

User Manual

Version 1.0
2024/11/11



VC48-20-25

General Purpose Voice Coil Actuator



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1. Document History

Ver.	Chapter	Description / Changes	Date
1.0		Initial release	2024.11.11



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2. Intended Use

The VC48-20-25 is a general-purpose voice coil actuator. Voice coil actuators are direct drive, enabling high dynamics and high velocities along with precise positioning and very high life cycles due to the absence of mechanical transmissions.

The VC48-20-25 is completely programmable in terms of force, position, and velocity. It incorporates a high-resolution linear position encoder and inherent force feedback. Due to weight force compensation, it can be used both horizontally and vertically. To achieve the optimum performance, this actuator is recommended to be used with ADMOTЕК CTRL1-48-5-G4. The ability to estimate force with high accuracy creates various applications for VC48-20-25, such as:

- **Switch Testing:** a switch transitions through various states when pressed and released. Accurately identifying and analyzing the characteristics of each state is essential in discovering possible mechanical defects.
- **Tactile Simulator:** This actuator offers Soft-Touch® technology, the ability to touch objects without exerting sensible force on them. This technology enables the delicate handling of objects by ensuring that no excessive force is applied during contact.
- **Pick and Place:** The actuator's shaft delivers highly accurate uni-axis pick-and-place capabilities, combined with precise force and position control.
- **Tissue Testing:** In biomedical applications such as tissue testing, force estimation at various tissue depths is critical. The VC48-20-25 is capable of characterizing and modeling tissue properties, accounting for both force and depth.
- **Robotic End Effector:** Robotic end effectors are the components at the end of a robotic arm designed to interact with the environment. This actuator can serve as an end effector and be integrated for specific purposes.

3. Product Description

3.1. Product View

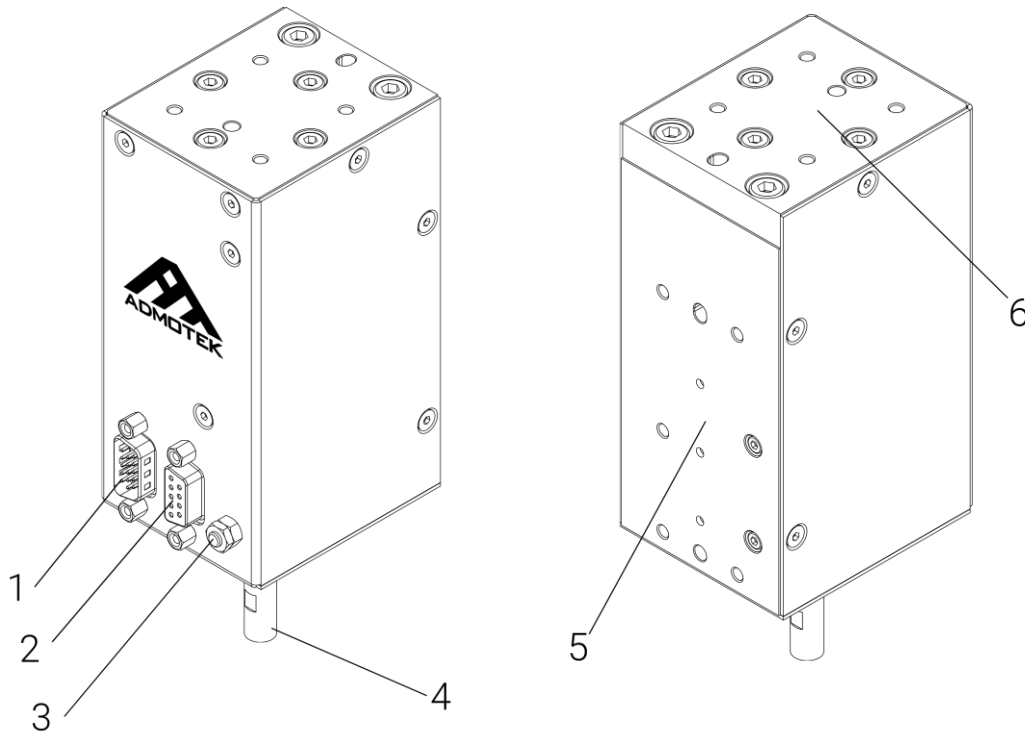










Fig. 1. VC48-20-25 overview.

1. Sensor connector: DB15 (Male)
2. Actuator connector: DB9 (Female)
3. Protective earth
4. Shaft interface with M5 thread
5. Mounting option #1 with M4 threads
6. Mounting option #2 with M4 threads

3.2. Labeling

The cover of the VC48-20-25 bears laser-printed information as follows:

Labeling	Description
VC48-20-25	Product name
24292588	Serial number (example), individual for each device. Meaning of each position (from the left): 1 and 2 = year of manufacture, 3 to 8 = consecutive number
Made in Iran	Country of origin
www.admotek.co	Manufacturer website address
	Manufacturer logo
	QR code containing the serial number. It can be scanned to download this manual.
	Warning sign "Pay attention to the manual!"
	Warning sign "High Voltage"
	Warning sign "Risk of crushing"
	Warning sign "Magnetic field"
	Prohibition sign for heart pacemakers, defibrillators, and other active implants
	Old equipment disposal

3.3. Model Overview

Model Number	Sensor Resolution	Unit
VC48-20-25-C	0.1	µm
VC48-20-25-D	1	µm
VC48-20-25-E	4	µm
VC48-20-25-F	16	µm

3.4. Suitable Controllers

Model Number	Description
CTRL1-48-5-G4	Single-phase controller board

4. Installation

4.1. General Notes on Installation

DANGER



Strong magnetic fields affect heart pacemakers!

The VC48-20-25 incorporates permanent magnets that may interfere with the operation of heart pacemakers and other active implants. However, when the actuator is at a distance of 10 cm from the pacemaker or active implant, the magnetic flux density of the actuator (with the housing intact) is well below 1 mT. **Even in the absence of a connection to a controller or electrical power, the magnetic fields persist and remain present.**



- It is important to prevent individuals with heart pacemakers and/or other active implants from accessing the VC48-20-25.
- If it is not possible to prevent individuals with heart pacemakers and/or other active implants from handling the device, it is advisable to maintain a minimum distance of 20 cm between the actuator and the person.
- Make sure to appropriately label hazardous areas.

CAUTION



Risk of cuts and crushing!

The device is capable of producing significant forces at high velocities, particularly when a contact part with a small contact surface is installed at the linear actuator interface. This may result in a substantial amount of pressure being exerted on a fixed part or obstacle during operation. As a result, there is a risk of minor injury from cuts and crushing if fingers or limbs become trapped between the pusher of the linear actuator and a fixed part or obstacle during operation. Use protective structures to keep limbs away from areas in which they could be seized by pushers.

- Adhere to the relevant safety standards for establishing appropriate safety distances when installing protective structures.

NOTICE



Attraction of magnetizable objects!

The VC48-20-25 magnets can attract magnetizable objects, including loose screws, which can potentially cause damage to the actuator.

- Ensure that no movable, magnetizable objects are present within a minimum radius of 10 cm around the device cover.
- Take appropriate precautions during the storage and transportation of the VC48-20-25.

NOTICE



Damage to magnetically sensitive objects!

The magnets in the device have the potential to cause damage to magnetically sensitive objects, such as magnetic data carriers and electronic devices.

- Ensure that no magnetically sensitive objects are present within a minimum radius of 10 cm around the device housing.
- Take appropriate precautions during the storage and transportation of the VC48-20-25.

4.2. Transport Lock Removal

The VC48-20-25 is delivered with a transport lock as shown in Fig. 3 which locks the rotor and stops it from moving freely. It should be removed before startup and operation.

Tools and Accessories

- 3 mm hex key

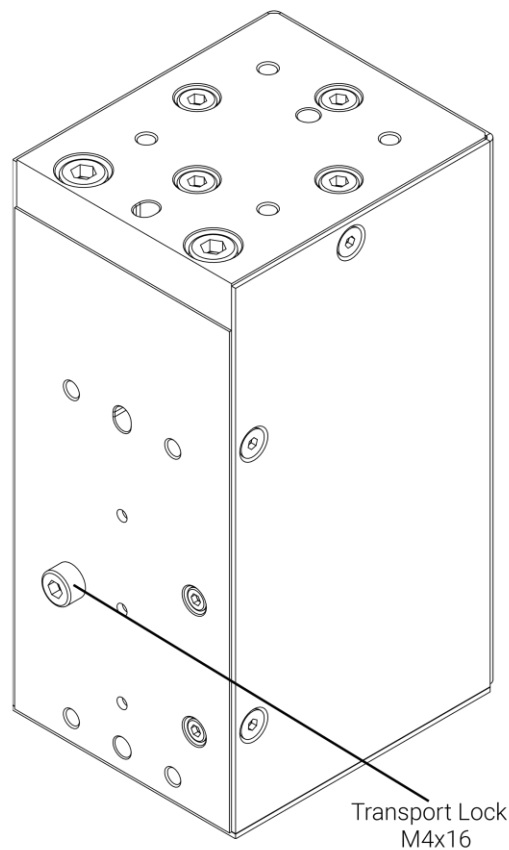


Fig. 2. Transport lock.

DANGER



Damage from the transport lock which has not been removed!

Damage can occur to the VC48-20-25 if the transport lock is not removed and motion is commanded.

- Remove the transport lock from the VC48-20-25 before you startup the VC48-20-25 with the controller.

4.3. Mounting on a Surface

You have the following mounting options as shown in Figs. 5, 6, and 7.

- **Mounting Option 1:**

Tools and Accessories

- M4 screws of suitable length
- Suitable torque wrench, the recommended maximum torque for tightening M4 screws is 260 N.cm
- 3mm hex key
- 4mm Locating pins of suitable length

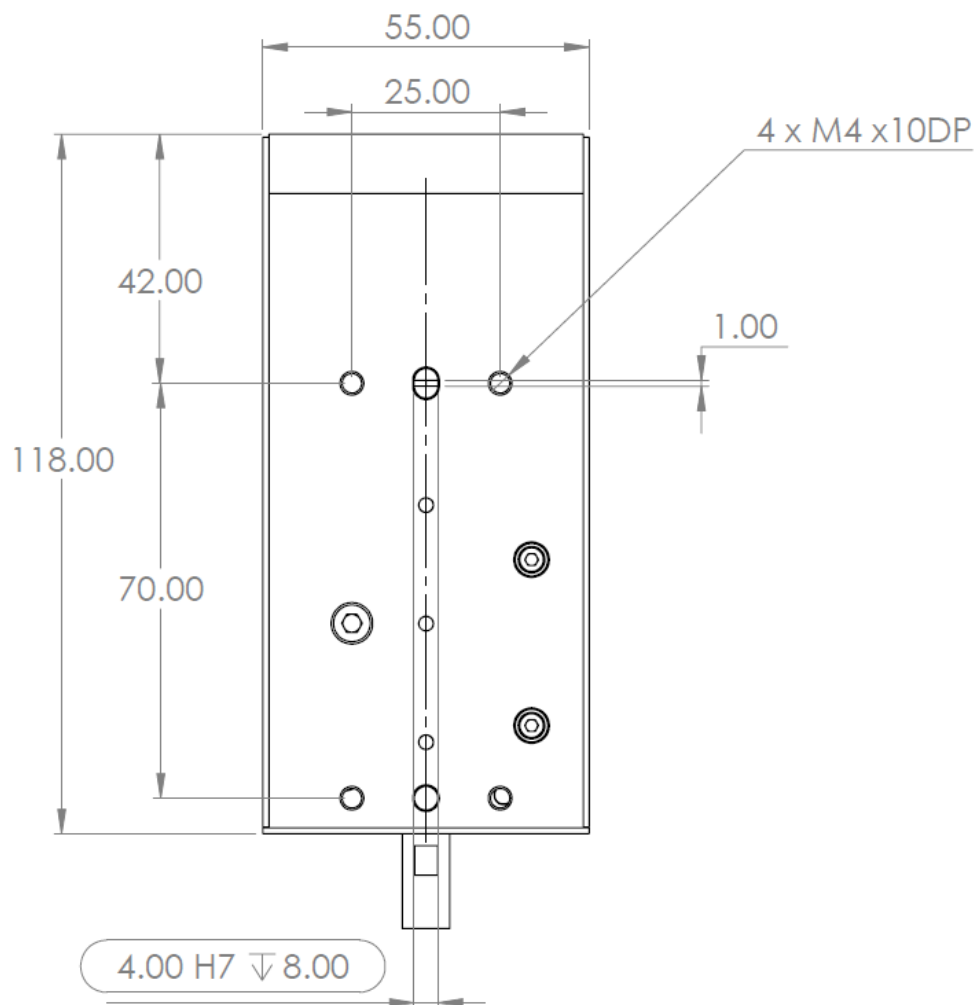


Fig. 3. Mounting option 1 with four M4 screws.

- Mounting Option 2:

Tools and Accessories

- M4 screws of suitable length
- Suitable torque wrench, the recommended maximum torque for tightening M4 screws is 260 N.cm
- 3mm hex key

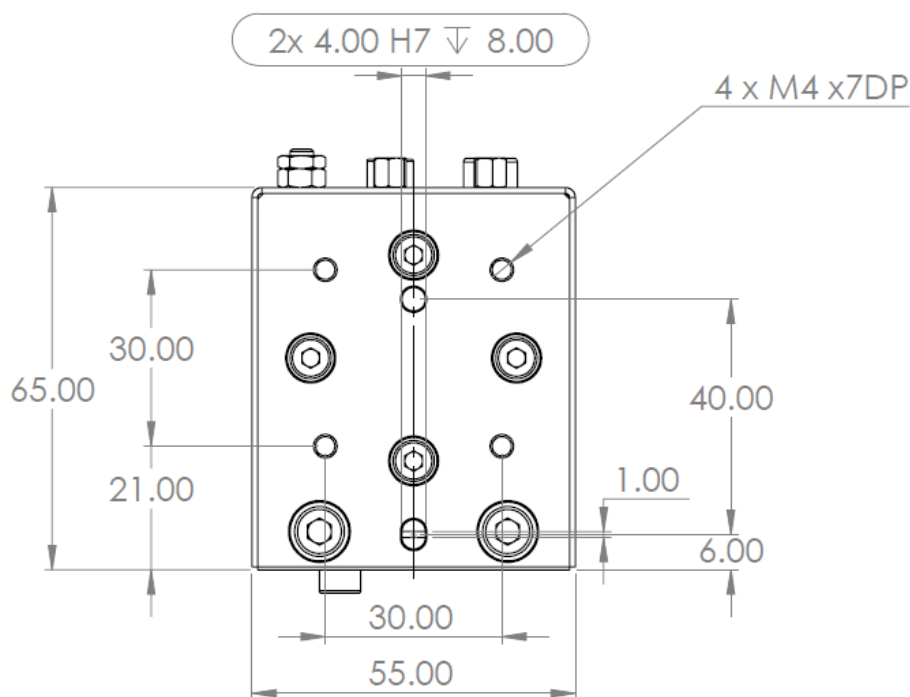


Fig. 4. Mounting option 2 with four M4 screws.

DANGER



Screws that are too long!

Screws that are inserted too deeply can damage the VC48-20-25 linear actuator. Observe the depth of the mounting holes in the housing of the VC48-20-25 linear actuator.

Only use screws of the correct length for the mounting holes.

4.4. Shaft Interface

The shaft of the VC48-20-25 features an M5 tapped hole for attaching desired tips. TM8 series tips, available in various geometries and dimensions, are recommended for this purpose. It is advisable to hold the shaft using the 7 mm wrench flats while tightening the tips.

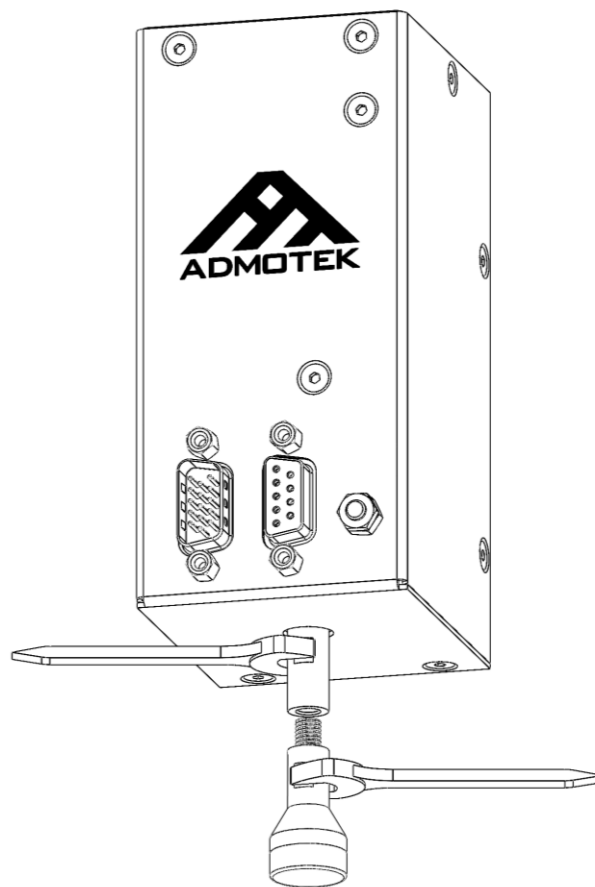


Fig. 5. Attaching a tip to the shaft interface.

Requirements

- The actuator is stationary and no commands are running.

Tools and Accessories

- 7mm wrench flats

NOTICE



Damage due to mechanical overload of the shaft!

Excessive torque or forces on the shaft can damage the VC48-20-25 actuator.

- Do **not** exceed a maximum screw-in depth of 8mm when attaching a tip to the shaft.
- Do **not** exceed a maximum torque of 15 N.cm when changing the tips.

4.5. Connecting Actuator Cable

Connect the connector of the actuator cable to the 9-pin D-sub panel plug of the VC48-20-25. Secure the connector of the actuator cable using the integrated screws against being accidentally pulled out.

Requirements

- You have read and understood the general notes on installation (p. 9).
- The actuator cable is **not** connected to the controller.

Tools and Accessories

- ADMOTTEK CBL1-9-1-0-0-1 cable
- Flat-head screwdriver

4.6. Connecting Sensor Cable

Connect the connector of the sensor cable to the 15-pin D-sub panel plug of the VC48-20-25. Secure the connector of the sensor cable using the integrated screws against being accidentally pulled out.

Requirements

- You have read and understood the general notes on installation (p. 9).
- The sensor cable is **not** connected to the controller.

Tools and Accessories

- ADMOTTEK CBL1-15-0-1-6-1 cable
- Flat-head screwdriver

5. Startup and Operation

5.1. General Notes

DANGER



Strong magnetic fields affect heart pacemakers!



The VC48-20-25 incorporates permanent magnets that may interfere with the operation of heart pacemakers and other active implants. However, when the actuator is at a distance of 10 cm from the pacemaker or active implant, the magnetic flux density of the actuator (with the housing intact) is well below 1 mT. **Even in the absence of a connection to a controller or electrical power, the magnetic fields persist and remain present.**

- It is important to prevent individuals with heart pacemakers and/or other active implants from accessing the VC48-20-25.
- If it is not possible to prevent individuals with heart pacemakers and/or other active implants from handling the device, it is advisable to maintain a minimum distance of 20 cm between the actuator and the person.
- Make sure to appropriately label hazardous areas.

NOTICE



Overheating is caused by selecting an unfavorable nominal current!

The nominal current as specified in the data table (p.19) applies when operating at room temperature. As ambient temperature rises, adjust the nominal current that is driving the actuator.

Otherwise, the actuator could be damaged by overheating.

Adapt your application (acceleration, velocity, load) so that the nominal current is not exceeded. If you have any questions, contact our customer service department (p. 17).

5.2. Starting up the VC48-20-25 with the CTRL1-48-5-G4

Requirements

- You have read and understood the following sections:
 - General Notes on Installation.
 - General Notes on Operation.
- You have properly installed the actuator.
- You have read and understood the user manual of the controller.
- All connections on the controller have been set up.

6. Maintenance

VC48-20-25 is maintenance-free.

NOTICE



Damage from opening VC48-20-25!

Opening the housing causes damage to VC48-20-25.

- Do **not** open VC48-20-25.

7. Cleaning

- Prior to cleaning, ensure that VC48-20-25 has been disconnected from the controller.
- If needed, use a cloth slightly moistened with a mild cleanser or disinfectant to clean the surfaces of the device.

8. Customer Service

If you have questions concerning your system, have the following information ready:

- Product codes and serial numbers of all products in the system
- The firmware version of the controller (if present)
- The version of the driver or the software (if present)
- Operating system on the PC (if present)

If possible, take photographs or make videos of your system that can be sent to our customer service department.

9. Technical Data

9.1. Specifications

	Value	Unit	Tolerance
Motion and positioning			
Travel range	24.5	mm	±1 mm
Integrated sensor	Optical linear encoder		
Sensor resolution	0.1-16	µm	max.
Velocity	1500	mm/s	max.
Acceleration	100	m/s ²	max.
Mechanical properties			
Bearing / guide	Linear recirculating ball bearing		
Motion straightness	±10	µm	±10%
Moving mass w/o load	164	g	typ.
Drive properties			
Motor type	Moving coil		
Coil resistance	5.7	Ω	typ. at 20°C
Coil inductance	4	mH	typ. at 1 kHz at 20°C
Time constant	0.76	ms	typ.
Back EMF	8	V.s/m	
Force constant	8	N/A	typ.
Nominal current	2	A	max.
Peak current (max. 100 ms)	5	A	



	Value	Unit	Tolerance
Power dissipation of the coil at 100% D.C.	23	W	
Maximum force	40	N	max.
Continous force	16	N	
Permitted temperature	60	°C	max.
Miscellaneous			
Operating temperature range	10 to 60	°C	
Material	Aluminum		
Mass	923	grams	±5%
Actuator connector	DB-9 (f)		
Sensor connector	DB-15 (m)		
Lifetime	> 10 ⁶	Cycles	
Recommended controller	CTRL1-48-5-G4		

9.2. Maximum Ratings of VC48-20-25

Operating Voltage	Operating Frequency	Peak Current (100 ms)	Continuous Current	Continuous Power Consumption
48 V		5 A	2 A	23 W

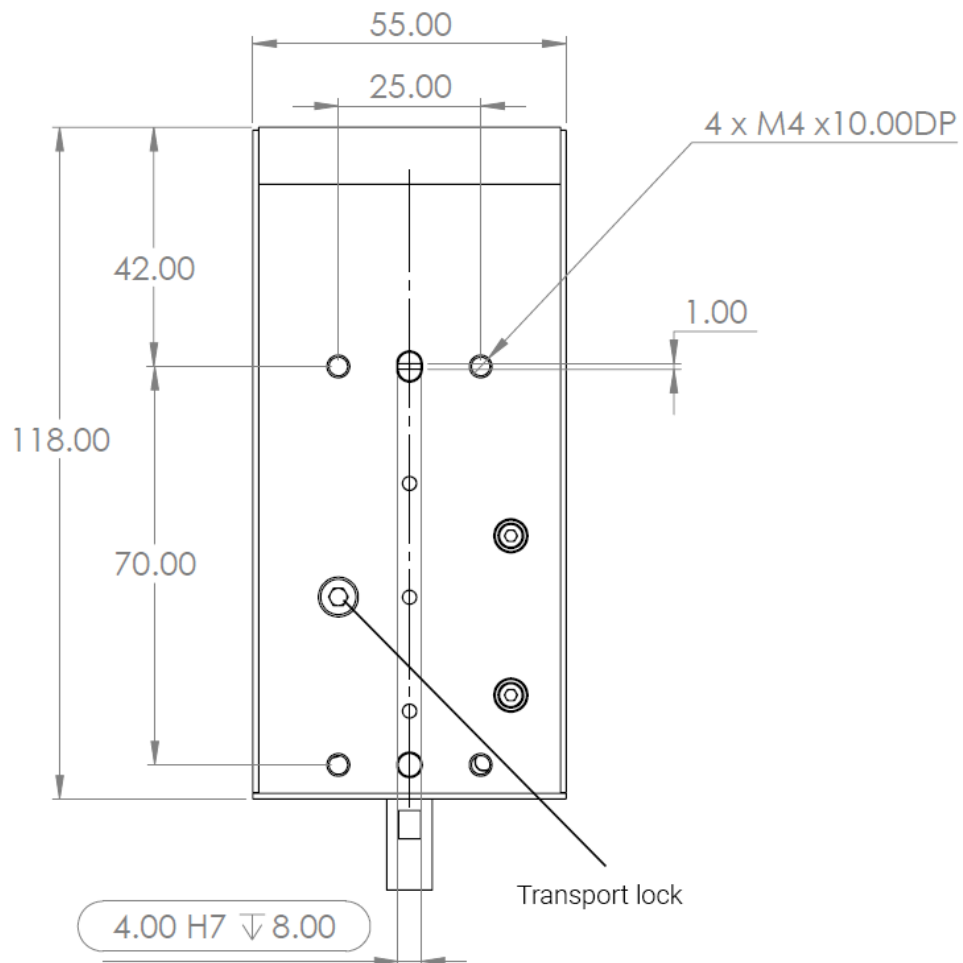


Fig. 8. VC48-20-25 dimension view 3.

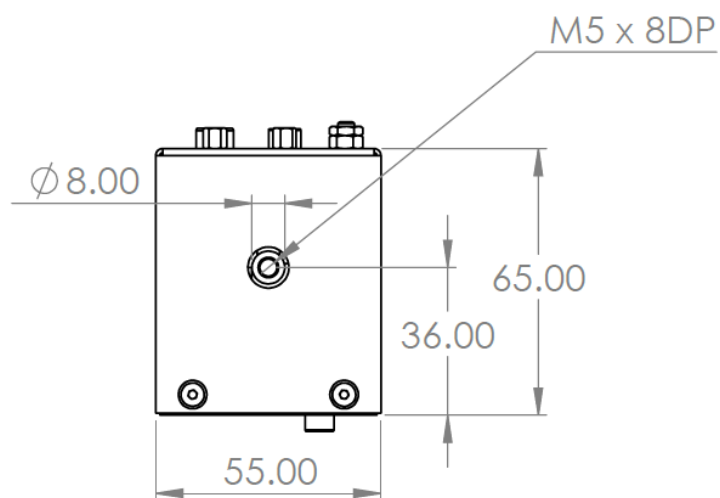


Fig. 9. VC48-20-25 dimension view 4.

9.4. Pin Assignment

Actuator (D-sub connector, 9-pin, female)

Pin	Description
1	Actuator P1
2	Actuator P1
3	NC
4	Actuator N1
5	Actuator N1

Pin	Description
6	Actuator P1
7	Actuator P1
8	Actuator N1
9	Actuator N1

Sensor (D-sub connector, 15-pin, high density, female)

Pin	Description
1	SPI CS-
2	SPI SCK-
3	SPI SCK+
4	SPI MOSI+
5	SPI MOSI-
6	Actuator Temperature
7	SPI CS+
8	Encoder A+

Pin	Description
9	Encoder B-
10	Encoder Z+ / SPI MISO+
11	GND
12	Encoder A-
13	Encoder B+
14	Encoder Z- / SPI MISO-
15	+5 VDC

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