UBC-XXXXX Brake Chopper

User Manual

Rev. No: 1.2

October 2024

1. PREAMBLE

This user manual has been prepared to inform you, as a user, about how you can work safely with our product. The guide has been prepared for the use of users with technical knowledge.
The device must be operated by people who have technical knowledge of **device usage training**.
Read the manual carefully before installation, operation, and maintenance. Ensure that all safety recommendations and precautions and supplier supplementary documentation are read and understood.
Users agree that they are responsible for the use in accordance with the recommendations in the manual.
This manual applies only to the "Brake Chopper" (referred to as "UBC"). For more information, please contact IMB Robot Teknolojileri Tic. Ve San. A.Ş. (referred to as "IMB Robotics") Aftermarket Support Department.
Our important recommendations as a manufacturer are:

- Contact the IMB Robotics team for emergencies and questions.
- Keep the instruction manual in a dry, safe, and accessible place for everyone involved.
- Keep all safety signs on the system visible.

1.1 GUIDE PLACEMENT

This guide includes the following topics.

- Security & warnings
- Product-specific information
- Setup & Commissioning
- Operation
- Maintenance and cleaning
- Storage and transport
- Disassembly and elimination

1.2 REVISION SERVICE

The content of this guide will be updated as required by revisions.

1.3 VERIFICATION

All applicable procedures described in this guide have been verified by IMB Robotics. The images provided are intended to represent the actual product, but the visual content may differ from the reality.

2. COPYRIGHT, MARKING AND CONTACT

IMB Robotics or **IMB Robot Teknolojileri San. Ve Tic. A.Ş.**

Equipment provided by IMB Robotics to which the machinery directive applies complies with CE.

IMB Robot Teknolojileri San. Ve Tic. A.Ş

A. Sanayi Mah. Teknopark Bulvarı No.1/11C No. 509 Teknopark İstanbul - Pendik/İstanbul/Turkey

M. info@imbrobotics.com

T. +90(216) 286 0106

W. www.imbrobotics.com

3. SAFETY AND NOTICES

WARNING

Risk of overheating or fire if the limits defined in the technical data (see Electrical properties and technical data) are not observed and there is insufficient cooling!

- Do **not** use the product in potentially explosive areas (EX areas).
- During use, make certain that the cooling and environmental conditions are ensured.
- Ensure that good heat dissipation is favored by either installing the device in vertical position or —if in a horizontal position— with the metal housing on top.
- Ensure that the permissible current is not exceeded when choosing an external braking resistor.
- Monitor the status during commissioning and operation, via the LEDs and/or the status output.

CAUTION

Risk of injury from electric shock if the product is damaged!

If the product is damaged, voltage carrying parts can cause an electric shock which can possibly lead to burns and injuries.

- Only change the wiring or touch the product in a de-energized state. After switching off, wait at least three minutes until the voltage in the capacitors has dissipated.

CAUTION

Risk of injury in case of a short circuit!

A short circuit can damage the product and possibly lead to burns and injuries.

- If you notice a short circuit or the product signals an error via the LEDs and/or the status output, immediately switch off the power supply. Commission the product again in a protected environment and check the error message.

CAUTION

Risk of burning!

The product may become very hot during operation

- During use, make certain that the cooling and environmental conditions are ensured.
- Do not touch the product while in operation. After switching off, wait until all components have cooled before you touch them.

CAUTION

Risk of injury from sharp edges!

Due to production tolerances, sharp edges may form on the DIN rail clip and the mounting lugs that could cause hand injuries.

- Do not touch the DIN rail clip or the mounting lugs to unpack or mount the product.

CAUTION

EMC: Interference and risk of injury from electromagnetic alternating fields!

Current-carrying cables – particularly around supply cables – produce electromagnetic alternating fields.

These can interfere with the product and other devices and lead to uncontrolled behavior and injuries.

- Connect the product to earth over a short distance using the PE conductor.
- Perform a risk assessment for the entire machine/system to identify possible risks due to electromagnetic interference and initiate suitable protection measures if necessary.

CAUTION

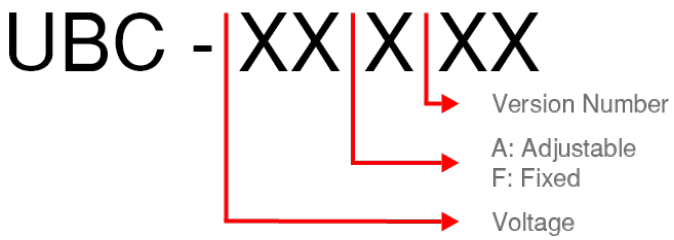
Risk of injury in case of electronics damaged through improper handling of ESD - sensitive components!

The device contains components that are sensitive to electrostatic and discharge. Improper handling and lack of ESD protection measures can damage the device and lead to uncontrolled behavior

- Observe the basic principles of ESD protection when handling the device.
- If you notice an unexpected behavior, restart the device and check the correct LED signaling. If an error is signaled, do not commission the device.

4. OVERVIEW

4.1 MODEL EXPLANATION



4.2 WHAT IS UNIVERSAL BRAKE CHOPPER?

Universal Brake Chopper, specifically the Brake Chopper is a shunt or regen board designed to manage excess energy in the DC bus during motor deceleration or braking. It is compatible with drivers that have suitable inputs and operates by converting the excess energy into heat and dissipating it through resistors.

This device is crucial for maintaining the safety and efficiency of electric motor control systems, as it prevents overvoltage and overcurrent conditions that could damage the motor or other system components. Commonly used in industrial and commercial applications such as conveyors, elevators, and cranes, the Brake Chopper offers a reliable and efficient solution for managing excess energy in electric motor control systems.

UBC can be configured as fixed voltage or adjustable voltage according to the power and voltage values requested.

When the motor is used to actively slow a load, electrical power will be regenerated. If the drivers are supplied with a standard power supply (without recovery function), such regenerative duty points will cause an overvoltage in the DC circuit and therefore the drive or power supply will be turned off.

To prevent this from happening, a shunt circuit is required to burn this recovered energy.

5. TECHNICAL SPECIFICATIONS

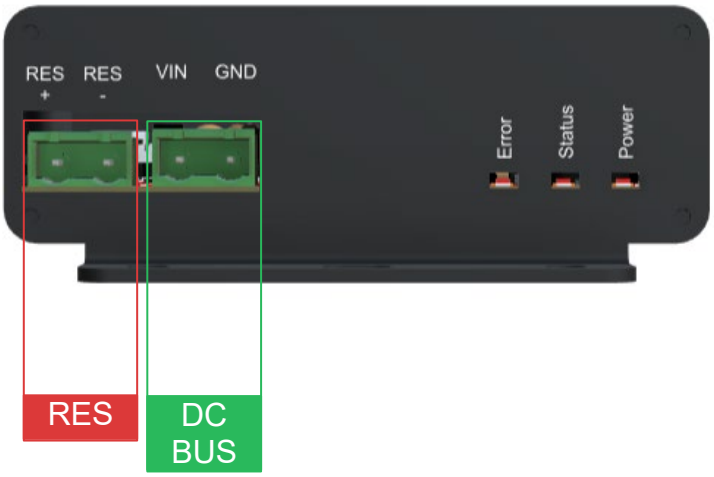
Table 1: Brake Chopper Features

General features	
Standard Bus Voltage	48 VDC (Configurable 24V)
Activation threshold voltage V_th*	It can be adjusted between 50-57 V by the user.
Maximum Voltage	57V
Rated continuous power	200 W, depending on cooling condition and duty cycle (Configurable up to 1kW)
Max. Power	200 Watt (up to 1kW)
Peak power application period ***	500 µs
Ambient temperature for power ratings	Room temperature (20 °C)
Maximum system temperature ***	< 75 °C
Protection class according to EN/IEC 60529	IP30

* This voltage defines the voltage at which the first shunt starts to become active.

*** The Brake Chopper can emit up to 200 W for periods of 500 µs. Please ensure that the Brake chopper is mounted on a suitable surface with a large enough volume to dissipate the heat generated.

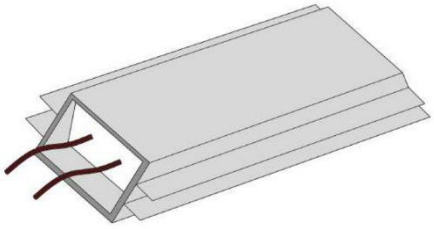
6. WIRING



1. Connect the suitable resistor to the UBC.
2. Ensure that threshold voltage is higher than nominal DC bus voltage.
3. Connect the UBC to the DC bus. The circuit must be connected in parallel with the DC bus.
4. Configure threshold voltage (If UBC is adjustable).

The threshold voltage is adjusted by rotating the potentiometer, following the V_Th displayed on the OLED display on the case

Install the resistor board connected to the brake chopper circuit in a suitable location with good cooling. Make sure the bottom is connected to a thermally conductive metal structure.



WARNING

Suitable thermal conductivity is essential to ensure optimum performance. It is recommended to use silicone paste or thermal pad.

If the voltage level in DC bus is higher than the threshold voltage, the UBC will be activated.

6.1 SUITABLE CABLES & CONNECTORS

1. V_IN, Red Core Cable , 14AWG with 2.5mm^2 lug.
2. GND, Black Core Cable, 14AWG with 2.5mm^2 lug.

WARNING

- Use suitable cable lugs for secure connection.
- Pay attention to the correct polarity indicated by +/- before connecting the wires.
- Pay attention to the cross-section of the resistance cables according to the power.

7. MULTI-CARD OPTION

Total shunt power required in a robotic system, robot inertia, payload, number of axes, size and type of motors, trajectory, controller settings, braking and fast stop strategies etc. It depends on many factors, including There is no universal rule to indicate how many UBC are required for a DC bus. Developers should calculate the regenerative forces and energies in the respective load cycle of their systems. If you think that you need assistance to calculate it, please contact with IMB Support.

Some practical tips for getting started:

If decelerations and loads are moderate, one brake chopper card can handle the renewed energy of several Drives. In many real-world applications this is already sufficient, so one IMB Brake card per robot is usually sufficient. But when the regen, power is high, regen power is wasted by using more than one card and resistor.

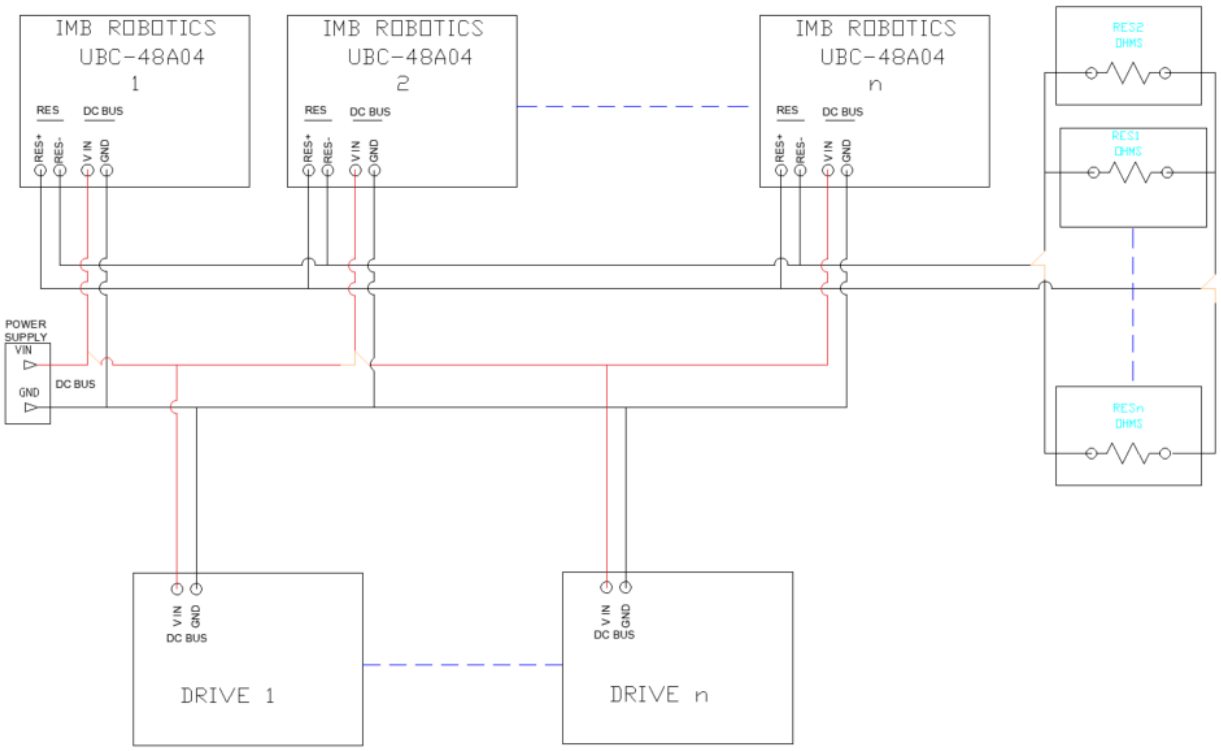


Figure 5: Multi-Drive Wiring Diagram

8. EXAMPLE RESISTANCE CALCULATION

Let's say we have a regen power of 500 W and a voltage limit of 54 V dc. After adjusting the Pot and Voltage here, let's move on to the resistance calculation.

P = Power
V = Voltage
I = Current

$$P_{(W)} = I_{(A)} \times V_{(V)}$$

Current:

$$500\ W \div 54\ V = 9.2592592592593\ A$$

Resistance:

$$54\ V \div 9.2592592592593\ A = 5.832\ \Omega$$

Our resistance should be chosen to be 500 w and 5.83 Ohm.

Note: If the resistor is required to withstand the temperature for a longer time, we must additionally cool the resistor and select it to withstand a higher power.
We strongly recommend that the required nominal power be selected with a safety factor of 1.2 - 1.5 times for the healthy, long-lasting and healthy operation of the system.

9. Failsafe Behavior

If the power on the DC bus exceeds Peak Power or the shunts reach their temperature limits, the shunt is disabled to prevent burnout of the resistors. In this case, the DC bus will act as if no shunt is installed. Thus, the DC bus voltage will continue to increase until the overvoltage protection of the Drive is triggered.

10. Led Indicators

There are three led indicators in the case. The function of these indicators is as follows:

Error: Indicates that the UBC is damaged or malfunctioned.
Status: Indicates that the resistors are activated.
Power: Indicates that there is electricity in the system.

Figure 6: Brake chopper Indicator LED

11. Dimensions

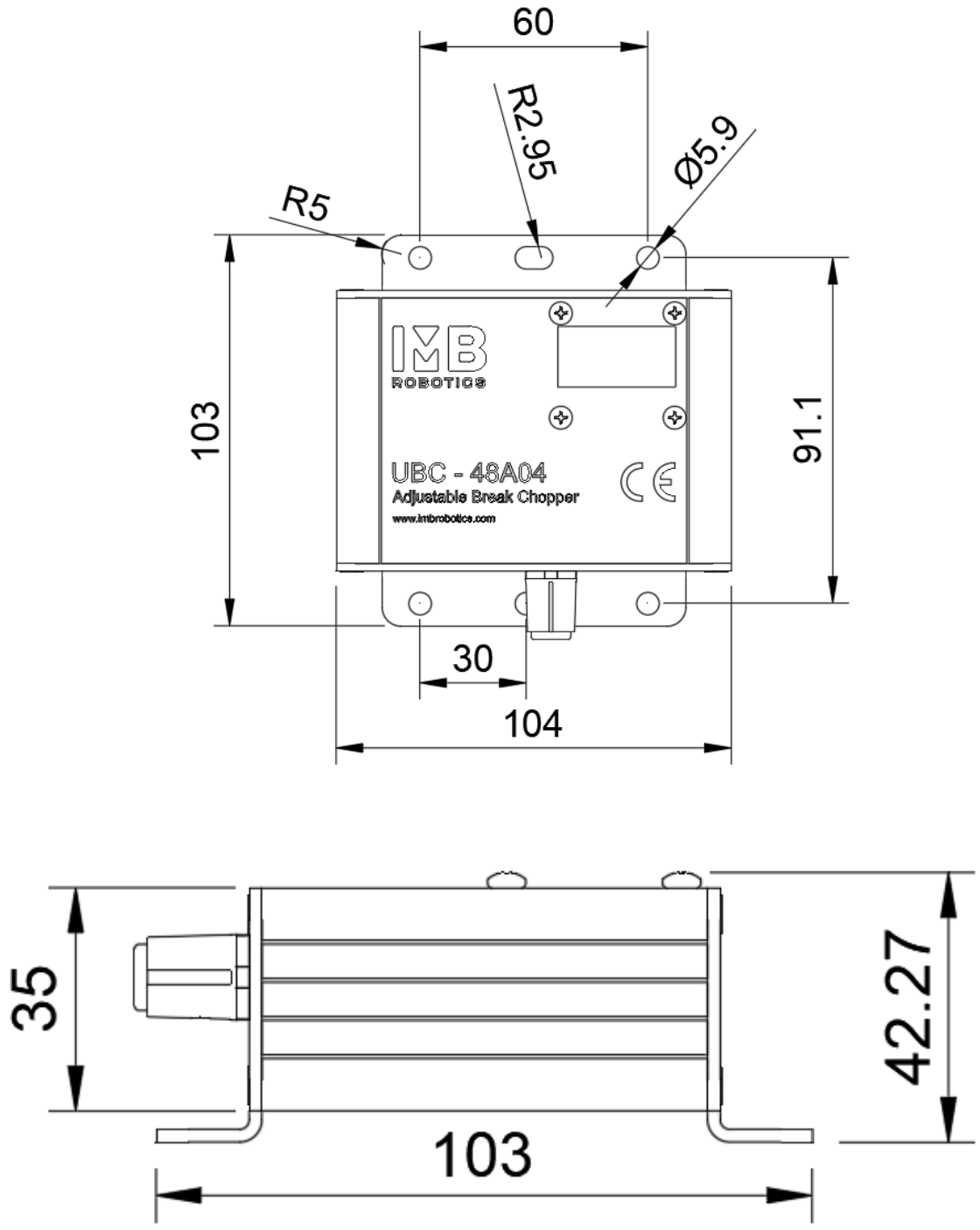


Figure 7: Dimensions of Brake Chopper