

TWARA ROBOTICS

TGrip-2 Product Manual



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1 Preface

1.1 Description of the user

The TGrip user manual is intended for individuals who will be involved in installing, operating, and maintaining the system. The product is designed for industrial, commercial, and research applications and is suitable for use in factories, warehouses, laboratories, and automated production lines. The user is responsible for setting up and configuring the soft gripper system, including integrating it into the larger automation system, operation, and troubleshooting. This role requires a strong understanding of mechanical and electrical systems, including knowledge of robotics, pneumatics, and safety protocols. The installer should be proficient in system integration and troubleshooting.

Required skills and experience:

- Proficiency in mechanical assembly and electrical wiring.
- Familiarity with automation systems and robotic arms.
- Experience with system calibration and testing.
- Ability to interpret technical drawings and manuals.
- Basic understanding of safety standards in industrial automation.

Required Training/Certification: On-the-job training to familiarize the operator with the specific soft gripper system and its functions. Familiarity with industry safety regulations is necessary.

User Restrictions:

- The soft gripper system is intended to be used only by qualified personnel who have received adequate training in its operation and safety. Untrained or unqualified individuals should not attempt to operate, install, or maintain the system.
- Only individuals with knowledge of the associated systems (e.g., robotics, pneumatics, or automation) are allowed to perform installation, configuration, and maintenance tasks.
- The product should only be operated within the specified environmental conditions and load limits. Users must not attempt to use the gripper for tasks beyond its design capabilities.

By ensuring that users have the appropriate skills, training, and expertise, we can ensure the safe and efficient operation of the soft gripper, extend its lifespan, and minimize the risks associated with misuse or improper handling.

1.2 Conventions used in this manual

The following style conventions are used in this document:

1. **Bold**

- Names of product elements, commands, options, programs, processes, services, and utilities
- Names of interface elements (such as windows, dialog boxes, buttons, fields, and menus).
- Interface elements the user selects, clicks, presses, or types.

2. *Italic* for:

- Publication titles referenced in the text.

- Emphasis (for example a *new term*).
 - Variables.
3. Courier for:
 - System output, such as an error message or script.
 - URLs, complete paths, filenames, prompts, and syntax.
 - User input variables.
 4. <angle brackets> surround user-supplied values.
 5. [square brackets] surround optional items.
 6. | vertical bar | indicates alternate selections - the bar means “or”.

1.3 Retaining Instructions

- Read and understand this manual and its safety instructions before using this product. Failure to do so can result in serious injury or death.
- Follow all the instructions. This will avoid fire, explosions, electric shocks or other hazards that may result in damage to property and/or severe or fatal injuries.
- Keep all safety information and instructions for future reference and pass them on to subsequent users of the product.

1.4 Obtaining documentation and information

If you need additional or latest documentation, user instructions, or technical information or wish to submit feedback, please reach out to info@twararobotics.com. We greatly appreciate your feedback and look forward to hearing from you.

2 Description of the product

2.1 Purpose of the product

Introducing the TGrip-2, a versatile soft pneumatic gripper, developed and manufactured by Twara Robotics. Designed to enhance automation workflows, the TGrip-2 is perfect for mounting as an End-of-Arm Tool (EOAT) on all popular Cobots and industrial robots. It operates through a pneumatic positive pressure input, enabling precise gripping, holding, and releasing of objects. Key features include a range of customizable finger configurations, with 2, 3, 4, and 6-finger options available, all within the included frame. The TGrip-2 is fully UR+ compatible, and a URCap file is conveniently available on our website for easy integration. Additionally, its control box is designed for seamless connectivity with Cobot controllers, making it an ideal solution for efficient automation in diverse industries.

2.2 TGrip-2 Technical Specifications

Parameter	Value
Gripper Dimensions (DxH)	175 x 123 mm ²
Finger Dimensions (LxWxH)	81 x 53 x 35 mm ³
Number of Fingers	2 / 3 / 4 / 6
Peak Operating Frequency	2 Hz
Rated Operating Pressure	0.6 Bar
Rated Normal Force per Finger	7 N
Maximum Payload(6-Finger gripper)	1500 g
Service Life	4.5 Million Cycles ^a
Finger Weight	56 g
Frame Weight	230 g
Finger Material	Silicone
Product Weight (For 6-Finger gripper)	615 g
Connector Flange	ISO 9409-1-50-4-M6
Pneumatic Connection	6 mm Push fit
Certifications ^b	Food-Safe, IP69

Table 1: TGrip Specifications

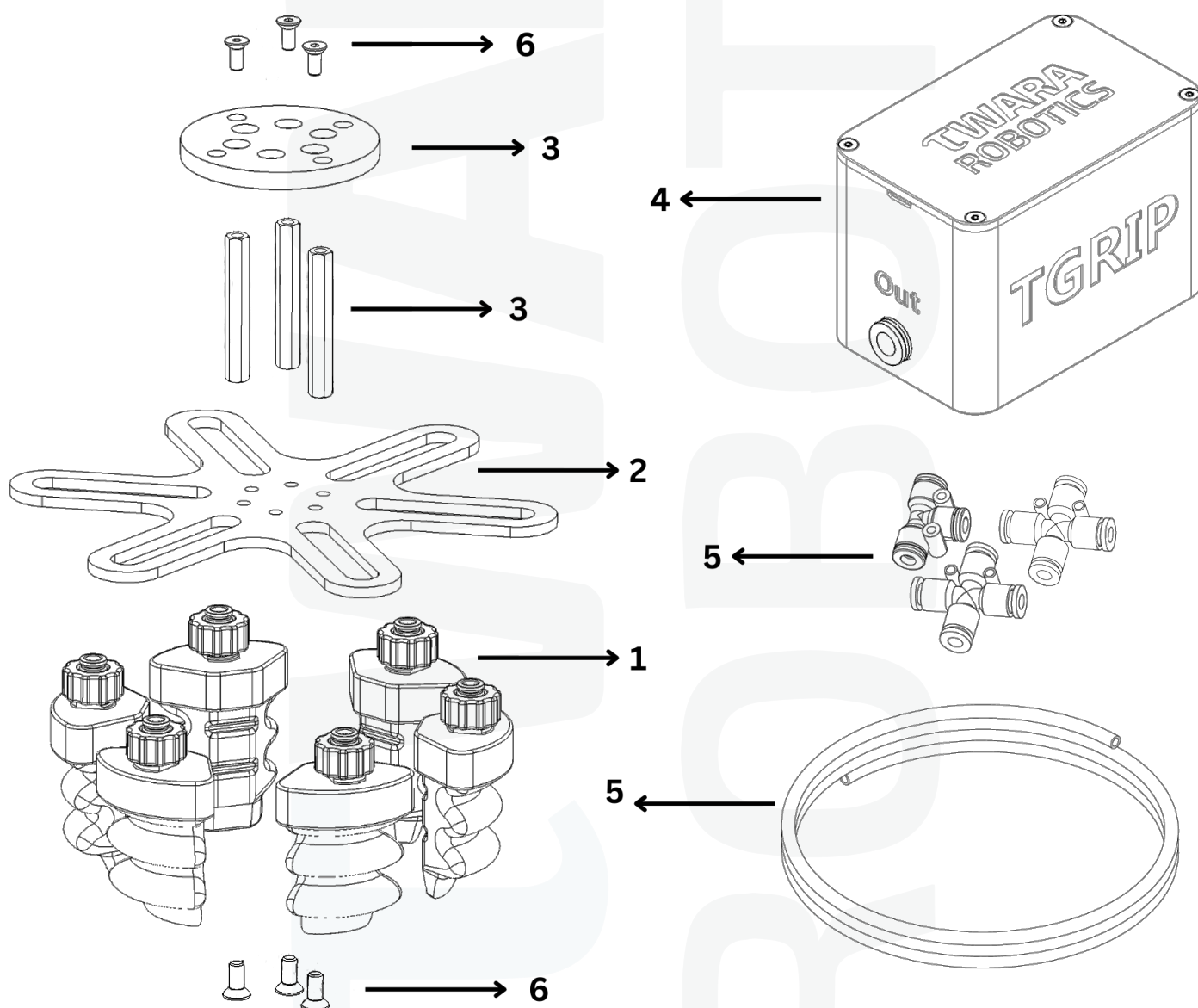
^a @ 0.6 bar, 0.5 Hz; Under continuous testing and improvement

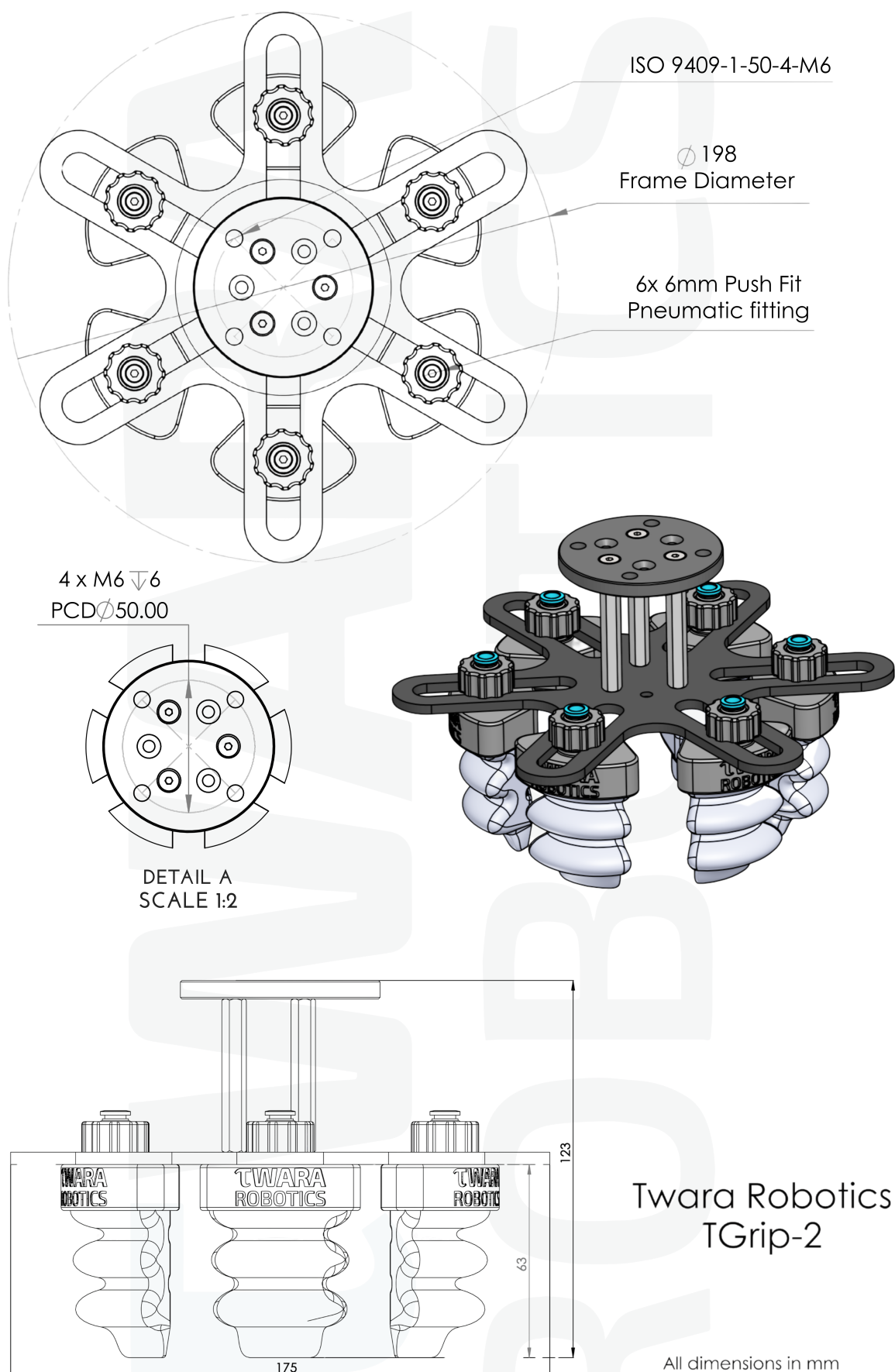
^b Testing reports and Certifications available on request

2.3 Package Contents

Part No.	Item Description	Quantity
1	TGrip Finger Module	6 units
2	Frame	1 unit
3	Universal Mounting Adapter	1 unit
4	TGrip Controller	1 unit
5	Pneumatic Connection Kit	1 unit
6	Fastener Kit A + B + C	1 unit

Table 2: Contents of the TGrip-2 Development kit





2.4 TGrip Control Box Specifications

Parameter	Value
Dimensions (LxBxH)	104 x 66 x 72 mm ³
Mass	425 g
Pneumatic Connection	6 mm Push fit
Air Preparation Unit	>2 bar, LC < 0.2 bar
Vacuum line source	>-0.5 bar
Operating Voltage	24V

Table 3: Control Box Specifications

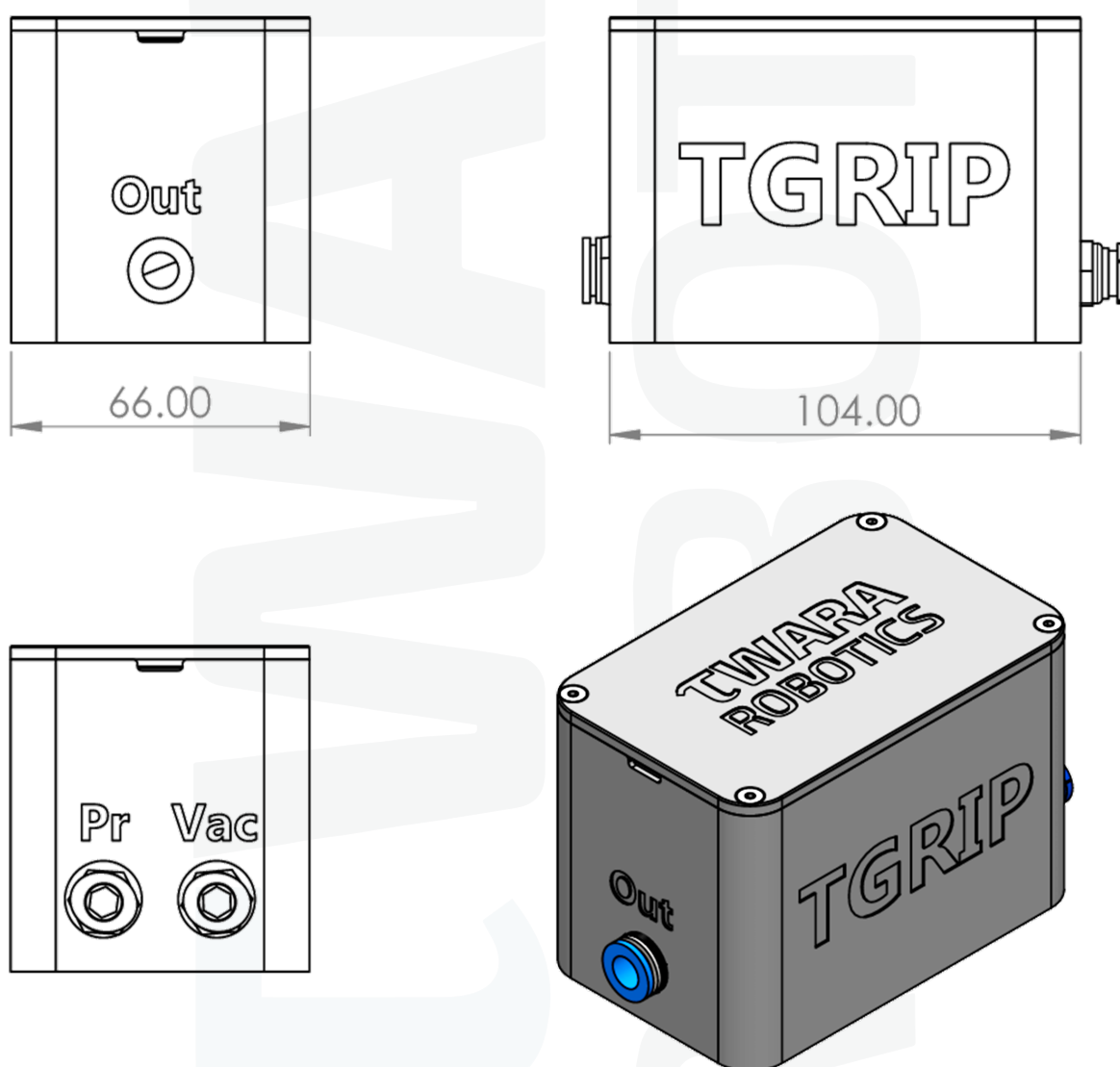


Figure 1: Control Box Dimensions

3 Safety Instructions

Before using the soft gripper, please read and understand these safety instructions to ensure safe and effective operation. Improper use may result in equipment damage or personal injury.

3.1 How to use the product safely

1. **General Safety Precautions:** Only trained and qualified personnel should operate the soft gripper. Ensure that the operator has received proper training on how to handle, install, and maintain the gripper. Always refer to the product manual before use to understand the specifications, features, and safety guidelines.
2. **Installation Safety:** Before using the gripper, ensure it is properly and securely mounted to the robot or mechanism. Incorrect installation can lead to equipment malfunction or failure.
3. **Electrical and Pneumatic Connections:** If applicable, ensure all electrical and pneumatic connections are installed according to the manual's instructions. Verify that all connections are tight and secure to avoid leaks or electrical faults.
4. **Avoid Overloading:** Do not exceed the maximum pressure rating **(0.8bar)** for the gripper. Exceeding these limits could lead to damage to both the gripper and the object being handled.
5. **Operational Safety:** Always set the appropriate pressure based on the fragility of the object being handled for Grip Force Control. Don't use a vacuum other than that specified in the manual. Ensure that there are no hands, fingers, or any other body parts within the operating area of the gripper while in use.
6. **Object Compatibility:** Only use the gripper with objects that fall within the specified size, shape, and weight limits. Verify that the gripper can securely hold the object before operation to avoid drops or mishandling.
7. **Maintenance and Inspection:** Frequently inspect the gripper for signs of wear, damage, or contamination. Look for cuts, tears, or abrasions on the gripper, and replace any parts that show signs of damage. Ensure the gripper is clean and free of debris, as dirt or particles can interfere with its operation or damage delicate objects. Regularly check all pneumatic lines, valves, and seals for leaks. If any issues are detected, address them immediately to prevent operational failure.
8. **Emergency Procedures:** In case of an emergency or malfunction, immediately stop the operation of the gripper using the emergency stop button or safety mechanism. **Disconnect Power/Pneumatic Lines:** Always disconnect power or depressurize pneumatic systems before performing maintenance or repairs to avoid accidental activation.
9. **Environmental Considerations:** Ensure that the gripper is operating within the specified temperature range (-20°C to 70°C). Extreme temperatures can cause material deformation or loss of function. If the soft gripper is used in environments with hazardous materials, special precautions may be needed for cleaning and maintenance to prevent contamination or damage.
10. **Storage:** When not in use, store the gripper in a clean, dry, and safe location (using original packaging provided with product is preferable). Avoid exposure to extreme conditions (e.g., excessive heat, moisture, or direct sunlight) that could reduce the gripper's life. Avoid cleaning the non-silicone parts of the gripper with Isopropyl Alcohol/Acetone.
11. **Transport with Care:** When moving or transporting the gripper, handle it carefully to avoid damage to the gripping surface or other components (use the original packaging).

12. Troubleshooting: In the event of malfunction or unexpected behavior, refer to the troubleshooting section of the manual for steps to diagnose and resolve the issue. If you are unable to resolve the issue, contact the manufacturer or authorized service provider for assistance.

3.2 Graphical symbols

Symbol	Meaning
	Do Not Topple: Symbol indicates that the package is unstable and can easily tip over if not handled carefully. It warns handlers to keep the item upright and avoid tilting or tipping it during transportation, lifting, or storage.
	Handle With Care: Symbol indicates that the package or item is fragile or sensitive and must be treated gently during handling, transportation, and storage. It warns handlers to avoid rough treatment such as dropping, shaking, or excessive force.
	Keep Dry: Symbol indicates that the package or item must be protected from moisture, rain, and damp conditions during handling, transportation, and storage. It warns handlers to keep the package in a dry environment and avoid exposure to rain, humidity, or wet surfaces to prevent damage to the contents.
	Avoid Stacking Over 4 boxes: Symbol indicates that no more than four packages or cartons should be stacked on top of each other during handling, storage, or transportation. It warns handlers that exceeding the stacking limit may cause damage to the items due to excessive weight or instability, ensuring product safety and preventing accidents.

Table 4: Explanation of safety information on the packaging

4 Mounting and Installation

The TGrip development kit includes a mechanical adapter for attaching the gripper to your robotic arm. This adapter is compatible with the ISO flange - ISO 9409-1-50-4-M6. The provided **Fastener kit** contains the M6x12 bolts which may be used to fasten the TGrip to a manipulator as an EOAT.

The TGrip controller, included in the TGrip development kit, accepts three pneumatic connections (Pressure input, Vacuum Input, and Gripper Output) and four electrical connections. Please refer to Section 5.1 and Figure 4,5 for the system-level integration of the TGrip Gripper and controller with the UR system.

4.1 Mounting Steps

1. Secure the universal mounting adapter to your robot's tool flange by utilizing the four M6x1.0x12 bolts (A) (refer to Figure 3).
2. The TGrip-2's frame is pre-assembled using the (A) fasteners. In case disassembled/loosened, please refer to Figure 3 to assemble the frame.
3. The TGrip-2 soft fingers can be mounted onto the frame using the in-built threaded nut in the soft finger. The threaded nut must be fully loosened and removed before inserting the soft finger from below into the frame slot, then thumb fastened. (B) (refer to Figure 3)

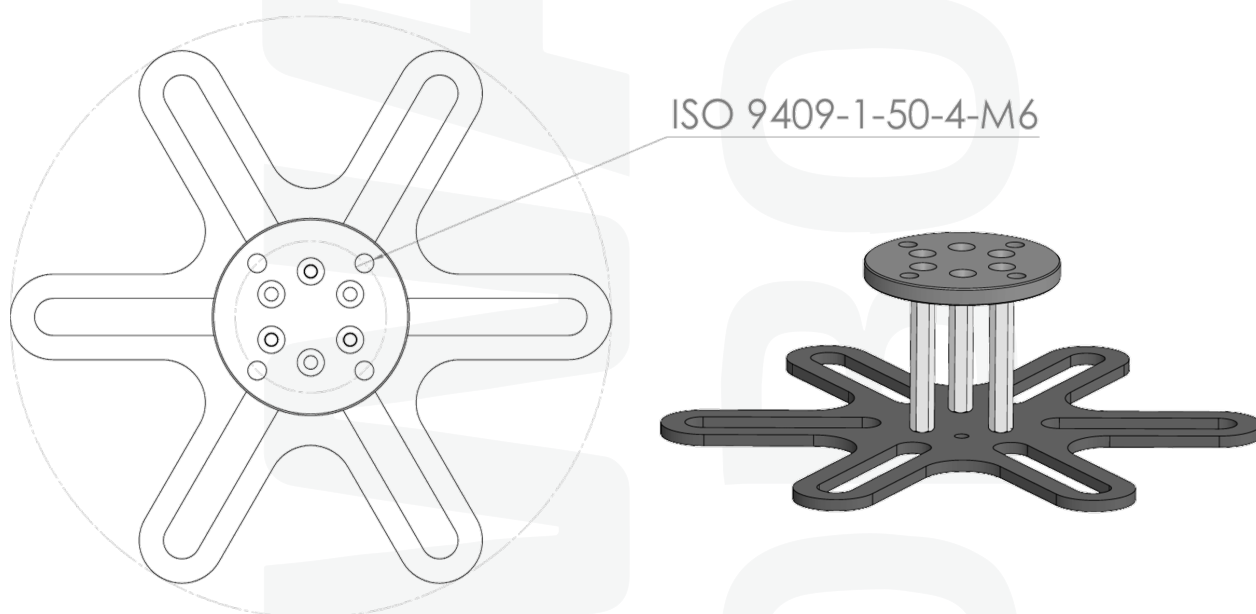


Figure 2: Universal Mounting Adapter (All dimensions in mm)

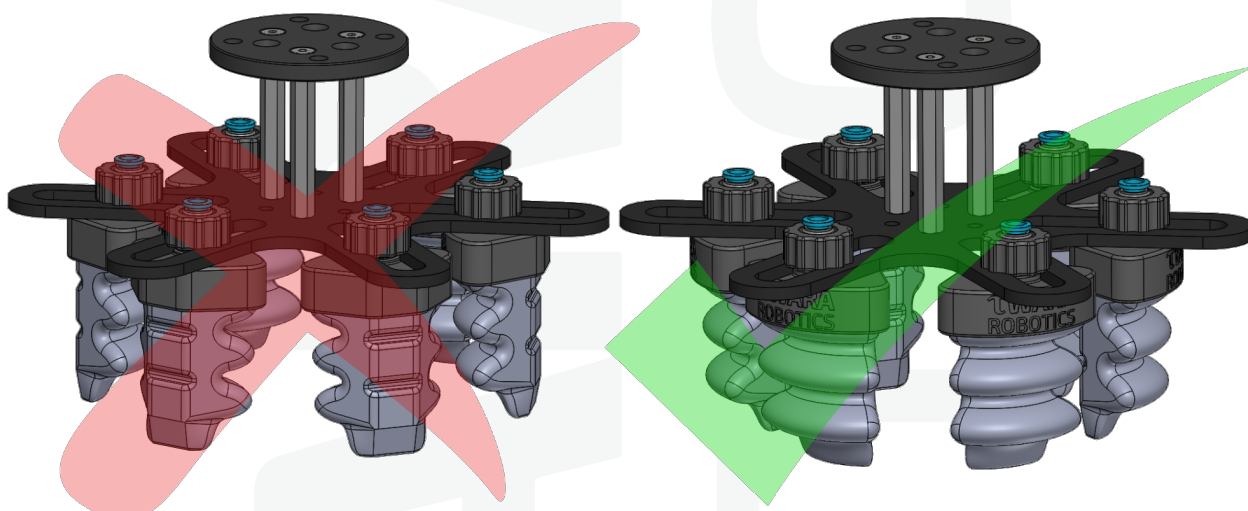


Figure 4: TGrip-2 Finger Mounting Orientation (Bellows must be facing outwards)

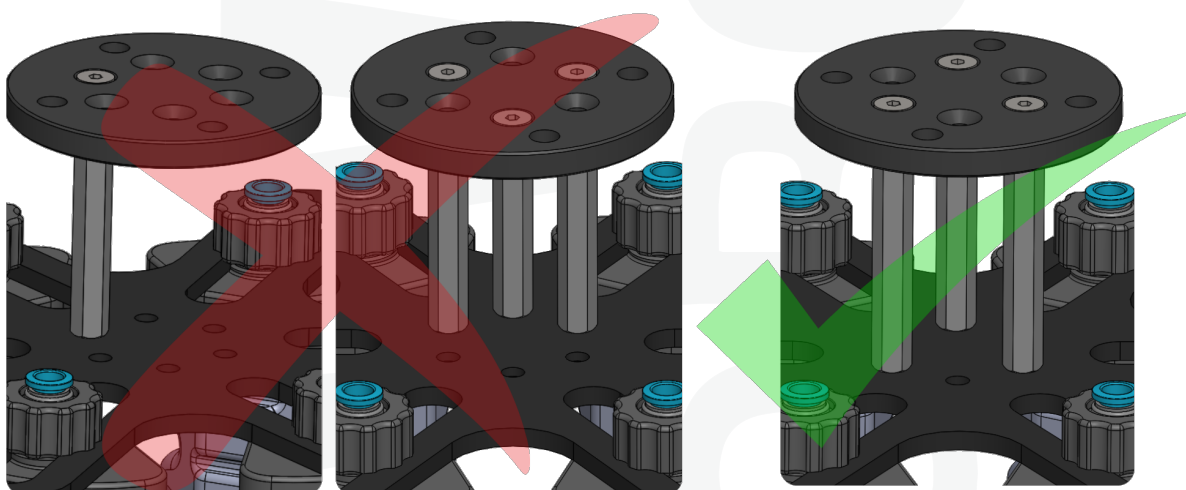


Figure 5: TGrip-2 Universal Mounting Adapter Assembly Orientation (3x Standoffs must be evenly spaced at 120 degree intervals)

5 Pressure Regulator (Optional Accessory)

5.1 Package Contents

Part No.	Item Description	Quantity
1	Pressure Regulator	1 unit
2	Pressure Gauge	1 unit

Table 5: Contents of Accessory kit



Figure 6: Pressure Regulator (left), Pressure Gauge (right)

5.2 Purpose

The pressure regulator and gauge are supplementary components, intended to enhance the safety and reliability of the gripper system. These components are not mandatory for all setups, but are strongly recommended in the following situations:

- The user does not have a precise or dedicated pressure regulation system.
- The existing pressure supply exceeds the optimal operating pressure (0.6 bar) required for the gripper.

5.2.1 Pressure Regulator

The regulator allows the user to adjust and maintain the pressure supplied to the gripper accurately. Maintaining pressure ≤ 0.6 Bar ensures that the gripper operates within its designed parameters, reducing the risk of overpressure, mechanical stress, or unintended actuation.

5.2.2 Pressure Gauge

The gauge provides a real-time visual indication of the supplied pressure. It enables the operator to verify and monitor system pressure at a glance, improving operational awareness and ensuring that the system remains within safe limits.

5.3 Installation

Follow the steps below for installation of the pressure regulator:

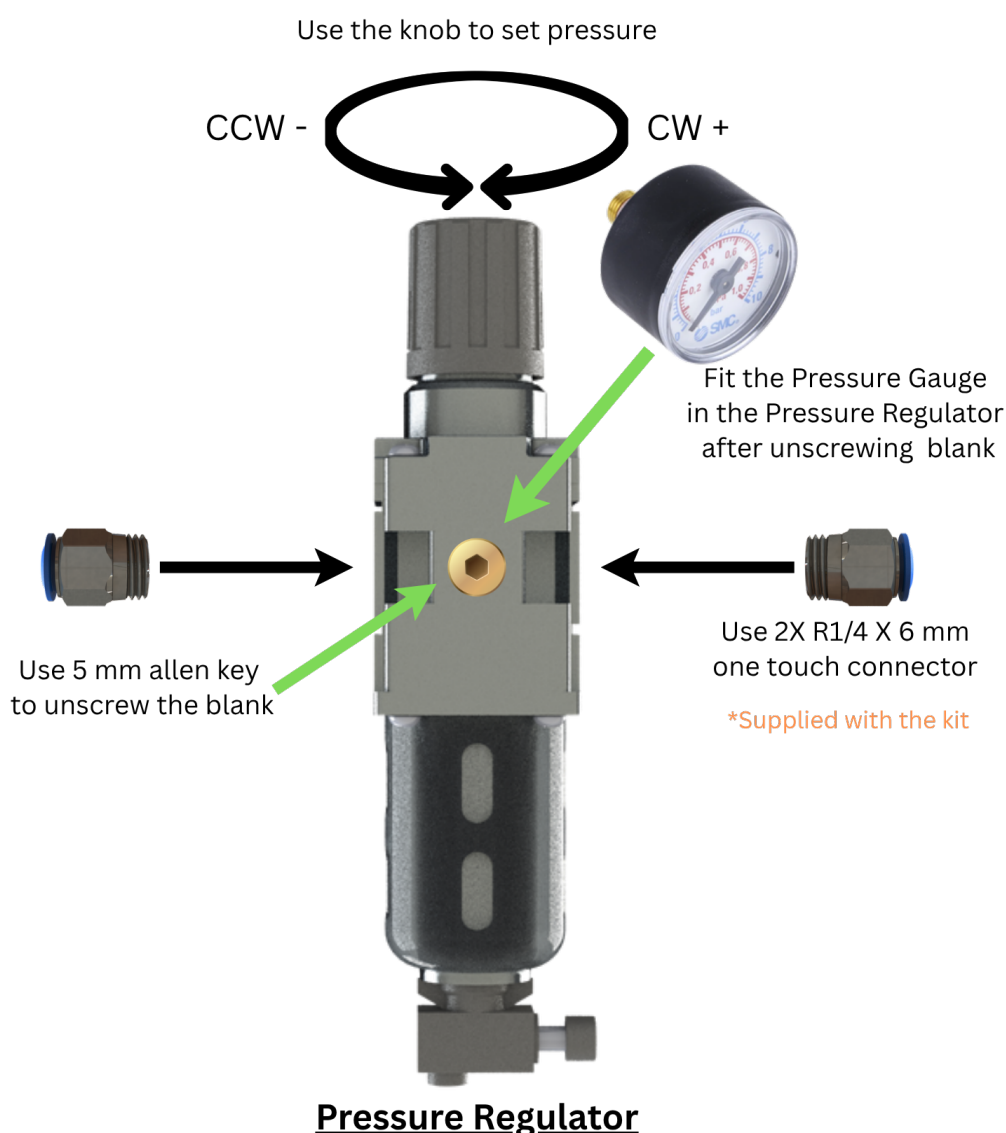


Figure 7: Assembly instructions for the Accessory kit

Step 1: Use R1/4 X 6 mm one touch connectors available off the shelf for connecting 6 mm PU tube to the inlet and outlet of the pressure regulator(refer to Figure 7)

Step 2: Unscrew blank of one side (which is in front) using 5 mm Allenkey

Step 3: Fit the Pressure gauge(Provided in the box) in the pressure regulator

Step 4: Connect Pressure lines and set desired pressure using the knob in the pressure regulator

Step 5: Connect gripper for safe operation

Note: We recommend that customers without a reliable pressure regulation setup install this regulator and gauge to ensure optimal performance and safety. Precise pressure control is critical in automated environments where delicate or high-precision gripping tasks are performed. Using the setup will help prevent potential damage to the gripper or objects being handled, and contribute to longer system lifespan and reduced maintenance needs.

6 Electrical Connection

The TGrip Control Box operates with a **24V** power supply and accepts a digital input signal of up to **24V** for controlling the opening and closing of the fingers to predefined positions. It is important to note that the digital input for the Soft Gripper requires a voltage range of **24V $\pm$ 10%** to register as **HIGH**. The provided connection cable includes four functional flying leads (**P0, P1, V0, V1**)

6.1 For Cobot Control boxes/ DO(x) Operation

Attach the flying leads to the appropriate pins in the control box as follows. Ensure the same DO(x) pins are selected in the URCap Configuration Node (Refer to Figure 8).

1. The **P0** lead to any **0V pin**
2. The **P1** lead to any available **Digital Output (DOx) pin**
3. The **V0** lead to any **0V pin**
4. The **V1** to any other available **Digital Output (DOx) pin**

7 Operation

Download the Twara Robotics URCap from <https://twararobotics.in/products-tgrip#main> for simplified operation. Additionally, you can utilize the **SET** function to configure **VAC** or **PRES-SURE** settings (DOx) to either 1 (HIGH - Open) or 0 (LOW - Close) for operational control. Consult the URCap manual, also found at the end of this document, for further insight into its usage. Refer to Table 4 to adjust the **PRESSURE** and **VAC** timing according to the number of fingers operating on the gripper (**WARNING! PRESSURE @0.6 bar, VACUUM @-0.5 bar. DO NOT OPERATE IN FLOW-BASED CONTROL, ONLY USE PRESSURE-BASED CONTROL.**)

Number of Fingers	VAC Time	PRESSURE Time
2 fingers	0.5 s	1.5 s
3 fingers	0.7 s	1.8 s
4 fingers	0.85 s	2.0 s
6 fingers	1 s	2.2 s

Table 6: Number of Fingers w.r.t Vacuum and Pressure ON time

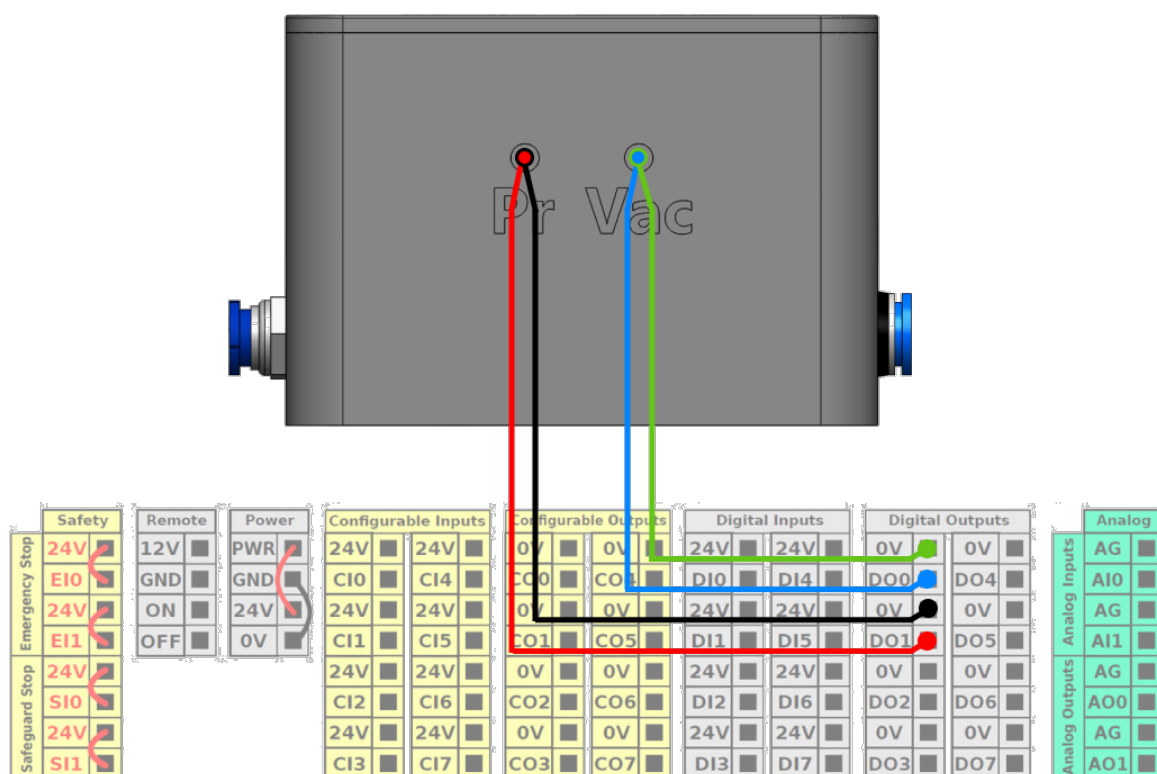


Figure 8: Electrical DO(x) Connections

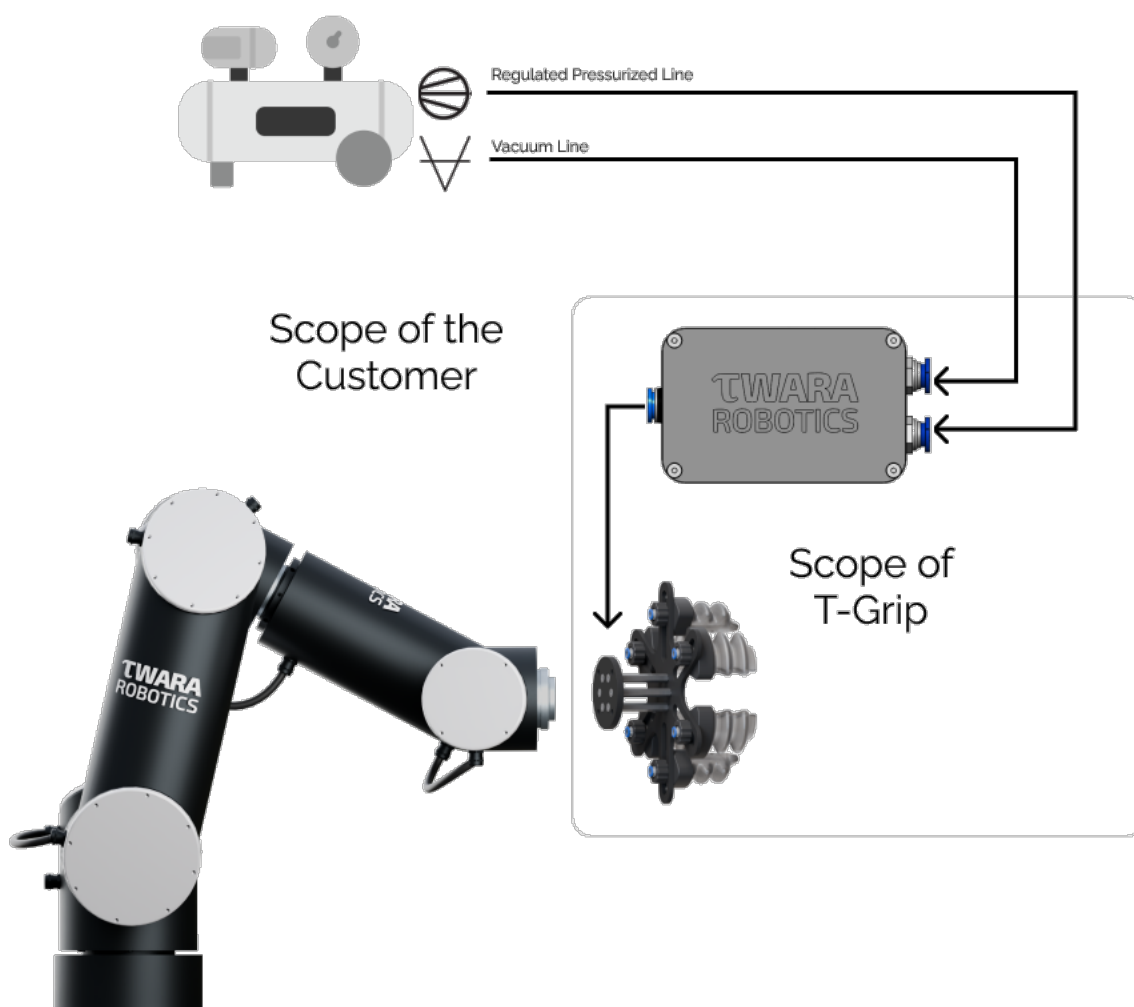


Figure 9: Pneumatic Connections

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