

Series 1520/1580/1585 Enclosure General User Manual

SKU#: UKRR



Image above shows the enclosure with door open (Series 1580 shown inside not included).



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Chapter 1: Introduction

The Series 1520/1580/1585 enclosure prevents parts larger than 6mm from being ejected during a dynamometer test when used within the specifications. It can also help to prevent operators from getting too close to the spinning propellers.

The enclosure features a door which allows users to quickly change the motor or propeller on the thrust stand. The stainless steel mesh has been tested and proved safe for plastic and carbon fibre propellers no larger than 16 inches respecting the speed limits specified in this document.

Propeller's diameter (inch)	Propeller's material	Rotation speed limit (RPM)	Linear speed limit (m/s)
< 6"	Nylon/Polymer	25000	199.49
6" to 10"	Nylon/Polymer	15000	199.49
10" to 16"	Nylon/Polymer	8000	170.23
< 12" Carbon Fiber		10000	159.59
All other propellers <16" in nylon, polymer and carbon fiber		6000	127.67

We still need to use safety goggles, as the airflow can project very small parts at high speed. The user manual of the enclosure is regularly updated. To ensure you have accurate information, please download the latest PDF copy from our website:

https://www.tytorobotics.com/blogs/manuals-and-datasheet/series-1520-1580-1585-enclosure

IMPORTANT!

We highly recommend that all operators who will be working with the assembly of the enclosure carefully read this user manual in its entirety.

Please note that not following the instructions in this user manual may result in structural failure of the enclosure and the test tool in it. Spinning motors and propellers may cause serious injuries or death of the operator.

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



1.1 Item checklist for the enclosure

The Series 1520/1580/1585 enclosure ships with its own package. You may use the following item checklist to verify the items:

Long corrugated carton:

- T-slotted frame beam 535 mm (SKU#: TSXM) x18
- Extended-height lower support (SKU#: DPYQ) x1
- Three-way connector bag (SKU#: KXPA) x1
- Two-way connector bag (SKU#: UPNG) x1
- Hinge bag (SKU#: RKLM) x1
- Lower support mounting fastener bag (SKU#: ZSKH) x1
- Small L corner bracket bag (SKU#: PVPD) x1
- Large L corner bracket bag (SKU#: QAKQ) x1
- Mesh fixture fastener bag (SKU#: QTAQ) x1
- ABS door handle bag (SKU#: UGES) x1
- Door holder bag (SKU#: NTAP) x1
- Other accessory bag (SKU#: RHSC) x1
- Enclosure user manual (SKU# UKRR) x1

Flat carton pad:

• Metal mesh 575 mm x 575 mm (SKU#: YKCX) x5



Chapter 2: General Safety Rules

Always put safety first! It is your responsibility!

It is always important to stay alert to work with a thrust stand. The enclosure protects the operators under most circumstances, however, it is not a guarantee of security and any abuse or misuse of the enclosure may result in damage to the equipment or injury to the users.

To ensure safety, please follow these instructions:

- 1. Wear safety goggles during a test.
- 2. Before construction, make sure you have all the components and tools needed.
- 3. Inspect all fasteners before every experiment and as often as possible.
- 4. Do not place the enclosure near 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 mesh may be sharp, wear gloves during assembly. Do not wear jewelry or long clothing when operating the tool.
- 8. Do not let children around the Series 1520/1580/1585.
- 9. Do not use or assemble the tool alone.
- 10. Do not substitute parts or modify the instrument.
- 11. Always disconnect the power source before opening the door on the enclosure.
- 12. Do not store anything near or above the enclosure, especially when performing a test.
- 13. Always keep your enclosure clear of debris.
- 14. The enclosure should be suitably rated for containing a propeller failure. It should also protect in case the Series 1520/1580/1585 comes apart (loose screw or mechanical failure).
- 15. Make sure nobody is in the spinning area of the thrust stand
- 16. Wait for the propeller to stop spinning before opening the door on the enclosure.



Chapter 3: Installation of the Enclosure

In this chapter, we will present you a full guide to install the enclosure for the Series 1520/1580/1585. Every section represents the suggested procedure to assemble and to install the enclosure, please follow the sequence accordingly.

The T-nuts are frequently used in the assembly of the enclosure. Please make sure that you insert the correct amount and correct model of T-nut into the slots of the beams before closing the frame with the metal mesh. If not respecting the correct sequence, you may need to dismount the mesh and redo certain steps of the assembly.

3.1 Main cage frame

Please unpack the following items:

ltem name	Item SKU	Qty	Located in (SKU# if exist)
T-slotted Frame Beam length 530mm	TSXN	14	Main Carton Box (#PHJY)
Three-way connector bag	KXPA	1	Main Carton Box (#PHJY)
Large corner bracket bag	QAKQ	1	Main Carton Box (#PHJY)

You can find the following components inside the three-way connector bag (#KXPA):

ltem name	Item SKU	Qty
2020 three-way connector	UKWW	8
M6 x 12 mm flat head screw	YQVV	24

You can find the following components inside the large corner bracket bag (#QAKQ):

ltem name	Item SKU	Qty
Enclosure large L corner bracket	FFVQ	4
M5 T-nut	ZQSS	8
M5 flat washer	APEH	8
M5 x 10 mm socket head screw	UZJK	8



Please follow these instructions to assemble the main frame:

- □ Open the three-way connector bag (#KXPA) and take out eight three-way connectors (#UKWW) and twenty-four M6 flat head screws (#YQVV).
- □ Insert one three-way connector (#UKWW) by aligning the notch with the T-slotted beam, and then fasten loosely the connector into the beam with one M6 screw (#YQVV). Do not fully tighten the screws as you may need room to move the parts around.
- □ Repeat the same step with the other two directions by connecting one three-way connector with three 535 mm beams, per Fig 3.1.



Fig 3.1: Assemble the three-way connector and the beams

- **□** Repeat the previous steps to construct the base with four vertical beams.
- Insert the rest of the three-way connectors by finishing the top part of the enclosure.
 Do not fully tighten the screws unless instructed.





- □ Open the large corner bracket bag (#QAKQ) and take out four L corner brackets (#FFVQ), eight M5 T-nuts (#ZQSS), eight M5 socket head screws (#UZJK) and eight M5 washers (#APEH).
- □ Take out two T-slotted beams (#TSXN). Insert one M5 T-nut (#ZQSS) into the slot (any side), and then align and insert the large corner bracket (#FFVQ) onto the rail (#TSXN).
- □ Make sure that the end-surfaces of the L bracket and the beam align, then fasten the bracket with M5 screws (#UZJK) and washers (#APEH), per Fig 3.3.







□ Repeat the previous steps to assemble the second L bracket on the other end the same beam, per Fig 3.4. And then repeat all steps to build the second beam with two brackets.



Fig 3.4: Assembly of the support rails of the thrust stand

- □ Take out the M5 T-nuts (#ZQSS) from the large L corner bracket bag (#QAKQ), and then insert two nuts into any two parallel beams on the base facing inside.
- Place two assembled support rails in the base and align the center of the chosen beams. And then align the assembled L corner brackets with the T-nuts on the base beams, as shown in Fig 3.5. Once ready, fasten the structure with the supplied M5 screws (#UZJK) and M5 washers (#APEH).

Fig 3.5: Integrate the support rails into the enclosure's base

Now you may fully tighten all fasteners on the three-way connectors and the L corner brackets.



3.2 Meshes on main cage frames

In this section, you will need to place the mesh on the frame of the enclosure. Please retrieve the following items:

ltem name	Item SKU	Qty	Located in (SKU# if exist)
575mm x 575 mm metal mesh	YKCX	4	Mesh Pad (#PHJY)
Mesh fixture fastener bag	QTAQ	1	Main Carton Box (#PHJY)
Small corner bracket bag	PVPD	1	Main Carton Box (#PHJY)
Enclosure hinge bag	RKLM	1	Main Carton Box (#PHJY)
Door holder bag	NTAP	1	Main Carton Box (#PHJY)

Please only retrieve the following quantity from the mesh fixture fastener bag (#QTAQ):

ltem name	Item SKU	Qty
M5 T-nut	ZQSS	48
M5 x 8 mm socket head screw	PKDR	48
M5 flat washer	APEH	48

You may find the following items in the small corner bracket bag (#PVPD):

ltem name	Item SKU	Qty
Enclosure small L corner bracket	MFFJ	4
M5 T-nut	ZQSS	8
M5 flat washer	APEH	8
M5 x 8 mm socket head screw	PKDR	8

Please only retrieve the following quantity from the enclosure hinge bag (#RKLM):

Item name	Item SKU	Qty
M4 T-nut	ZFLE	4



Please only retrieve the following quantity from the door holder bag (#NTAP):

Item name	Item SKU	Qty
Door holding metal strip	LZXH	1
M5 T-nut	ZQSS	1
M5 x 15 mm socket head screw	CLKD	1

IMPORTANT!

You may not need to fully install the hinge or the door holder at this section. However, you must insert the corresponding T-nuts into the beams BEFORE closing the frame with the mesh.

Please follow these instructions to assemble the mesh:

□ Open the mesh fixture fastener bag (#QTAQ) and take out twenty-two M5 T-nuts (#ZQSS). Insert three M5 T-nuts into the slot of the beam, please take note that for each beam that will be enclosed with mesh, **THREE** T-nuts are required.



Fig 3.6: Insert the T-nuts into before placing the mesh

- □ **IMPORTANT!** You will need to add extra T-nuts in the following four positions. Please refer to the number and orientation in Fig 3.7.
 - □ Beam #2: Two extra M5 T
 - in the coordinate (for ground fixture, retrieve from bag #PVPD)



- □ Beam #4: Two extra M5 T-nuts (#ZQSS) facing X- in the coordinate (for ground fixture, retrieve from bag #PVPD)
- □ Beam #11: Four extra **M4 T-nuts (#ZFLE)** facing Z+ (for door hinge, retrieve the T-nuts from bag #RKLM)
- □ Beam #14: One extra M5 T-nut (#ZQSS) facing X- in the coordinate (for door holder, retrieve the T-nut from bag #NTAP)



Fig 3.7: Assigned for each beam

- Please take note that you will only need to place the mesh on the following four surfaces:
 - Upper XOY surface with beam #11, #12, #13, #14
 - **Graph Right YOZ surface with beam #4, #9, #10, #14**
 - Back XOZ surface with beam #3, #8, #9, #13
 - Left YOZ surface with beam #2, #7, #8, #12
- □ The front surface XOZ with beam #1, #7, #10, #11 is reserved for the reclosable door.
- □ Take out the M5 x 8 mm socket head screw (#PKDR) and M5 flat washer (#APEH) from the fastener bag (#QTAQ) and install a metal mesh at the location indicated in the image above.
- □ Attach the mesh to the beam by turning the screw into the T-nuts. If necessary, make a small cut-out on the mesh to fit the position of the screw.





Fig 3.8: Applying the mesh onto the enclosure with M5 screws and washers

- **□** Repeat the same steps to apply the mesh onto the assigned four surfaces.
- □ Open the door holder bag (#NTAP) and retrieve the metal strip door holder (#LZXH), and one of the M5 x 15 socket head screw (#CLKD). Make sure the T-nut for the door holder on beam #14 is about 90mm from the edge of the beam #11.



Fig 3.9: Installation of the door holder on beam #14

- □ Place one M5 x 15 socket head screw (#CLKD) through the hole on the door holder (#LZXH), and then turn the screw into the assigned T-nut (#ZQSS).
- □ Fully fasten the M5 screws with the T-nut. Please take note that the screw is longer in order to provide functionality as a pivot for the holder.



- □ Open the small corner bracket bag (#PVPD) and retrieve the small L corner brackets (#MFFJ), the M5 x 8mm socket head screws (#PKDR).
- □ Install two small corner brackets (#MFFJ) on beam #4, facing right (X-).



Fig 3.10: Installation of the small corner bracket on the base enclosure

- □ Repeat and install two small corner brackets on beam #2, facing left (X+). These small L corner brackets can help you to fix the whole enclosure on a table or on a bench.
- **□** Check all fasteners and tighten all of them.
- □ You can now move the installed enclosure aside or move it to the assigned testing area.



3.3 Reclosable door, the hinge and the mesh

In this section, you will assemble the door. Please retrieve the following items:

ltem name	Item SKU	Qty	Located in (SKU# if exist)
T-slotted Frame Beam length 535mm	TSXN	4	Main Carton Box (#PHJY)
Two-way connector bag	UPNG	1	Main Carton Box (#PHJY)
ABS door handle with fasteners	UGES	1	Main Carton Box (#PHJY)
Door holder bag	NTAP	1	Partially used
575 mm x 575 mm metal mesh	YKCX	1	Mesh Pad (#PHJY)
Mesh fixture fastener bag	QTAQ	1	Partially used

You can find the following components inside the two-way connector bag (#UPNG):

Item name	Item SKU	Qty
2020 two-way connector	NKDR	4
M6 x 12 mm flat head screw	YQVV	8

You can find the following components inside the door handle bag (#UGES):

ltem name	Item SKU	Qty
ABS door handle	XQUK	1
M5 T-nut	ZQSS	2
M5 x 12 mm socket head screw	HATR	2

Please retrieve the remaining material in the door holder bag (#NTAP):

ltem name	Item SKU	Qty
M5 T-nut	ZQSS	1
M5 x 15 mm socket head screw	CLKD	1



Please retrieve the remaining material in the mesh fastener bag (#QTAQ):

Item name	Item SKU	Qty
M5 T-nut	ZQSS	12
M5 x 8 mm socket head screw	PKDR	12
M5 flat washer	APEH	12

Please follow these instructions to assemble the door:

- **□** Take out two from the remaining four T-slotted beams (#TSXN).
- □ Open the two-way connector bag (#UPNG) and retrieve the connector (#NKDR), the M6 flat head screws (#YQVV).



Fig 3.11: Install the two-way connector to connect the beams

- **□** Repeat the step and connect all four beams with the other three two-way connectors.
- □ Insert **THREE** T-nuts (#ZQSS) from the mesh fastener bag (#QTAQ) into the slot of each beam, facing up. You shall finish the remaining 12 M5 T-nuts (#ZQSS) from bag (#QTAQ).
- □ Place the metal mesh onto the door frame, and then use the supplied M5 x 8mm socket head screws (#PDRR) and the M5 washer (#APEH) to fix the mesh (#YKCX) onto the door.
- □ When necessary, use cutters to trim extra cut-out on the mesh to allow your screws passing through.





Fig 3.12: Installation of the mesh on the door with fasteners

- □ Take out the door handle (#XQUK) and then insert two T-nuts (#ZQSS) on any side of the beam on the door.
- \Box Place the handle, and then turn the supplied M5 x 12 socket head screws (#HATR) down to fix the handle on the beam with the T-nuts.



Fig 3.13: Installation of the handle on the door

- By loosening the screws, you may move the door handle to a comfortable position for the operator.
- □ Check and tighten all fasteners.



3.4 Door assembly on the enclosure

In this section, you will install the door assembly onto the enclosure's main body. Please retrieve the following items:

ltem name	Item SKU	Qty	Located in (SKU# if exist)
Enclosure main body	N/A	1	built by you
Door assembly	N/A	1	built by you
Enclosure hinge bag	RKLM	1	Partially used
Door holder bag	NTAP	1	Partially used

Please retrieve the remaining material from the enclosure hinge bag (#RKLM):

ltem name	Item SKU	Qty
2020 four hole hinge	BTCU	2
M4 T-nut	ZFLE	4
M4 x 8 mm flat head screw	YQJS	8

Please retrieve the remaining material from the door holder bag (#NTAP):

ltem name	Item SKU	Qty
M5 T-nut	ZQSS	1
M5 x 15 mm socket head screw	CLKD	1

Please follow these instructions to install the door on the enclosure:

- □ Please take note that the M4 T-nuts on the enclosure should have been inserted in section 3.2.
- □ Install the hinge on the top surface of the **enclosure** using the M4 T-nuts. Tighten the hinge (#BTCU) with four M4 Flat head screws (#YQJS).



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Fig 3.14: Install the hinge on the enclosure using the T-nuts inserted in the aluminum frame

- Place the door on the front face of the enclosure. The door handle should be on the right or the left side of the door.
- □ Make sure that the hinge (#BTCU) is open and flat (360 degrees).
- □ Insert two M4 T-nuts (#ZFLE) in the slots on the beam of the door, facing up Z+ to align with the hinge.
- □ Connect the door with the hinge by fastening the M4 flat head screws (#YQJS) into the T-nuts (#ZFLE).



Fig 3.15: Install the hinge onto the door to connect it to the enclosure

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- **□** Repeat the previous steps to install the second hinge.
- □ Tighten all screws on the hinges, and check that the door can open and close properly and smoothly.
- □ If necessary, adjust the position of the handles again in order to make yourself comfortable when opening and closing the door.
- Open the door holder bag (#NTAP) and take out the last M5 T-nut (#ZQSS) and the M5 x 15 mm socket head screw (#CLKD).
- □ Insert the T-nut (#ZQSS) on the same side (facing left or right) of the door holder and insert the screw (#CLKD) to position the nut and the screw at around 90mm from the upper edge of the door. This section will perform as a pin for the door holder metal strip.



Fig 3.16: Install the T-nut and the screw on the door to perform as a hanging pin

- □ Hook the metal strip with the M5 x 15 mm screw (#CLKD) on the door and test if the door can be properly held.
- □ If necessary, adjust the position of the T-nut until the door is held at an angle in the image below.





Fig 3.17: Use of the metal strip to keep the door open

□ Tighten all fasteners. The cage is now fully functional.



3.5 Mounting of the thrust stand and other accessories

In this section, you will replace the lower support part of the Series 1520, the Series 1580 or the Series 1585 by an extended-height lower support in order to accomodate propeller of up to 16". You may keep using the original lower support from the current thrust-stand, but please pay attention to the clearance between the ground and the prop.

This section will also demonstrate how you may install the Series 1520/1580/1585 in the enclosure. Please unpack the following items:

ltem name	Item SKU	Qty	Located in (SKU# if exist)
Finished enclosure	N/A	1	built by you
Extended-height lower support plate for Series 1520/1580/1585	DPYQ	1	Main Carton Box (#PHJY)
Support mount fastener bag	ZSKH	1	Main Carton Box (#PHJY)
Thrust Stand Series 1520/1580/1585	Q81X or J8UD or PKYB	1	Purchased separately

You may find the following items in the support mount fastener bag (#ZSKH):

ltem name	Item SKU	Qty
M5 T-nut	ZQSS	6
M5 x 12 button head screw	APGU	6
M5 flat washer	APEH	6

IMPORTANT!

- For your convenience, please calibrate the load cells, install the ESC, the wires, and all the accessories before installing the Series 1580 and the Series 1585 into the enclosure.
- You can still access to change the propeller between tests, but it may be difficult to swap the motor and the ESC inside the enclosure.

Please follow these instructions to install the thrust-stand into the enclosure:



 Replace the lower support with the extended-height lower support in your Series 1520, 1580 or 1585.



Fig 3.18: Series 1580/1585 replaced with the extended-height lower support

- □ If necessary, calibrate the stand before installing it inside the enclosure
- □ Use the door holder to keep the cage open.
- □ Open the support mount fastener bag (#ZSKH), take out four M5 T-nuts (#ZQSS) and four M5 x 12 mm socket head screws (#APGU).
- □ Insert two M5 T-nuts (#ZQSS) on each beam #5 and #6 (see Fig 3.7 for reference), making sure that all T-nuts are facing up (Z+). And then adjust the distance between beam #5 and #6 to fit the mounting hole of the lower support.
- □ Place the Series 1520/1580/1585 with the motor, the ESC and all the accessories such as optical RPM probe, temperature probe, and no-solder board, etc. into the enclosure. And then align those fixture holes on the lower support to the T-nuts inside the beam.



- □ Use the M5 x 12 mm screws (#APGU) to hold the thrust-stand onto the beam, but do not fully tighten those screws. You may now move the thrust-stand along the parallel beams in order that your propeller will be well in the center of the enclosure. This will help to achieve the best aerodynamic effect.
- □ You may now fully tighten the M5 x 12 mm screws and fix the Series 1520/1580/1585 into the enclosure.



Fig 3.19: Installation of the thrust-stand inside the enclosure



Chapter 4: Final Preparation before Tests

4.1 LiPo battery management

If you are using a LiPo battery as the power source of a test, we recommend putting the LiPo battery OUTSIDE the enclosure for safety reasons. It also simplifies changing and charging the batteries.

You should always have a fire extinguisher on hand when testing and handling LiPo batteries.

4.2 Cable management

It is easier to connect all the cables before installing the dynamometer inside the enclosure.

You may find two rubber grommets inside the other accessory bag (#RHSC). These grommets have a grove diameter at 1", thus please cut out an adequate hole on the metal mesh and then insert the grommet. Please make sure not to install the grommets on the door.

You may then pass the USB cord, the power cord and all necessary wires through these rubber grommets.

4.3 Safety goggles sign

The Series 1520/1580/1585 enclosure includes a CAUTION sticker to remind end operators to always wear safety goggles. Please attach that sticker to an apparent area on the enclosure, we recommend placing it near the door handle in order to always remind the operator to wear eye protection before and after opening the door.

You can find this sign inside the other accessory bag (#RHSC).



Chapter 5: Warranty and Technical Support

In this chapter, we will present you the necessary information regarding the after-sales services for the Series 1520/1580/1585 enclosure. You may use the information given in this chapter to contact our technical support team, to purchase extra components or for any other inquiries.

5.1 Technical support

Tyto Robotics offers technical support for the enclosure over the telephone and by email. We recommend sending your questions with pictures to:

support@tytorobotics.com

We usually reply within one business day.

5.2 Product's warranty

All our products go through a complete quality assurance program before shipping. We offer a 1 year warranty on manufacturing defects.

For safety purposes, if the mesh is broken, you should stop using the enclosure and contact Tyto Robotics' technical support for information about getting a new mesh to fully enclose the thrust stand inside the structure.