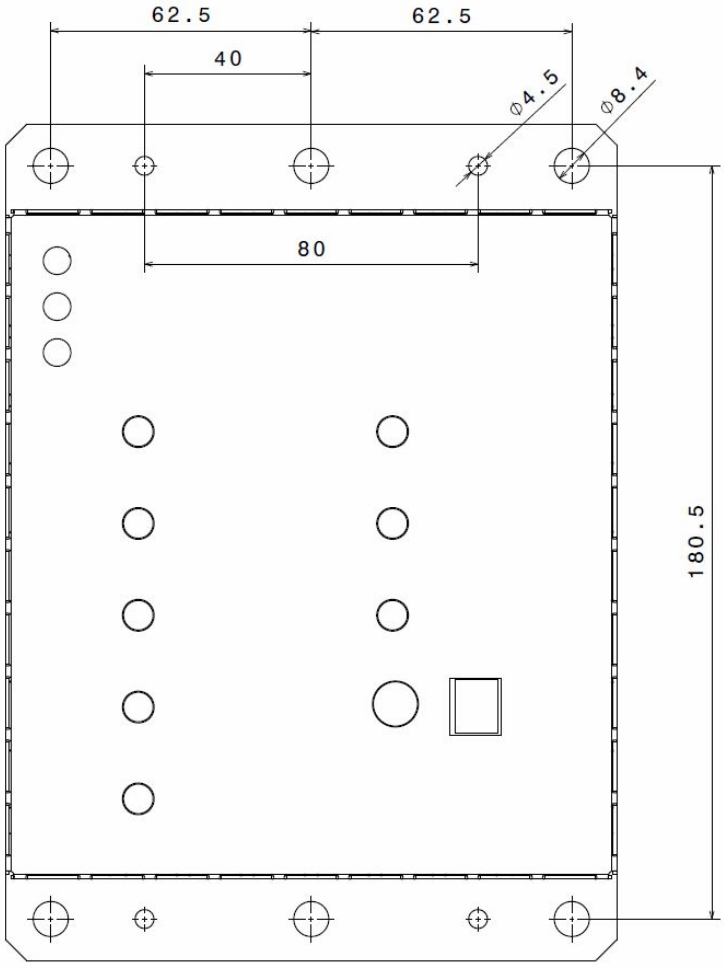


Fig. 4.34: Schematic drawing for main board mounting holes

You can use any of these holes to mount the Series 1780 main board onto your structure. You will need to prepare your own fasteners. There are two types of holes you can choose:

- Diameter 4.5mm - 4 holes on two sides
- Diameter 8.4mm - 6 holes in the center and two sides

4.5.3 Install the main board on the RCbenchmark enclosure

If you purchased the RCbenchmark Series 1780 enclosure (any format), the main board can be fixed on the T-slotted rails. You will need the following material:

Item name	Item SKU	Qty	Located in (SKU# if exist)
Mono main board or Dual main board	BJXT or JAGY	1	Mono or dual main board package (#RHGQ or #GDPE)
T-slotted rails	N/A		Any rail on the enclosure you want to mount the main board with
5/16"-18 11/16" long button screw - end feed fastener	KEDB	2	End feed fastener bag (#TEBK) in the enclosure package
5/16"-18 slot nut - end feed fastener	YREC	2	End feed fastener bag (#TEBK) in the enclosure package
Spacer 3/4" OD, 3/16" Long, for 5/16" Screw Size	CRKD	2	Mono or dual main board package (#RHGQ or #GDPE)

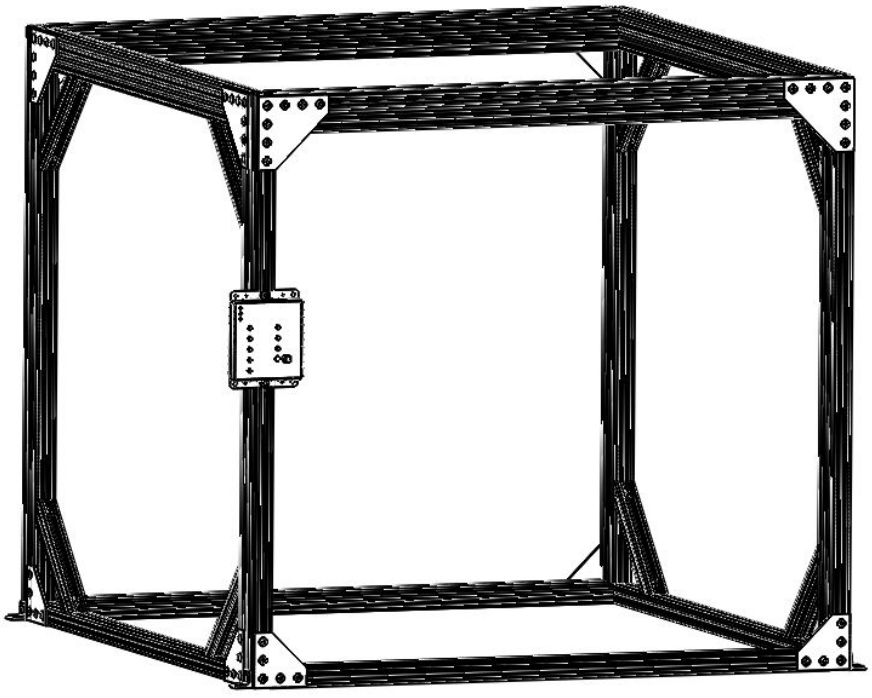


Figure 4.35: Enclosure with Main board

Please follow these instructions to install the main board on the enclosure:

- ❏ Take your mono or dual main board (#BJXT or #JAGY)
- ❏ Take one end feed fastener screw and nut (#KEDB and #YREC) and one spacer for main board on enclosure (#CRKD)
- ❏ Put the screw the spacer and the nut through the hole in the main board like the Fig. 4.36. Don't tighten yet to allow the main board to slide on the groove.
- ❏ You may have to open a part of your enclosure to allow your main board to slide on the vertical beam. Fix it at the height you want as shown in Fig. 4.37.

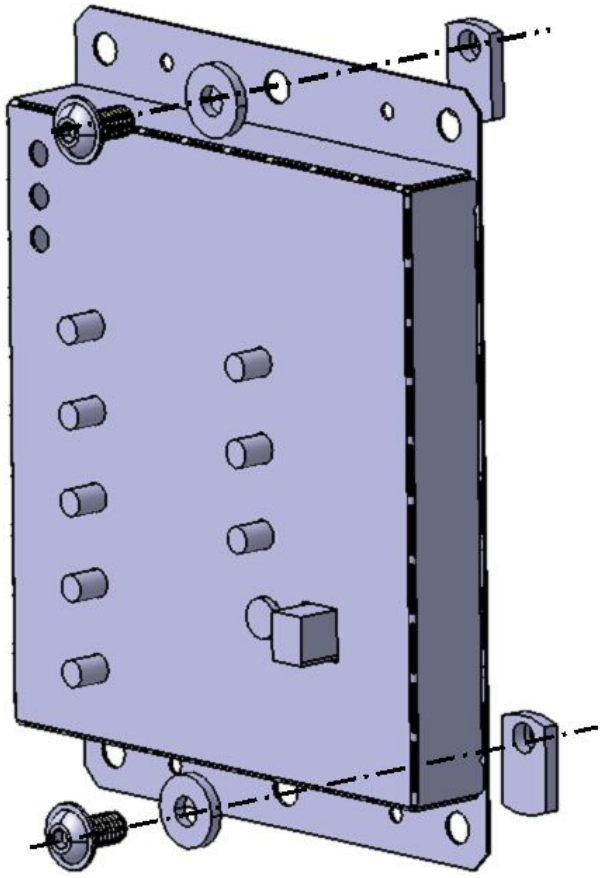


Figure 4.36: End fasteners with spacers on main board

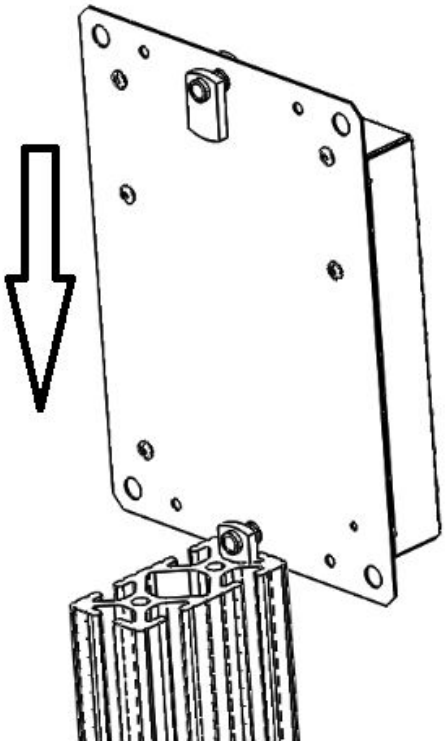


Figure 4.37: Main board with fastener sliding on the vertical beam

- ❏ Finish the assembly of the enclosure as shown in Fig. 4.35.
- ❏ Tighten the 5/16"-18 11/16" (#KEDB) long button screws.
- ❏ Please make sure that the main board is at an accessible distance for the COM cable from the electrical components, for the power cord from the power source as well from the USB cord to your PC. You may optionally purchase COM cable extensions (contact our support team).

4.6 Coaxial back-to-back special mount

This section of the manual is only applicable to the customers who purchased the Series 1780 Dynamometer: Ultimate coaxial (SKU#: KCHQB or SKU#: KDRHP).

In Ultimate coaxial configuration, you will be able to set up two motors back-to-back, with a minimum distance of 100mm. If you are using only the Basic coaxial for a back-to-back setup, the minimum achievable distance between the back of each motor is 250mm (with railing system). To achieve 100mm axial distance you must use the back-to-back special mount and put the two vertical beams off-center (Fig. 4.38).

The range that this coaxial back-to-back special mount provide is [100, 188] mm. When your axial distance between two motors exceeds 188mm you can place the B side unit directly in the back of the A side unit, on the same parallel two rails, similar to the face-to-face unit.

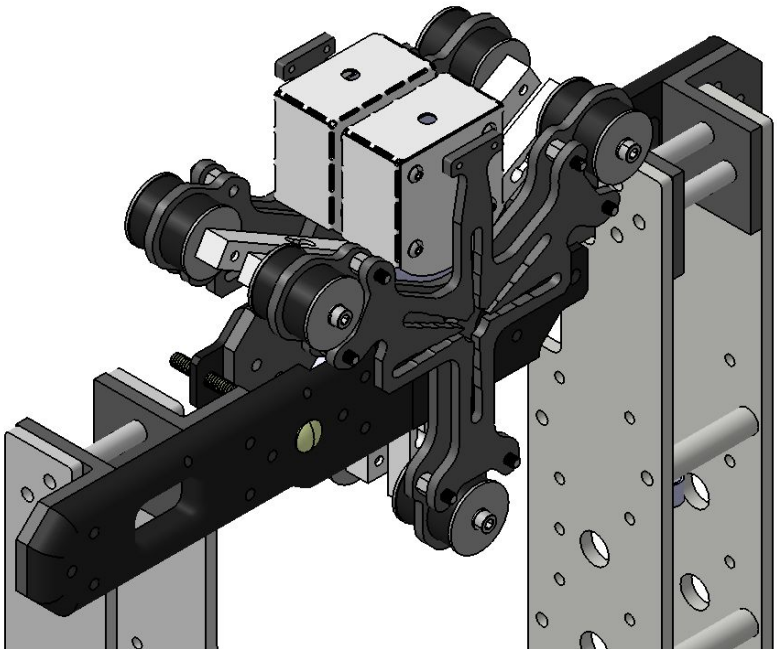


Fig. 4.38: Motors offset from supports for coaxial back-to-back with the special mount. [100, 188] mm.

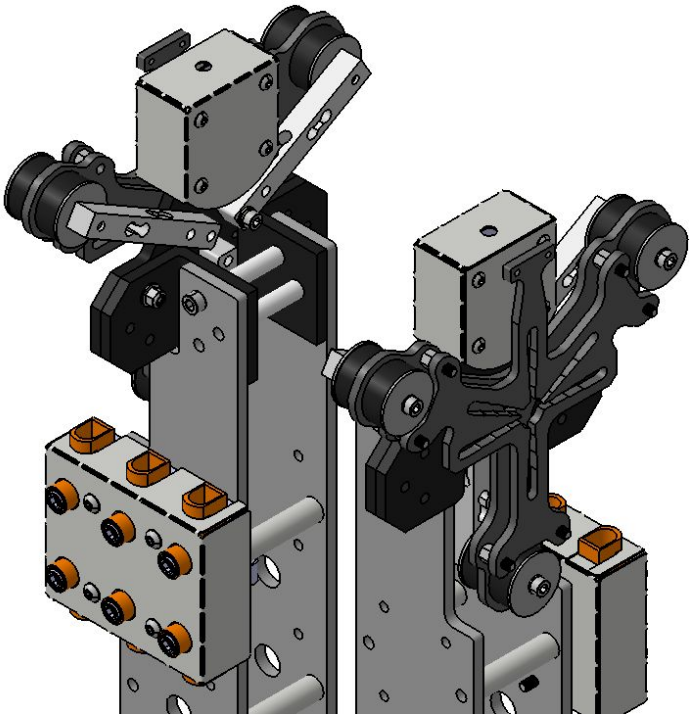


Fig. 4.39: Coaxial back-to-back without the special mount. Above 170mm range, or 250mm with the railing system.

4.6.1 What's included

If you ordered the Series 1780 Dynamometer 25kgf-100A: Ultimate coaxial (SKU#: KCHQB) or the Series 1780 Dynamometer 40kgf-150A: Ultimate coaxial (SKU#: KDRHP), you will receive an extra box for the special mounting (SKU#: JCTX) inside the main shipping carton.

You can find the following items inside the box of #JCTX:

Item name	Item SKU	Qty
Back-to-back coaxial mount	JRCQ	2
Coaxial special mounting fasteners	AKGY	1

Within the bag of fasteners for coaxial special mounting, you will find:

Item name	Item SKU	Qty
M5 x 25mm socket head screw	YBJA	12
M5 x 20mm socket head screw	3NGA	6
M5 x 15mm socket head screw	CLKD	6
M5 flange nylon insert nut	BAKT	24
1/4"-20 3.5" long neck bolt	AJXB	2
1/4"-20 4.5" long neck bolt	QGKD	2
1/4"-20 6" long neck bolt	GHAE	2
1/4"-20 serrated flange nut	CGYE	2
1/4"-20 1/2" long female-female standoffs	RAJP	4
1/4"-20 hex nut	RBPY	4

4.6.2 Placing the load measurement unit onto the special mount

It is recommended to first put the load measurement unit, either A or B side, onto the coaxial special mount. Since this must be a coaxial setup, you will need to repeat the same operations to mount the other side's unit onto the second mount.

You will need to prepare the following material before starting the assembly:

Item name	Item SKU	Qty	Located in (SKU# if exist)
Back-to-back coaxial mount	JRCQ	1	Back-to-back special mount box (#JCTX)
Load measurement unit 25kgf-12Nm side A / Side B or Load measurement unit 40kgf-18Nm side A / side B	XBKH RJGT QEAT HDKJ	1	Load meausrement unit package (#TRAK, #GDBA, #GYJT, or #EPDY)
M5 x 20mm socket head screw	3NGA	3	Coaxial special mount fastener bag (#AKGY)
M5 x 15mm socket head screw	CLKD	3	Coaxial special mount fastener bag (#AKGY)
M5 flange nylon insert nut	BAKT	6	Coaxial special mount fastener bag (#AKGY)

The following instruction demonstrates operations with the 25kgf-12Nm load measurement unit side A. For other side or other rating, operations are similar. Please follow these instructions:

- ❏ Take out the back-to-back coaxial special mount plate (#JRCQ)
- ❏ Take out the load measurement unit (#XBKH) from the packaged protected case. For operations about how to open the protective casing, refer to section 4.2.3 in this chapter.
- ❏ Insert the back-to-back coaxial special mount (#JRCQ) into the load measurement unit (#XBKH): in between the lower plate and the upper plate. Use the support edges indicated in Fig. 4.39 to align and keep sliding the mount in.
- ❏ Slide the special mount all the way in as shown in Fig. 4.40 until the edges in contact and the six holes on the special mount aligning with the lower plate of the load measurement unit.

- There is a tie-wrap that fix the COM cables from the load measurement unit extending on the sliding side. Simply adjust a bit the distance between the special mount and the load measurement unit lower plate in order to go through the tie wrap. When the special mounting plate is completely inserted, there will be a hole specially designed on the mounting plate for this tie-wrap.

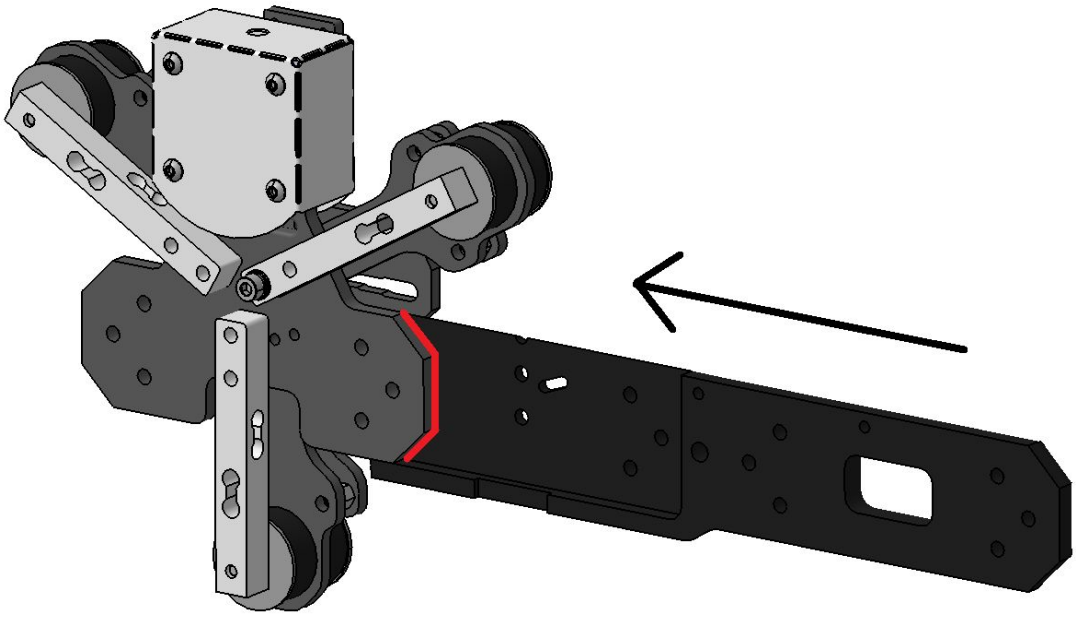


Fig. 4.40: Slide the special mount plate into the load measurement unit using highlighted feature

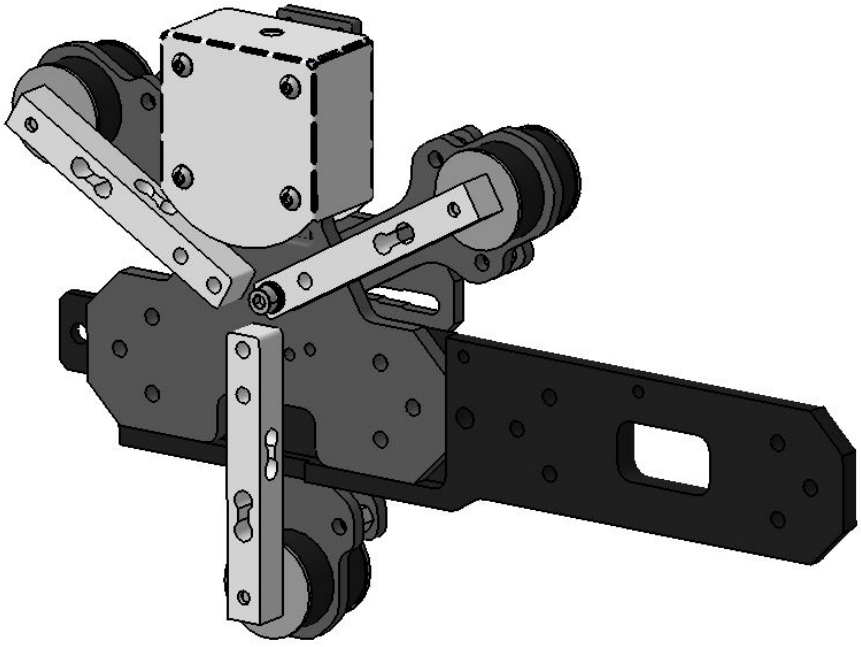


Fig. 4.41: The coaxial back-to-back special mount completely inserted into the load measurement unit

- ❏ Take three M5 x 15mm socket head screws (#CLKD)
- ❏ Take three M5 x 20mm socket head screws (#3NGA)
- ❏ Take six M5 flange nylon insert nuts (#BAKT)
- ❏ Insert the M5 x 15mm socket head screws (#CLKD) into the edge side 3 holes through the special mount (#JRCQ) and the load measurement unit (#XBKH).
- ❏ Insert the M5 x 20mm socket head screws (#3NGA) into the center side 3 holes through the special mount (#JRCQ) and the load measurement unit (#XBKH)
- ❏ Rotate in six M5 flange nylon insert nuts (#BAKT) in the back of the load measurement unit to the M5 x 15mm and M5 x 20mm socket head screws (#CLKD and #3NGA)

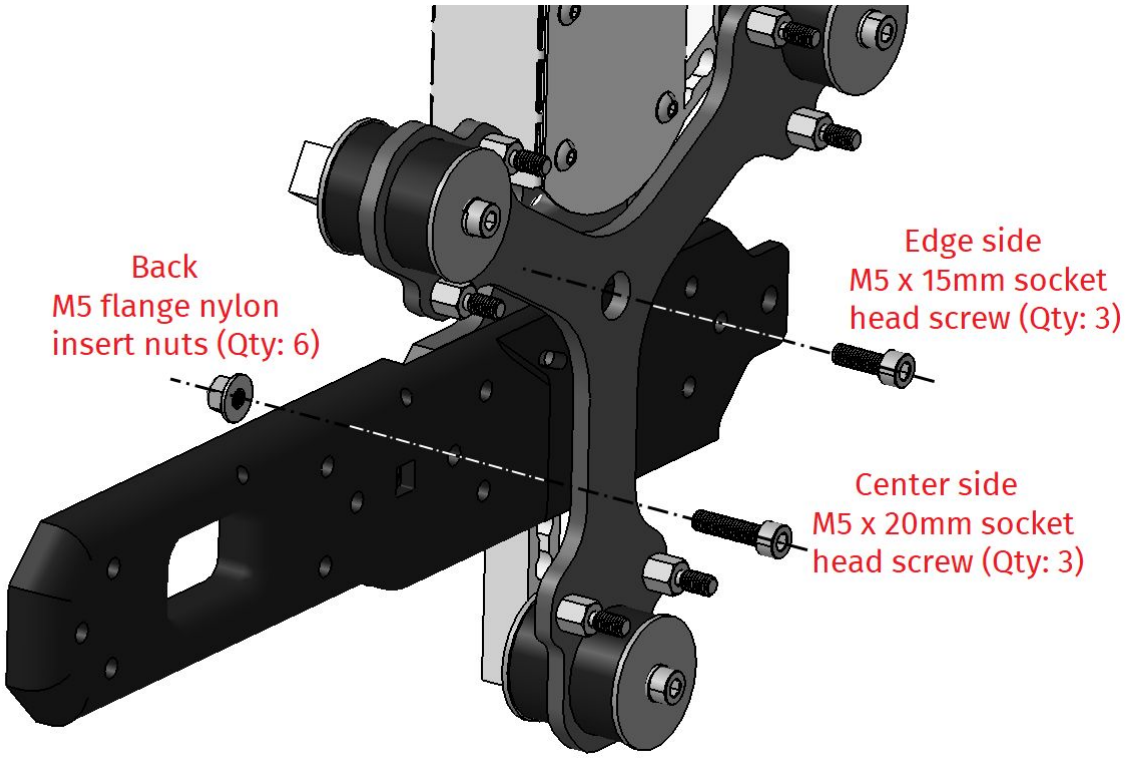


Fig. 4.42: Fasteners to tighten the special mount and the load measurement unit

- ❏ Use the wrench to tighten the M5 flange nylon insert nuts into the socket screws, following a diagonal sequence.
- ❏ Check the tightness of all the fasteners.
- ❏ Repeat all the steps above to build the second assembly with the B side load measurement unit (#RJGT or #HDKJ).

4.6.3 Fixing the special mount assembly onto the support

Once you finish the assembly of the load measurement unit with the special mount. You can now place the mount onto the two-plate support.

You need to prepare the following material:

Item name	Item SKU	Qty	Located in (SKU# if exist)
Load measurement unit assembled with the back-to-back special mount	N/A	1	Assembled by you
Assembled two-plate support	N/A	1	Assembled by you
M5 x 25mm socket head screw	YBJA	6	Coaxial special mount fastener bag (#AKGY)
M5 flange nylon insert nut	BAKT	6	Coaxial special mount fastener bag (#AKGY)

Similar to the other coaxial setup, please be careful about where to place the A side and the B side. You must install all components from the same side together, having the load measurement unit side A to work with the power sensor side B may cause incorrect test results..

Please follow these instructions to install the mount:

- ❏ Take out the six M5 x 25mm socket head screws (#YBJA)
- ❏ Take the load measurement and coaxial special mount assembly and place it onto the two-plate support: aligning the six hole features on the black upper L brackets.
- ❏ Insert the M5 x 25mm socket head screws (#YBJA) into the one of the six holes through the special mount and the L brackets.

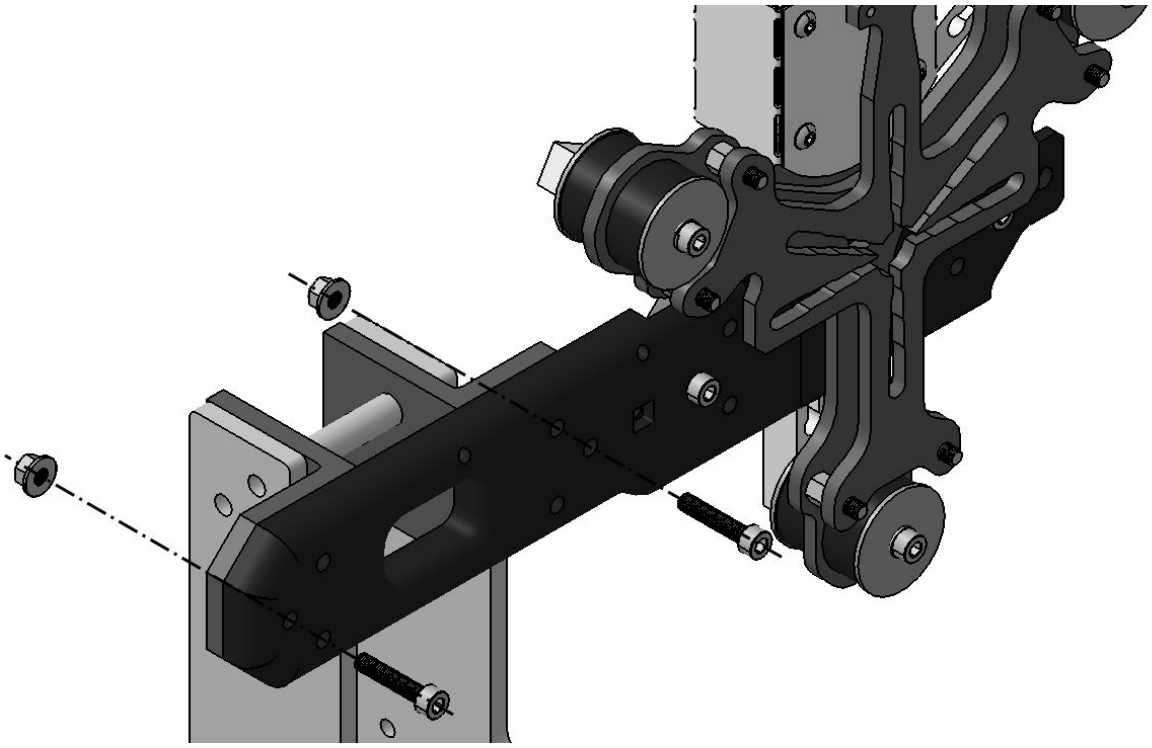


Fig. 4.43: Insertion of fasteners to connect the special mount and the two-plate support

- ❏ Repeat the last step for the rest five screws and nuts
- ❏ Use a wrench and an allen key to firmly tighten all the six nuts into the screw, in a diagonal sequence
- ❏ Double check the tightness of the fasteners
- ❏ Repeat all these steps for the B side unit.

4.6.4 Bonding of two load measurement units

Since the load measurement unit is now offset from the support center, the structure will eventually bend a certain angle when the motor and propeller are generating high thrust. In order to avoid this bending, you should bond the two load measurement units together.

You will need to prepare the following material:

Item name	Item SKU	Qty	Located in (SKU# if exist)
Load measurement unit: Side A on the support and special mount	N/A	1	Assembled by you on the rails/testbench
Load measurement unit: Side B on the support and special mount	N/A	1	
1/4"-20 3.5" long neck bolt	AJXB	2	Coaxial special mount fastener bag (#AKGY)
1/4"-20 4.5" long neck bolt	QGKD	2	
1/4"-20 6" long neck bolt	GHAE	2	
1/4"-20 serrated flange nut	CGYE	2	
1/4"-20 1/2" long female-female standoffs	RAJP	4	
1/4"-20 hex nut	RBPY	4	
OD1/2, ID1/4, 1/2" long spacer	XHEB	4	

To connect the two load measurement units together, you will need the two hole features on the coaxial back-to-back special mount. In the center side of the coaxial mount, this features a square hole; while in the edge side, this features only a round hole.

Within the fastener bag, you can find three formats of ¼”-20 square neck bolts. Each format is used for certain range of axial distance between two motors:

- 3-½” long bolt: [100, 115] mm
- 4-½” long bolt: [110, 140] mm
- 6” long bolt: [120, 188] mm

If your motor is thick enough, you may always keep using the 6” long bolt. However, pay attention if the extra length of bolt may interfere with the propeller.

Please follow this instruction to bond the two units together:

- ❏ Take one size of the square neck bolt out from the bag: you may need to decide which one to use based on the axial distance you wish to test.
- ❏ Insert the bolt through the square hole on the A side unit, but not the round hole on the B side unit.

- ❏ Possible action 1: rotate two ¼”-20 ½” long female-female standoffs (#RAJP) to the neck bolt, in between two load measurement units. And then let the bolt through the round hole on the B side unit. Apply a ¼”-20 hex nut (#RBPY) on the end of the bolt.

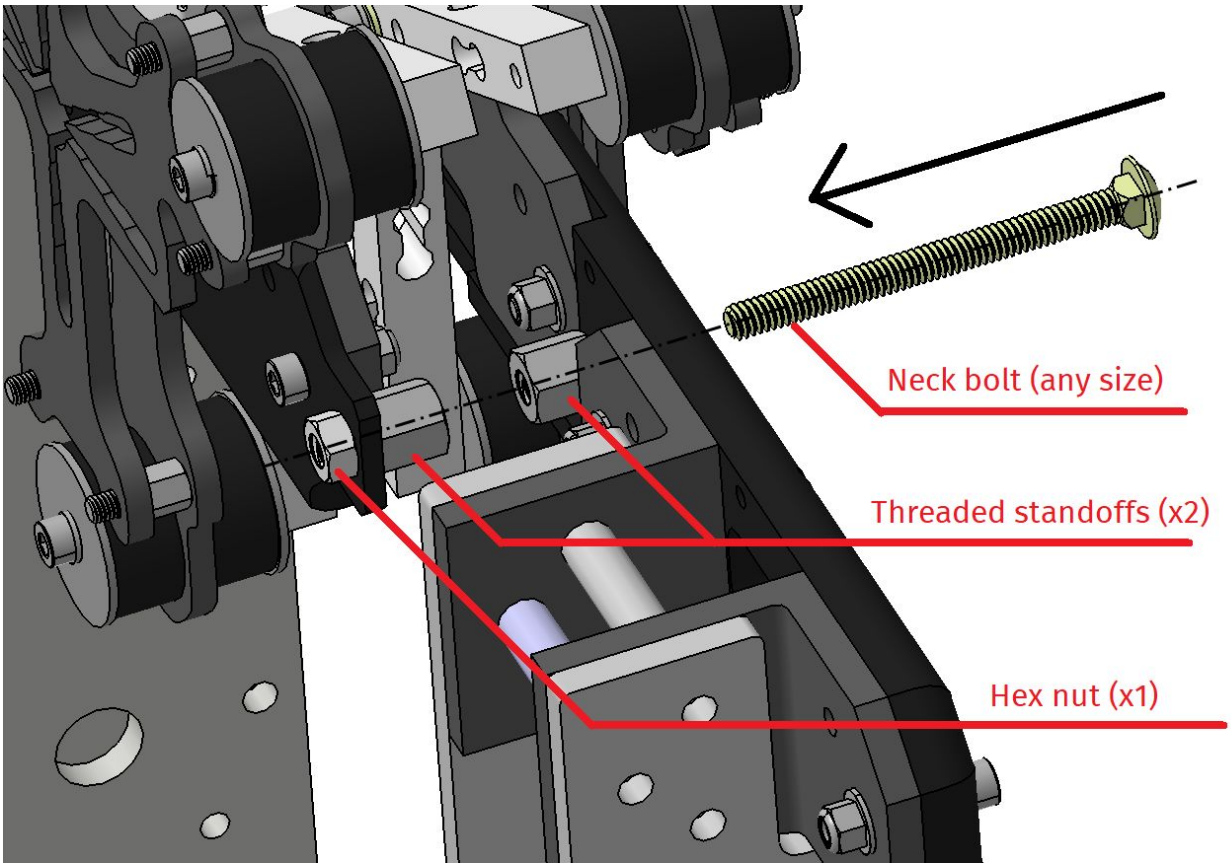


Fig. 4.44: Bonding two load measurement units with neck bolts and standoffs (Possible action 1)

- ❏ Possible action 2: rotate these four components to the neck bolt, in between two load measurement units, in such a sequence:
    - ❏ OD1/2, ID1/4, 1/2" long spacer (#XHEB)
    - ❏ 1/4"-20 hex nut (#RBPY)
    - ❏ 1/4"-20 hex nut (#RBPY)
    - ❏ OD1/2, ID1/4, 1/2" long spacer (#XHEB)

- ❏ Once you finish rotating these components into the bolt, let the bolt go through the round hole on the B side unit. And then apply the 3rd ¼”-20 hex nut on the end of the bolt.

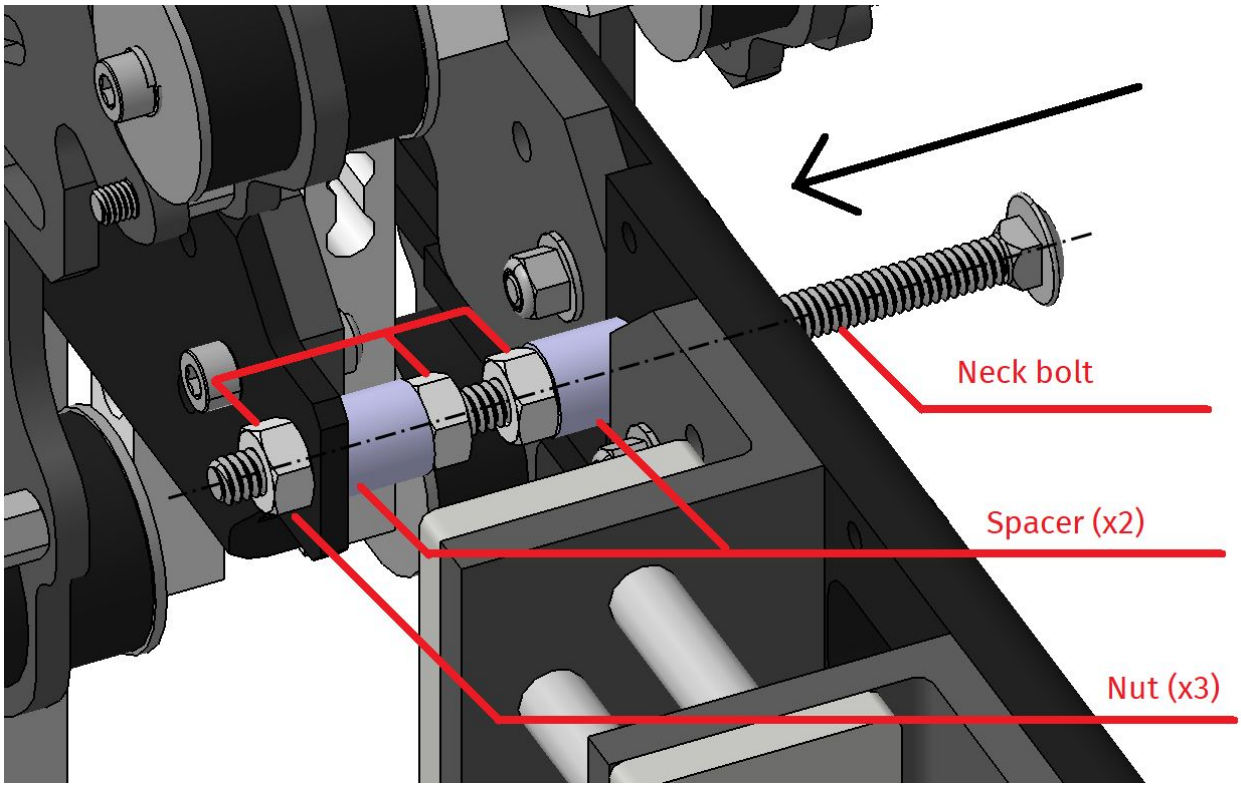


Fig. 4.45: Bonding two load measurement units with neck bolt, spacers and nuts (Possible action 2)

- ❏ Make sure the head of the square neck bolt reaches the square hole on the coaxial back-to-back special mount.
- ❏ You may adjust the axial distance by loosening the nuts or standoffs and rotate them forward or backward. Once you reach the ideal axial distance, tighten the nuts or standoffs with two units. During all the tests, you must make sure that all these bolts, nuts or standoffs are well fastened.
- ❏ Repeat the same steps to have another bolt go from the B side to A side.

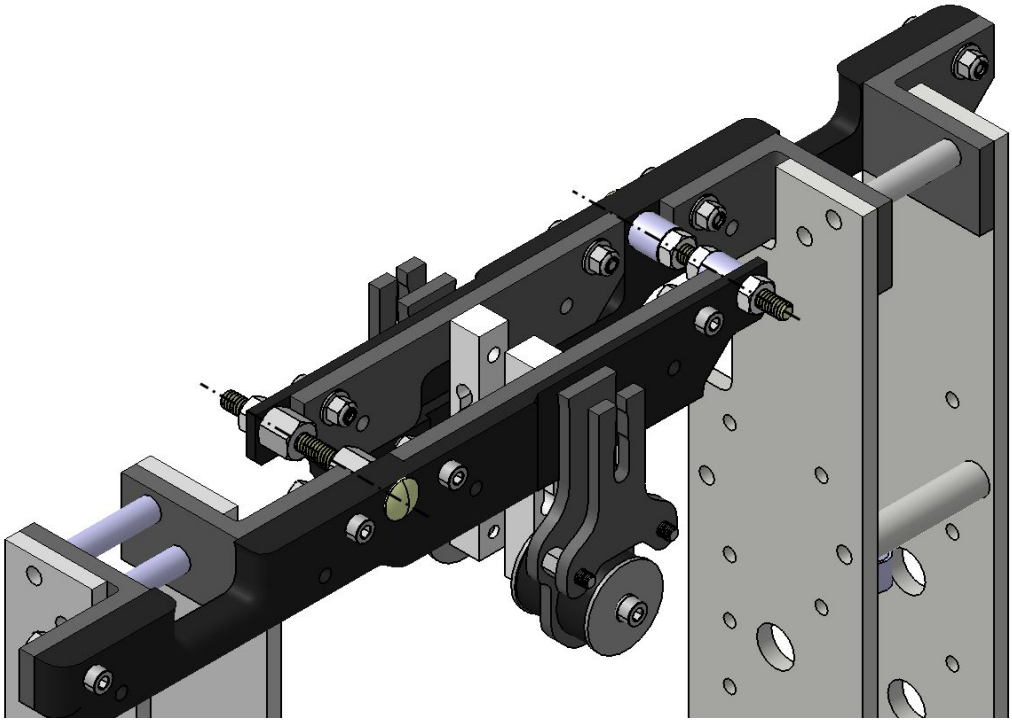


Fig. 4.46: Cut view of two bolts connecting two load measurement units (using two methods)

- ❏ You must be very careful for using long bolts to reach small axial distance. Turn the propeller with your hand for several rounds to double-check if there is any interference between the bolt and the propeller. Never let the end of your bolt reach too close to your propellers as the propeller may deform when it spins.
- ❏ If you need to reach another range of distance, it is recommended to use another format of bolt supplied in the fastener bag.

IMPORTANT!

Check interference before every test when using the bolts and special mount!

Check the tightness of the nuts every time when you adjust the axial distance.

Chapter 5: How to connect electrical components

In this chapter, we will present you a guide to connect all your electrical components together. Please follow this guide carefully and respect all the safety rules.

5.1 Electrical safety rules

- The mainboard is power by a 5V, 2A power adapter, which is included in the package. Do not try to power it by using other power supplies that output other voltages.
- The maximum measuring voltage of the Series 1780 Power and control console is 60V. Maximum continuous current input is 100A or 150A, depending on the capacity that you have chosen.
- When connecting the power cable or bullet connectors on the Power and control console, do not let the exposed metal of the wire touch the casing.
- Turn off the power supply when you are connecting the power wire to the Series 1780.

5.2 Motor power chain

5.2.1 Motor, no-solder board to ESC

Please follow this instruction to connect the motor's power chain:

- ❏ On the no-solder, untighten the six 7/16-20 lugs in order to put cable inside.
- ❏ Put the motor's cable on the no-solder board on motor side and tighten the three 7/16-20 lugs.
- ❏ On the other side put the ESC's cable and tighten the three 7/16-20 lugs.

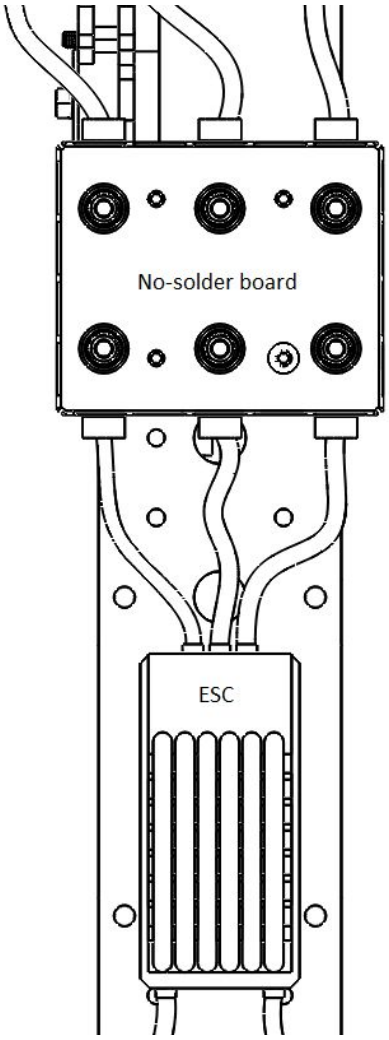


Fig. 5.1: Power chain between motor, no-solder board and ESC

5.2.2 ESC to power and control console

IMPORTANT!

High voltage operation. Make sure the power is cut-off before carrying out this operation!

Reversed pole or flipped ESC/power side or short-circuit can cause severe damage to the sensor and may cause fatality.

Please follow this instruction to connect your ESC to your power and control console:

- ❏ On the power and control console, untighten the four M4 lugs in order to put the ESC cable.

- ❏ Take the red ESC's power cord (Positive), plug it into the lug on the power and control console: ESC side, +(POSITIVE). And then tighten the 7/16"-20 screw on the lug.
- ❏ Take the black ESC's power cord (negative), plug it into the lug on the power and control console: ESC side, - (NEGATIVE). And then tighten the 7/16"-20 screw on the lug.
- ❏ Double check the polarity of the two cords, confirm they are matching the polarity indication on the power and control console.

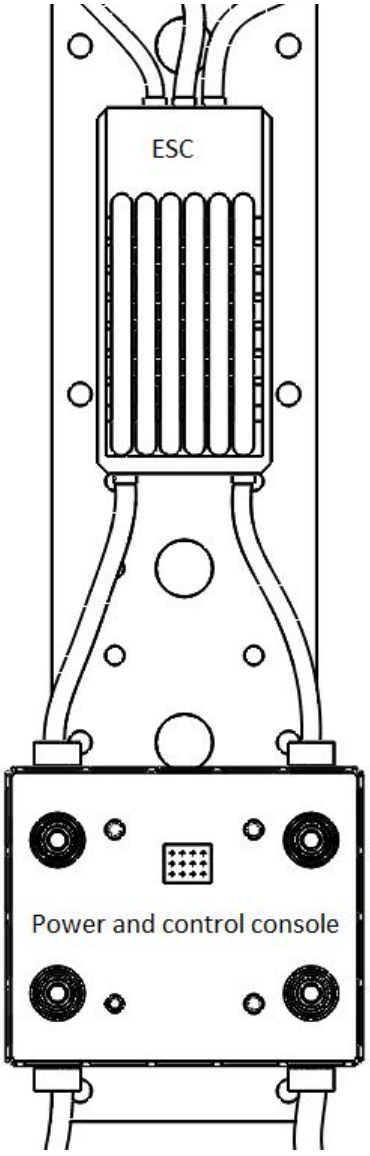


Fig. 5.2: Power chain between ESC and power and control console

5.2.3 Power and control console to your power source

Please follow this instruction to connect the cable:

- ❏ Insert the positive pole cord into the lug on the power and control console: Power side, + (POSITIVE), and then tighten the 7/16”-20 screw.
- ❏ Insert the negative pole cord into the lug on the power and control console: Power side, - (NEGATIVE), and then tighten the 7/16”-20 screw.
- ❏ Check the power source, the cords, and the console, confirm the polarity is matching.

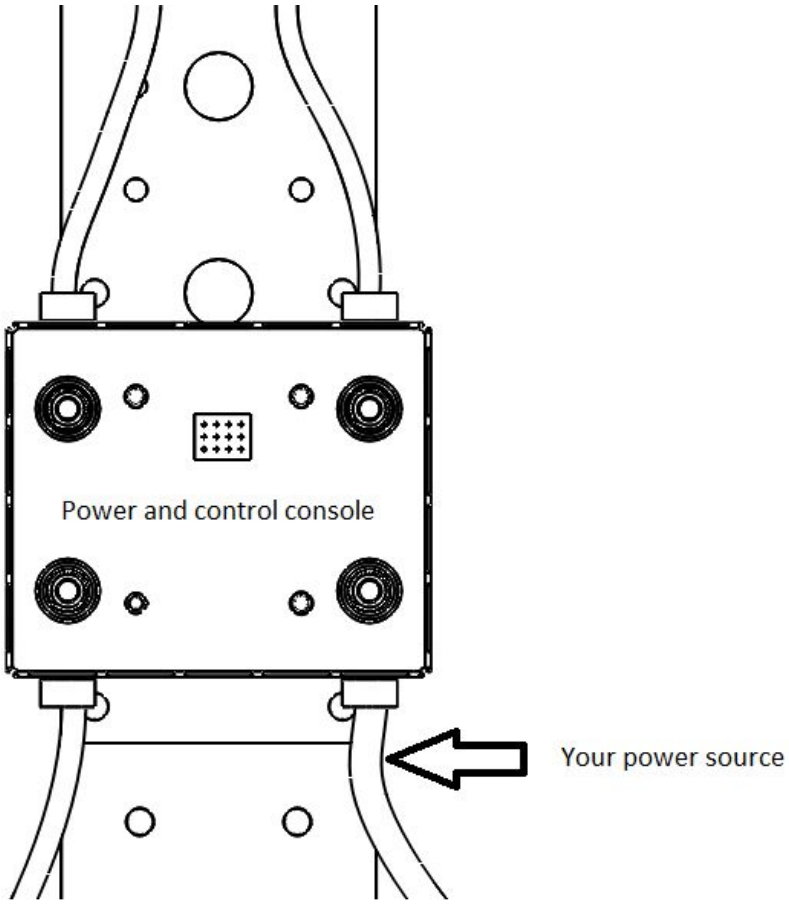


Fig. 5.3: Power chain between power and control console and your power source

5.3 Sensor chain

5.3.1 Optical RPM probe and force sensor

Please follow this instruction to connect:

- ❏ Connect the optical RPM probe cable to the connector on the load cell measurement unit as shown in Fig. 5.4.

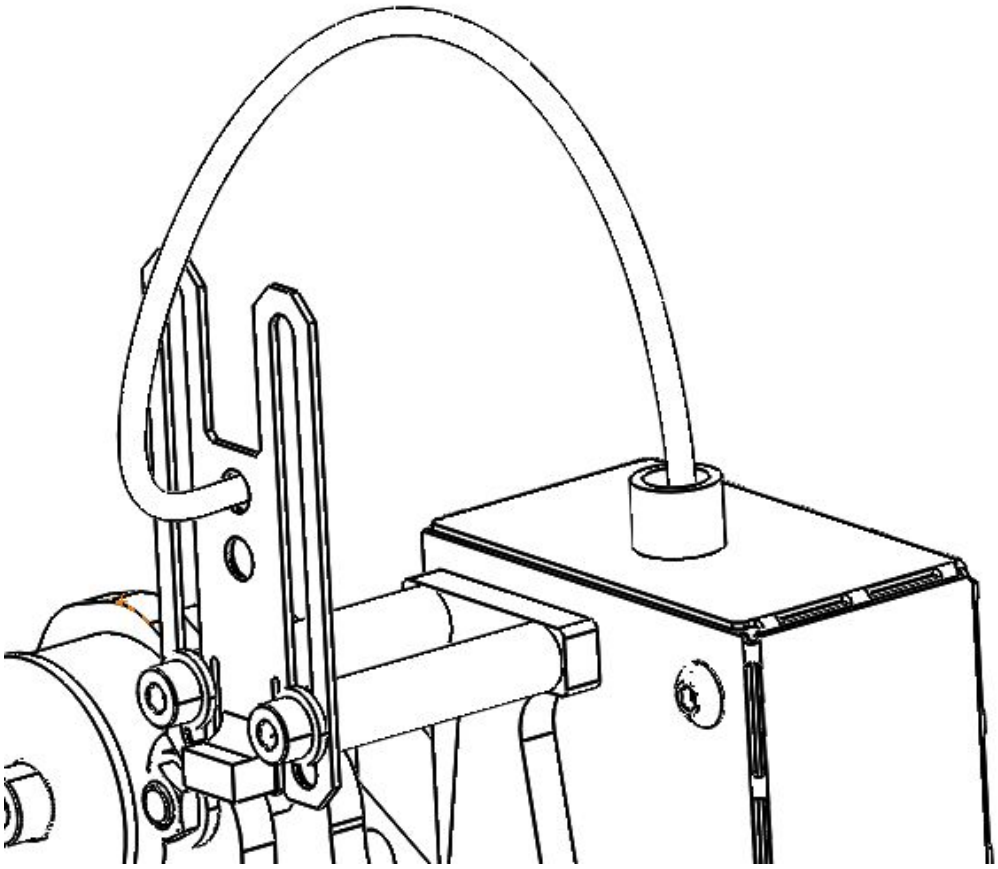


Fig. 5.4: Optical probe connected to the control console

- ❏ Connect the force sensor and optical probe COM cables to the Main board at the correct connector location by following writings on the Main board. Be careful if you have a dual main board, make sure your cable are connected on the right side (A or B side).

5.3.2 Power sensor

Connect the Power sensor COM cable to the Main board at the correct connector location by following writings on the Main board. Be careful if you have a dual main board make sure your cable are connected on the correct side (A or B side).

5.3.3 Temperature probe

Connect the Temperature probe COM cable to the Main board at the correct connector location by following writings on the Main board. Be careful if you have a dual main board make sure your cable are connected on the correct side (A or B side).

Please use the thermal adhesive to glue the temperature sensor on the devices that you need to measure the temperature. There are additional instructions built-in the software. Please contact our technical team for more information.

5.3.4 Air-speed probe

The Series 1780 can be connected to one pressure probe (additional purchase required) for connecting to a wind tunnel Pitot tube. You should connect the pressure probe on the “Addons” port of the main board. After the probe is detected by the software, additional instructions will be available in the software.

5.4 Control chain

5.4.1 Power and control console

Connect the control COM cable to the Main board at the correct connector location by following writings on the Main board. Be careful if you have a dual main board, make sure your cables are connected on the right side (A or B side).

Then connect your ESC’s control cable (small 3-pin connector) to the connectors available on the Power and control console, as shown in Fig. 5.6. Make sure to use the correct polarity, and follow the pin assignment as printed on the casing.

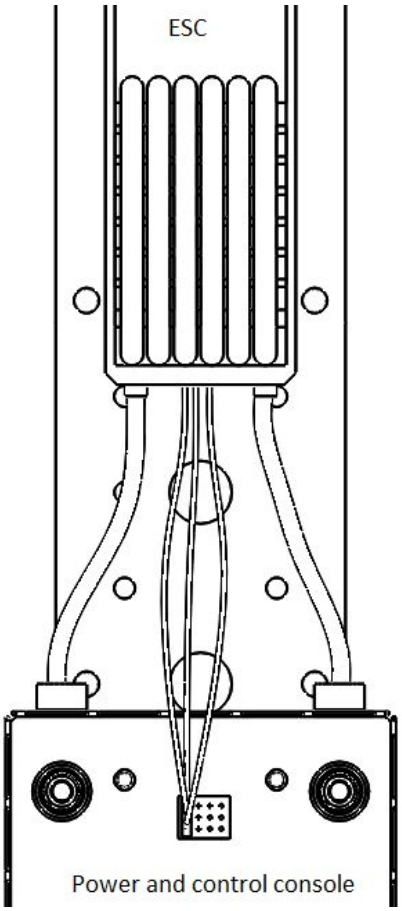


Fig. 5.6: Control chain between ESC and power and control console

5.5 Main board and PC

5.5.1 Indicator lights

There are three different indicators on the Series 1780 main board: Power, Activity, and Error.

- ❏ Power indicator LED: it will turn on when it is powered by the 5V power supply.
- ❏ Activity indicator LED: it will be flashing when the Main board is communicating with the PC.
- ❏ Error indicator LED: it will flash when an error event happens. It will flash momentarily upon connection, this is normal. If it is continuously flashing, please contact our technical support team.

5.5.2 Power and USB to your PC

Connect the power adapter and the USB cable to the main board. Then connect the power adapter to a suitable outlet with suitable blade and the USB cable to your computer.

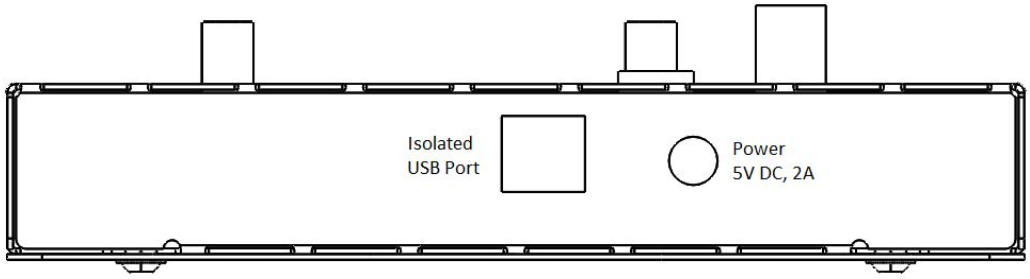


Fig. 5.7: Mono-main board USB and power ports

5.5.3 Buzzer and safety cut-off switch

The Buzzer and the Safety cut-off connector are embedded on the Series 1780 main board. The Buzzer will sound in the following two situations:

- One of the 12 strain gauges in the load cell is being overloaded. Stop applying force immediately to avoid permanent damage.
- The safety cut-off switch is triggered.

Customers can build their own safety switch by using the safety cut-off connector on the Main board. When the wire is short, the cut-off of the Series 1780 will be triggered and it will stop running. This logic (short or open) can be inverted in the RCbenchmark App. Please remember this is only a software cutoff, it will not cut power to the motors (only the control signal).

5.6 Cable management

This part is just an example for your cable management using the different screw-in cable holders ID3/8 or 1/2.

To install the cable holders between the two support plates you take one M5-12mm button head screw (#GRTH), one M5 lock washer (#T9DQ) and one M5 hex nut (#EX8B) for each cable holder, as shown in Fig. 5.8.

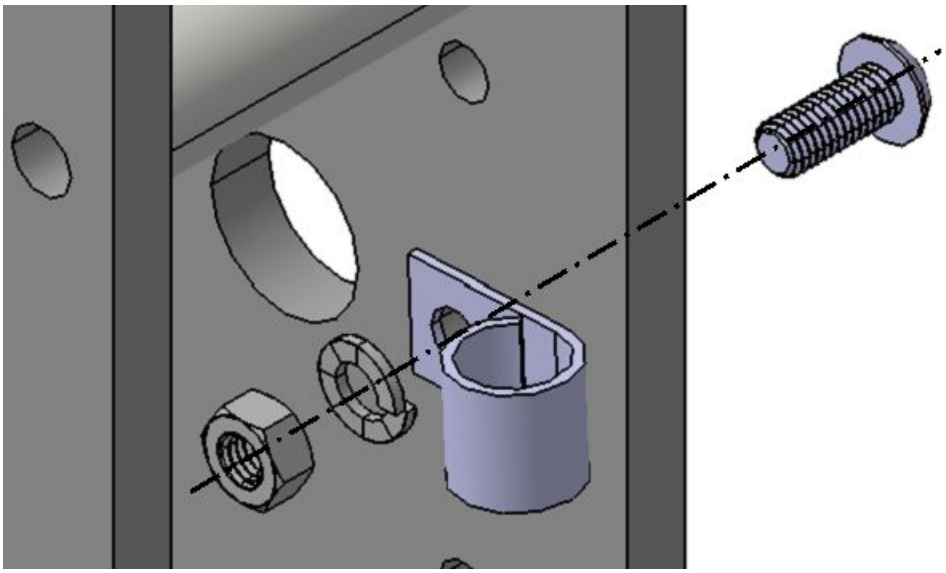


Fig. 5.8: Insertion of fasteners to setup the screw-in cable holder

You can pass your cables through the screw-in cable holder as you can see on Fig. 5.9.

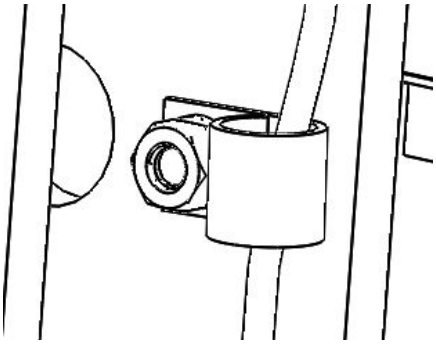


Fig. 5.9: Cable through a screw-in cable holder

For the cables on the ground you can fix it together with tie-wraps. If you ordered a ground railing system you can fix cables on beam with tie-wrap too.

Before using the Series 1780 dynamometer, make sure all cables are secured. Any cable that hits the spinning propeller may cause damage to the sensor, the propeller or the whole facility.

Chapter 6: Two motors testing

In this chapter, we will mainly introduce how to run tests for two motors, or run tests for a single motor when you have purchased the coaxial configurations. If you purchased the Series 1780 Dynamometer: single motor, you can bypass completely this chapter unless you require an upgrade for the system.

Here you can find what you can do with each coaxial product:

Series 1780 Dynamometer: Basic coaxial (SKU#: KYQXD and SKU#: KDAPQ)

- ❏ One motor
- ❏ Two motor face-to-face
- ❏ Two motor face-to-face offset: partial overlapping (with 2-axis railing system)

Series 1780 Dynamometer: Ultimate coaxial (SKU#: KCHQB and SKU#: KDRHP)

- ❏ One motor
- ❏ Two motor face-to-face (not to use special mount)
- ❏ Two motor face-to-face offset: partial overlapping (with 2-axis railing system)
- ❏ Two motor back-to-back (minimum axial distance 100mm)

In the following sections, we will present some possible testing configurations.

6.1 Two motors face-to-face

This setup can be achieved by both Series 1780 Dynamometer: Basic coaxial and Ultimate coaxial. The advantage of having two motors facing each other is that there will be no more restriction on the axial distance between the propellers.

If you are using your Series 1780 Dynamometer: Ultimate coaxial unit to test two motors face-to-face, you must NOT use the back-to-back special mount.

You should arrange the two-plate supports and the load measurement units on the rails or on your own fixture. In Fig. 6.1 you can find an example of having two motors face-to-face setup on the RCbenchmark 1-axis railing system.

In this setup, you are able to adjust the axial distance by moving either side A or side B assembled unit (it is not necessary to move both as all movements are relative). When you need to adjust the distance, simply untighten the eight 5/16”-18 button head screws that connect the base fixture plate and the rails. And then push or pull slowly the whole assembled unit with the plate along the axis, be carefully to avoid collisions as it could damage the load cells, motors, or propellers.

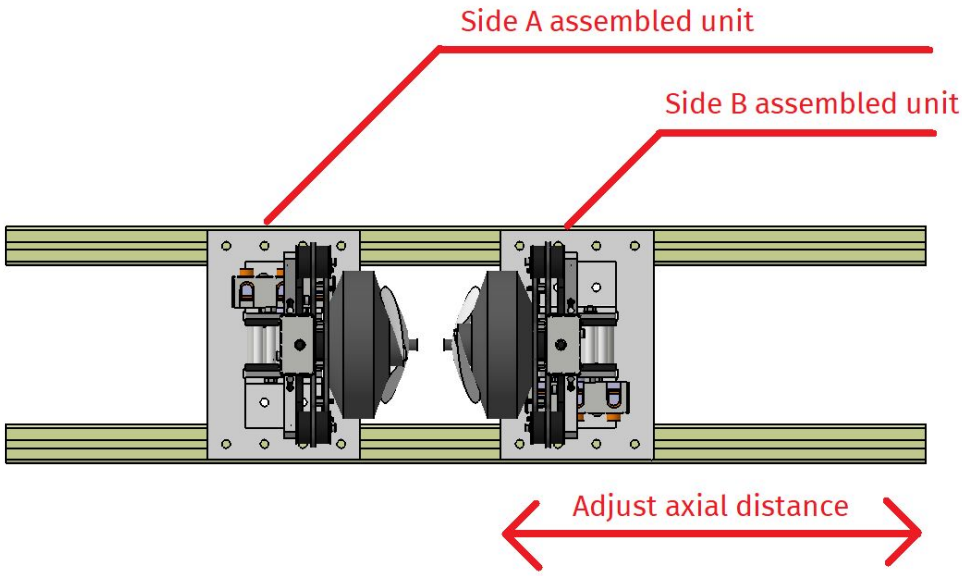


Fig. 6.1: Two motors face-to-face with 1-axis ground railing system

Once the unit reach the assigned position, refasten all these eight 5/16”-18 screws with allen key. Double-check the tightness of these fasteners by applying an axial force on the motor to see if the two-plate support and the load measurement unit move.

Keep in mind the electronics have an A and B side, and should match the connections on the main board. For more details see the chapter about electrical connections. Under certain circumstances, the COM cable may not be long enough for your application. All the electrical components in the Series 1780 support an extension cord. If you need this cord, please contact our sales team by this SKU#: JCXK.

6.2 Two motors face-to-face offset: partial overlapping

This setup can be achieved by the Series 1780 Dynamometer: Basic coaxial and Ultimate coaxial. In this setup, you are able to adjust not only the axial distance between two motors, but also the radial distance between two propellers. It allows testing the effects of partially overlapping propellers.

If you are using your Series 1780 Dynamometer: Ultimate coaxial unit to test two motors face-to-face offset, you must NOT use the back-to-back special mount.

In order to build this setup, it is recommended to use the RCbenchmark 2-axis ground railing system. This system allows linear movements on two axis: axial and radial. Here is an example of having two motors face-to-face offset on the RCbenchmark 2-axis railing system:

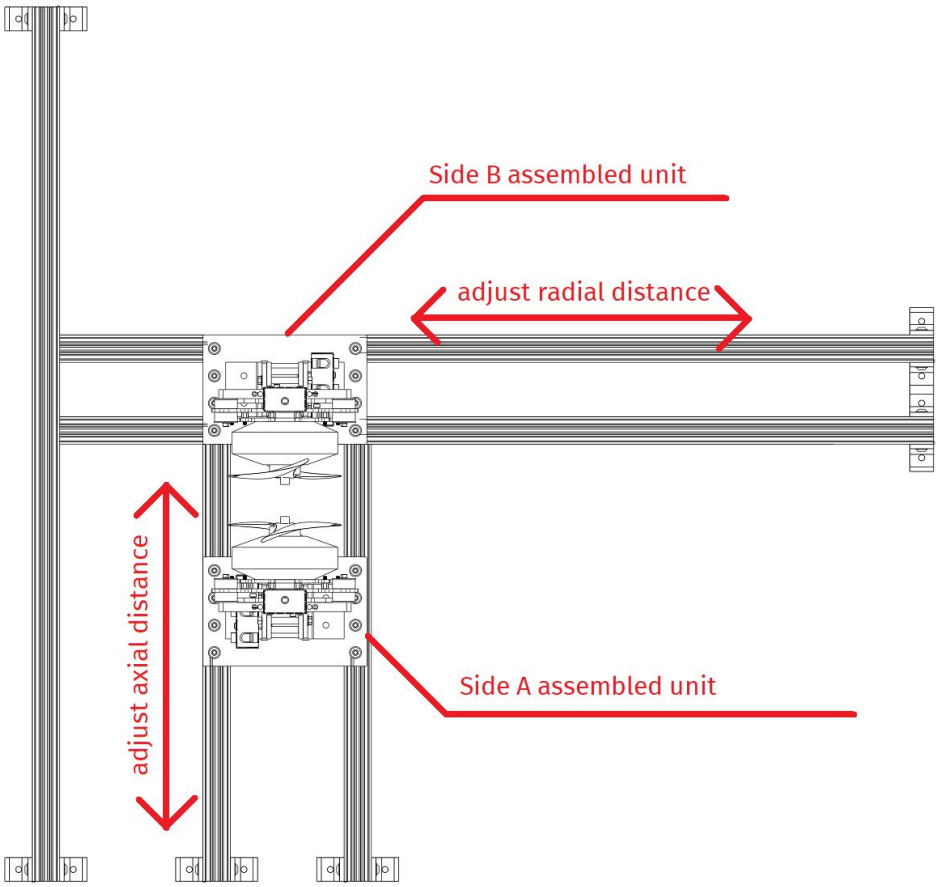


Fig. 6.2: Two motors face-to-face offset with 2-axis railing system

In this setup, you are able to adjust the axial and radial distances by moving either or both side A and side B assembled unit. Per Fig. 6.2, you will need to move side A assembled unit to adjust axial distance, while using side B assembled unit to adjust radial distance. It is not important which side is functioning for either axial or radial movement, as long as you keep all the same side components on one assembled unit.

When you need to adjust the distance, simply untighten the eight 5/16”-18 button head screws that connect the base fixture plate and the rails. And then push or pull slowly the whole assembled unit with the plate through the direction, be carefully to avoid collisions as it could damage the load cells, motors, or propellers.

Once the unit reaches the assigned position, refasten all these 5/16”-18 screws with the allen key. Double-check the tightness of these fasteners by applying an axial force on the motor to see if the two-plate support and the load measurement unit move.

6.3 Two motors back-to-back (min: 100mm)

This setup can only be achieved by the customers who purchased the Series 1780 Dynamometer: Ultimate coaxial. It is still possible for the customers who got the Basic coaxial to test two motors in a back-to-back setup, however, you won't be able to reach minimum 100mm axial distance between two motors.

In order to achieve 100mm, you will have to assemble the Series 1780 with the special mount. You can refer to section 5.6 in Chapter 5 for more details about the operations on the assembly. This section will only introduce how to setup the rails and run the tests.

It is recommended to use the RCbenchmark 2-axis railing system to setup two motors back-to-back if you want to achieve axial distance between two motors 100mm. Here is an example of how you can test two motors back-to-back using 2-axis railing system:

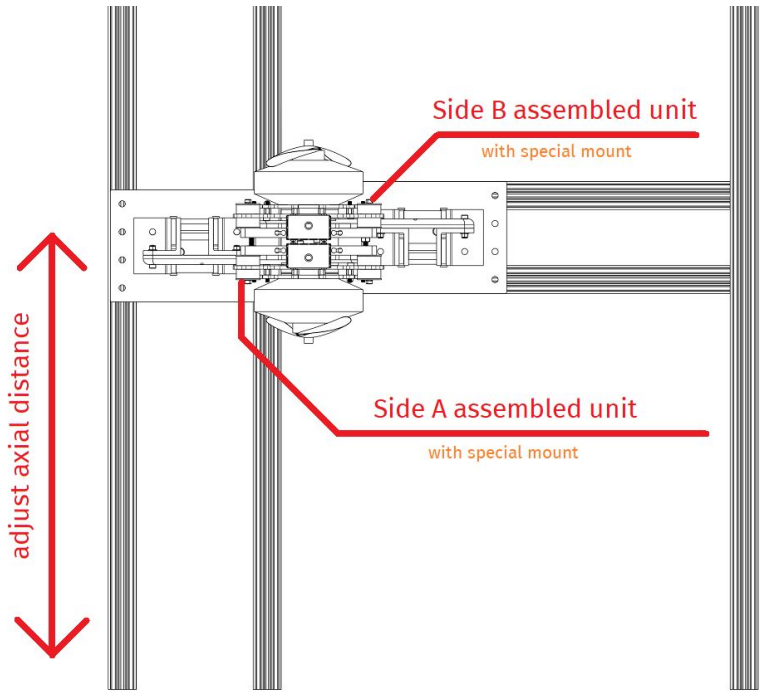


Fig. 6.3: Two motors back-to-back with 2-axis railing system

When you need to change from two motors face-to-face offset to back-to-back with special mount, you will need to re-arrange the T-slotted frame rails on the ground. Please follow the drawing shown in Fig. 6.3 to reinstall your ground railing system. It is also necessary to store your load measurement unit properly when you are changing setups.

In this setup, you should always follow the instructions in section 4.6.4 to adjust the distance. When you need to adjust the distance, untighten the eight 5/16"-18 button head screws that connect the base fixture plate and the rails on the side A assembled unit. And then loosen

the nuts on the square neck bolts that connect the two load measurement units, leave enough gap for to allow linear movement. Finally push or pull slowly the whole assembled unit with the plate through the direction, be carefully to avoid collisions as it could damage the load cells, motors, or propellers.

Once the unit reaches the assigned position, refasten all 5/16”-18 screws with the allen key. And then tighten back all the nuts on the square neck bolts that connect two load measurement units. Double-check the tightness of these fasteners by applying an axial force on the motor to see if the two-plate support and the load measurement unit move.

6.4 Single motor running for coaxial products

All Series 1780 Dynamometer configurations can support only one motor testing.

If you purchased any of the Basic coaxial or Ultimate coaxial, and you need to test single motor, you will have to remove side B unit completely from the ground fixture. It is not recommended to run the unit side B only, you shall use side A if you want to run in single motor configuration.

IMPORTANT!

To avoid damage to the load cells, follow instructions in section 4.2.4 to store the load measurement unit back into the protective case when you unmount them from the fixture!

Chapter 7: Using the RCbenchmark software

In this chapter, we will present you how to get started using the RCbenchmark thrust-stand software (GUI).

Please visit this link to download the latest version of the software:

https://docs.rcbenchmark.com/en/dynamometer/software/dynamometer-software-download.html

We currently support the following operating systems:

- Windows
- Linux
- Mac

Once downloaded, you may open the installer and follow the on-screen instructions. After installation, you may open the program and you will see the Welcome tab (Fig. 7.1).

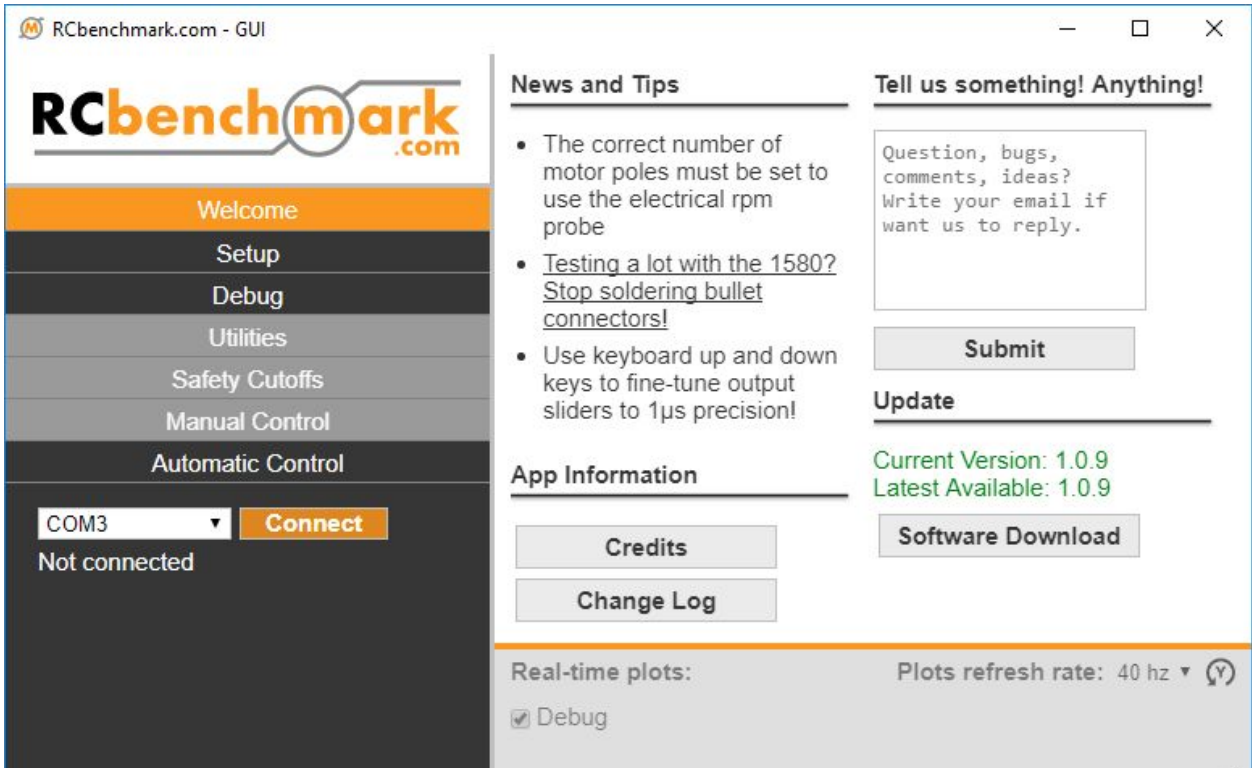


Fig. 7.1: Welcome tab of the RCbenchmark software

7.1 Connecting to the tool

Fig. 7.2: Connecting the tool

Fig. 7.2 shows the connection section of the software. Normally, you do not need to install any drivers for the tool to be detected. In Windows, you might have to wait a few minutes for the OS to automatically download the driver in the background (an Internet connection will be required).

To confirm the software detects the tool, connect the USB cable and the power adapter to the main board. Then the COM port will automatically change to the newly connected tool. If you disconnect the USB cable, the COM port will switch back to another one.

If the COM port does not automatically switch when connecting the tool, please contact us or try troubleshooting driver issues:

https://www.rcbenchmark.com/learning-center/troubleshooting-driver-issues/

The product already comes preloaded with the correct firmware, but future GUI updates might require you to flash a new firmware. If a firmware update is necessary, the software will notify you. The process is very simple, just follow the on-screen instructions.

We highly recommend you watch our two introductory videos on using the software. They are only five minutes each and will teach you all you need to know in order to automate tests:

https://rcbenchmark.gitlab.io/docs/en

The software was designed to be easy to use. In case you need help understanding some features, please email us at support@rcbenchmark.com and we will more than happy to help you.

Chapter 8: Upgrade, warranty and technical support

In this chapter, we will present you all necessary information regarding to the after-sales services for the Series 1780 Dynamometer. You may use the information given in this chapter to contact our technical support team, to purchase extra components, to request a part repair or recalibration, or any other inquiries.

8.1 Technical support

RCbenchmark offers technical support for the Series 1780 Dynamometer over the telephone and email. If you prefer using emails, please send your questions, or your doubts or your technical difficulties using the Series 1780 to our company's email:

support@rcbenchmark.com

We will strive to find a solution within 24 business hours. If you prefer calling us by telephone, you may use this number:

+1-844-722-8378

Our office opens Monday to Friday, from 9am to 5pm EST/EDT except Canadian and Quebec statutory holidays. We offer service in English and French, and depending on staff availabilities, even Chinese.

8.2 Upgrade your products

The Series 1780 Dynamometer follows a modular design, so you will be able to add more features or to upgrade your product.

Currently the Series 1780 offers the following accessories:

- Series 1780 no-solder board (SKU#: HABT)
- Series 1780 temperature probe (SKU#: JTKB)
- Series 1780 pressure sensor (contact our sales team)

For each measurement unit, it supports one no-solder board and up to three temperature probes. (A two motor configuration includes two measurement units)

If you are planning to test inrunner motors, please contact our technical support to order a special mount to adapt these motors.

It is also possible to upgrade your Series 1780 Dynamometer to a higher configuration that supports more testing setups. Here is a list of all the possible upgrades on the Series 1780:

- Series 1780 Dynamometer: Single motor -> Basic coaxial
- Series 1780 Dynamometer: Single motor -> Ultimate coaxial
- Series 1780 Dynamometer: Basic coaxial -> Ultimate coaxial
- Series 1780 Dynamometer 25kgf-100A -> 40kgf-150A

Each type of upgrade requires extra components to be purchased. To proceed to an upgrade, please send us an email by indicating which configuration you currently have and which configuration you are planning to upgrade to, we will prepare a quote.

Please take notice that you may also need to upgrade your ground railing system and the enclosure in order to create a larger area to adapt to more testing setups. More details will be given in our reply regarding to your upgrade.

8.3 Product's warranty

We hope you enjoy many sessions of successful tests with our tool. Nevertheless some problems could arise requiring repairs.

The Series 1780 provides 1 year warranty for repair and replacement. Outside this period, we will charge a fee for the repair or you may purchase a new component from our online store or offline via quote.

However, there are several situations where RCbenchmark does not bear responsibility for the damages caused by:

- Overloading the load measurement unit
- Applying power (voltage and current) out of the tool specification
- Opening the circuit casing
- Opening the load measurement unit
- Water damage
- Excessive exposure to dust
- Applying any unlock code in the software
- Using an unofficial firmware
- Testing outside of the supported range
- Deliberately damaging the product

If the dynamometer is damaged, you should stop using the Series 1780 and contact the RCbenchmark technical support for information about the repair and replacement.