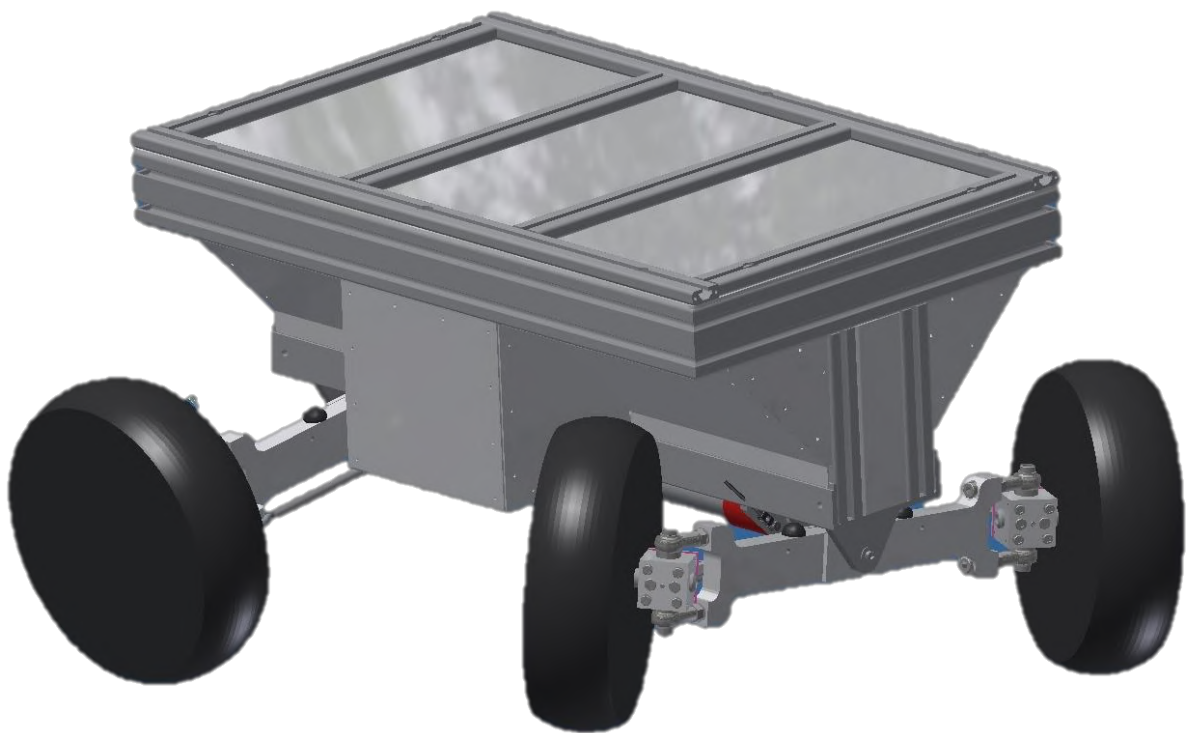


ARTI – CHASI

Instruction manual



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Table of contents

ARTI – CHASI	1
Copyright and Disclaimer	2
1.Introduction	4
1.1 Overview	4
1.2 Change log	4
1.3 Information	4
2.Safety	5
2.1 Overview	5
2.2 Safety concept.....	5
2.3 General safety instructions.....	5
2.3.1 Warnings.....	6
2.3.2 Safety instructions.....	6
2.3.3 Attention required	7
2.4 Battery	7
3.First Steps	9
3.1 Contents included	9
3.1 Powering on / Powering off	9
3.2 Connecting	10
3.3 Charging	10
3.4 Testing the robot.....	11
4.Robot.....	12
4.1 Components.....	12
4.2 Sensor systems.....	13
4.3 System overview	15
5.Technical Information	16
5.1 General data	16
5.2 Dimension blueprint	17

1. Introduction

1.1 Overview

These operating instructions contain all important information for setting up and operating the Chasi Prototyping Platform. It also contains the information necessary for the safe use of the robot, technical data, troubleshooting tips, and instructions for its proper maintenance. The manual is intended for end users who are responsible for the daily operation of the Chasi Prototyping Platform.

1.2 Change log

The table shows the current and previous versions of this document and the associated versions of the product software.

Version	Date	Description	SW-Vers.	HW-Vers.
1.0	11.09.2020	First edition	1.0	1.0
1.1	30.09.2020	Revised	1.0	1.0
1.2	23.02.2021	Sensors extended	1.0	1.0

1.3 Information

After consultation with the manufacturer, additional information such as "how to" instructions, circuit diagrams, CAD drawings can be provided if required.

Mail: office@arti-robots.com



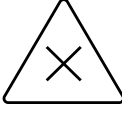

Web: www.arti-robots.com

2. Safety

2.1 Overview

These instructions contain information that you must observe for your personal safety and to avoid damage to property. The instructions that refer to your personal safety are marked with a warning symbol in the manual. The extent of the risk is indicated by the signal words listed below.

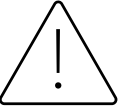
2.2 Safety concept

 HAZARD	<p>Indicates an immediate hazard which, if not avoided, will result in death or serious injury.</p>
 WARNING	<p>Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.</p>
 CAUTION	<p>Indicates a situation which, if not avoided, may result in minor injury or damage to the equipment.</p>
 ATTENTION	<p>Indicates a situation which, if not avoided, may result in property damage.</p>

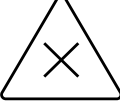
2.3 General safety instructions

This chapter provides general safety instructions. In other chapters of the manual, some of these safety instructions are repeated, further explained and supplemented by additional safety instructions.


2.3.1 Warnings

 <p>WARNING</p>	<ul style="list-style-type: none"> • Risk of injury from tipping robot or overturning loads. All accessories and loads on the vehicle must be properly secured. • Only use original charger. Risk of injury and/or risk of material damage to the robot. Only the charger supplied by the manufacturer may be used. Using any other charger may destroy the battery and cause a fire. • Drive the vehicle responsibly. Risk of injury and/or risk of property damage to the robot. The robot must not be driven over edges or in any other improper manner.
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2.3.2 Safety instructions


 <p>CAUTION</p>	<ul style="list-style-type: none"> • Do not use the robot to transport people. Risk of injury and/or risk of property damage to the robot. Do not use the robot to transport people at any time. • Avoid slopes of more than 5% on the route. Risk of injury and/or risk of damage to the robot. The surface slope (ramps, etc.) must not exceed 5%, otherwise the robot may start to slide. • Only drive on level and dry surfaces. Risk of injury and/or risk of material damage to the robot. The robot may slip on wet and uneven surfaces. • Do not overload the robot Risk of injury and/or risk of property damage to the robot. The maximum payload is 100 kg (220 lbs) when the load is on top of the robot. • Immediately switch off the on-board power supply after opening the cover. Risk of injury and/or risk of property damage to the robot. Switch off the on-board power supply relay to avoid short circuits to ground.
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2.3.3 Attention required

 <p>ATTENTION</p>	<ul style="list-style-type: none"> • For indoor use only. Risk of property damage to the robot. The robot is intended for indoor use and must not be used outdoors. • Avoid small objects on the floor in the area of the robot. Risk of property damage and/or minor damage to the robot. • Remove unwanted objects from the floor near the robot. • Avoid overheating of the components. Risk of property damage to the robot or robot components. Ambient temperature in the area of the vehicle must not exceed 50°C (122°F). • Avoid excessively humid or dry environments. Risk of property damage to the robot or robot components. The humidity in the environment of the robot must be within the limit values, see Technical Data.
---	--

2.4 Battery

Lithium batteries are primary energy sources with high energy content, designed for maximum safety.

 <p>WARNING</p>	<p>Potential hazard</p> <p>Lithium batteries can become hot, explode, or ignite from electrical or mechanical misuse, causing serious injury.</p> <p>Observe the following precautions for handling and using lithium batteries:</p> <ul style="list-style-type: none"> • Do not short-circuit the battery. Ensure correct polarity when inserting and recharging. • Do not expose the battery to temperatures outside the specified temperature range. Do not ignite the battery. • Do not crush, puncture or disassemble the battery. The battery contains safety and protective devices which, if damaged, may cause the battery to generate heat, explode, or ignite.
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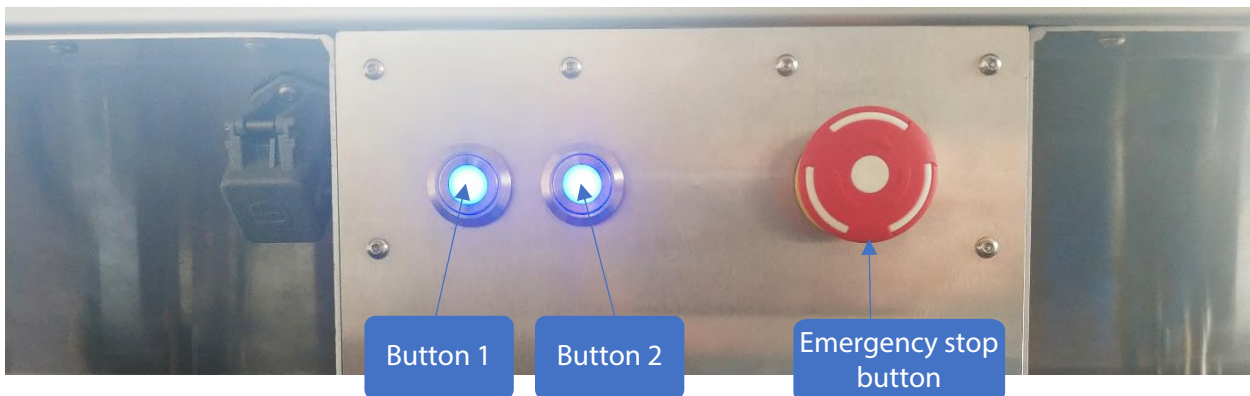
- Do not allow the battery to get wet.
- If leaking battery fluid comes into contact with the eye, do not rub the eye. Rinse the eye with water and seek medical attention immediately. If not treated, the battery fluid may damage the eye.
- Only use the original charger and always follow the battery manufacturer's instructions.

3. First Steps


3.1 Contents included

- Robot
- Laser scanner Ouster OS1-16
- Controller
- Instruction manual

3.1 Powering on / Powering off



Powering on

Step	Action
1	Disengage the emergency stop button
2	Press button 1 (left) and wait a few seconds
3	Switch on the controller by pressing the main key for a longer time. Lamp on the controller lights up continuously (successfully connected to the robot). 
4	Starting the control process (via SSH - see below) and roslaunch arti_chasi_mark3 arti_chasi_mark3_upstart_with_teleop.launch
5	Control via gamepad / control via ROS interfaces is now functional

Powering off

Step	Action
1	Connect to the control unit and shutdown with the command sudo shutdown now
2	Press button 2 (right)
3	Secure the robot against rolling away

3.2 Connecting


Step	Action
1	Computer entweder direkt oder mit dem LAN / WLAN verbinden. WLAN SSID: ARTI Chasi Password: ARTIDefaultPW1! The computer is automatically assigned an IP.
2	To connect to the control unit, SSH is required. On Linux this is done with the command ssh ubuntu@192.168.5.3 . After entering the password ubuntu , direct access to the system is possible.
3	Connection via ROS Kinetic: The Raspberry PI starts a Roscore that can be reached via IP 192.168.5.3 . In order for a foreign system to communicate with the Roscore it must set the following environment variables: export ROS_IP=x.x.x.x (Corresponds to the automatically assigned IP address). export ROS_MASTER_URI=http://192.168.5.3:11311/
4	Connection to ROS and the robot is now possible.
5	Optional: Connection to the router via 192.168.5.1. Username and password are ubnt
6	Optional: Connection to the Ouster laser via IP 192.168.5.4



3.3 Charging

The robot is shipped with a charged battery and can run for several hours before the battery needs to be recharged.



To charge the robot using the supplied charging cable, follow the steps below:

Step	Action
1	Power off the robot (see chapter 3.1)
2	Connect the charging cable to a power supply
3	Connect the charging cable to the charging socket (protective flap must be opened first)



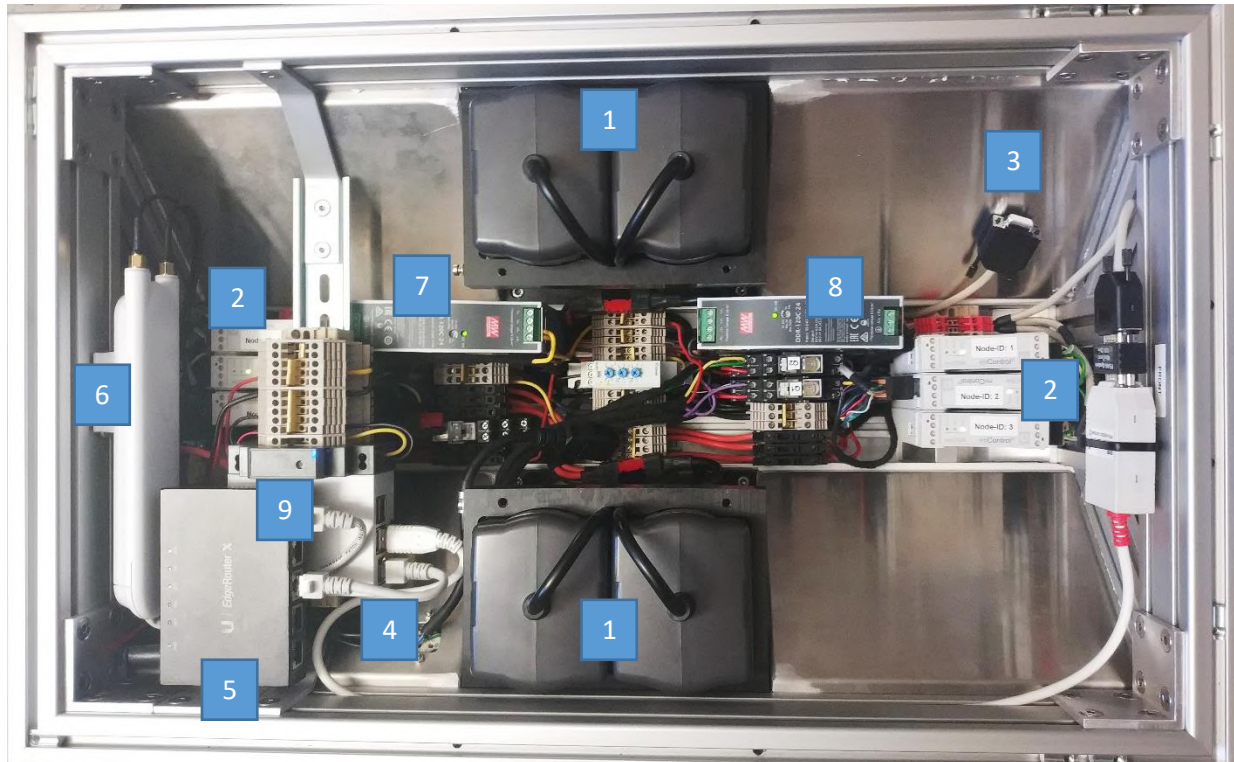
	
	<div style="display: flex; align-items: center;"> <div style="text-align: center; margin-right: 20px;">  <p>ATTENTION</p> </div> <div> <ul style="list-style-type: none"> • Use only the original charging cable. • It is recommended to power off the robot during charging. </div> </div>

3.4 Testing the robot

Step	Action
1	Power on the robot (see chapter 3.1)
2	Switch on controller (see chapter 3.1)
3	<p>Robot can be steered with the controller (deadman switch must be pressed)</p> <p>Steering controls:</p> <ul style="list-style-type: none"> - Both axles move during steering operations - All powered wheels (4 pieces) turn according to the commands <div style="text-align: center; margin: 20px 0;">  </div>
	<div style="display: flex; align-items: center;"> <div style="text-align: center; margin-right: 20px;">  <p>ATTENTION</p> </div> <div> <ul style="list-style-type: none"> • Ensure there is sufficient free space and distance from obstacles. </div> </div>

4. Robot

4.1 Components



1 - Lithium-ion batteries - 4 pcs.

2 - Motor controller - 3 pcs. per side. Left to right: left drive motor, control motor, right drive motor

3 - CAN Interface

4 - Raspberry Pi computing unit: Ubiquity Robotics Image with Xenial and ROS Kinetic or an IPC suitable for the application.

5 - Router: Port 1 Wan (Ethernet 0); Port 2 Raspberry Pi; Port 4 WIFI Accesspoint passive PoE active.

6 - WIFI antenna

7 - VDC2: logic supply for the motor controller; power supply for the router/network

8 - VDC1: for further power consumers and is controlled with the emergency stop

9 - Power supply for the computing unit (Raspberry PI or IPC)

4.2 Sensor systems

The sensor systems may differ depending on the configuration, therefore various sensors are also listed.

- Laser scanner Ouster OS1-16



Ouster OS1-16 - technical specifications	
Name	OS1-16 Gen 1
Vertical field of view	45°
Vertical resolution	16 Channels (16 layers)
Horizontal resolution	512, 1024, 2048 - selectable
Maximum range	120m
Vertical angular resolution	0.53°- 2.2° (multiple options)
Precision	+/- 1.5 – 10cm
Dots per second	327.680
Rate of rotation	10 oder 20 Hz
Power consumption	14 – 20 W
Weight	425 g
Ingress protection rating	IP 68, IP 69K

Additional information from the manufacturer:

<https://ouster.com/products/os1-lidar-sensor>

- PTP and NMEA/PPS time synchronization options
- On-the-fly programming of frame rate and horizontal resolution
- Fixed angle data measurement
- Multi-sensor crosstalk resistance
- Pluggable space-style bayonet connector
- Over-the-network firmware updates
- Class 1 Eye Safe per IEC/EN 60825-1:2014
- Output: range, intensity, reflectivity, ambient NIR, azimuth angle, time stamp

- Laser scanner TIM781S-2174104

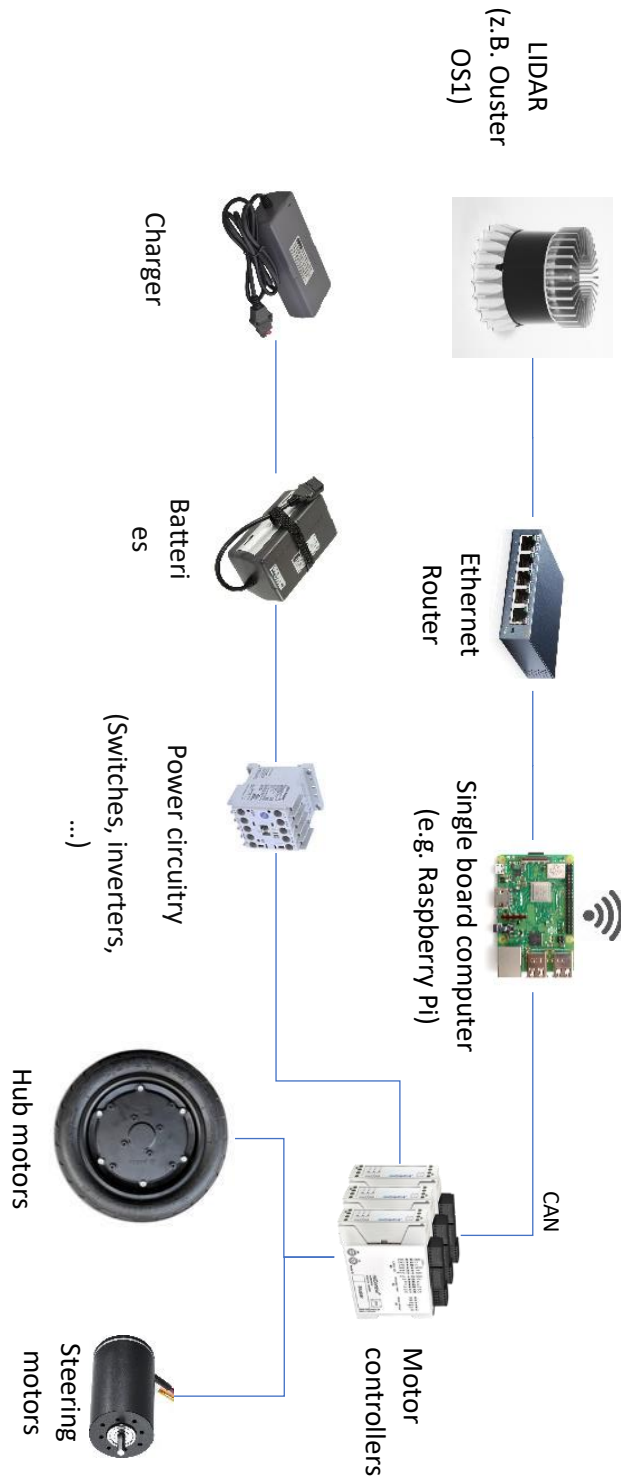


TIM 781S - technical specifications	
Name	TIM781S-2174104
Vertical field of view	270°
Horizontal resolution	0.33°
Maximum range	25m
Use area	Indoor
Rate of rotation	15 Hz
Power consumption	4-16 W
Weight	250 g
Ingress protection rating	IP 67

Additional information from the manufacturer:

<https://www.sick.com/at/de/p/p594149>

4.3 System overview



5. Technical Information

5.1 General data

Dimensions	
Length	800 mm
Width	600 mm
Height	400 mm
Ground clearance	90 mm
Weight (without load)	46 kg
Loading area/mounting surface	650 mm x 410 mm

Performance values	
Load capacity	80 kg
Speed	9 km/h
Range	30 km
Operating time	8-10 h
Driving time	3-4 h

Operational environment	
Operating temperature range	+5 °C bis +50 °C

Power supply	
Battery	Lithium-ion; charging time: up to 4h
Internal charger	Input: 100-230V AC, 50-60 Hz

Communication	
WLAN/WIFI	Dualband, wireless, AC/G/N/B
Bluetooth	4.0 LE, Range: 10-20m
In- and output	USB and ethernet

5.2 Dimension blueprint

