ROTRIX FLIGHT BENCH 20 USER MANUAL

Version 1.0

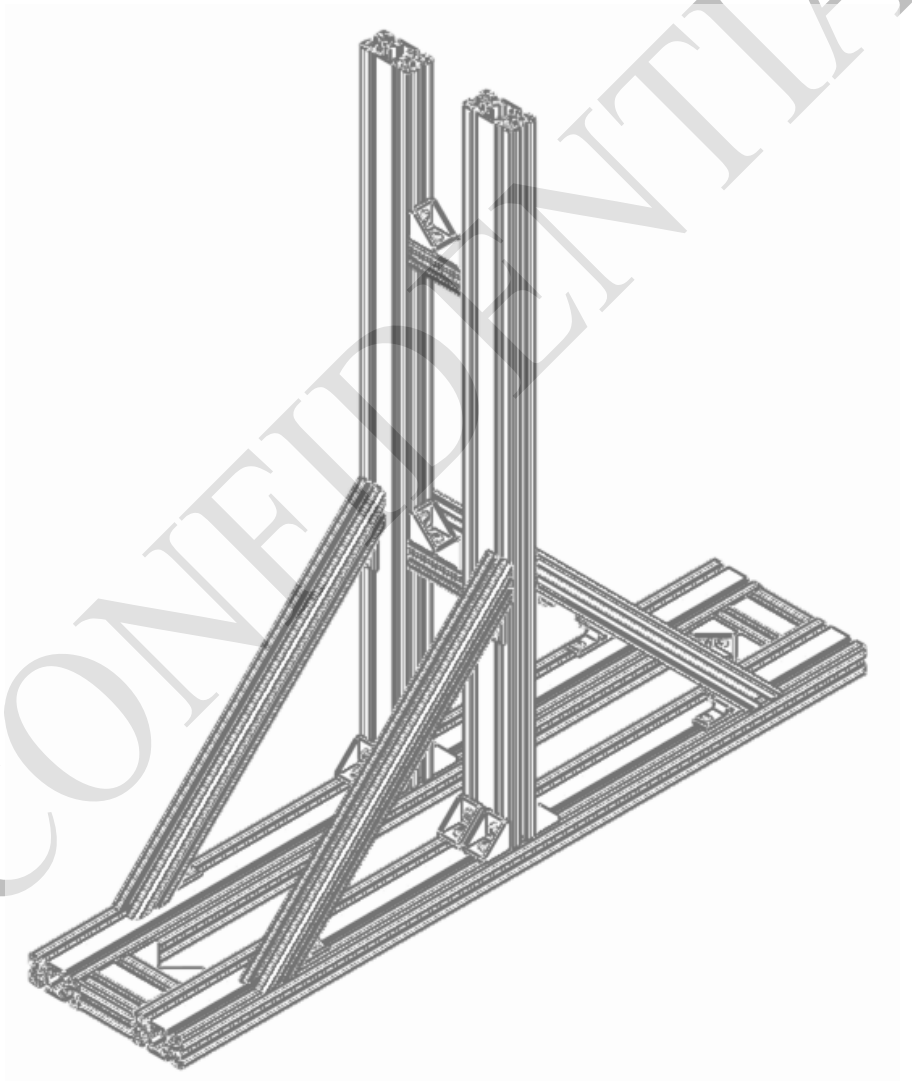


Table of Contents

FIGURES

Chapter 1. Item Checklist and Safety Guidelines

Section 1.1. Introduction

The Flight Bench 20 Motor Test Stand is a precision-engineered system designed for testing motors and propellers with a maximum capacity of 20 kgf of thrust and 10 Nm of torque. It is suitable for both indoor and outdoor use; however, the sensors and data-acquisition unit are not weatherproof and must not be exposed to rain, snow, or icing conditions. The test stand is calibrated to ASTM standards, ensuring high accuracy in measuring critical parameters of your drone's propulsion system, including Thrust, Torque, Voltage, Current, Motor rotation speed (RPM), and Efficiency.

IMPORTANT SAFETY NOTE:

- A **minimum of three people** is required for assembly to ensure safety and proper setup.
- Always wear appropriate personal protective equipment (PPE), such as safety gloves and goggles, during assembly and operation.
- Ensure the test stand is placed on a **stable, level surface** before use.

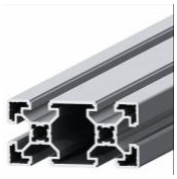
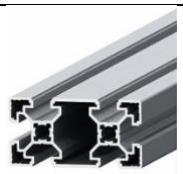
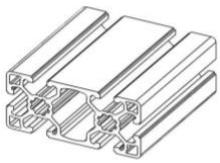
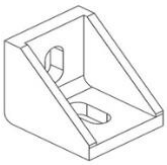
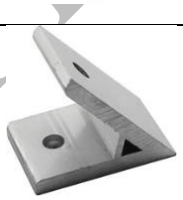
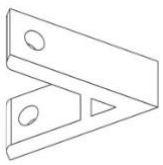
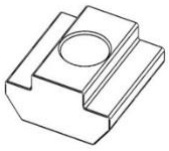
This manual provides step-by-step instructions for assembling, operating, and maintaining the Flight Bench 20 Motor Test Stand. It is intended for **technicians, engineers, or individuals with basic technical knowledge**.

Section 1.2. Item Checklist

Before beginning assembly, verify that all components listed below are present. Use the following checklist to ensure no parts are missing.

S.No	SKU	COMPONENT	DIMENSIONS (mm)	QTY
1	SKU-EX40A-1000	Profile - Extrusion – A	40x80x1000	4
2	SKU-EX40B-0085	Profile - Extrusion – B	40x80x85	2
3	SKU-EX40C-0566	Profile - Extrusion – C	40x40x566	2
4	SKU-EX40D-0085	Profile - Extrusion – D	40x40x85	2
5	SKU-CB90L-0035	Support - Corner Bracket – L90	40x40x35	16
6	SKU-AB45L-0005	Support - Angle Bracket – L45	40x40x5	8
7	SKU-SN90T-0019	Fastener - Slide Nut – T90	19.5x19.5x9.5	52
8	SKU-BB08M-0010	Bolt - Button Socket – M8	M8 x 10	20

Note: If any components are missing or damaged, contact customer support immediately. Do not attempt assembly with incomplete or faulty parts.

SKU	Components	
SKU-EX40A-1000		
SKU-EX40B-0085		
SKU-EX40C-0566		
SKU-EX40D-0085		
SKU-CB90L-0035		
SKU-AB45L-0005		
SKU-SN90T-0019		
SKU-BB08M-0010		

Section 1.3. Safety Guidelines

To ensure safe and efficient operation of the Flight Bench 20 Motor Test Stand, adhere to the following safety guidelines:

1. **Personal Protective Equipment (PPE):**
   - Always wear safety gloves to protect your hands during assembly.
   - Use safety goggles to shield your eyes from debris or accidental tool slippage.
2. **Work Environment:**
   - Ensure the assembly area is clean, well-lit, and free of obstructions.
   - Use a level surface to prevent instability during assembly and operation.
3. **Tool Safety:**
   - Use only the recommended tools specified in this manual.
   - Inspect tools for damage before use.
4. **Electrical Safety:**
   - Ensure all electrical connections are secure and free of damage.
   - Avoid exposing the data-acquisition unit or sensors to moisture/extreme temperatures.
5. **Operational Safety:**
   - Never exceed the stand's maximum capacity of 20 kgf thrust or 10 Nm torque.
   - Keep bystanders at a safe distance during testing.
6. **Maintenance:**
   - Regularly inspect the stand for wear, damage, or loose components.
   - Replace any damaged parts immediately.

By following these guidelines, you can ensure the safe and effective use of the Flight Bench 20 Motor Test Stand.

Chapter 2. Structural Assembly Instructions

Step 1. SUB-ASSY-001: Build Aluminum Extrusion Joints Supporting

Assemble the central aluminum extrusion with corner brackets and sliding nuts to create the foundational sub-assembly for the Flight Bench 20 Motor Test Stand. This sub-assembly will be referred to as SUB-ASSY-001.

1. Prepare the Components:

Gather the following components:

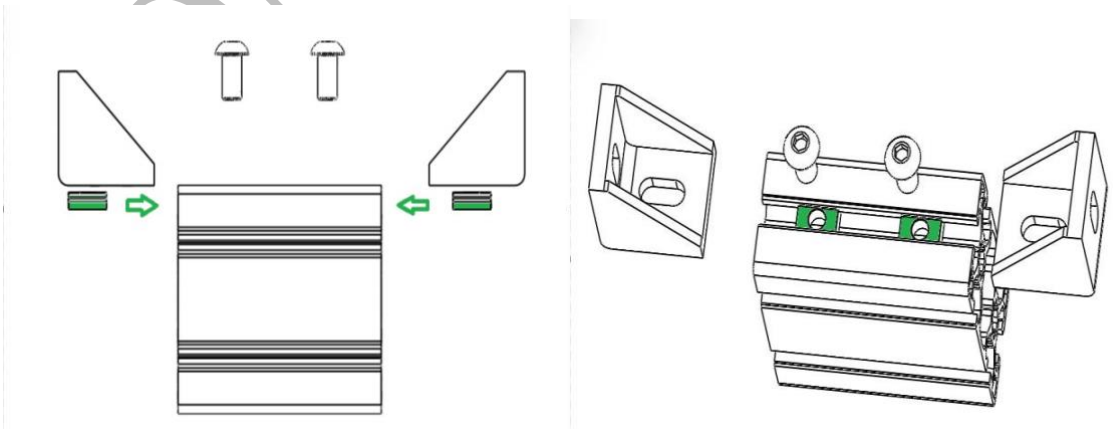
- 1x Central Aluminum Extrusion (SKU-EX40B-0085) – This is the centerpiece of the sub-assembly.
- 2x Triangular Corner Brackets (SKU-CB90L-0035) – Used to reinforce the central extrusion.
- 2x Sliding Nuts (SKU-SN90T-0019) – Highlighted in green for easy identification.
- 2x M8 Bolts (SKU-BB08M-0010) – For securing the corner brackets to the central extrusion.

Ensure all components are clean, undamaged, and ready for assembly.

2. Insert the Sliding Nuts:

- Slide one sliding nut (SKU-SN90T-0019) into the top slot of the central extrusion (SKU-EX40B-0085) on each side.
- Position the sliding nuts approximately where the corner brackets will be mounted, as shown in Figure 1.

TIP: Use a small tool or your fingers to guide the sliding nuts into the slots if necessary.



(a) Side View (b) Top View

Figure 1 Sliding nuts inserted into the central extrusion

3. Attach the Corner Brackets:

- Place one triangular corner bracket against each side of the central extrusion.
- Align the holes in the corner brackets with the sliding nuts inside the extrusion, as shown in Figure 2.

NOTE: Ensure the brackets are oriented correctly and sit flush against the extrusion.

4. Insert and Tighten the Bolts:

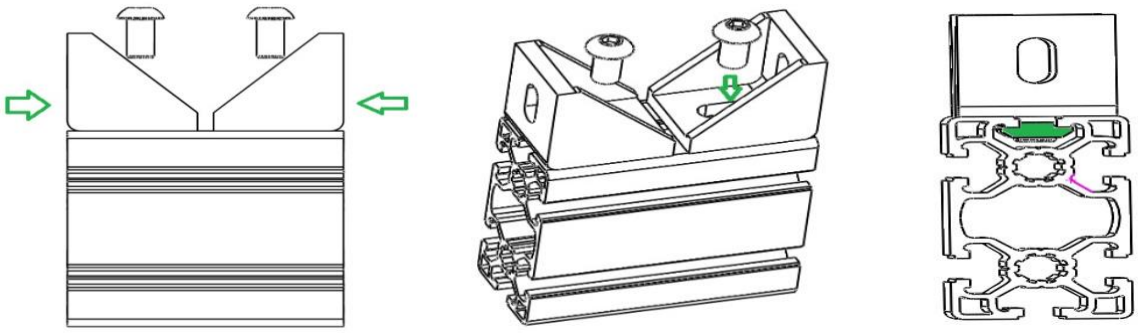
- Insert an M8 bolt through the hole in each corner bracket and thread it into the corresponding sliding nut inside the extrusion, as shown in Figure 2 (green arrow).
- Use a wrench or Allen key to tighten the bolts securely.

CAUTION: Do not over-tighten the bolts, as this may damage the threads or deform the components.

5. Final Check:

- Verify that the corner brackets are tightly secured to the central extrusion, as shown in Figure 2.
- Ensure the assembly is properly aligned and there are no loose components.

REPEAT: Follow Step 1 to assemble another identical Sub-assembly SUB-ASSY-001.



(a) Side View (b) Top View (c) Front View

Figure 2 Positioning of sliding nuts for corner bracket support

Step 2. SUB-ASSY-002: Assemble Base Plate Support Structure

Assemble the base support structure by connecting the SKU-EX40A-1000 Aluminum Extrusions with the SUB-ASSY-001 sub-assemblies created in Step 1. This completed assembly will be referred to as SUB-ASSY-002.

1. Prepare the Components:

Gather the following components:

- 2x SKU-EX40A-1000 Aluminum Extrusions – These will form the base of the structure.
- 2x SUB-ASSY-001 Sub-assemblies – Prepared in Step 1.
- Sliding Nuts (SKU-SN90T-0019) – For securing the brackets.
- M8 Bolts (SKU-BB08M-0010) – For fastening the components.

2. Align the central extrusion Sub-assembly:

- Insert sliding nuts into the slots of both SKU-EX40A-1000 extrusions at both ends.

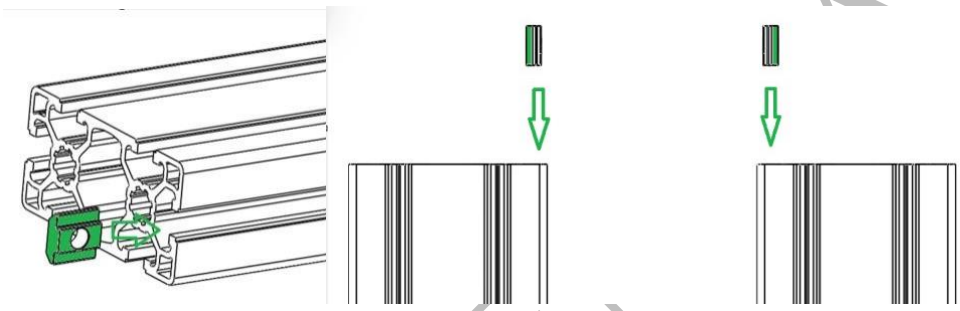


Figure 3 Positioning of sliding nuts into SKU-EX40A-1000 aluminum extrusion

- Position the SUB-ASSY-001 sub-assemblies at each end of the SKU-EX40A-1000 extrusions, ensuring they are symmetrically aligned and flush with the central slot.

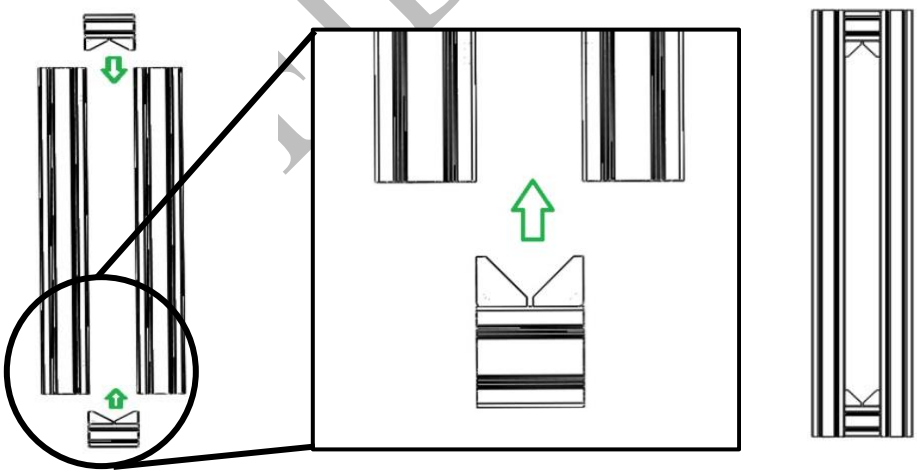


Figure 4 Alignment of SUB-ASSY-001 with base aluminum extrusions

3. Secure the Brackets:

- Insert bolts through the SKU-CB90L-0035 corner brackets into the sliding nuts within the SKU-EX40A-1000 extrusion slots, as shown in Figure 5.
- Use a wrench or Allen key to tighten the bolts while ensuring the brackets remain properly aligned.

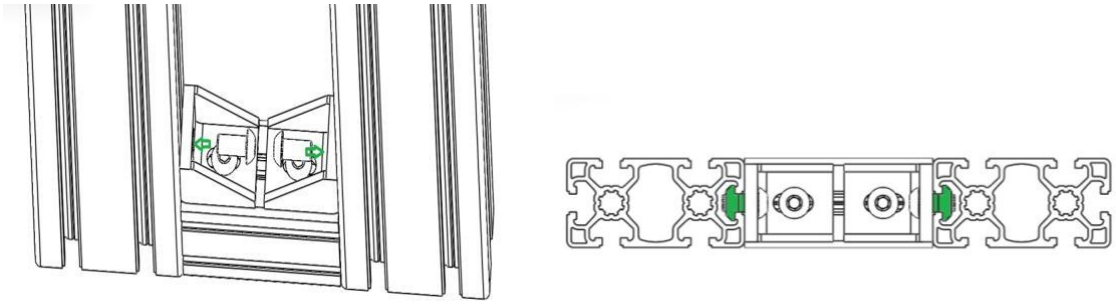


Figure 5 Secure SUB-ASSY-001 and aluminum extrusions with button socket bolt

4. Check the Assembly:

- Verify that the brackets are firmly attached to the SKU-EX40A-1000 extrusions, as shown in Figure 6.
- Ensure there is no wobble or misalignment in the base structure.

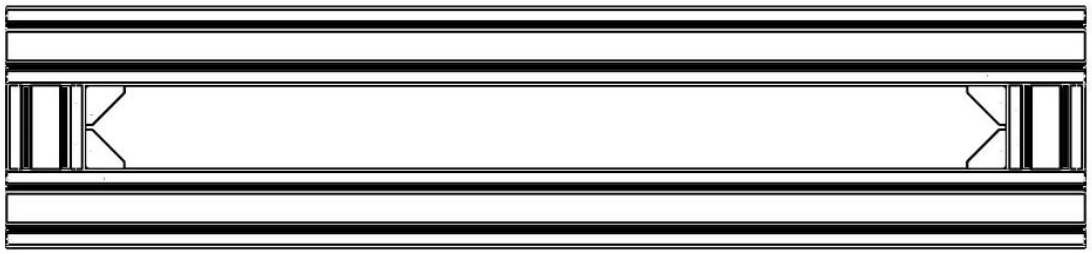


Figure 6 Assembled base support structure: SUB-ASSY-002

Step 3. SUB-ASSY-003: Integration of Base Structure and Pillar Support

Secure the pillar aluminum extrusions to the base support structure using corner brackets, forming the main framework. This assembly is designated as SUB-ASSY-003.

1. Prepare Components:

Gather the following components:

- 1 x SUB-ASSY-002 Sub-assemblies – Prepared in Step 2
- 2 x SKU-EX40A-1000 Aluminum Extrusions – These will serve as the pillar supports.
- 8 x SKU-CB90L-0035 Corner Brackets – For securing the pillar extrusions to the base.
- 16 x SKU-SN90T-0019 Sliding Nuts – For attaching the brackets.
- 16 x SKU-BB08M-0010 – For fastening the brackets.

2. Position the Vertical Supports:

- Place the two SKU-EX40A-1000 aluminum extrusions vertically at the center of the base structure (SUB-ASSY-002).

- Insert sliding nuts (SKU-SN90T-0019) into the respective intersection joints of the pillar extrusions and base support structure extrusions to secure the corner brackets.
- Align the vertical supports with the corner brackets on both sides of the base, as shown in Figure 7.

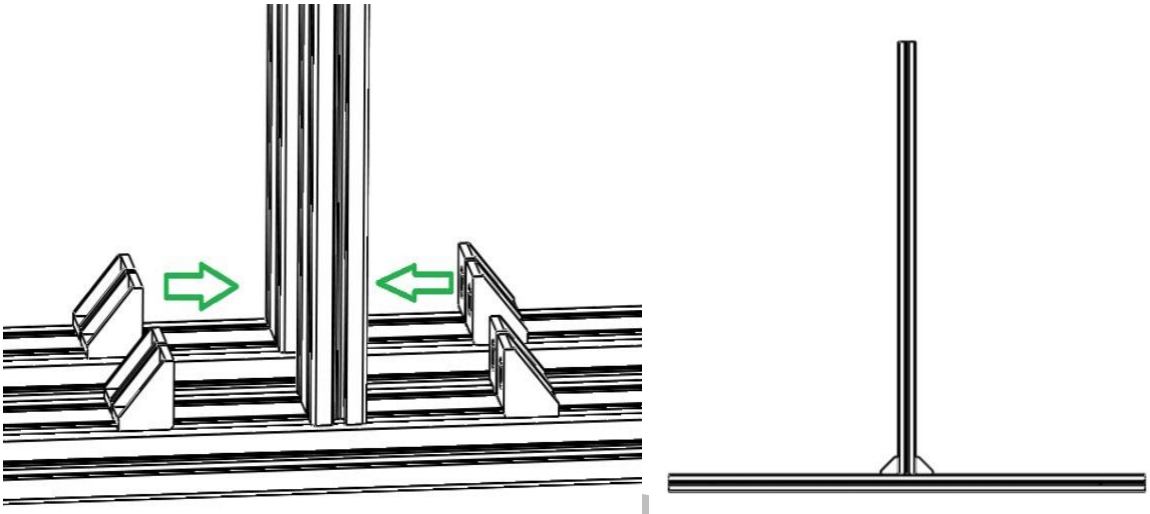


Figure 7 Perpendicular alignment between base structure and pillar support extrusions

3. Attach Corner Brackets:

- Secure the bottom of each vertical extrusion using SKU-CB90L-0035 corner brackets.
- Use M8 bolts, washers, and sliding nuts to fasten the corner brackets tightly to both the base structure and the vertical extrusions.

4. Verify Alignment and Tighten Fasteners:

- Ensure the vertical supports are parallel and perpendicular to the base.
- Make adjustments if necessary to maintain proper alignment.
- Once aligned, tighten all bolts securely to ensure a stable assembly.

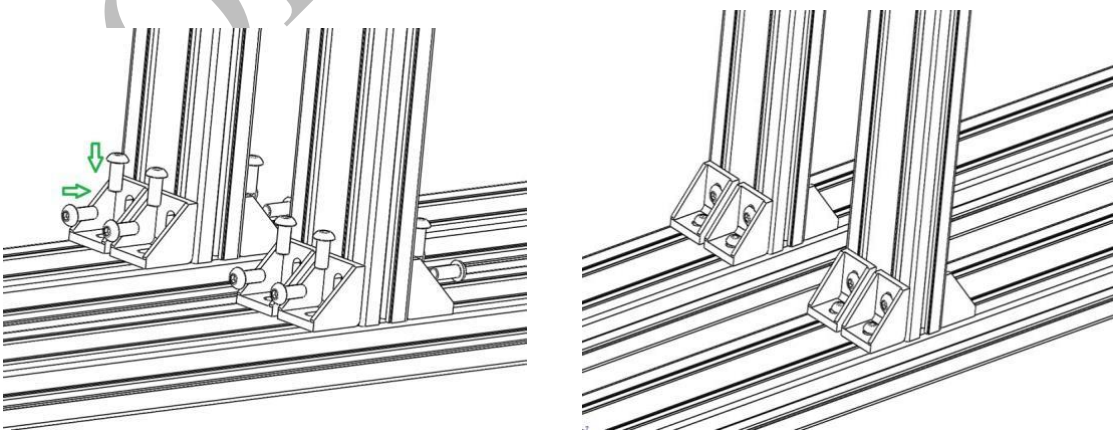


Figure 8 Assembled inverted T-joint base support and pillar structure: SUB-ASSY-003

Step 4. SUB-ASSY-004: Inclined Support to Base-Pillar Structure

Install inclined supports using angled brackets to enhance stability, counteract motor vibrations, and reinforce the structure against forward and backward movement. This assembly is designated as SUB-ASSY-004.

1. **Prepare Components:**

Gather the following components:

- 4 x SKU-EX40C-0566 Inclined Aluminum Profiles – These will act as angled supports.
- 8 x SKU-AB45L-0005 Angled Corner Brackets – For attaching the diagonal profiles.
- 8 x SKU-SN90T-0019 Sliding Nuts – For securing the brackets.
- 8 x SKU-BB08M-0010 M8 Bolts – For fastening the components.

2. **Position the Incline Aluminum Profiles:**

- Position the four diagonal aluminum profiles between the base structure and the pillar supports, as shown in Figure 9.
- Ensure they are aligned at an angle, connecting the base structure to the vertical supports.

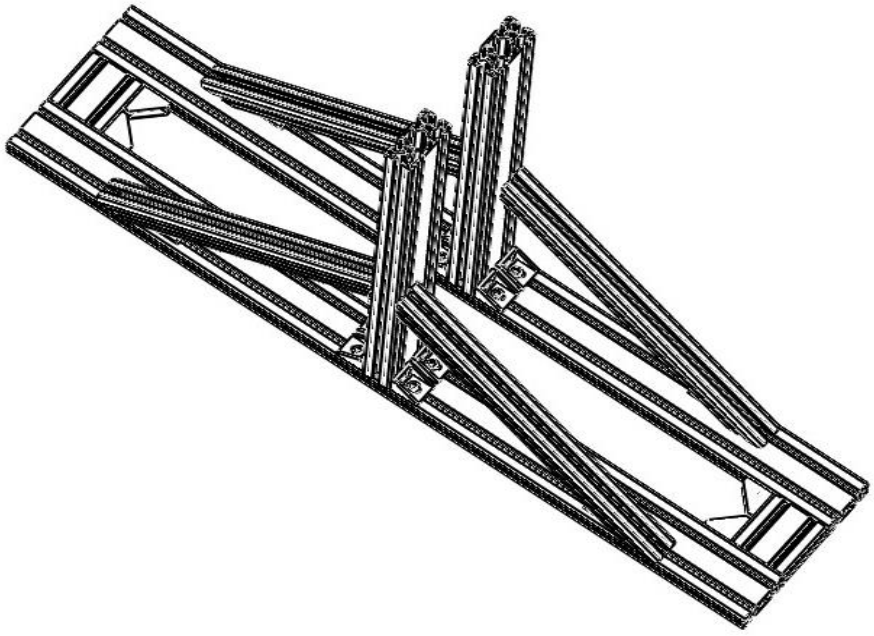


Figure 9 Inclined alignment between SUB-ASSY-003 and diagonal aluminum extrusions

3. **Align and Secure with Angled Corner Brackets:**

- Place angled corner brackets at each end of the diagonal profiles (4 in total for both sides), as shown in Figures 10.
- Align the brackets with the holes in the aluminum profiles.

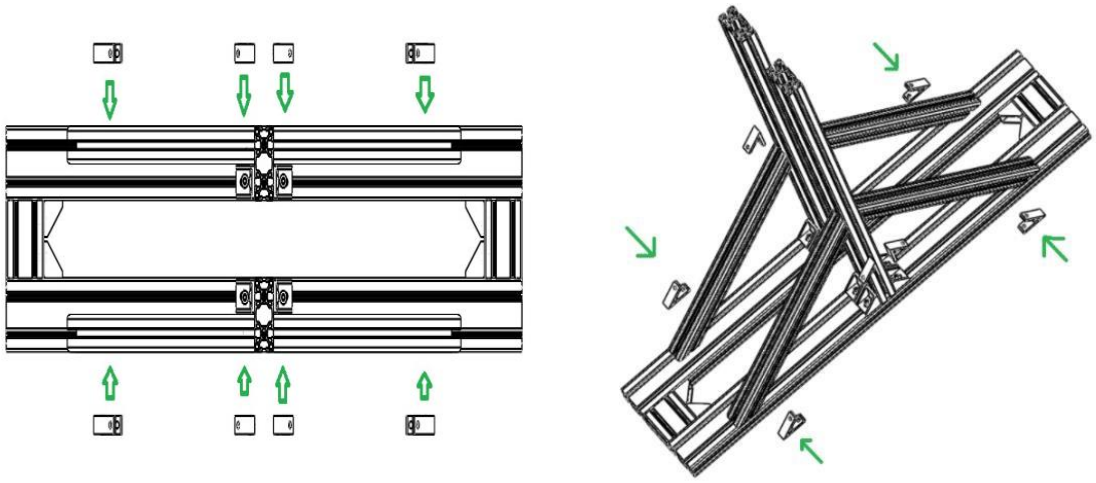


Figure 10 Position angled brackets and sliding nuts at the intersection joints

4. Install Sliding Nuts and Fasten with Bolts:

- Insert sliding nuts into the slots of the base structure and vertical support extrusions where the brackets will attach.
- Use M8 bolts to secure the angled corner brackets to the sliding nuts.
- Tighten the bolts evenly to ensure the brackets are firmly connected, ref Figure 11.

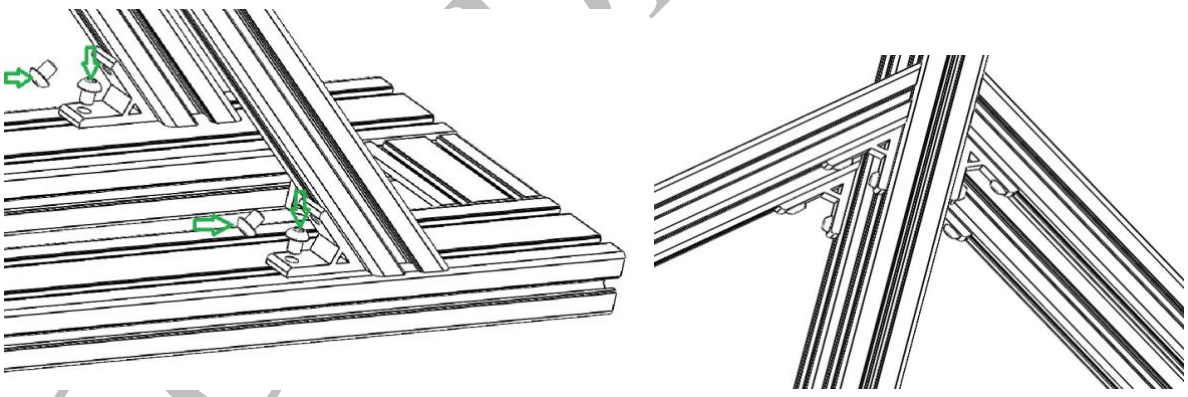


Figure 11 Secure angled brackets with button socket bolts

- Follow the same steps to install the two remaining diagonal brackets on the opposite side of the structure.

5. Check Alignment:

- Verify that all brackets are securely attached and the entire structure is properly aligned for stability.

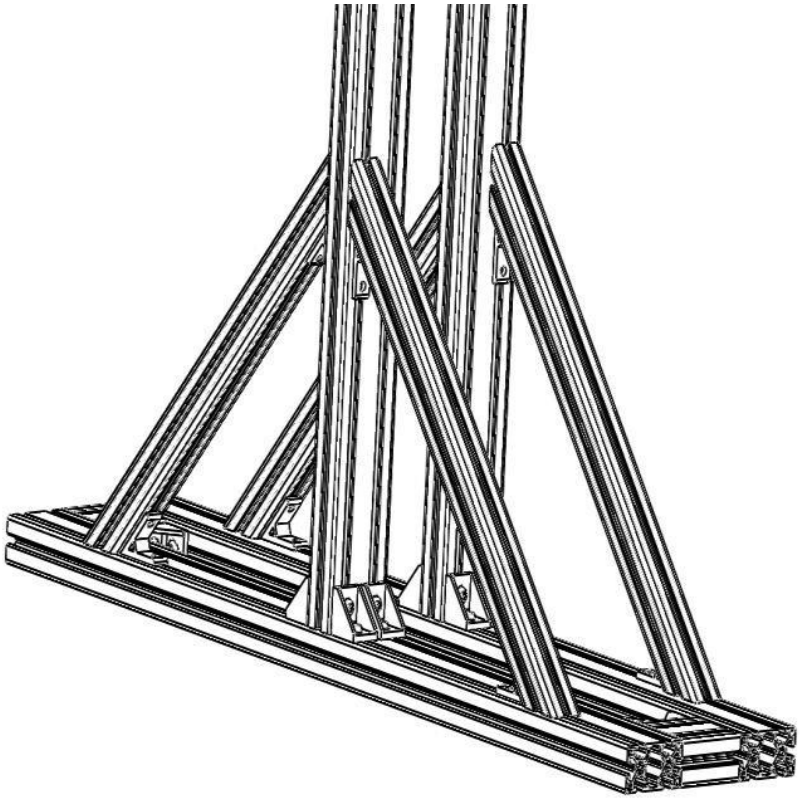


Figure 12 Assembled inclined support to base-pillar structure: SUB-ASSY-004

Step 5. SUB-ASSY-005: Bridge the Pillar Support with Extrusion Joints

Bridge the two pillar supports of the assembled base structure using extrusion joints to provide rigid support and withstand oscillation motion during operation. This completed assembly will be referred to as SUB-ASSY-005.

1. Prepare Components:

Gather the following components:

- 2 x SKU-EX40D-0085 Aluminum Profiles – These will act as connectors between the vertical supports.
- 4 x SKU-CB90L-0035 L-brackets – For securing the profiles.
- 8 x SKU-SN90T-0019 Sliding Nuts – For attaching the brackets.
- 8 x SKU-BB08M-0010 M8 Bolts – For fastening the components.

2. Position and Attach Connectors:

- Position the SKU-EX40D-0085 aluminum profiles centrally between two pillars at respective defined locations with the structure, as shown in Figure 13.

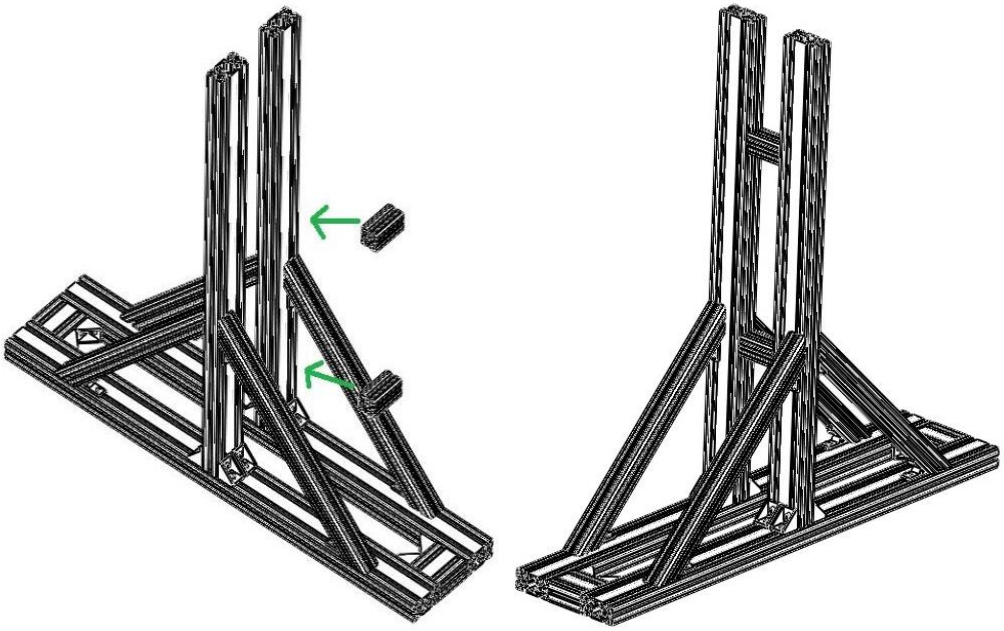


Figure 13 Alignment of extrusion profiles between two pillars with base structure

- Secure the top of the SKU-EX40D-0085 profiles to the vertical extrusions using SKU-CB90L-0035 L-brackets and sliding nuts.

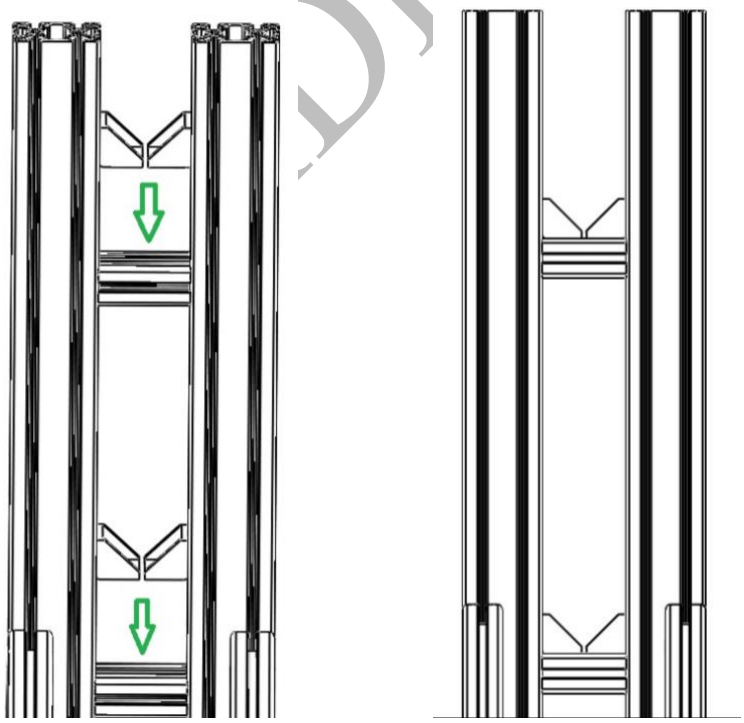


Figure 14 Position corner brackets on extrusion bridge support

- Ensure the profiles are parallel and aligned with the previously installed structure.

3. Install Sliding Nuts:

- Insert sliding nuts into the slots of the vertical structure assembly and SKU-EX40D-0085 extrusions where the SKU-CB90L-0035 brackets will attach.
- Tighten all screws securely to ensure stability, as shown in Figures 15.

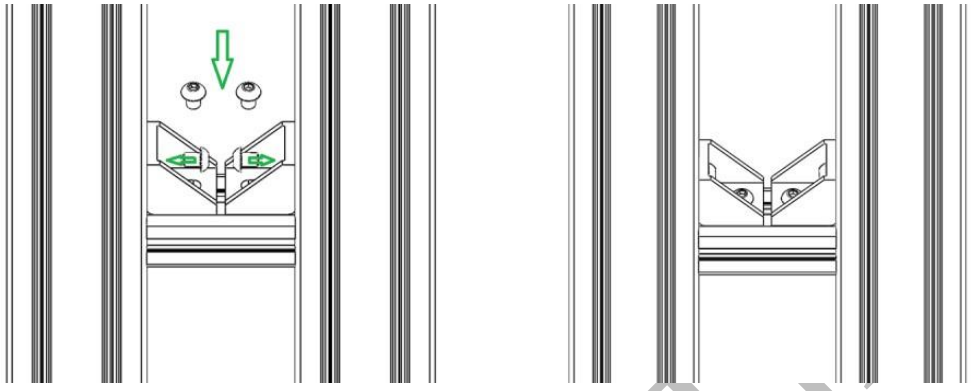


Figure 15 Secure bolts with corner brackets to bridge support

4. Check for Stability:

- Verify that all parts are securely attached and the entire assembly remains sturdy.
- Make any necessary adjustments to ensure proper alignment and balance.

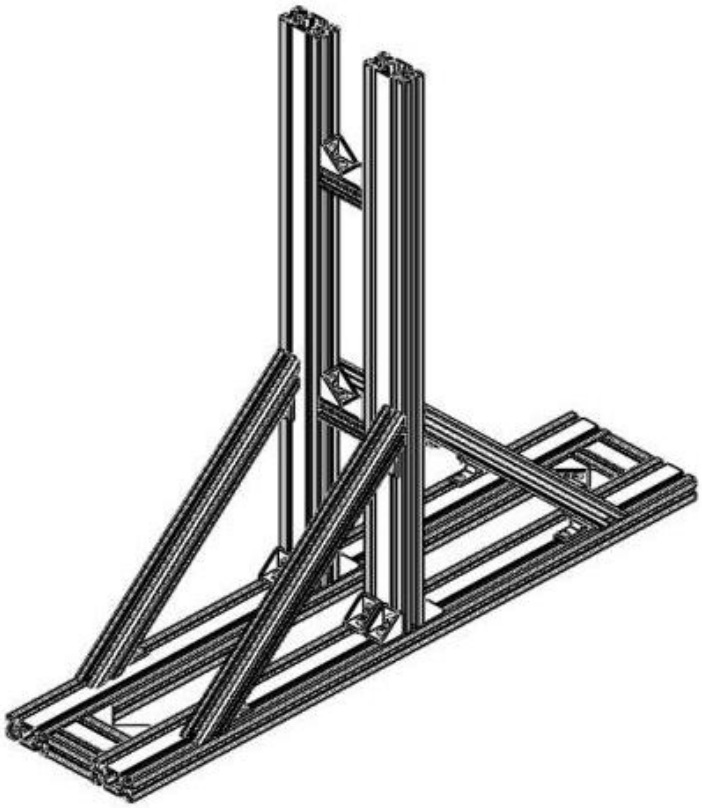


Figure 16 Assembled Flight Bench Motor Test Stand

Chapter 3. Final Assembly and Operational Instructions

Step 6. SUB-ASSY-006: Mounting the Motor and Sensor Assembly

Attach the motor and sensor assembly to the test stand for accurate measurements.

1. **Prepare Components:**

Gather the following components:

- Motor Mounting Plate – For securing the motor to the test stand.
- Thrust and Torque Sensors – Pre-installed on the mounting plate.
- M6 Bolts and Nuts – For fastening the motor to the mounting plate.
- Wiring Harness – For connecting the sensors to the data-acquisition unit.

2. **Attach the Motor:**

- Place the motor onto the mounting plate, aligning the screw holes.
- Secure the motor using M6 bolts and nuts, ensuring it is tightly fastened.

3. **Mount the Assembly to the Test Stand:**

- Position the motor and sensor assembly onto the vertical supports of the test stand.
- Use M8 bolts and sliding nuts to secure the assembly to the SKU-EX40D-0085 aluminum extrusions.

4. **Connect the Wiring:**

- Route the wiring harness from the sensors to the data-acquisition unit.
- Ensure all connections are secure and free from interference.

5. **Verify Alignment:**

- Check that the motor is centered and aligned with the test stand structure.
- Ensure there is no obstruction to the motor's rotation or airflow.

Step 7. SUB-ASSY-007: Calibration and Testing

Calibrate the test stand and perform initial tests to ensure accurate measurements.

1. **Power On the Data-Acquisition Unit:**

- Connect the data-acquisition unit to a power source and turn it on.
- Ensure all sensors are detected and functioning properly.

2. **Calibrate the Sensors:**

- Follow the calibration procedure outlined in user manual for the thrust and torque sensors.
- Use calibration weights or known loads to verify accuracy.

3. **Perform Initial Tests:**
- Run the motor at low RPM to ensure smooth operation.
- Monitor the sensor readings to confirm they are within expected ranges.

4. **Adjust as Necessary:**
- Make any adjustments to the motor alignment or sensor calibration if discrepancies are observed.

Step 8. SUB-ASSY-008: Operational Guidelines

Provide guidelines for safe and effective operation of the Flight Bench 20 Motor Test Stand.

1. **Safety Precautions:**
- Always wear safety goggles and gloves during operation.
- Keep bystanders at a safe distance while the motor is running.

2. **Operating Limits:**
- Do not exceed the stand's maximum capacity of 20 kgf thrust or 10 Nm torque.
- Avoid operating the stand in wet, snowy, or icy conditions.

3. **Data Recording:**
- Use the data-acquisition software to record and analyze test results.
- Save data files for future reference or comparison.

4. **Maintenance:**
- Regularly inspect the stand for loose bolts, wear, or damage.
- Clean the sensors and motor mounting plate after each use to ensure accuracy.

Chapter 4. Conclusion

The Flight Bench 20 Motor Test Stand is a precision-engineered system designed to provide accurate and reliable measurements of your drone's propulsion system. By following this manual, you have successfully assembled, calibrated, and prepared the test stand for operation.

Key Takeaways:

- Proper assembly and alignment are critical for accurate measurements.
- Regular maintenance and calibration ensure long-term reliability.
- Adherence to safety guidelines protects both the operator and the equipment.

We hope this manual has been a valuable resource in setting up and using your Flight Bench 20 Motor Test Stand. For further assistance, troubleshooting, or technical support, please contact our customer support team support.rotrix@reude.tech