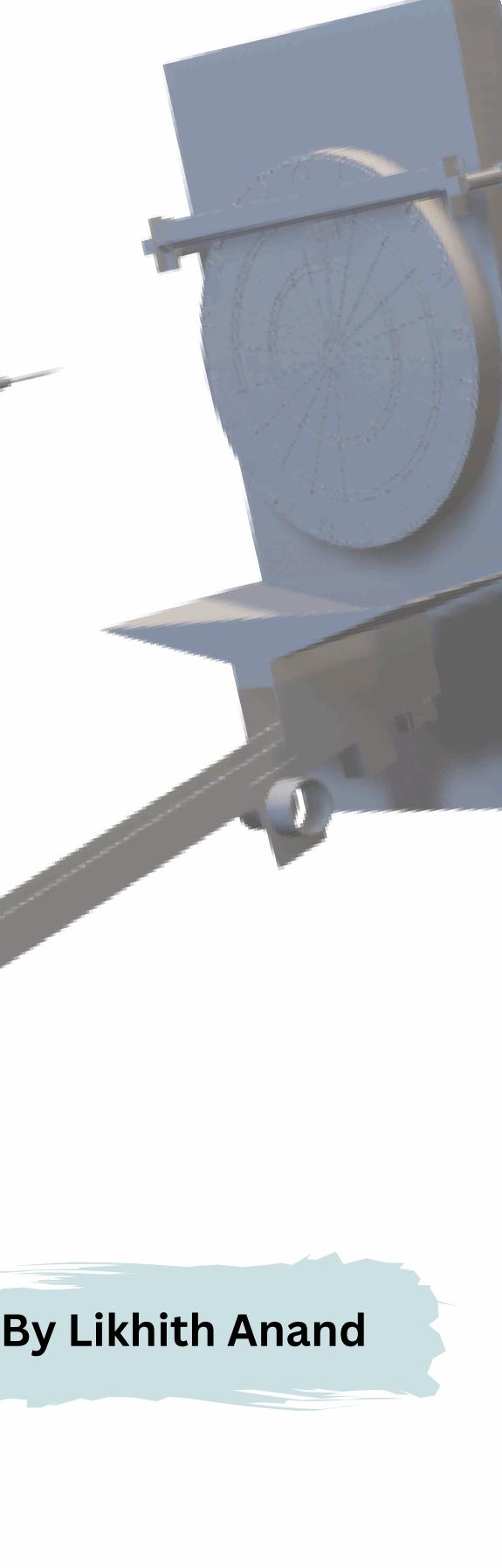
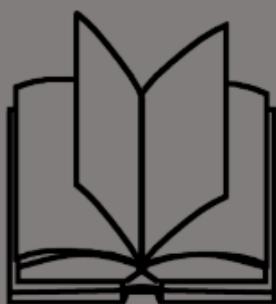


# Dart Retrieval System



By Likhith Anand



**USER MANUAL**

# **CONTENT**

**Introduction**

**Product Overview**

**Safety Instructions**

**Functional Description**

**Technical Data**

**Maintenance and Cleaning**

**Maintenance**

# INTRODUCTION

The DartLoop Dart Retrieval System is a user-centred, semi-automated solution designed to improve the efficiency, accessibility, and safety of dart training and recreational play. This system enables users to retrieve darts from a standard dartboard without leaving their throwing position, promoting uninterrupted practice and enhancing user comfort, especially for professional players or individuals with limited mobility.

Developed as part of a mechatronic product development project, DartLoop integrates mechanical components with basic electronic control to deliver reliable, low-maintenance performance. The design emphasises simplicity, compatibility, and safety, making it suitable for both home use and semi-professional training environments.[1],[4].

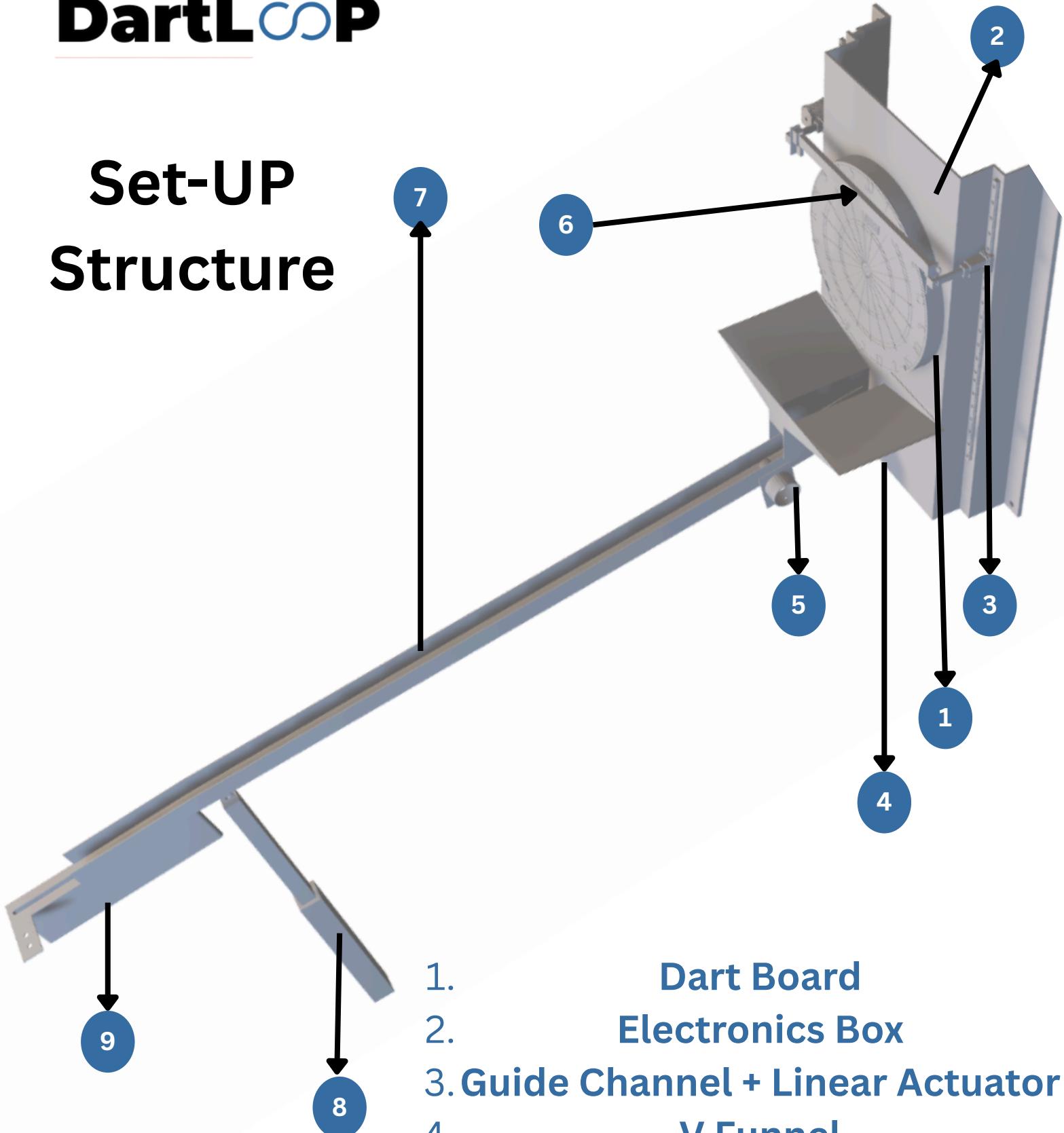
This user manual provides an overview of the system, its key components, safe usage guidelines, maintenance recommendations, and technical data necessary for effective and long-term operation.

# Product Description

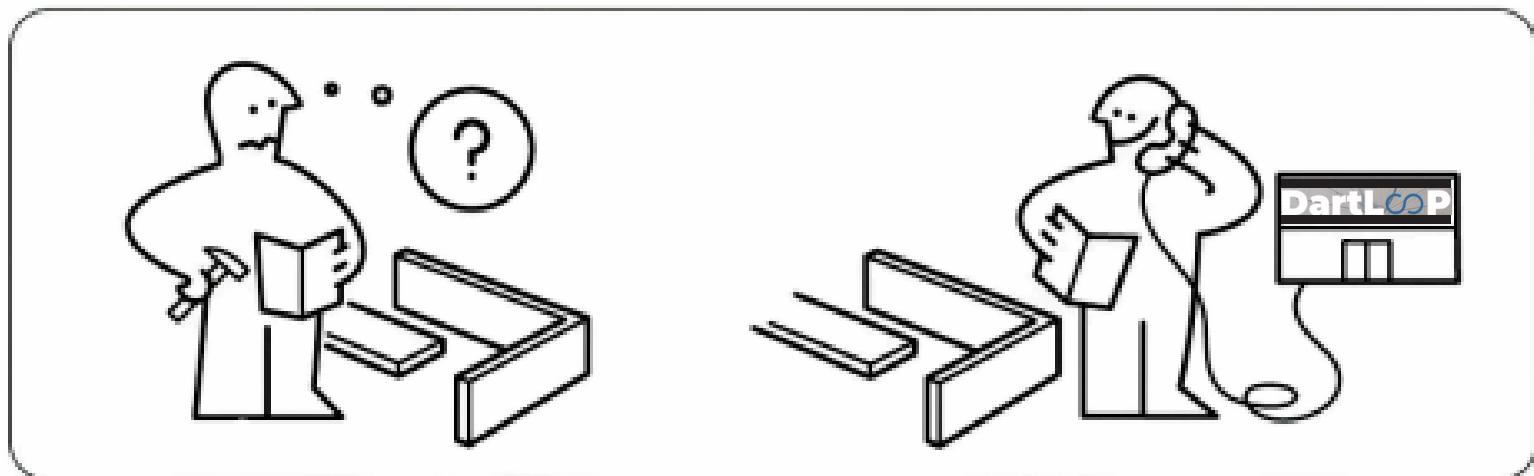
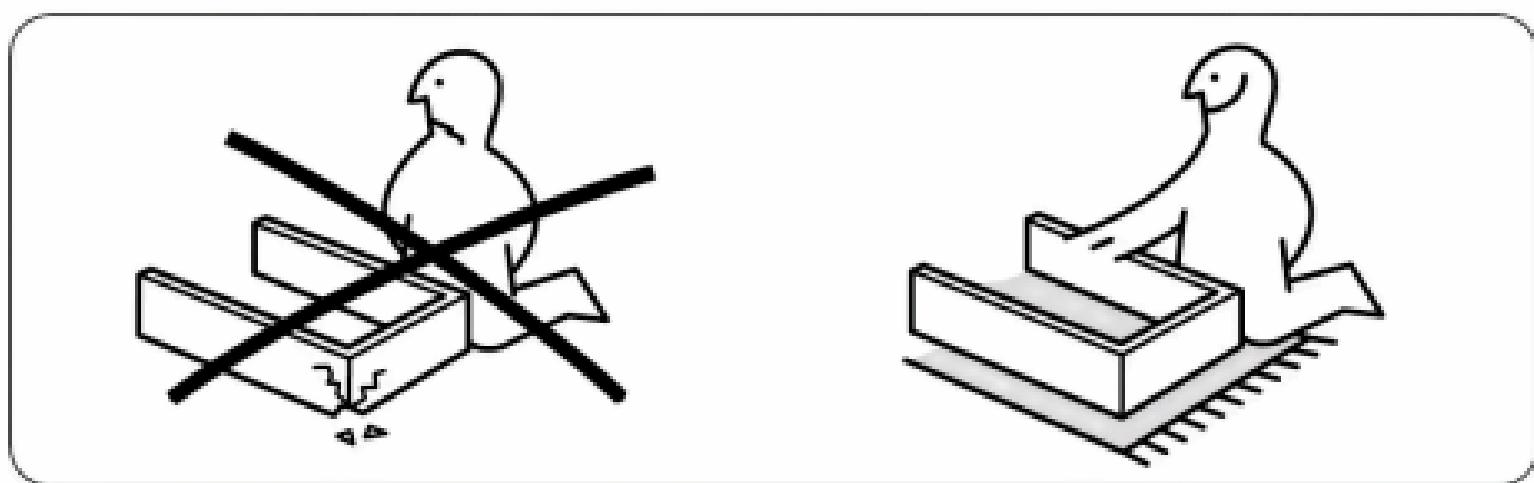
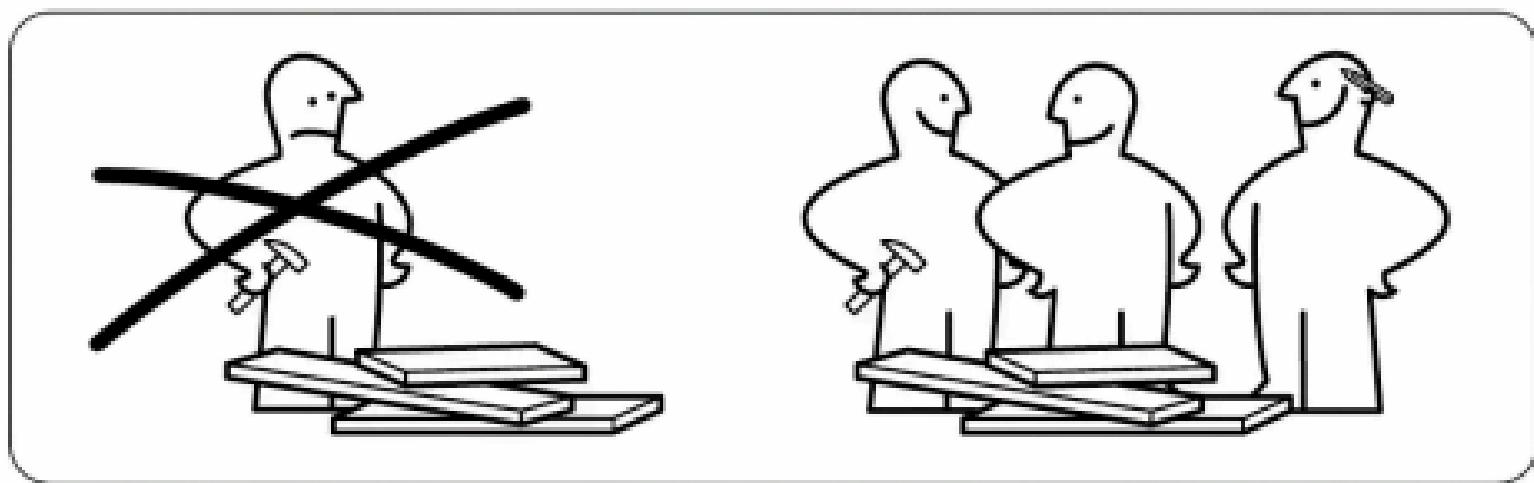
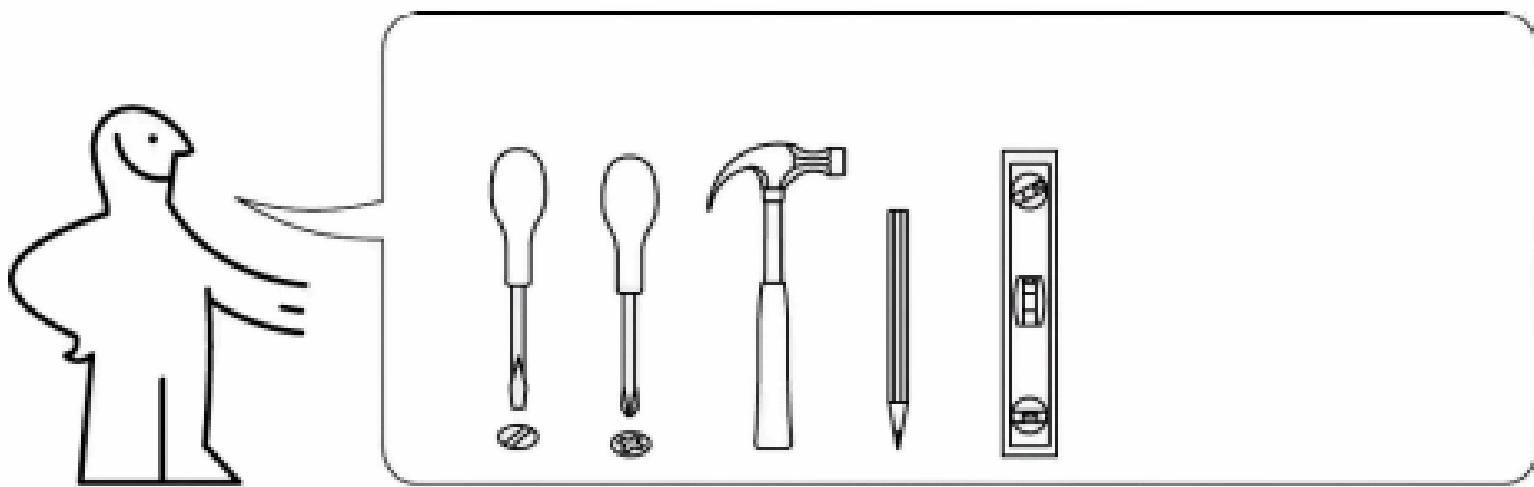
# DartLoop

The DartLoop Dart Retrieval System is a semi-automated system that removes darts from a normal dartboard and returns them to the player. DartLoop, which combines mechanical sensors, an actuator-driven release mechanism, and a smooth return ramp, improves practice flow and accessibility while maintaining player posture. Its sturdy, adaptable, and low-maintenance design makes it suitable for both personal and commercial use.

# Set-UP Structure



1. Dart Board
2. Electronics Box
3. Guide Channel + Linear Actuator
4. V Funnel
5. Servo
6. Steel Rod Integration
7. Chute
8. Height Adjuster
9. Collection Tray





# Safety Instructions

## ENGLISH

Important information

Read carefully.

Keep this information for further reference.

## CAUTION

For safe and smooth operation, disconnect power before maintenance.

Keep hands away from moving parts during use.

## NEDERLANDS

Belangrijke informatie

Goed lezen.

Bewaar deze informatie voor toekomstig gebruik.

## LET OP

Voor veilig gebruik: trek de stekker uit voor onderhoud.

Houd handen weg van bewegende onderdelen tijdens gebruik.

## କ୍ଷେତ୍ର

ମୁଖ୍ୟ ମାହିତିଗଲୁ  
ଦଯାପିଣ୍ଡୁ ଜାଗ୍ରତ୍ତୀଯିଂଦ ଓହି.  
ତା ମାହିତିଯନ୍ତ୍ର ମୁଠିନ  
ବଳକିଗେ ଲୁଛିଲି.

## ଏକ୍ସରିକ୍

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## DEUTSCH

Wichtige Information

Sorgfältig lesen.

Diese Information aufbewahren.

## VORSICHT

Für einen sicheren Betrieb:  
Netzstecker vor Wartung ziehen.

Hände während des Betriebs von beweglichen Teilen fernhalten.

## DANSK

Vigtige oplysninger

Læs omhyggeligt.

Gem disse oplysninger til senere brug.

## PAS PÅ

For sikker brug: afbryd strøm før vedligeholdelse.

Hold hænder væk fra bevægelige dele under brug.

## Turkish (Türkçe)

Önemli bilgi

Lütfen dikkatlice okuyun.

Bu bilgiyi daha sonra başvurmak üzere saklayın.

## DİKKAT

Güvenli kullanım için bakım öncesinde cihazın fişini çekin.

Kullanım sırasında hareketli parçalara dokunmayın.

## FRANÇAIS

Information importante

À lire attentivement.

Conserver ces informations pour un usage ultérieur.

## ATTENTION

Pour un usage sûr : débranchez l'appareil avant l'entretien.

Ne touchez pas les pièces mobiles pendant le fonctionnement.

## SVENSKA

Viktig information

Läs noga.

Spara denna information för framtida bruk.

## OBS!

För säker användning: koppla ur strömmen före underhåll.

Håll händer borta från rörliga delar vid drift

## Portuguese

## (Português)

Informações importantes

Leia com atenção.

Guarde estas informações para referência futura.

## CUIDADO

Para um uso seguro, desligue a alimentação antes da manutenção.

Mantenha as mãos longe das partes móveis durante o uso.



# Safety Instructions

## ÍSLENSKA

Mikilvæg upplýsing  
Lestu vel.  
Geymið þessar upplýsingar  
til að nota síðar.

## VARÚÐ

Taktu strauminn af fyrir  
viðhald til að tryggja örugga  
notkun.  
Forðastu snertingu við  
hreyfanlega hluta í gangi.

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Informazioni importanti  
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Conservare queste  
informazioni per riferimento  
futuro.

## ATTENZIONE

Per un uso sicuro, scollegare  
l'alimentazione prima della  
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Tenere le mani lontane dalle  
parti mobili durante l'uso.

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重要な情報  
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安全にご使用いただくために、メ  
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作動中は可動部分に手を近づけな  
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## NORSK

Viktig informasjon  
Les nøye.  
Ta vare på denne  
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## FORSIKTIG

For trygg bruk: Koble fra  
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Unngå kontakt med  
bevegelige deler under drift.

## Polski

Ważna informacja  
Przeczytaj uważnie.  
Zachowaj te informacje do  
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Odłącz zasilanie przed  
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Trzymaj ręce z dala od  
ruchomych części podczas  
pracy.

## 한국어

중요한 정보  
주의 깊게 읽어주세요.  
이 정보를 나중에 참조할 수 있도  
록 보관하십시오.

## 주의

안전한 작동을 위해 유지보수 전  
에 전원을 차단하십시오.  
작동 중에는 움직이는 부품에 손  
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Información importante  
Lea cuidadosamente.  
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Para un uso seguro,  
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Mantenga las manos alejadas  
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请仔细阅读。  
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## 注意

为确保安全操作，请在维护  
前断开电源。  
使用时请远离运动部件

## हिन्दी

महत्वपूर्ण जानकारी  
कृपया ध्यानपूर्वक पढ़ें।  
इस जानकारी को भविष्य के लिए  
सुरक्षित रखें।

## সাবধানী

সুরক্ষিত সংচালন কে লিএ, রখরখাব সে  
পহলে বিজলী আপুর্তি বাং কৰে।  
উপযোগ কে দৌৰান চলতী ভাগো সে হাথ দূর  
রখে।



# Safety Instructions

[1]



## 3.1 Purpose of Safety Information

These safety instructions are designed to advise users about potential hazards, safe handling, and operational procedures to avoid harm or damage to the DartLoop Dart Retrieval System or its components. This section must be read and understood by all users before they can operate or assemble the system.



## 3.2 General Safety Guidelines

- Read the complete handbook before using the system.
- Only trained or instructed persons may install or operate the equipment.
- Please do not modify the system without written permission from the manufacturer or development team.
- You can only use the system for its intended purpose: retrieving darts from compatible dartboards.

## 3.3 Mechanical Safety

- Hands, tools, or objects should not be placed near the actuator, moving components, or dart release mechanism while the device is in operation.
- Ensure that no part of the user's body is in the dart retrieval route when operating.
- Before each use, inspect all mechanical fasteners (bolts, screws, and mounts).



## 3.4 Electrical Safety

- Turn off the power supply before maintaining, cleaning, or changing internal components.
- Use only the specified or approved 5V/12V low-voltage power supply.
- Do not use the system with moist hands or in damp conditions.
- Keep the Arduino controller and other electronic components in a dry, contained space.



# Safety Instructions

[1]

## 3.5 Operating Conditions



- Indoor usage only.
- The operating temperature ranges from 10 to 40°C.
- Max humidity: 80% (non-condensing).
- Avoid operating near heat sources or combustible materials.
- Avoid making sharp hits, falling, or overloading the system.



## 3.8 Emergency Instructions

- If the system malfunctions, turn off the power immediately.
- Use the emergency stop switch if it is installed.
- Report any repeated faults to technical support or maintenance workers.

## 3.9 Regulatory Compliance Statements

- This system is designed for prototyping or instructional purposes. If marketed, it must conform with the
- CE Machinery Directive (2006/42/EC) and FCC Part 15 for electronic emissions.
- RoHS (Restricted Hazardous Substances)
- Proper marking and documentation must be applied on the housing and included in the packaging.

### FCC Compliance Statement:

This gadget complies with Part 15 of the FCC rules. The device's functioning is subject to two conditions:

- (1) it cannot create harmful interference, and
- (2) it must accept any interference received, even if it may cause unwanted operation.

# Function

The DartLoop functions in a sequential cycle that the user initiates. When three darts are thrown, the following sequence takes place:

- **User Input**  
The system is engaged using a control button or a foot pedal once all the darts are in place on the board.
- **Verification & Safety Check**  
Sensors and copper contacts verify that the darts are properly positioned and confirm that the system is prepared for operation.
- **Extraction**  
A linear actuator moves a magnetic plate located behind the board to release the darts. After dislodging the darts, the plate retracts, allowing the darts to fall freely due to gravity.
- **Collection & Guidance**  
The dropped darts pass through a funnel system that minimizes impact and directs them smoothly into a ramp.
- **Return**  
The darts slide down the sloped rubber ramp and into a collection tray for the user.
- **Feedback**  
An RGB LED light strip indicates the status of the system; for instance, green means it's ready, blue indicates that it is in operation, and red signals an error or reset

# **General and Special advantage of use**

- Hands-Free Dart Retrieval**

No need to approach the dartboard or bend after each throw – darts are retrieved for you.

- Faster Practice Flow**

Minimizes interruptions between throws, allowing for more focused and efficient training.

- Simple Operation**

Operate with a single button- no configuration required.

- Safe Dart Handling**

Ensures safe release and return of darts to avoid injuries or equipment damage.

- Durable Construction**

Crafted from durable materials such as aluminum, stainless steel, and Teflon for long-term use.

# Technical Data

Category	Specification
System Name	DartLoop – Automated Dart Retrieval System
Weight	~6.2 kg (80% chute assembly)
Overall Dimensions	L × W × H: 60 × 35 × 110 cm (max extended height)
Height Adjustment	70 – 110 cm (telescopic frame)
Power Supply	230V AC ~ 50Hz (via AC/DC Buck Converter)
Operating Voltage	5V / 12V / 24V DC (low-power control + actuators)
Control Unit	Arduino Uno R3 with relay and PWM modules
Dartboard Compatibility	Standard size (451 mm diameter)
Funnel Dimensions	50 cm × 25 cm tapering to 25 cm × 6 cm (Teflon-coated)
Chute Return Angle	11° to 20° (adjustable by height)
Dart Alignment Slit	53 cm × 6 cm – allows only barrel
Maximum Dart Capacity	Up to 9 darts per cycle

# Technical Data

[7],[8]

<b>Actuators</b>	2 × 30 N Linear Actuators (15 mm/s speed)
<b>Triggering Mechanism</b>	Push Button
<b>Sensing Logic</b>	Mechanical deflection + copper wire contact
<b>Return Mechanism</b>	Rubber roller + DC motor (100 RPM)
<b>Material Composition</b>	Aluminum 6061-T6, AISI 304 Stainless Steel, Copper, ABS
<b>Noise Level</b>	≤ 50 dB during operation
<b>Safety Features</b>	Emergency Stop Button, Enclosed Moving Parts, LED Status
<b>Temperature Range</b>	0°C to 40°C operating environment
<b>Surface Finish</b>	Matte black or neutral gray (abrasion and stain resistant)
<b>Ergonomic Features</b>	Centered return tray, passive tip-down dart alignment
<b>Compliance</b>	RoHS, CE Marking, WEEE labeling, Recyclable Packaging [8],[9],
<b>Transport Size</b>	Box: 250 × 150 × 1000 cm, 2–3 layer
<b>Typical Retrieval Time</b>	~15 seconds per 3 darts (2s/dart extraction + return)

# Maintenance and Cleaning

Proper maintenance ensures safe operation, extends product life, and maintains consistent performance of the DartLoop Dart Retrieval System. The system is designed to require minimal upkeep but must be checked periodically for mechanical wear and electronic functionality.



## Cleaning Instructions

- Always disconnect power before cleaning any component.
- Use a soft, dry cloth for most surfaces.
- For more stubborn dirt (e.g., dart residue on ramp/funnel), use a slightly damp cloth with mild soap solution. Avoid any strong solvents.
- Avoid spraying water directly on sensors, actuator, or control housing.
- Use compressed air (low pressure) to clean around electronics and moving parts if dust accumulation is visible.

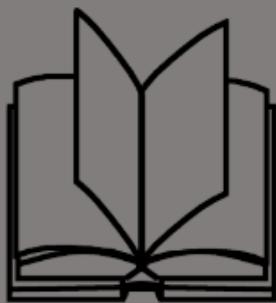


## Warnings

- Do not immerse any part of the system in water.
- Do not lubricate electrical components.
- Use only approved power supplies and actuator replacements.
- Unauthorised modifications or repairs may void the warranty and safety compliance.
- Perform all servicing in a dry, well-lit, and static-safe environment.



## Dart Retrieval System



## ASSEMBLY MANUAL

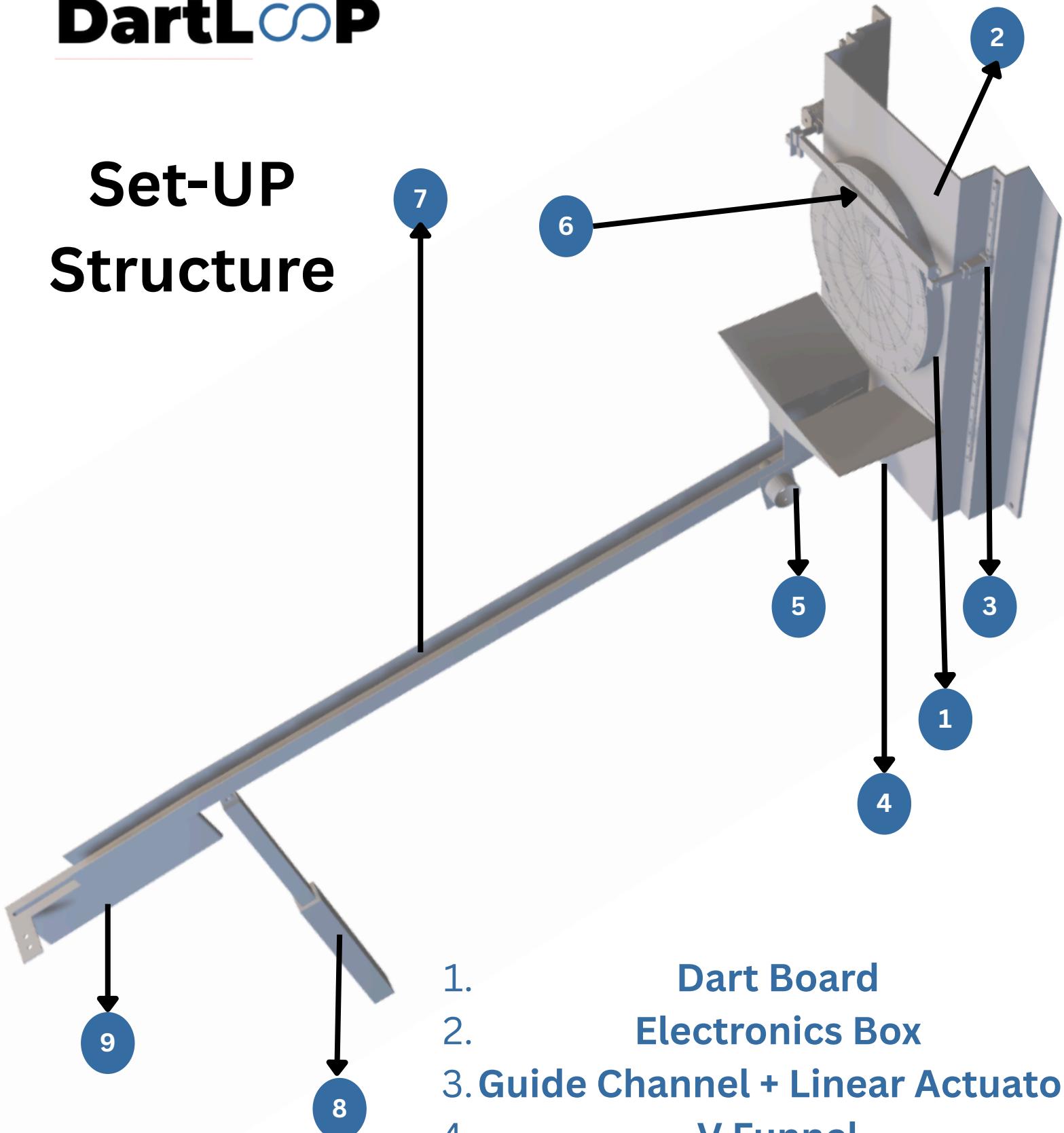
# CONTENT

ENGLISH

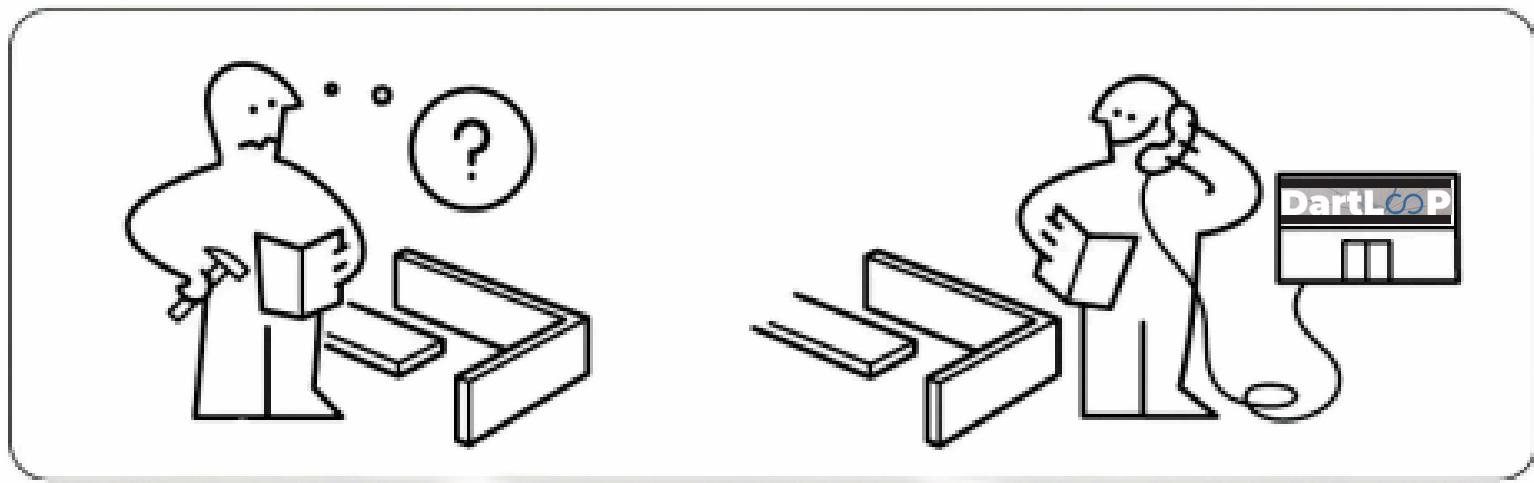
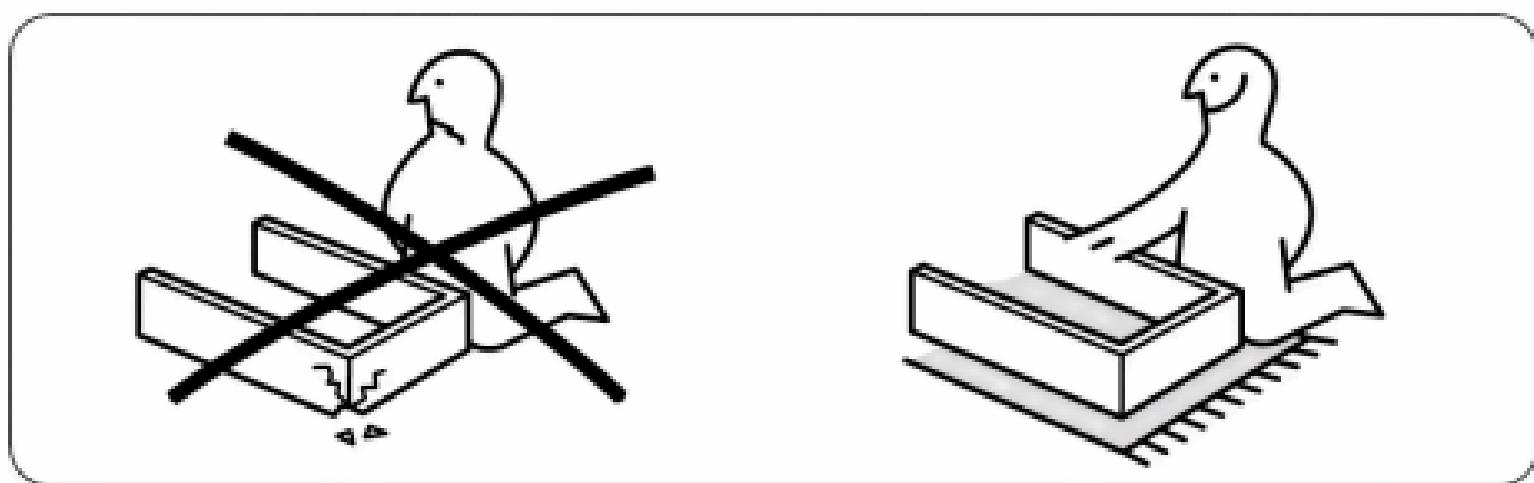
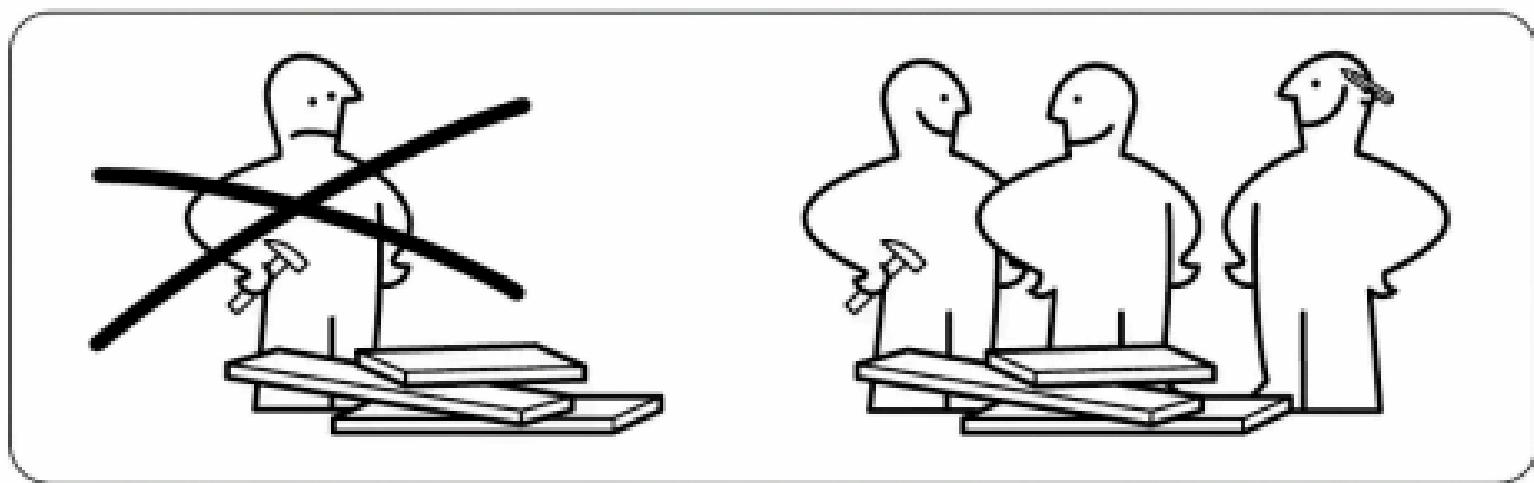
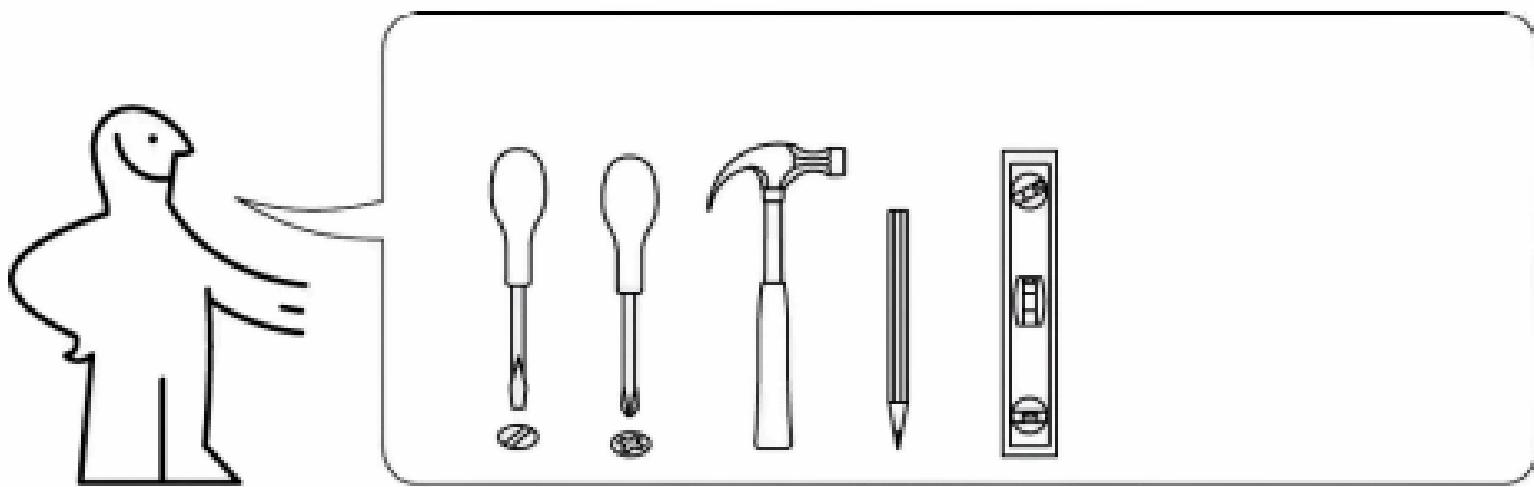
## **Components**

## **Assembly Instruction**

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## ଏଜ୍ଞାରିକ

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Informações importantes

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महत्वपूर्ण जानकारी

कृपया ध्यानपूर्वक पढ़ें।

इस जानकारी को भविष्य के लिए  
सुरक्षित रखें।

## सावधानी

सुरक्षित संचालन के लिए, रखरखाव से  
पहले बिजली आपूर्ति बंद करें।

उपयोग के दौरान चलती भागों से हाथ दूर  
रखें।



# Safety Instructions



## 3.1 Purpose of Safety Information

These safety instructions are designed to advise users about potential hazards, safe handling, and operational procedures to avoid harm or damage to the DartLoop Dart Retrieval System or its components. This section must be read and understood by all users before they can operate or assemble the system.



## 3.2 General Safety Guidelines

- Read the complete handbook before using the system.
- Only trained or instructed persons may install or operate the equipment.
- Please do not modify the system without written permission from the manufacturer or development team.
- You can only use the system for its intended purpose: retrieving darts from compatible dartboards.

## 3.3 Mechanical Safety

- Hands, tools, or objects should not be placed near the actuator, moving components, or dart release mechanism while the device is in operation.
- Ensure that no part of the user's body is in the dart retrieval route when operating.
- Before each use, inspect all mechanical fasteners (bolts, screws, and mounts).



## 3.4 Electrical Safety

- Turn off the power supply before maintaining, cleaning, or changing internal components.
- Use only the specified or approved 5V/12V low-voltage power supply.
- Do not use the system with moist hands or in damp conditions.
- Keep the Arduino controller and other electronic components in a dry, contained space.



# Safety Instructions

## 3.5 Operating Conditions



- Indoor usage only.
- The operating temperature ranges from 10 to 40°C.
- Max humidity: 80% (non-condensing).
- Avoid operating near heat sources or combustible materials.
- Avoid making sharp hits, falling, or overloading the system.



## 3.8 Emergency Instructions

- If the system malfunctions, turn off the power immediately.
- Use the emergency stop switch if it is installed.
- Report any repeated faults to technical support or maintenance workers.

## 3.9 Regulatory Compliance Statements

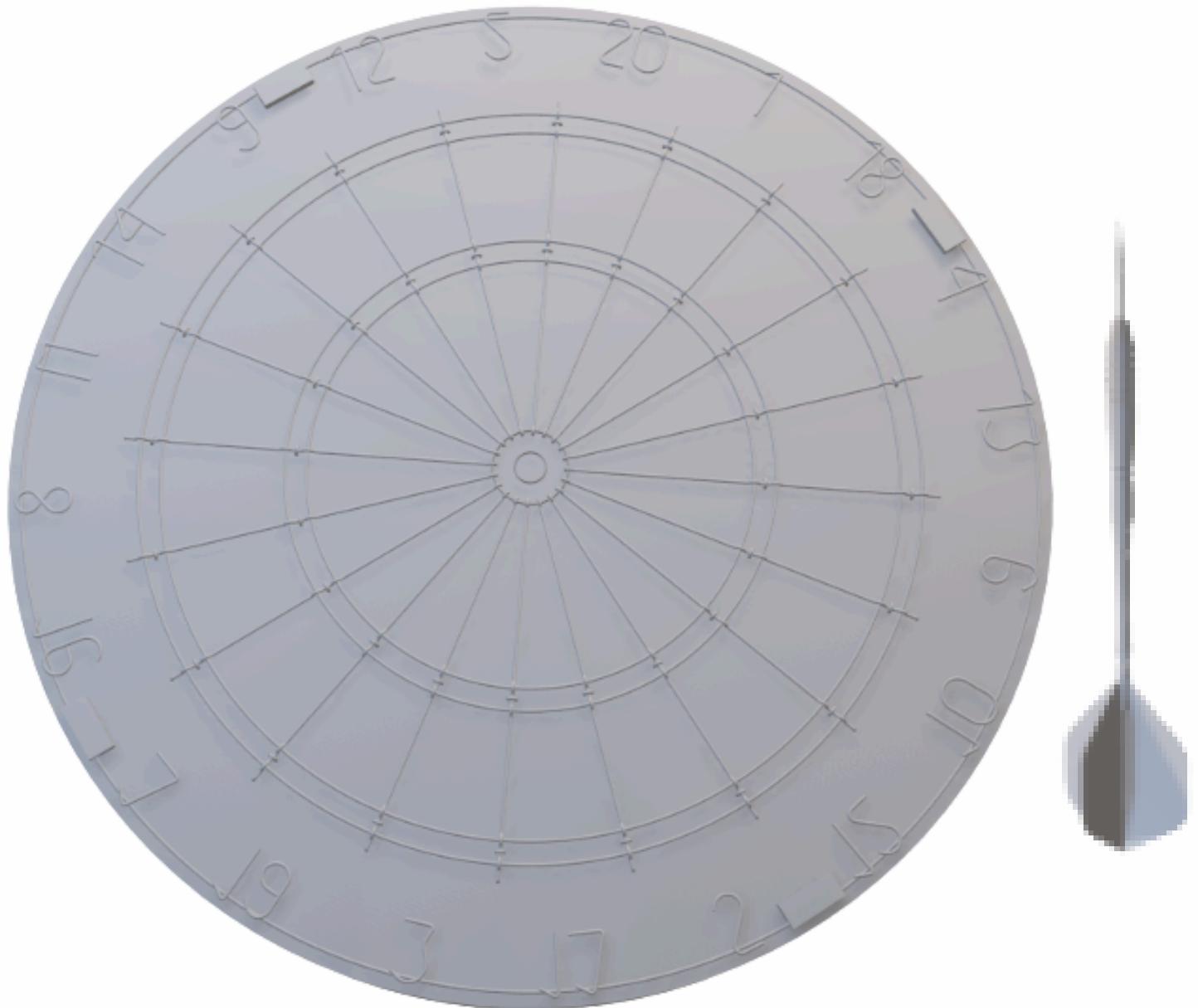
- This system is designed for prototyping or instructional purposes. If marketed, it must conform with the
- CE Machinery Directive (2006/42/EC) and FCC Part 15 for electronic emissions.
- RoHS (Restricted Hazardous Substances)
- Proper marking and documentation must be applied on the housing and included in the packaging.

### FCC Compliance Statement:

This gadget complies with Part 15 of the FCC rules. The device's functioning is subject to two conditions:

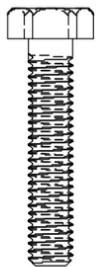
- (1) it cannot create harmful interference, and
- (2) it must accept any interference received, even if it may cause unwanted operation.

# **NOTE :**



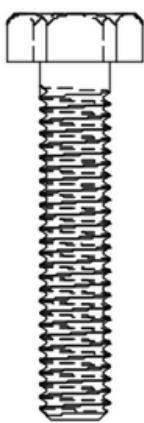
**Dart Boards and Darts are not included in the purchase parts; they are supposed to be externally procured.**

# Components

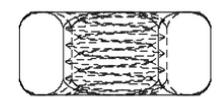


100513

M 5

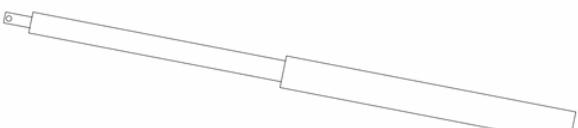
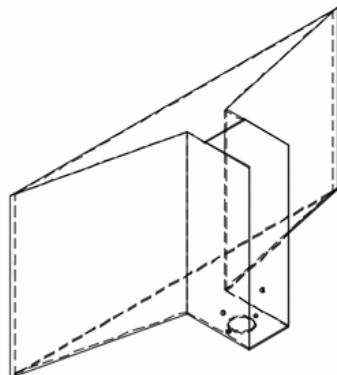
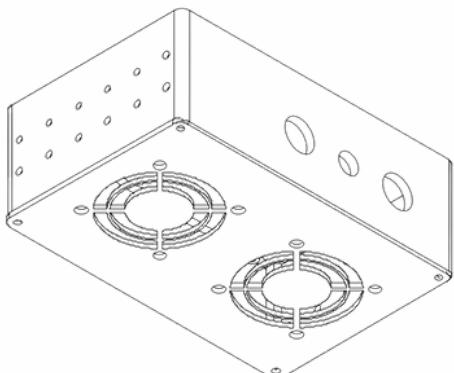
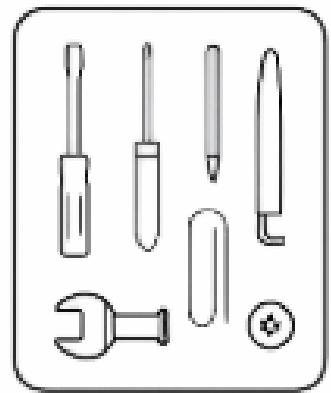
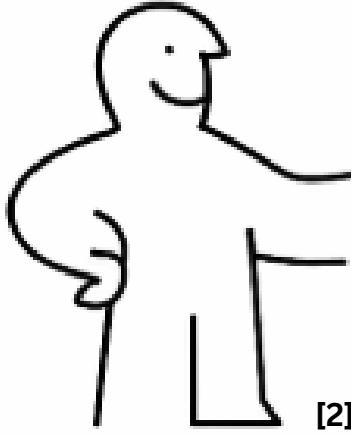
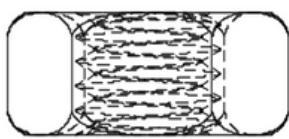


100514

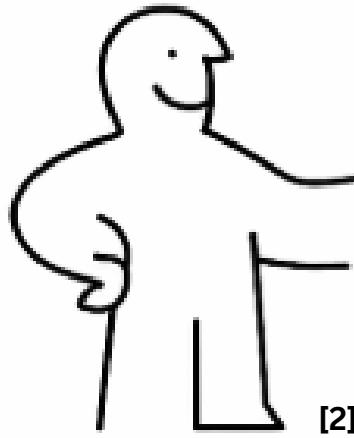


100512

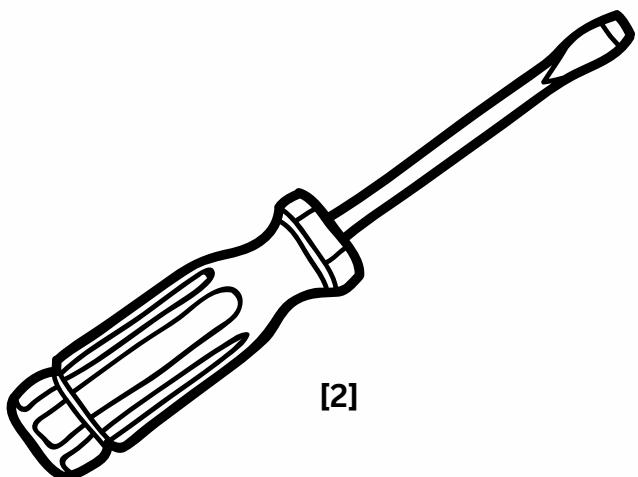
100515



# Tools Needed

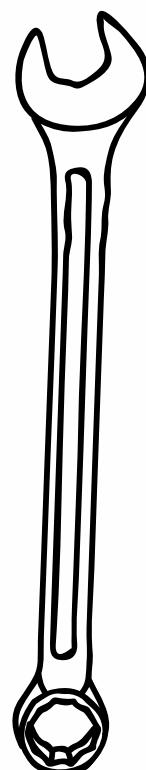


[2]



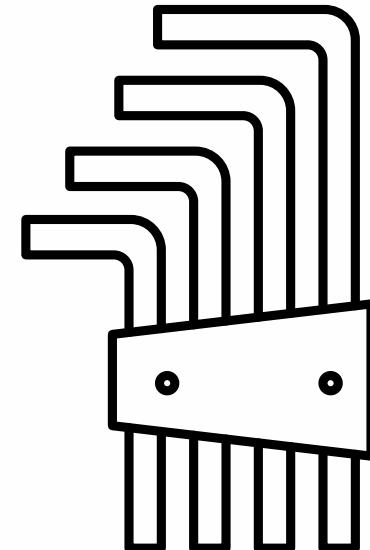
[2]

Screwdriver

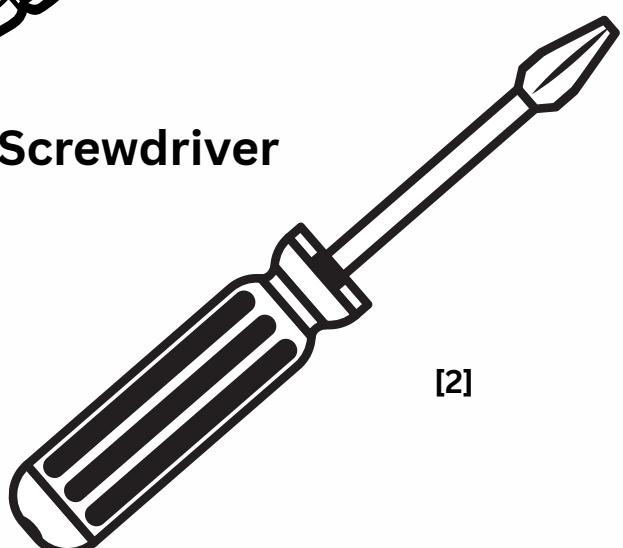


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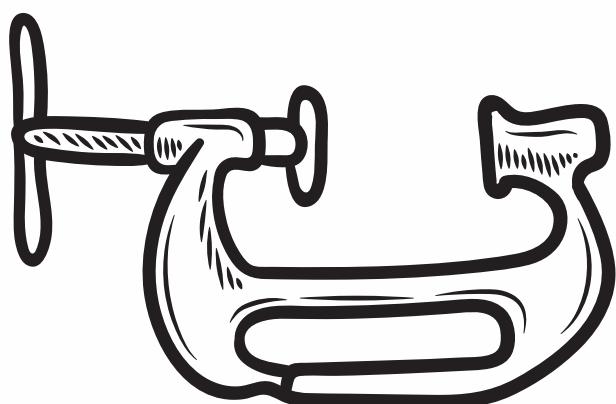
Spanner



Allen Key [2]

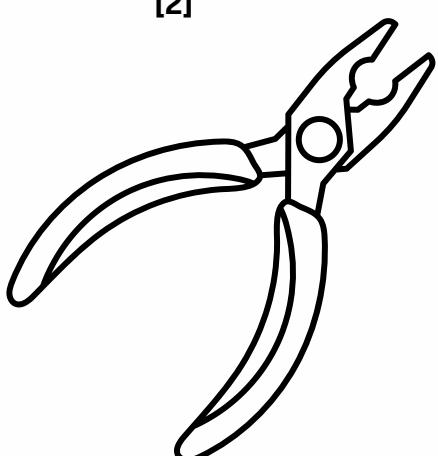


[2]



[2]

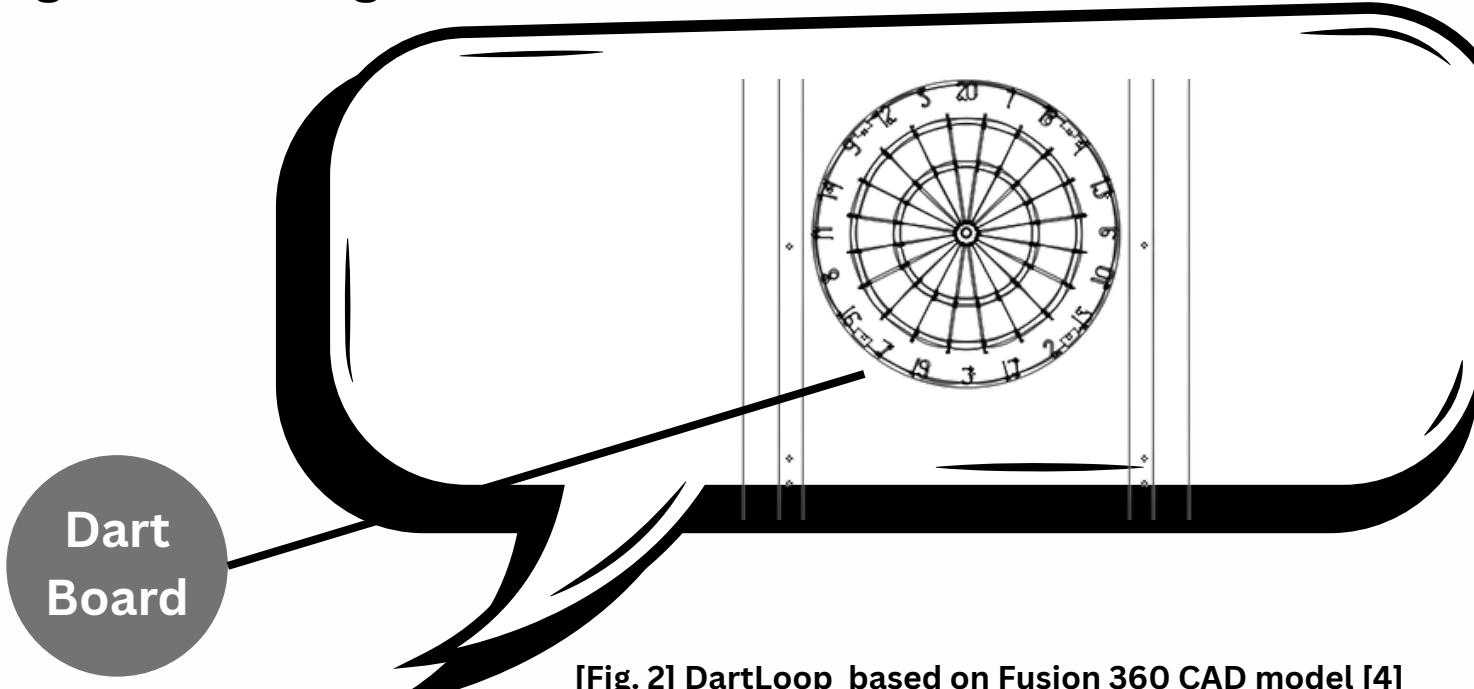
Adjustable Wrench



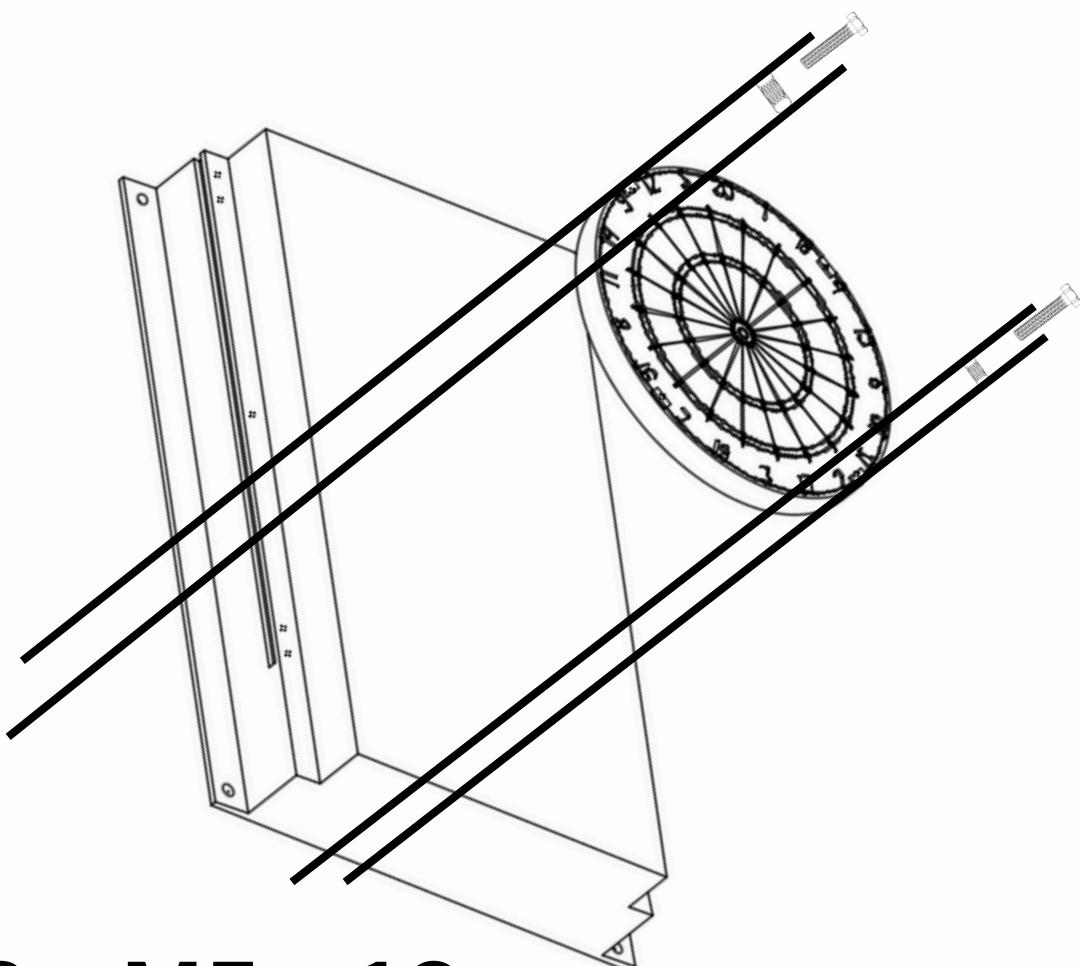
Cutter

# Assembly Instruction

Align it according to the arrows



[Fig. 2] DartLoop based on Fusion 360 CAD model [4]



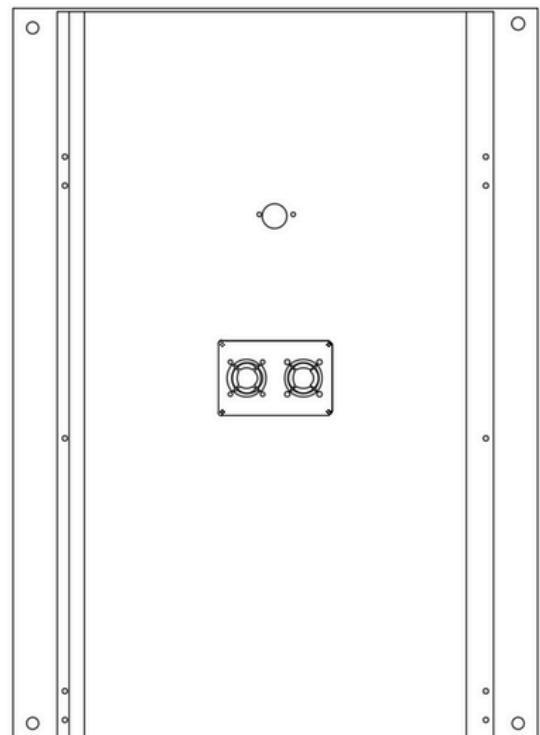
**2 x M5 x 10**

**1**

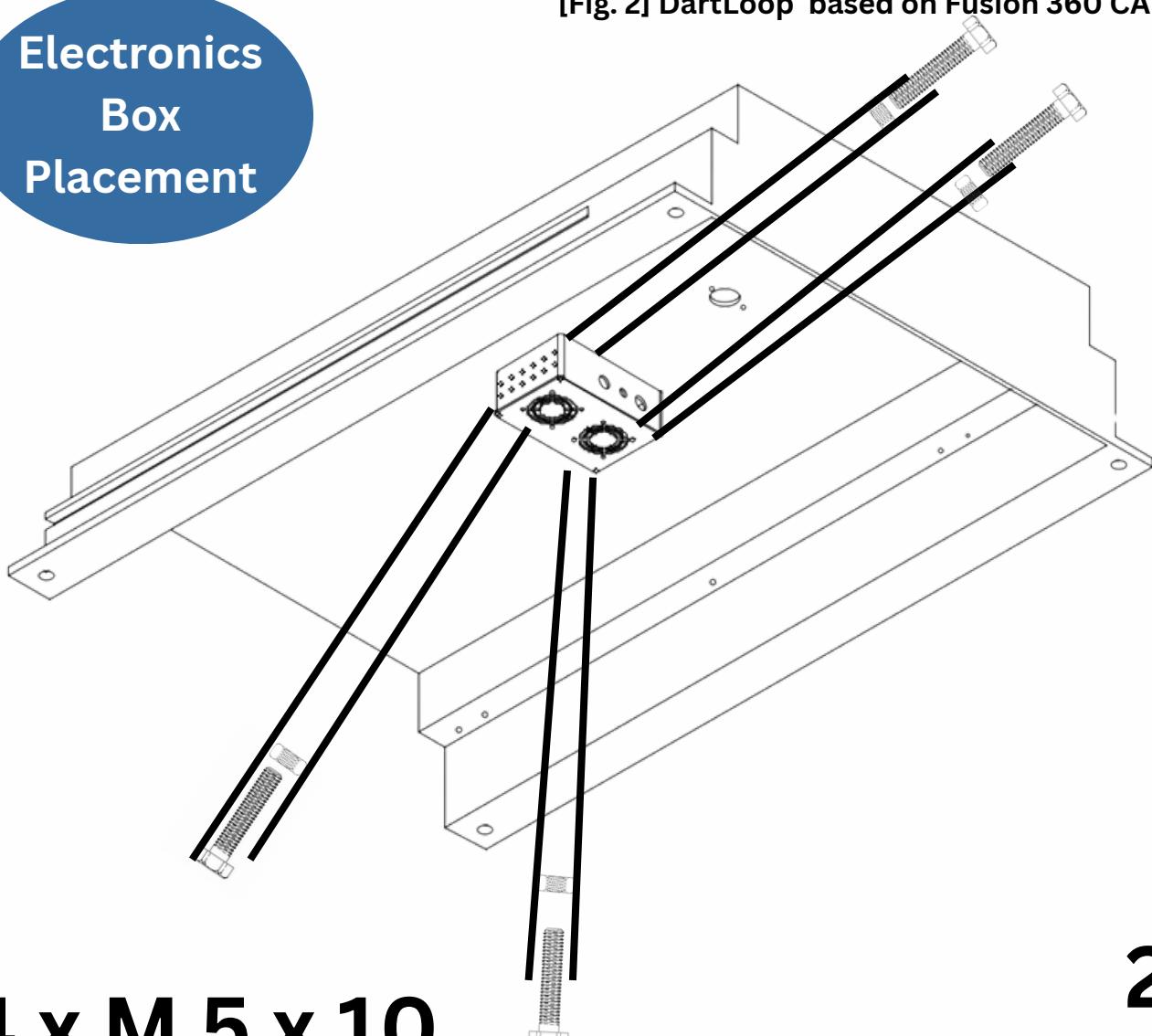
The 2 screws are used to fix the Dart Board to  
the Base

**10**

**The 2 screws are used to fix the Electronic Box to the base**

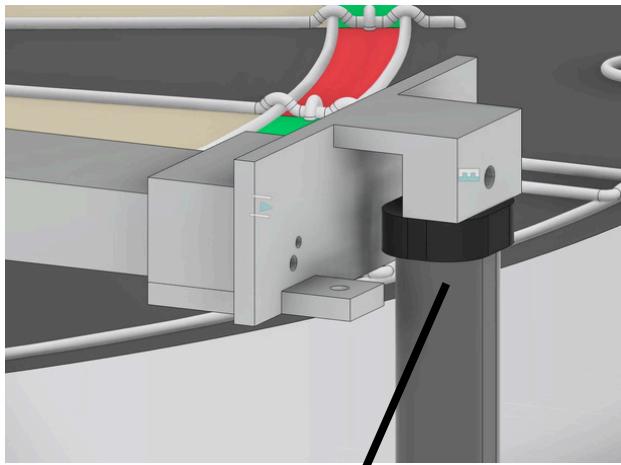


[Fig. 2] DartLoop based on Fusion 360 CAD model [4]

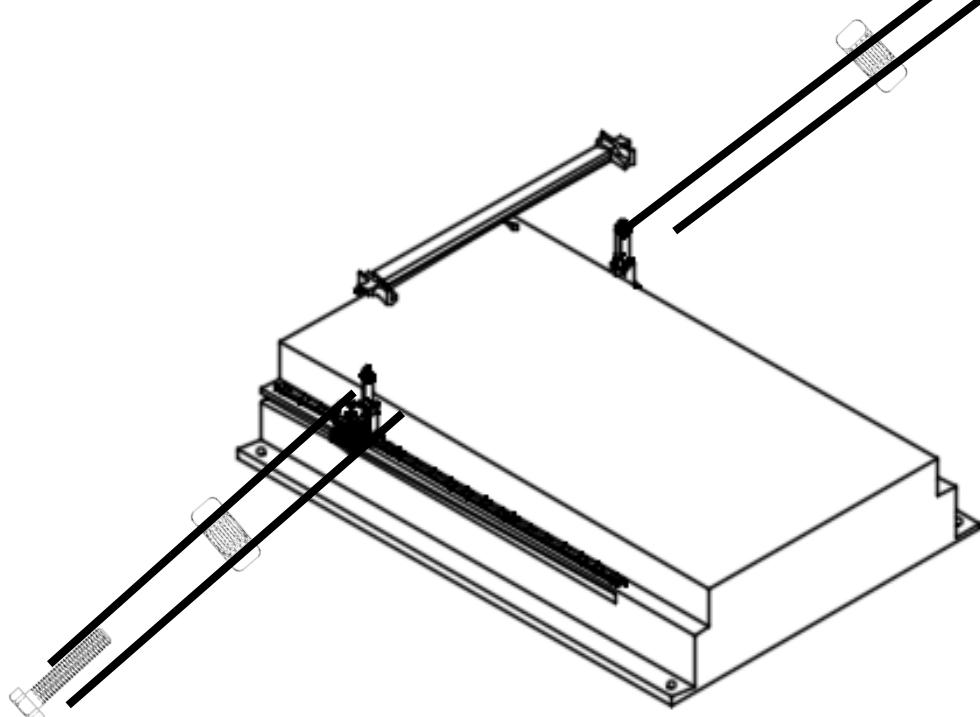
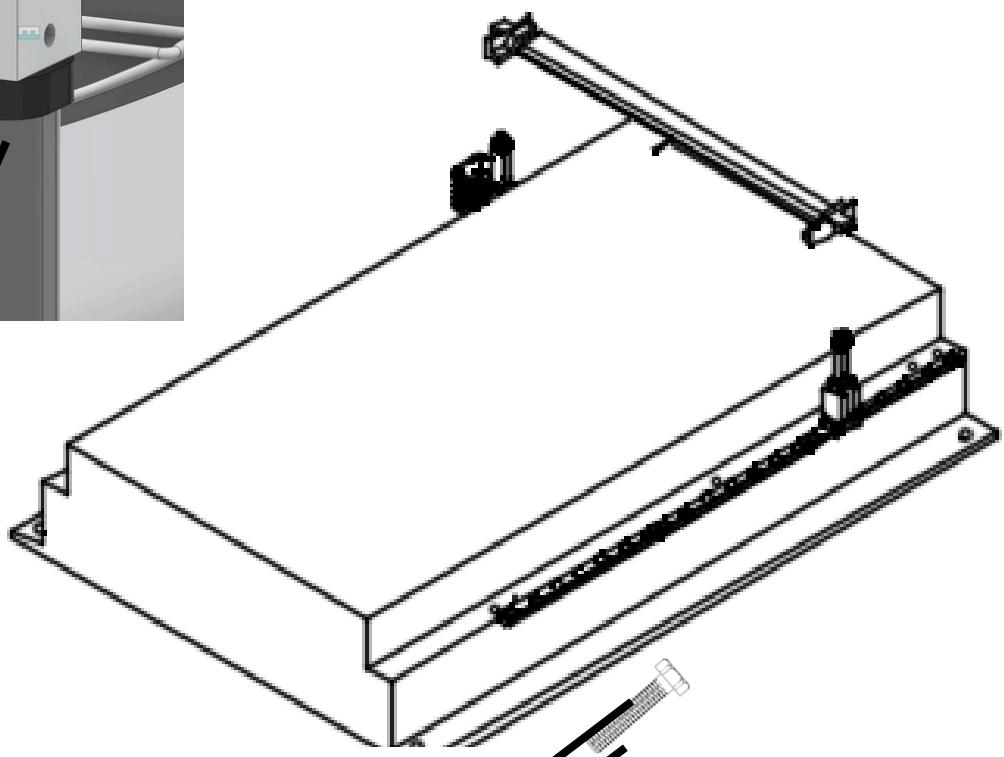


**4 x M 5 x 10**

**2**



[Fig. 2] DartLoop based on Fusion 360 CAD model [4]



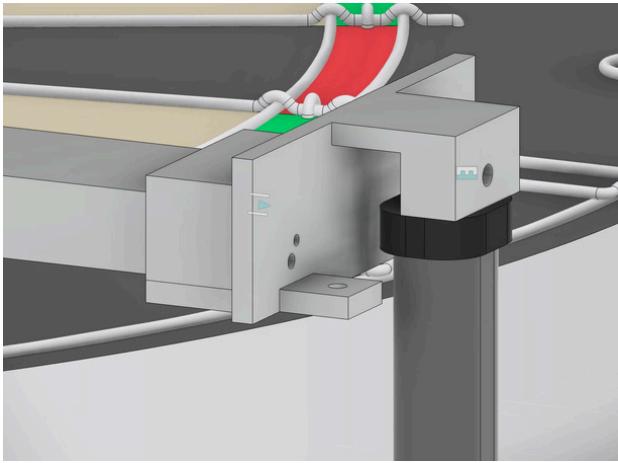
**2 x M5 x 10**

The 2 screws are used to fix the Mechanical plate with pins to the linear actuator

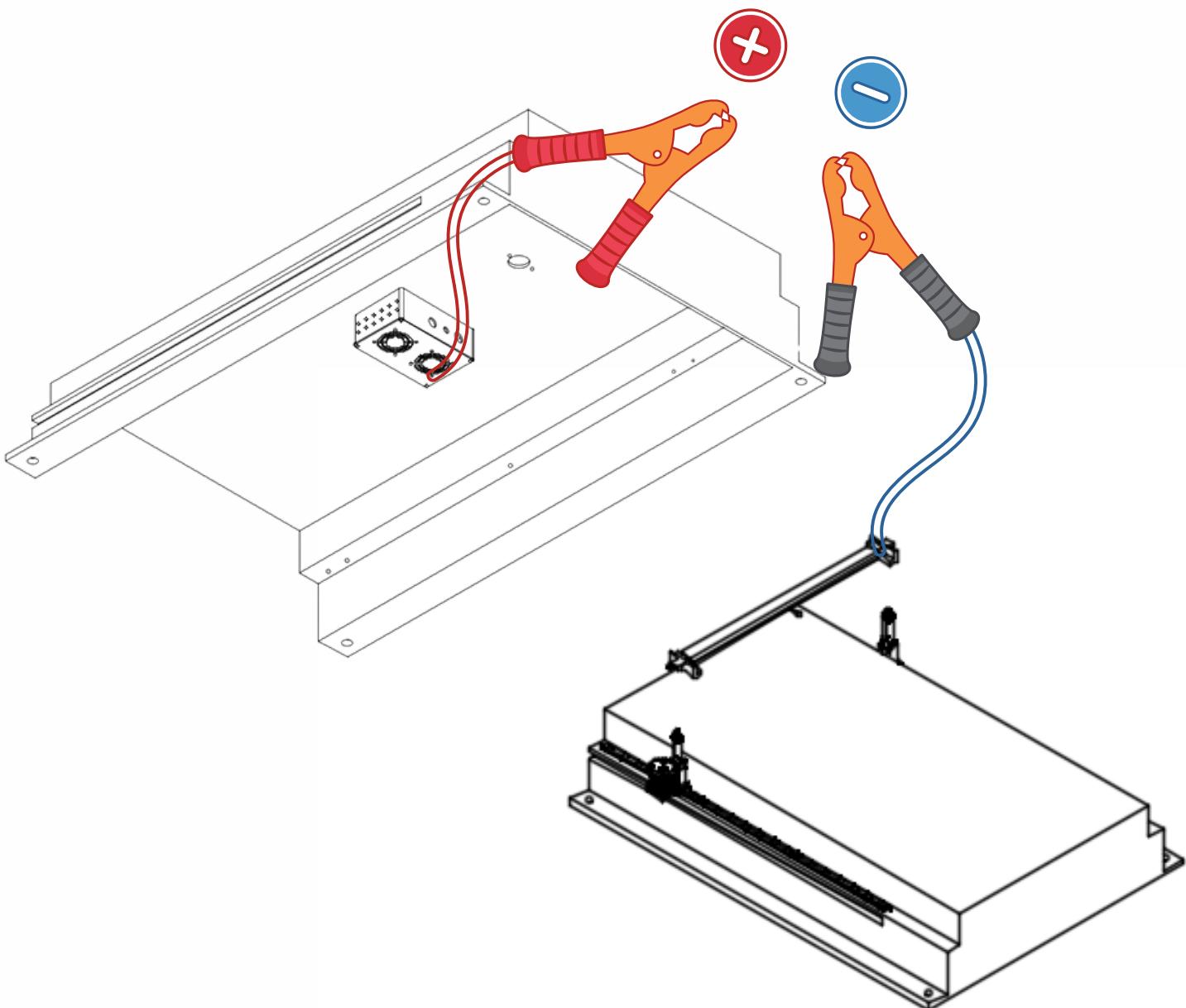
Note- The pins come attached to the plate.

**3**

**12**

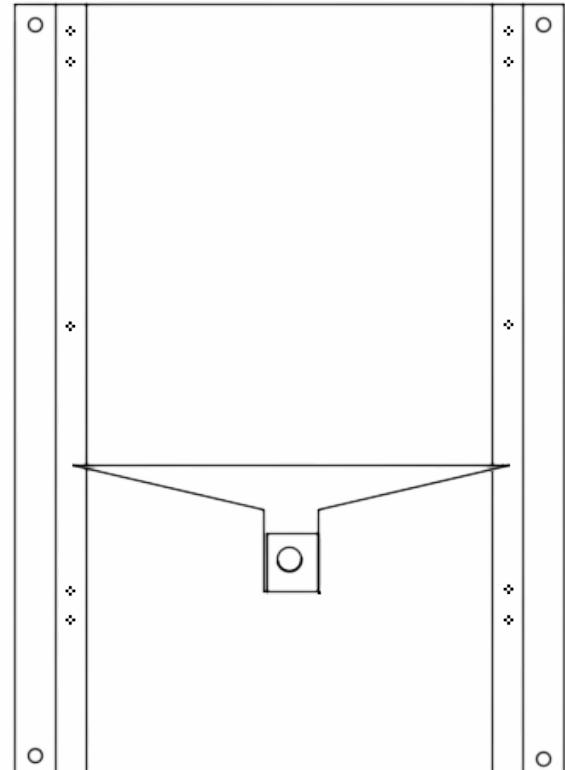


[Fig. 2] DartLoop based on Fusion 360 CAD model [4]



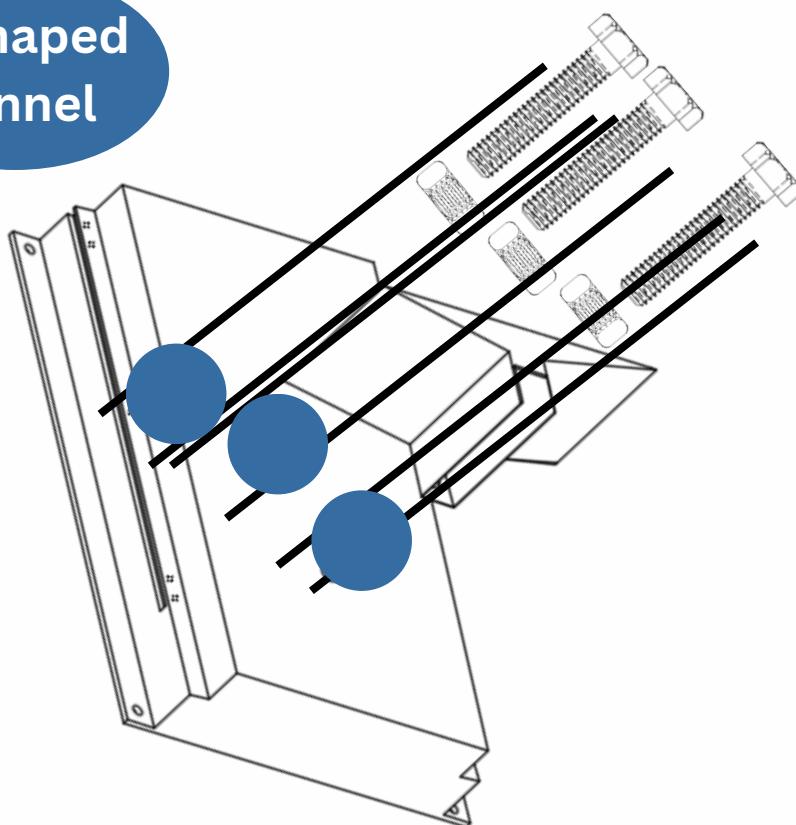
The electronics box comes with a pre-assembled clamp that includes the wiring. The pin holder also features a pre-assembled clamp that the user must clamp once the electronics box and the pin holder are in place.

**The single M15 screw is used to fix  
the V funnel to the Base**



[Fig. 2] DartLoop based on Fusion 360 CAD model [4]

**V-Shaped  
Funnel**

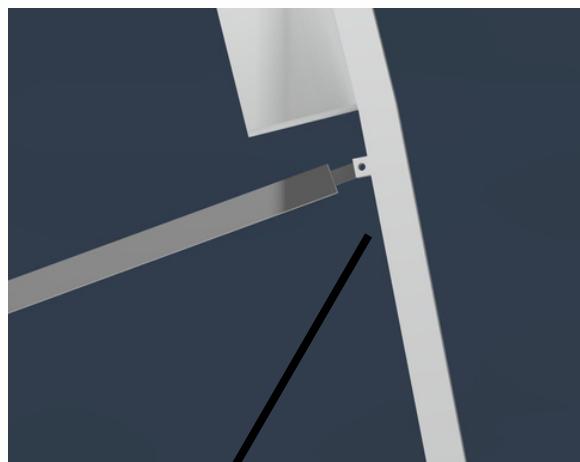


**5**

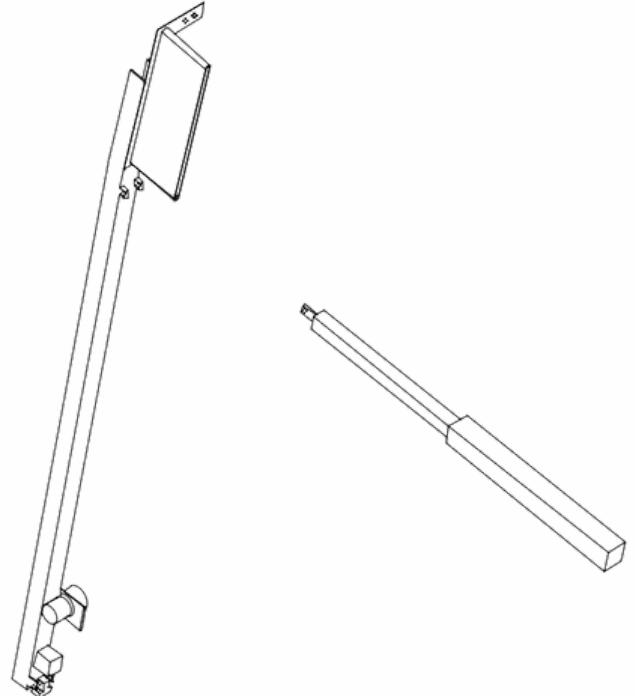
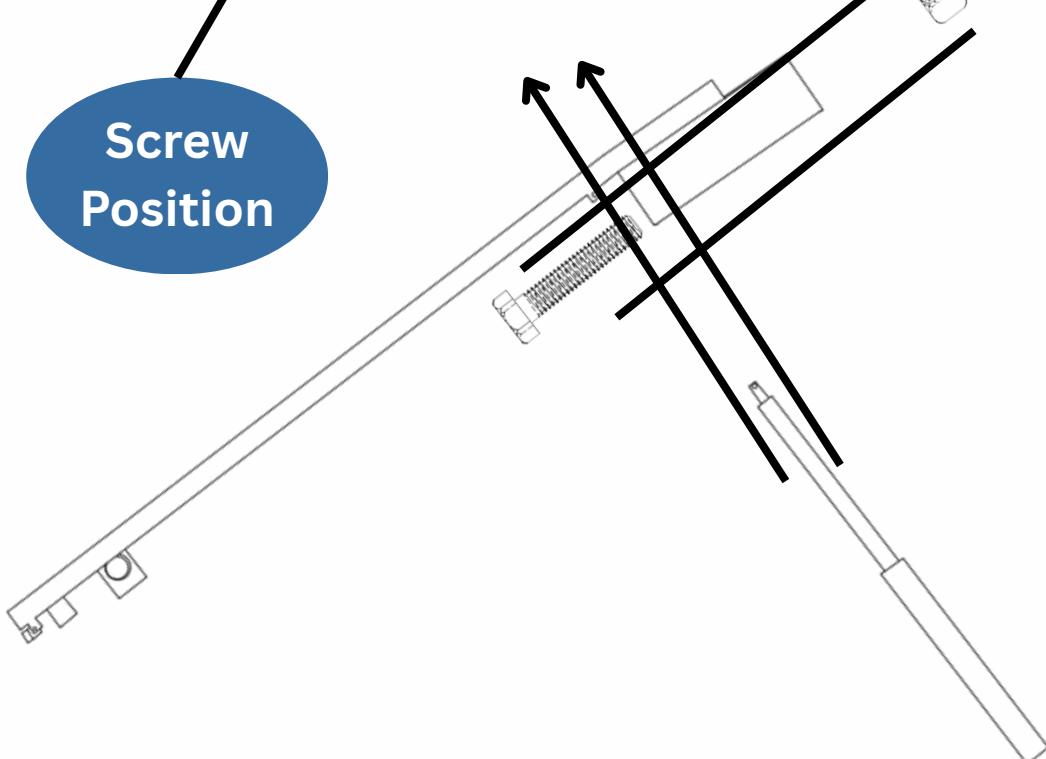
**3 x M 6 x 10**

**14**

**The single M15 screw is used to fix the Chute with the Height adjustre**



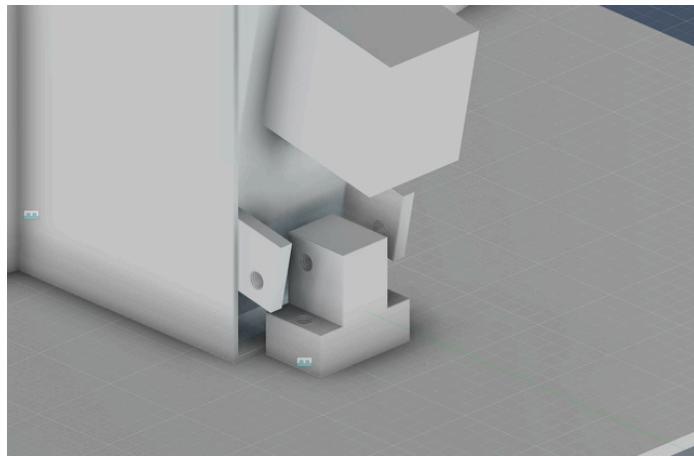
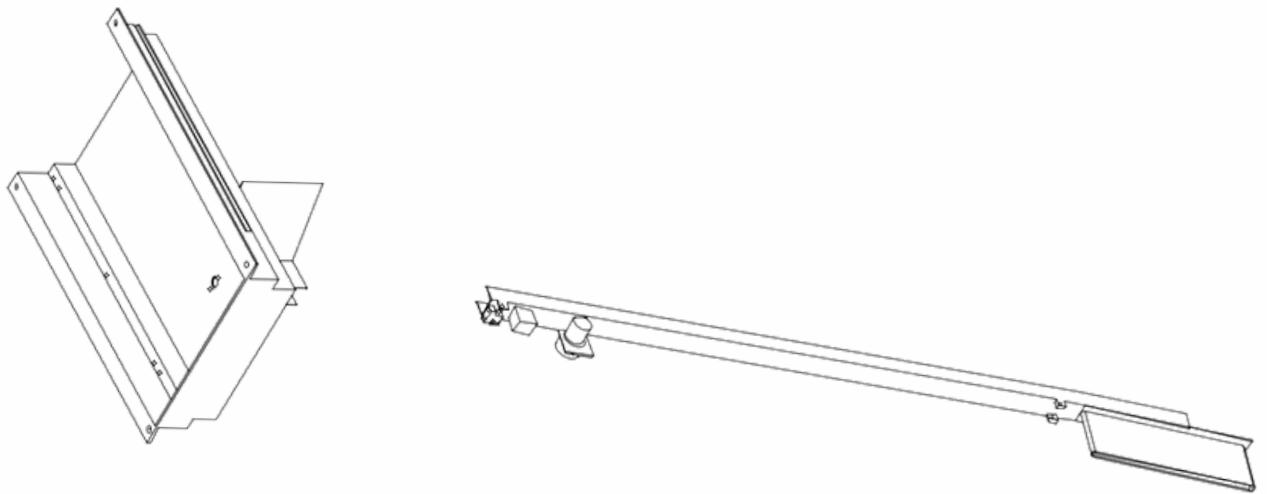
**Screw Position**



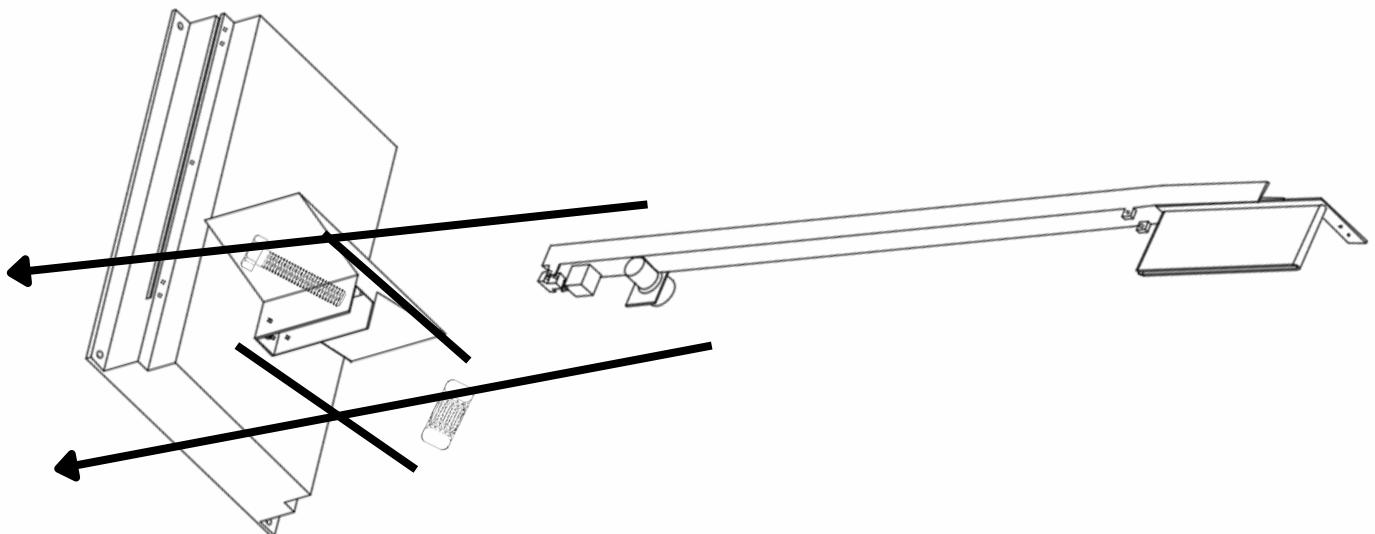
[Fig. 2] DartLoop based on Fusion 360 CAD model [4]

**1 x M 7 x 60**

**6**



[Fig. 2] DartLoop based on Fusion 360 CAD model [4]



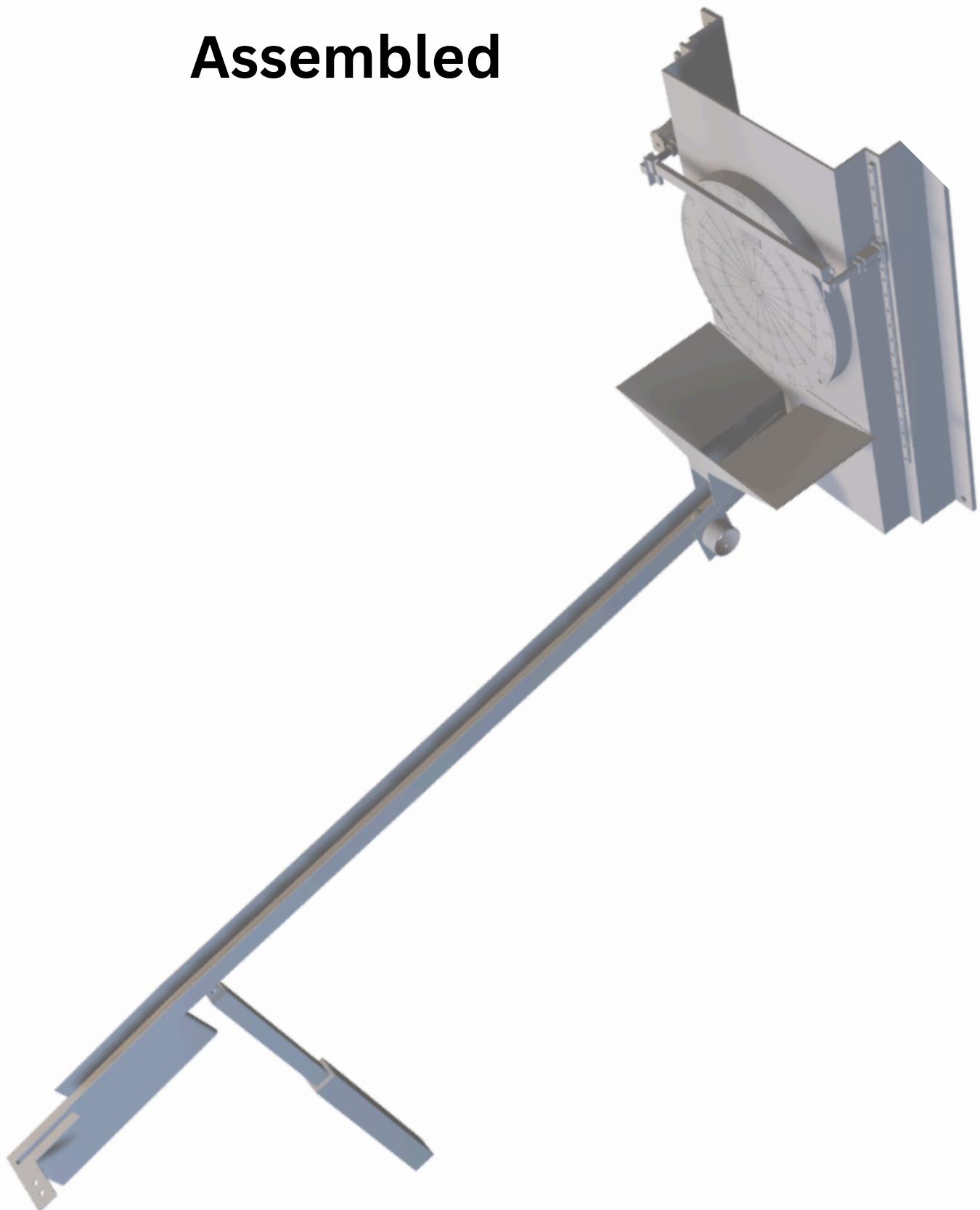
**The single M15 screw is used to fix  
the V funnel to the Completed  
Chute**

**1 x M7 x 60**

**7**

**16**

# Assembled



[Fig. 2] DartLoop based on Fusion 360 CAD model [4]

## List of References

- [1] OpenAI, ChatGPT Multilingual Safety Instruction Generator, OpenAI, San Francisco, CA, USA. Accessed: 2025. [Online]. Available: <https://chat.openai.com/>
- [2] Canva, Design Platform for Icons and Layouts, Canva Pty Ltd., Sydney, Australia. Accessed: 2025. [Online]. Available: <https://www.canva.com/>
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- [6] World Darts Federation, Standard Dartboard Setup Guidelines, Accessed: May 2025. [Online]. Available: <https://www.good-darts.com/adviser/dart-distance-and-height.html>
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- [8] European Union, Directive 2006/42/EC – Machinery Directive, Official Journal of the European Union, 2006.
- [9] Federal Communications Commission (FCC), FCC Part 15 – Radio Frequency Devices, U.S. Government Printing Office, Washington, DC, USA, 2024.
- [10] European Union, Directive 2012/19/EU – Waste Electrical and Electronic Equipment (WEEE), Official Journal of the European Union, 2012.