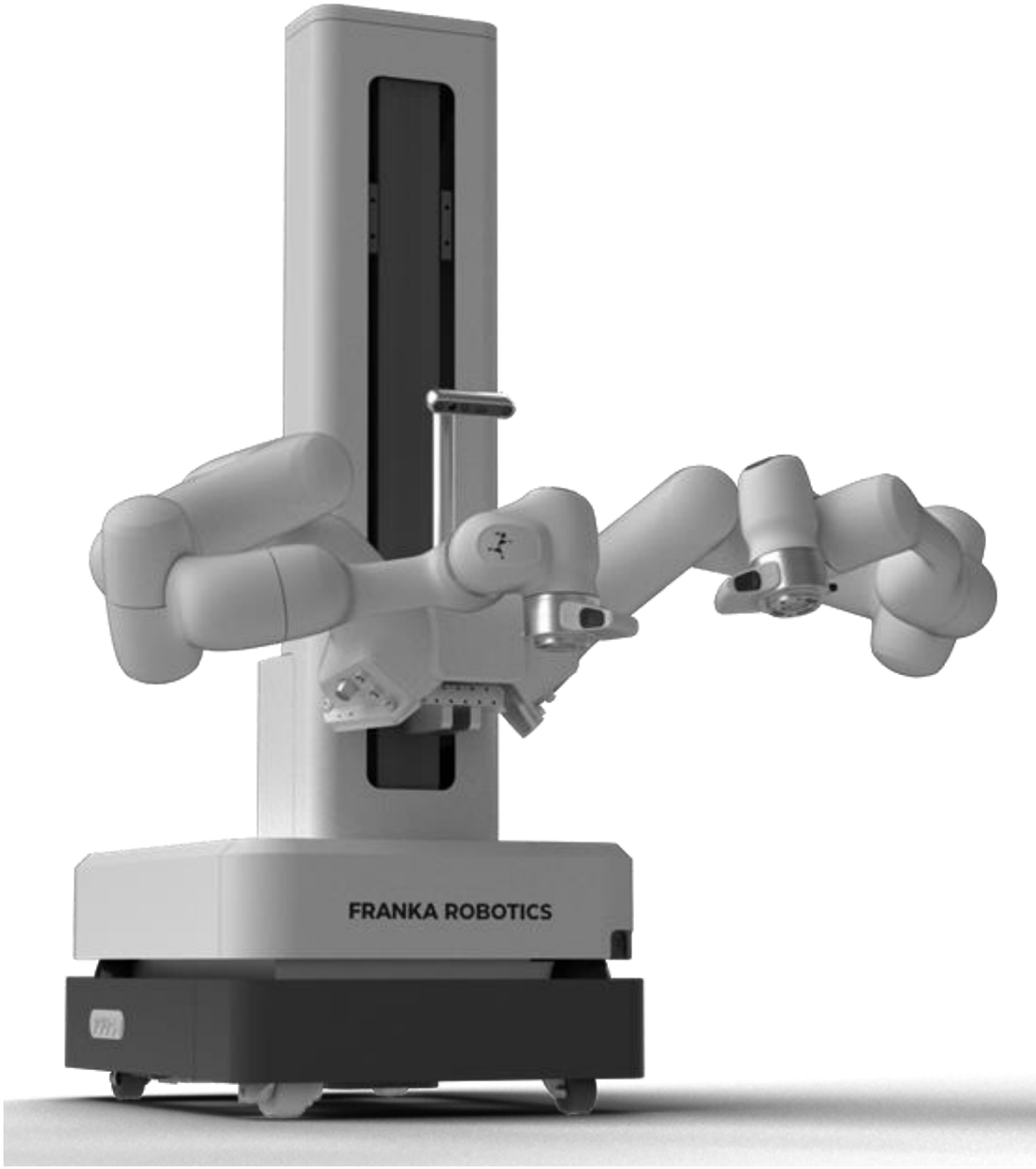
FRANKA ROBOTICS



Prototype Manual & Datasheets

MOBILE FR3 DUO

Document name: Prototype Manual and Datasheets
Document number: R04245
Change log:

Content Iteration	Release Date	Release notes / Changes
1.0	03.09.2026	Prototype manual and datasheets first draft release
1.1	01.04.2026	Added document number and change log. Added and/or updated the following new Chapters: • Chapter 4.2 Dual Arm Workspace: Reach and Manipulation • Chapter 5.3 Physical User Interfaces • Chapter 5.4 Turning on the TMR • Chapter 5.5 Shutting Down the TMR • Chapter 7.3 Nominal Charging Sequence • Chapter 7.4 Rescue Charging Sequence • Chapter 8.2.1 Spine Back and Top Plate Mounting Holes • Chapter 12 FAQ

TABLE OF CONTENTS

1 Introduction 5
1.1 Prototype Disclaimer 5
1.2 Document Purpose 5
1.3 Document scope 5
1.4 Product Prototypes 5
1.5 Accessory Prototypes 5
2 Safety Guidelines 6
2.1 Electrical Safety 6
2.2 Operational Guidelines 6
3 Type labels on the equipment 7
3.1 Tactile Mobile Robot 7
3.2 Franka Spine 7
3.3 TMR Charging Station 7
4 Mobile FR3 Duo 8
4.1 Datasheet 8
4.2 Dual Arm Workspace: Reach and Manipulation 8
4.3 Scope of Delivery 10
4.4 Other User Devices 11
4.5 Limitations, Constraints and Misuse 11
5 Tactile Mobile Robot 12
5.1 Datasheet 12
5.2 Scope of Delivery 13
5.3 Physical User Interfaces 13
5.3.1 Power Switch and Rescue Charging Port 13
5.3.2 Emergency Stops 13
5.3.3 Configuration and pairing of the FORT wireless E-Stop 14
5.3.4 UI-Panel and Related Connections 15
5.3.5 Battery SoC Monitor on the UI Panel 15
5.3.6 Spine Connection Bays 15
5.3.7 Router WAN Port 16
5.3.8 TMR Top Plate Mounting Holes 16
5.3.9 TMR Type Label 19
5.4 Turning on the TMR 19
5.5 Shutting Down the TMR 19
5.6 Sensors 19
5.6.1 LIDARs 19
5.6.2 IMU 19
5.6.3 Cameras 20
5.6.4 Sensor Testing 20
5.7 Software UI TMR v0.2 20

5.8 Software Integration Interfaces TMR v0.2 21
5.9 Internal network setup 21
5.9.1 IP Address Allocation 21
5.9.2 Wireless Configuration 22
5.9.3 Internet Access for internal components for Software Updates. 22
5.10 Working with User PC of TMR v0.2 22
5.10.1 System specifications 22
5.10.2 Access methods 23
5.10.3 ROS 2 workspace setup 23
5.10.4 Available Demos 23
5.10.5 Repositories 23
5.10.6 Gamepad Demo 23
5.10.7 Steps 23
5.10.8 Controls 23
5.10.9 ROS 2 Sensors Demo 24
6 FR3 Duo 25
6.1 Datasheet 25
6.2 Scope of Delivery 25
7 TMR Charging Station 27
7.1 Datasheet 27
7.2 Scope of Delivery 27
7.3 Nominal Charging Sequence 27
7.4 Rescue charging sequence. 28
7.5 Software-Interfaces 29
8 Franka Spine 30
8.1 Datasheet 30
8.2 Physical User Interfaces 31
8.2.1 Spine Back and Top Plate Mounting Holes 31
8.3 Software Interfaces 31
9 FR3 Duo Mounting Kit v0.3 32
9.1 Datasheet 32
10 Franka Head Bracket v0.2 33
10.1 Datasheet 33
11 Handling, Transport & Maintenance 34
11.1 Areas for Manual Handling without Special Equipment 35
11.2 Areas for Handling with Special Equipment 35
12 FAQ 36
12.1 Desk Shows 500 Internal Server Error 36
13 Table of figures 37

1 INTRODUCTION

1.1 Prototype Disclaimer

This document is for the internal use of Franka Robotics GmbH only. Specifications and features described herein are preliminary and may change without prior notice. Not for commercial distribution.

NOTICE

This manual applies to prototype hardware and is not certified according to IEC 60204 or other safety standards. Use only in controlled environments by qualified personnel.

1.2 Document Purpose

This manual provides technical specifications, operational guidelines, and accessory details for the Mobile FR3 Duo prototype. It is intended for internal use during prototype evaluation and testing.

1.3 Document scope

This document covers:

- Safety guidelines
- Operational guidelines
- Datasheets

1.4 Product Prototypes

- Mobile FR3 Duo – v0.2
- Tactile Mobile Robot (TMR) – v0.2

1.5 Accessory Prototypes

- Franka Spine – v0.1
- Franka Head Bracket – v0.2
- FR3 Duo Mounting Kit – v0.3
- Charging Station – v0.1

2 SAFETY GUIDELINES

The following guidelines are essential for safe operation and handling of prototype hardware. These instructions apply to the Mobile FR3 Duo, Tactile Mobile Robot (TMR), and all associated accessories.

The following notices are used throughout this manual to indicate the level of risk and importance of information:

⚠ DANGER

Indicates a hazardous situation that, if not avoided, will result in death or serious injury.

⚠ WARNING

Indicates a hazardous situation that, if not avoided, could result in death or serious injury.

⚠ CAUTION

Indicates a hazardous situation that, if not avoided, could result in minor or moderate injury.

NOTICE

Indicates important information not related to personal safety, but essential for proper operation.

SAFTEY-INSTRUCTIONS

Indicates processes or steps that must be strictly observed to ensure safe operation.

2.1 Electrical Safety

⚠ WARNING

- All E-stops are designed with redundancy. Still, the current design does not claim compliance with IEC 60204-1 or ISO 13849-1. Additionally, no diagnostic functionality is currently implemented.
- The operator should perform a daily test to ensure E-Stops are operational.

2.2 Operational Guidelines

- **Qualified Personnel Only:** Operate and maintain prototypes only by trained individuals familiar with robotic systems.
- **Controlled Environment:** Use prototypes exclusively in supervised, indoor environments with stable surfaces.
- **Personal Protective Equipment (PPE):** Wear safety gloves and protective eyewear during assembly, adjustment, or maintenance.
- **Keep Clear of Moving Parts:** Never place hands or objects near active joints, drives, or robotic arms during operation.
- **Disconnect Power Before Maintenance:** Always power down and unplug the system before performing any adjustments or repairs.
- **Wireless E-Stop:** Always use the wireless E-Stop during operation of the prototype.

3 TYPE LABELS ON THE EQUIPMENT

3.1 Tactile Mobile Robot

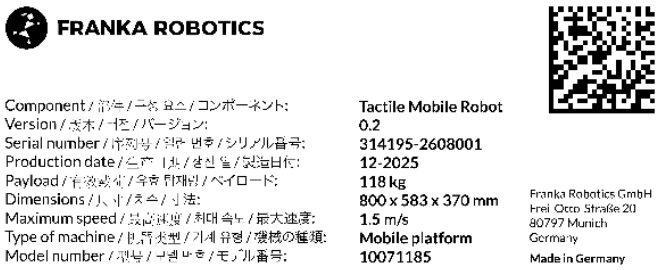


Figure 1: TMR Type Label

3.2 Franka Spine

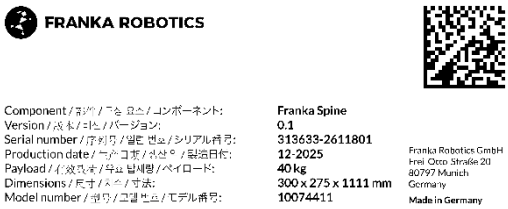


Figure 2: Franka Spine Type Label

3.3 TMR Charging Station

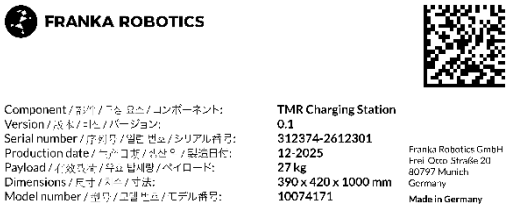


Figure 3: TMR Charging Station

4 MOBILE FR3 DUO

(Type: Product Prototype)

The Mobile FR3 Duo is a prototype mobile manipulator optimized for research in the areas of teleoperation, mobile manipulation, and embodied AI. This system is intended to be used exclusively for use in research and development within industrial laboratory environments and/or for training and educational purposes related to industrial applications. It is not designed or approved for production use, or safety-critical applications.

Figure 4: Mobile FR3 Duo

4.1 Datasheet

Mobile FR3 Duo			
Platform		**Onboard devices**	
Drive System	Holonomic / Omnidirectional	**Mobile Platform**	Tactile Mobile Robot
Degrees of freedom	18	**Vertical Lift**	Franka Spine
Dimensions	800 x 583 x 1461 mm	**Robot Arms**	Franka Research 3
Max. payload	TMR: 125 kg Franka Spine: 50 kg FR3: 3 kg		
Weight	225 kg		
Max. speed	1.5 m/s		

4.2 Dual Arm Workspace: Reach and Manipulation

From investigations of the workspace of a single FR3 arm, there is a region right in front of the robot with good manipulability. This knowledge is used to define the so-called ISO-cube for performance experiments.

See Datasheet Franka Research 3 (Document Number: R02212)

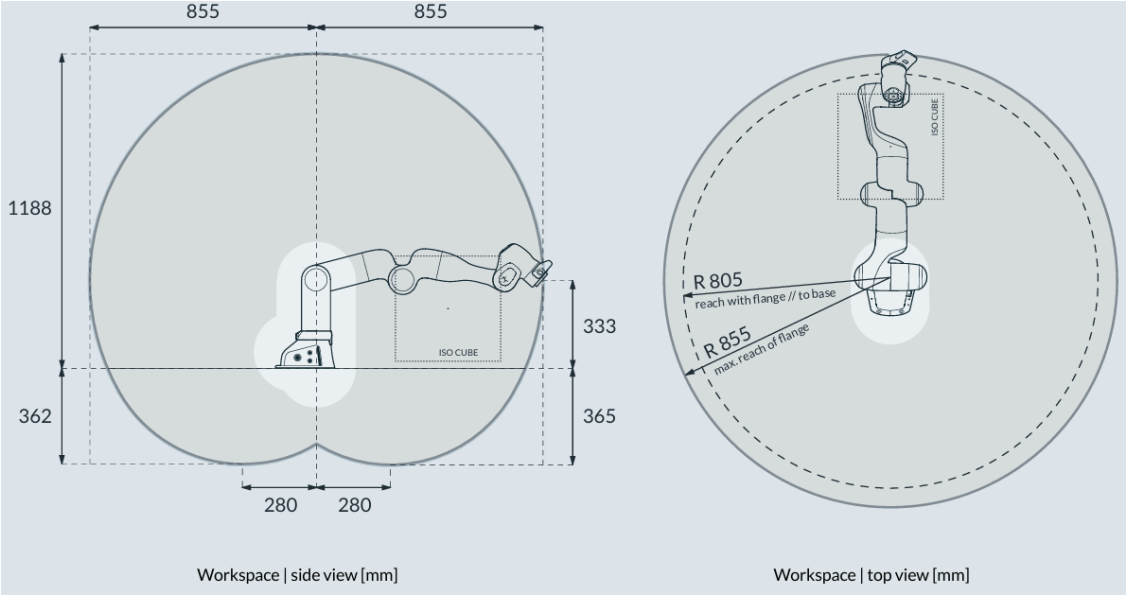


Figure 5: Side and top views of the robot workspace, showing maximum reach and operating envelope dimensions.

In the case of FR3 Duo, overlapping the centers of the two ISO-cubes of the two FR3 arms ensures good manipulability for both the robots.

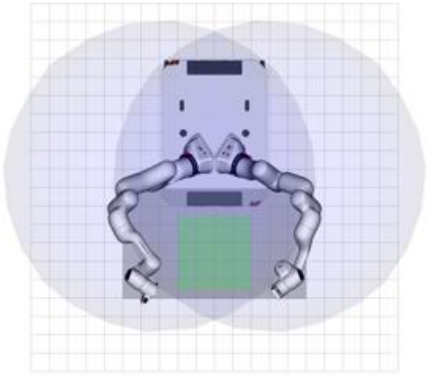


Figure 6: ISO cube for FR3 Duo

The current positioning of the two FR3 arms with the shoulders (J2) further away from each other and the bases (J1) close to each other ensures a large workspace, reduces the likelihood of collisions, and ensures a small overall footprint.

For visualizing the workspace, a simplified sphere with a 0.855m radius about the shoulder joint represents the reach, whereas a sphere with 0.7m radius about the shoulder joint represents manipulability. A voxelated Monte Carlo representation of reachability and a heatmap considering ideal the Yoshikawa's Manipulability Index have not been provided in this manual.

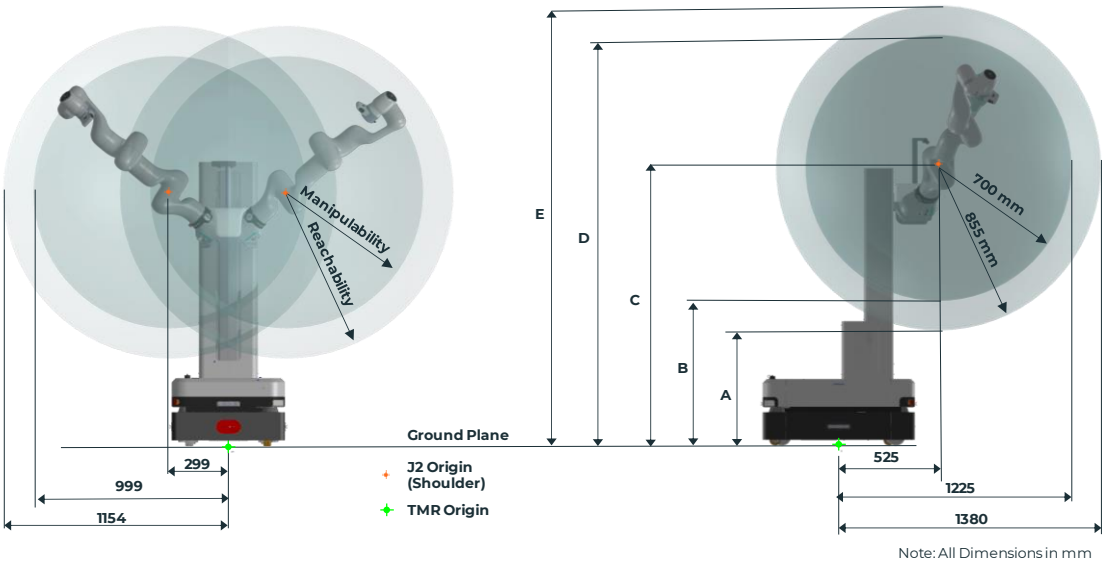


Figure 7: Dual arm workspace.

Dimension	Position of Spine		
	Lowest	Nominal	Highest
A	- 142	451	609
B	13	606	764
C	713	1306	1464
D	1413	2006	2164
E	1568	2161	2319

Note: All dimensions in mm

Figure 8: Workspace relative to Franka Spine Position

The only constraints for using the full extent of the workspace are joint limits and collisions. Self-collision checks with ROS2 is planned to be released soon.

4.3 Scope of Delivery

The following items are included in the delivery of the Mobile FR3 Duo system. Optional accessories are listed separately.

System Components

- Tactile Mobile Robot – TMR (Mobile Platform)
- FR3 Duo (dual-arm system)
    - FR3 Duo Mounting Kit v0.3
    - Franka Research 3

Optional Accessories

- Franka Spine (vertical lift)
- TMR Charging Station (wireless and rescue charger)
- FR3 Duo Vision and Manipulation *
    - Head Camera Bundle: with ZED Mini
    - Wrist Camera Bundle: with RealSense D405
    - Grippers Bundle: with Robotiq 2F-85 kit
- Franka Gello Duo §

NOTICE

** Refer to Quick Guide for Installation FR3 Duo (Document Number: R04240) on Franka Product Documentation.*

§ Refer to Quick Guide for Installation Franka GELLO Duo (Document number: R62040) on Franka Product Documentation.

4.4 Other User Devices

Connecting additional user devices (e.g., PC, router, sensors) is permitted at dedicated locations on the TMR Top Plate and the Franka Spine Back Plate, where a dedicated grid of mounting points is provided.

The risk assessment conducted does not cover additional interfaces/devices beyond those delivered with the system. Connecting additional user devices requires a renewed risk assessment to be performed by the user or system integrator.

4.5 Limitations, Constraints and Misuse

Any application different to the intended use is misuse and is not permitted. This includes, but is not limited to, the following uses:

Operational Misuse

- Transport of people or animals.
- Transport without original packaging.
- Use as climbing assistance.
- Leaning against the TMR.
- Handling of liquids.

Environmental Restrictions

- Use in potentially explosive areas.
- Use below ground or in confined spaces.
- Not designed for flammable/explosive environments.
- Use for the handling of radioactive objects.
- Use outdoors.
- Use in private environments e.g. real homes.
- Use in the vicinity of children.

Safety And Compliance

- Use as a medical product.
- Use outside of the specified operating limits.

Expected Environment

- Location: Dry, indoor lab or industrial setting.
- Humidity: typically, non-condensing
- Floor conditions: Clear paths; avoid uneven surfaces.
- Shared spaces: Allowed but require restricted access and monitoring.

Required Operator Skill Level

- Trained R&D or technical personnel only
- Must complete safety briefing and understand:
    - Emergency stop procedures.
    - Handling of charging station
    - Shared-space safety rules.

5 TACTILE MOBILE ROBOT

(Type: Product Prototype)

Tactile Mobile Robot is a prototype mobile platform optimized for research in the areas of autonomous navigation, obstacle avoidance and embodied AI. A seamless integration with Franka Research 3 and Franka Spine allows the user to transform the mobile platform into a mobile manipulator seamlessly.

Some of the key features of the platform are omnidirectional drive and wireless charging.

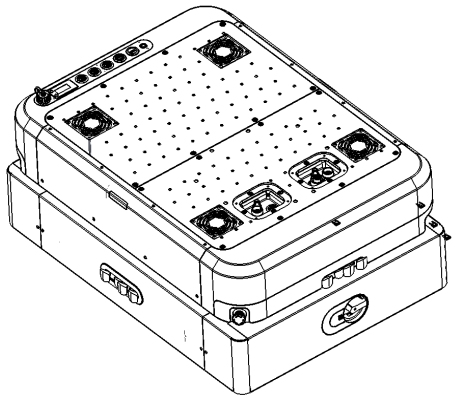


Figure 9: Tactile Mobile Robot (TMR)

5.1 Datasheet

Tactile Mobile Robot			
Platform		**Onboard devices**	
Drive System	Holonomic / Omnidirectional	**Lidars**	2 x Sick NanoScan3
Degrees of freedom	3	**Cameras**	4 x Realsense D455
Suspension type	Three-point suspension	**IMU**	olixSense™ X1 Pro
Dimensions	800 x 583 x 370 mm	**User PC**	NVIDIA Jetson AGX Orin Developer Kit (64GB)
Max. payload	125 kg	**Network switch**	Unifi Flex 2.5G 8-Port
Max. speed	1.5 m/s	**Router**	Teltonika RUTX10
Weight	130 kg	**Emergency Stop**	FORT VSC / WES
Power		**External Ports Panel**	1x HDMI 2x USB-C 2x Ethernet (Switch) 1x Ethernet (User PC) 1x External Power 1x Manual Charging
Batteries	4x MuRata-LFP-TypeB 24V/21Ah		
Battery voltage	48 V		
Total capacity	44 Ah		
Charging Rate	Up to 2C		
Charging System	Wiferion CW1000		

5.2 Scope of Delivery

The following items are included in the delivery of the Tactile Mobile Robot system. Optional accessories are listed separately.

System Components

- Tactile Mobile Robot – TMR (Mobile Platform)

Accessories

See Chapter 5.3 Physical User Interfaces

- FORT Robotics Wireless Emergency Stop
- Microsoft X-Box Controller / Gamepad
- External User Power Cable for the user power port on the UI Panel

Optional Accessories

- TMR Charging Station
- Franka Spine

5.3 Physical User Interfaces

5.3.1 Power Switch and Rescue Charging Port

The power switch and charging port can be found on the front side of the TMR.

Refer to Chapter 5.4 Turning on the TMR and Chapter 5.5 Shutting Down the TMR. For additional information on the Rescue Charging Port, see the chapter TMR Charging Station.

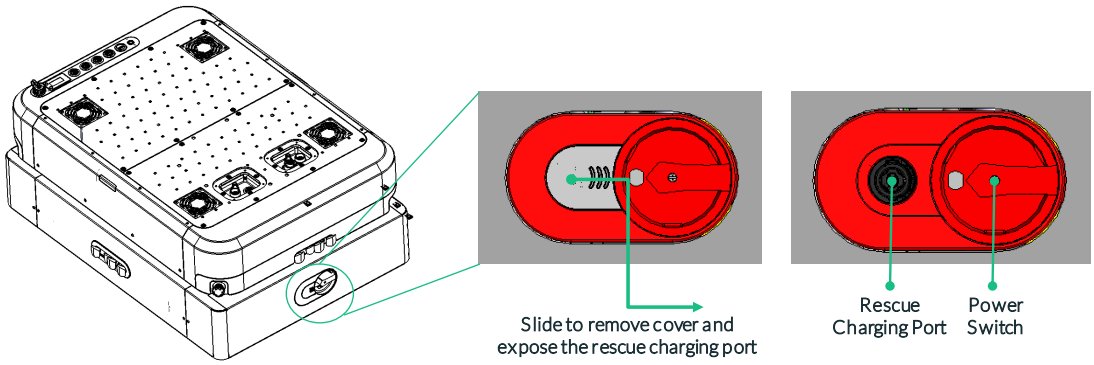


Figure 10: Power Switch and Rescue Charging

5.3.2 Emergency Stops

The TMR is equipped with a redundant emergency stop (E-Stop) architecture designed to arrest all motion immediately upon activation.

5.3.2.1 E-Stop Locations

Onboard: Two physical E-Stop buttons are mounted on diagonally opposite corners of the TMR chassis for 360° accessibility.

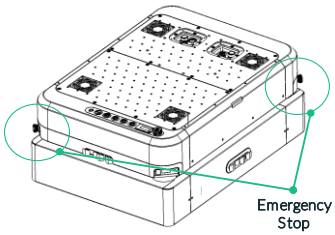


Figure 11: TMR onboard E-Stop

Wireless: A handheld wireless E-Stop is provided for the safety operator. This must be maintained within line-of-sight of the robot during all autonomous or manual operations.

Figure 12: FORT Wireless E-Stop (WES-Tx)

NOTICE

If the wireless handheld E-Stop moves out of range of the TMR or loses battery power, the system will default to a Protective Stop. Always ensure the handheld unit is fully charged before beginning usage.

5.3.2.2 System Protective Stops

Activating any of the three E-Stops will lead to behaviors that vary by subsystem, as explained below:

Subsystem	Stop Category	Functional State	Mechanical Behavior
TMR	Category 0	Safe Torque Off (STO)	Power is cut immediately; mechanical brakes engage and lock wheels.
Franka Spine	Category 0	Power Removed	Power to the motor drive is severe; power to the motor controller is still on; electromechanical holding brakes engage.
FR3 Arms	Category 1	Controlled Stop	Joint motors execute a controlled deceleration to zero velocity before the brakes engage.

NOTICE

The TMR drive units utilize mechanical braking during Category 0 events, and dynamic braking should be limited, i.e., stopping when the robot is in motion. Engaging the E-Stop while the TMR is at a standstill (e.g., when parked and during setup) does not utilize the friction budget and causes no significant wear to the braking system.

5.3.3 Configuration and pairing of the FORT wireless E-Stop

TMRv0.2 has a FORT Vehicle Safety Controller (VSC-Rx) that pairs with the portable FORT Wireless E-Stop (WES-Tx). To configure the VSC-Rx and access the FORT Configuration Tool, the USB-mini port is exposed on the VSC-Rx, as shown below.

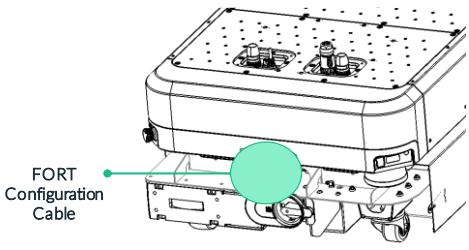


Figure 13: FORT VSC-Rx Configuration Cable

NOTICE

Detailed instructions for pairing and configuration of the VSC-WES will be described in the upcoming Quick Guide for Installation Mobile FR3 Duo (not yet released). If a need arises that the VSC and WES must be re-paired, contact the Franka team.

Refer to the FORT Robotics products page for detailed information.

5.3.4 UI-Panel and Related Connections

The UI Panel is located on the rear-top side of the TMR. The following ports are provided on the UI Panel:

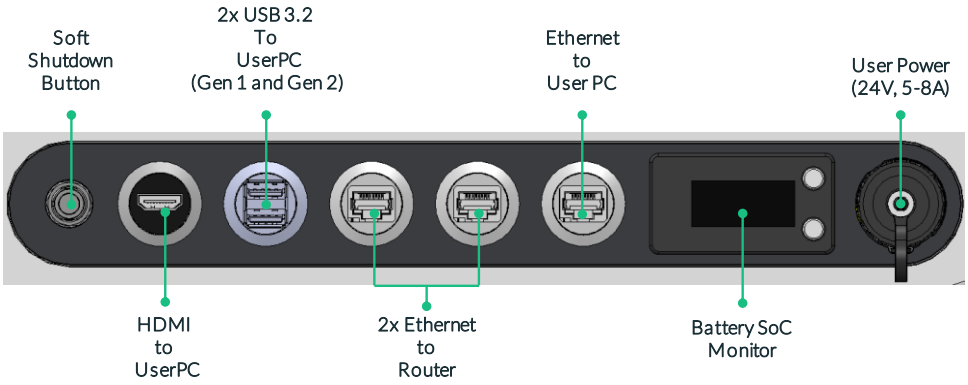


Figure 14: UI Panel

The User Power port on the UI panel consists of a 4-pin panel mount receptacle C016 20G003 100 12 from Amphenol. This accepts a C016 20H003 100 10 plug from Amphenol.

5.3.5 Battery SoC Monitor on the UI Panel

In the current prototype version of the TMR, a simple open-circuit voltage-based battery capacity read-out is integrated in the UI Panel. Given below is a table showing a mapping between SoC monitor voltage and the actual state of charge read from the battery BMS-SoC:

SoC Monitor Voltage	State of Charge Approximation
52.70 V	100%
52.15 V	70%
51.24 V	33%
50.87 V	25%
50.45 V	15%

NOTICE

In a system that experiences dynamic loading of the batteries, voltage-based estimations tend to be inaccurate. The user is advised to refer to the voltage read-out and not the percentage read-out on the monitor.

For an accurate SoC of the system, the user should rely on the Battery Service functionality from the Franka Desk and Desk API.

See Chapter 5.7 Software UI TMR v0.2

5.3.6 Spine Connection Bays

The Spine Connection Bays Left/Right are located at the front-top side of the TMR:

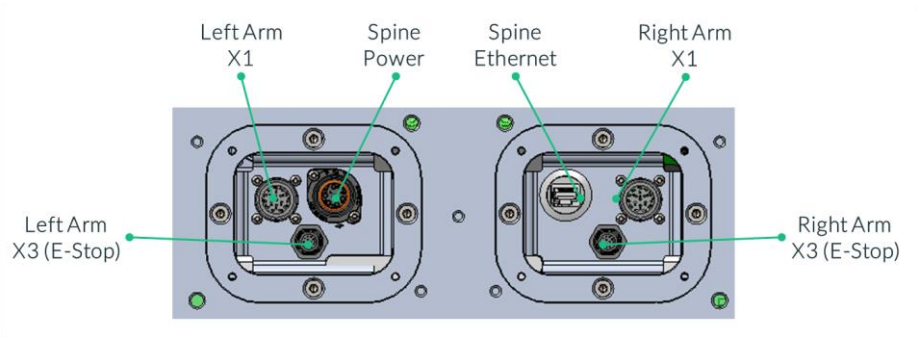


Figure 15: Spine Connection Bays

5.3.7 Router WAN Port

The WAN Port of the router can be accessed by removing the cover surrounding the UI Panel:

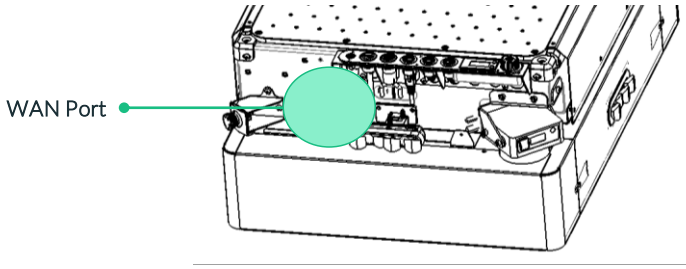


Figure 16: Exposed Router WAN Port

5.3.8 TMR Top Plate Mounting Holes

Mounting holes are provided to the user on the front and rear Top Plates of the TMR.

Depending on the version of the TMR received, the user will find one of the following top plates on the front side of the TMR:

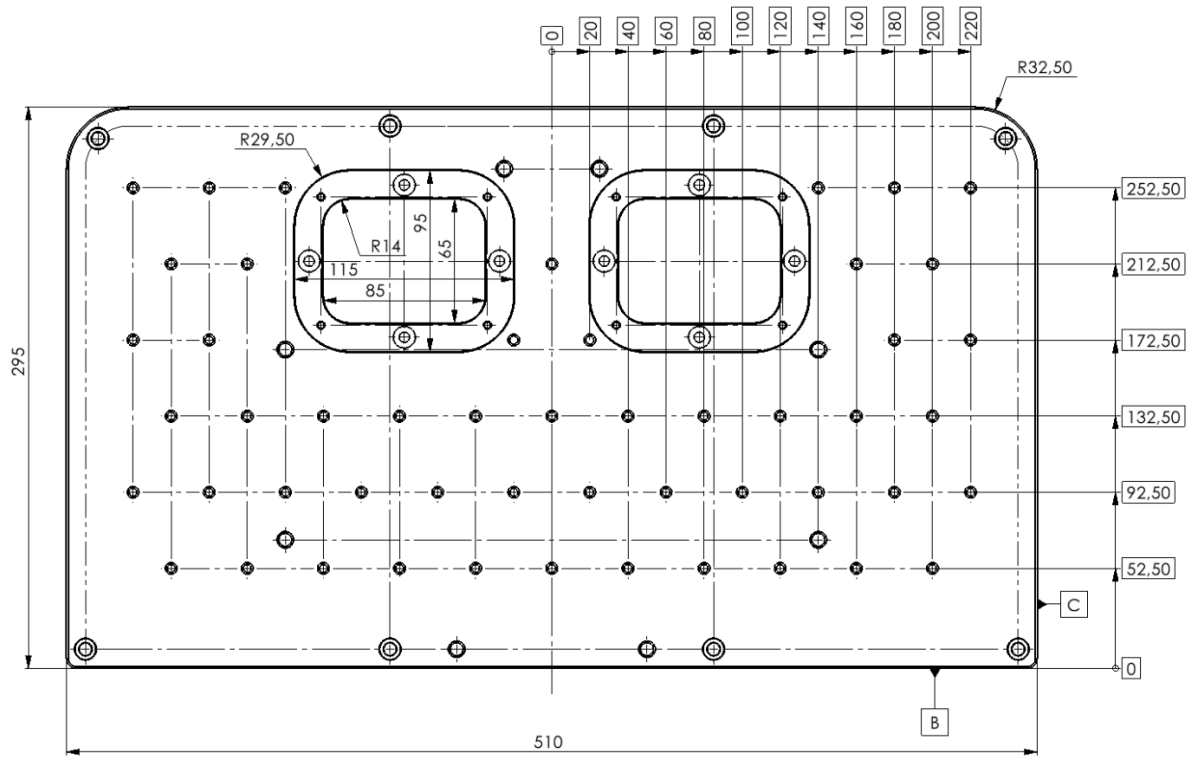


Figure 17: TMR Top Plate Front - variant A

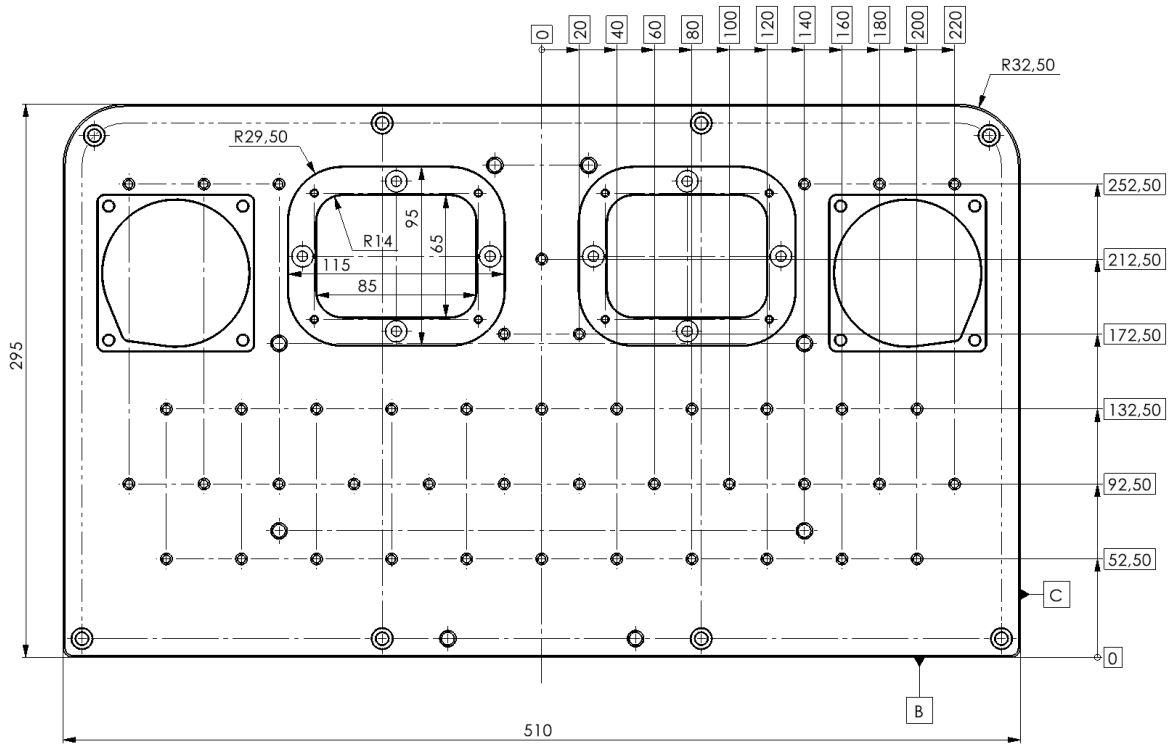


Figure 18: TMR Top Plate Front - variant B

Depending on the version of the TMR received, the user will find one of the following Top Plates on the rear side of the TMR:

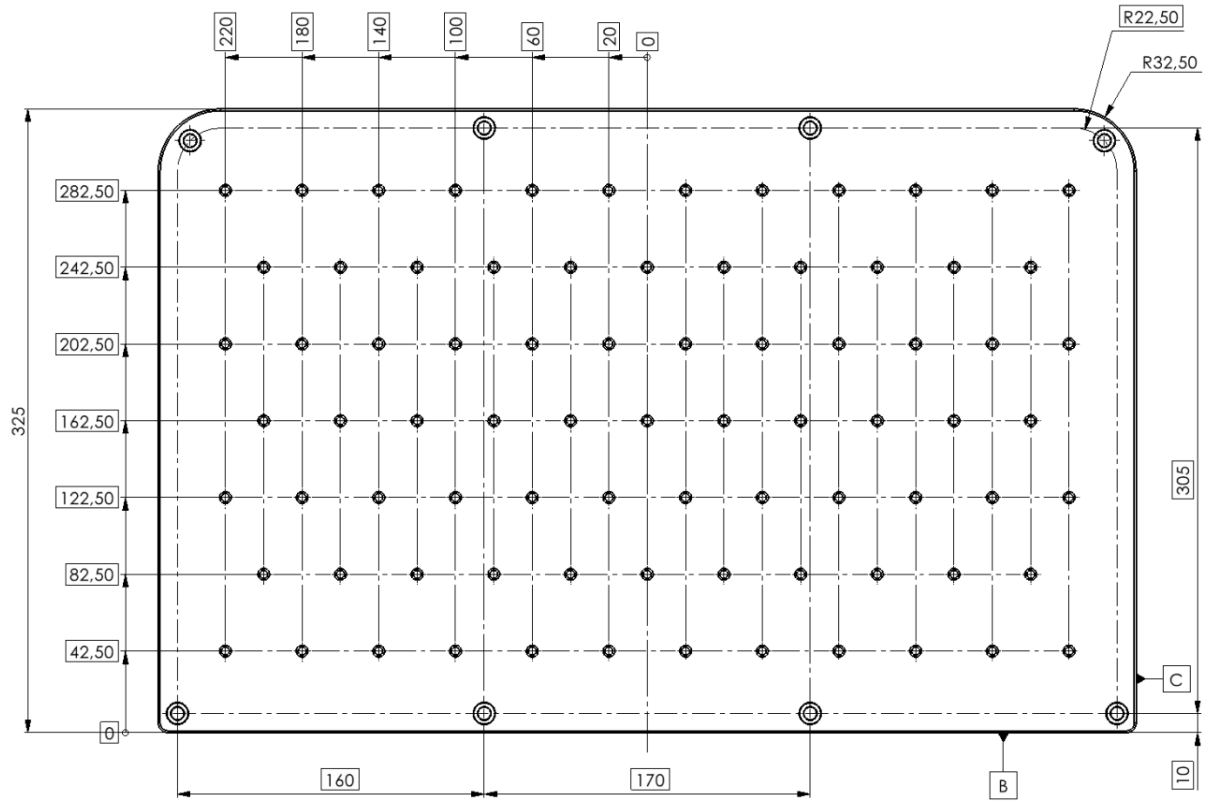


Figure 19: Top Plate - variant A

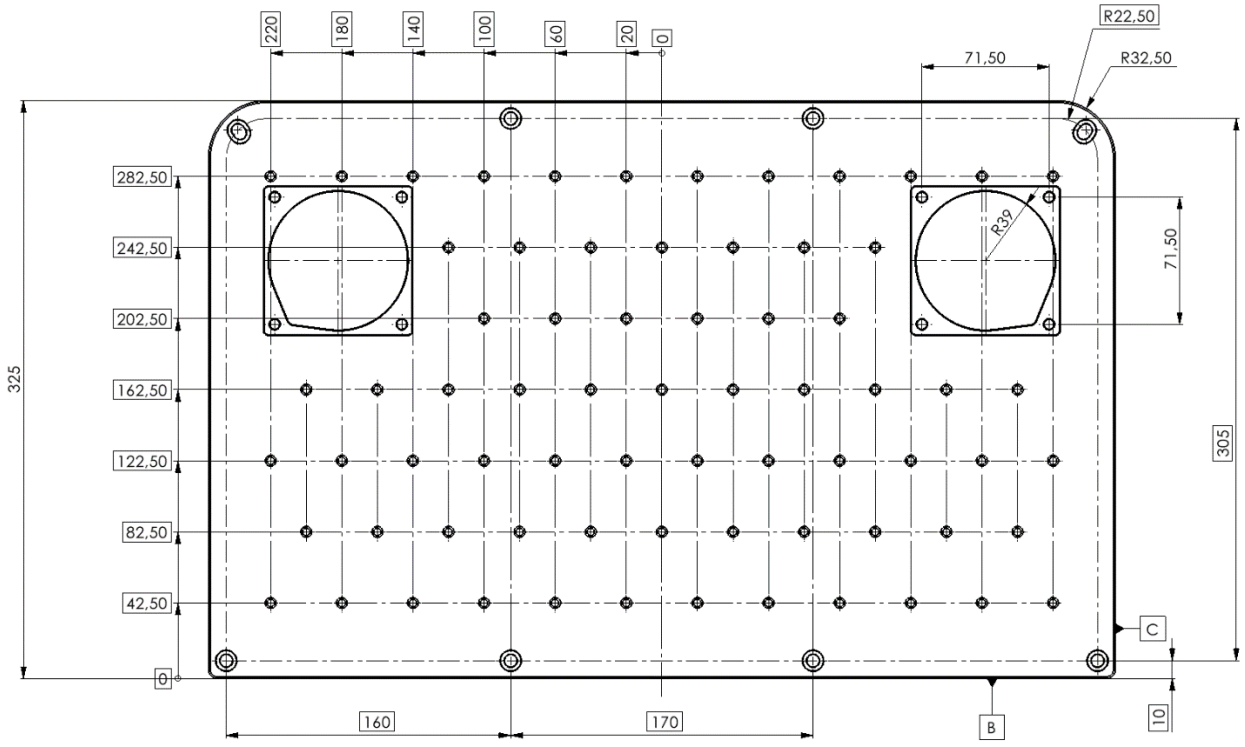


Figure 20: Top Plate Rear - variant B

5.3.9 TMR Type Label

To access the Type Label on the TMR, flip-open the enclosure on the right side of the TMR.

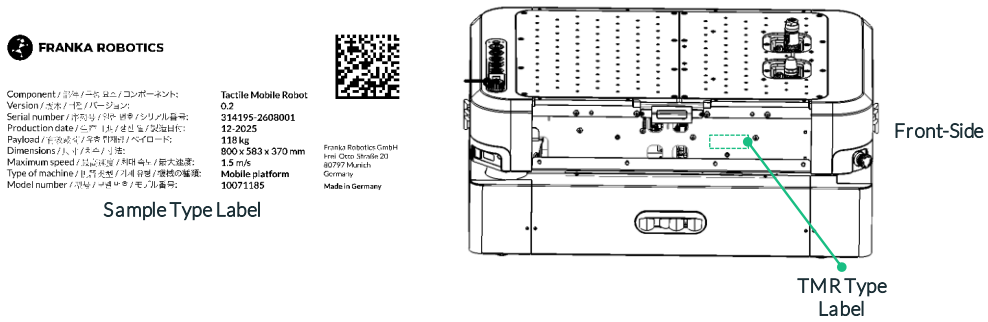


Figure 21: TMR Type Label

5.4 Turning on the TMR

To turn on the TMR, simply twist the Power Switch to the ON position.

See Chapter 5.3.1 Power Switch and Rescue Charging Port.

5.5 Shutting Down the TMR

- Press and quickly release the soft shutdown button (*short press of ~500ms*) to perform a soft shutdown of the robot controllers.

See Figure 14: UI Panel

- This is necessary to prevent data corruption on the controller disks.

See Chapter 12.1 "Desk Shows 500 Internal Server Error".

- After the exhaust fans on the TMR top plate stop, twist the TMR's Power Switch to fully turn off power from the rest of the system.

NOTICE

- For the soft shutdown to work for the TMR controller, the TMR needs to have the 5.9.2-tmr-os-0.3.
- Holding the button ~4s will trigger a hard shutdown.

5.6 Sensors

TMR integrates multiple sensors that interface with the User PC for environmental perception and navigation.

5.6.1 LIDARs

The TMR is equipped with two Sick NanoScan3 LIDARs that scan the environment using lasers to generate precise distance and outline data of surrounding objects. LIDARs are not pre-configured but can be set up using the Sick Safety Designer software.

Refer to the Sick documentation for configuration instructions.

5.6.2 IMU

The TMR features an Olive Robotics IMU providing precise orientation, acceleration, and angular rate measurements. The olixSense X1 Pro IMU is ROS 2 native and publishes sensor data to ROS 2 topics by default.

Web interface access: http://192.168.7.100

Refer to the Olive Robotics documentation for detailed information.

NOTICE

Modifying the IMU's IP address or topic names will break the provided ROS 2 demos.

5.6.3 Cameras

The TMR is equipped with four Intel RealSense D455 cameras for visual and depth data acquisition, positioned at the front, left, right, and rear of the platform. Additionally, a ZED Mini Stereo Camera is mounted on the Franka Head Bracket, and one RealSense D405 is mounted on each wrist of the FR3 Duo.

5.6.4 Sensor Testing

A comprehensive test suite is available to verify sensor functionality. Execute **test_sensors** in the terminal to run automated tests for IMU frequency and gravity detection, LIDAR frequency and range measurements, camera frequency and image quality, as well as position verification tests. Use **test_sensors --help** for all available options.

5.7 Software UI TMR v0.2

The TMR user interface is based on the interface provided with Franka Research 3, featuring familiar pages under Settings:

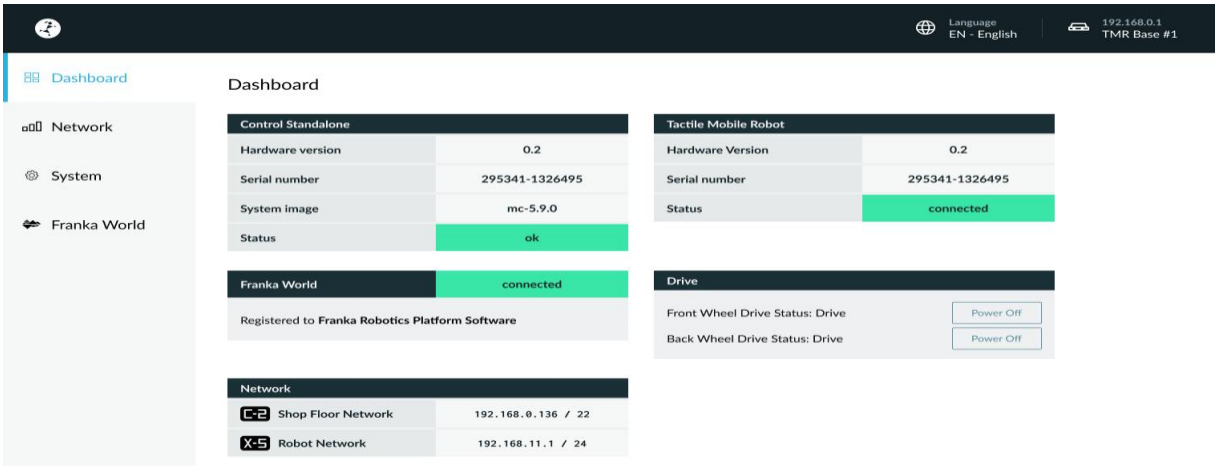


Figure 22: User Interface

Dashboard

Displays the state of the robotic system, including:

- **Drives** (enable/disable, recovery options)
- **Spine** (enable/disable, recovery options)
- **Battery status** (start/stop charging)

NOTICE

Some features may be unavailable in early versions.

Network

- Allows setting up the network interface for the TMR. T
- Internal router configuration is pre-set.

System

- Allows you to download safety and other log files

Software Updates

- Allow us to update the system image version when a new version is assigned in Franka World.

5.8 Software Integration Interfaces TMR v0.2

The software interfaces for the TMR can be found under the following routes:

- **<robot-ip>/deskapi** for the normal DeskAPI functionality that lets you set up your robot
- **<robot-ip>/spineapi** that allows the user to enable and recover the spine
- **<robot-ip>/driveapi** that allows to enable and recover the drives.

All three APIs mentioned above provide OpenAPI specifications, that allow direct interaction.

5.9 Internal network setup

The internal network comes pre-configured, with all components assigned IP addresses via DHCP from the WiFi router. This setup ensures IP address consistency, even after a factory reset. Furthermore, each device is accessible via a unique DNS hostname (e.g., Desk of the Right arm is available at https://right/). All components connect through a high-performance switch, and each TMR broadcasts a WiFi network with a unique SSID. Passwords are provided on the TMR labels. Please note that FCI over WiFi is not supported.

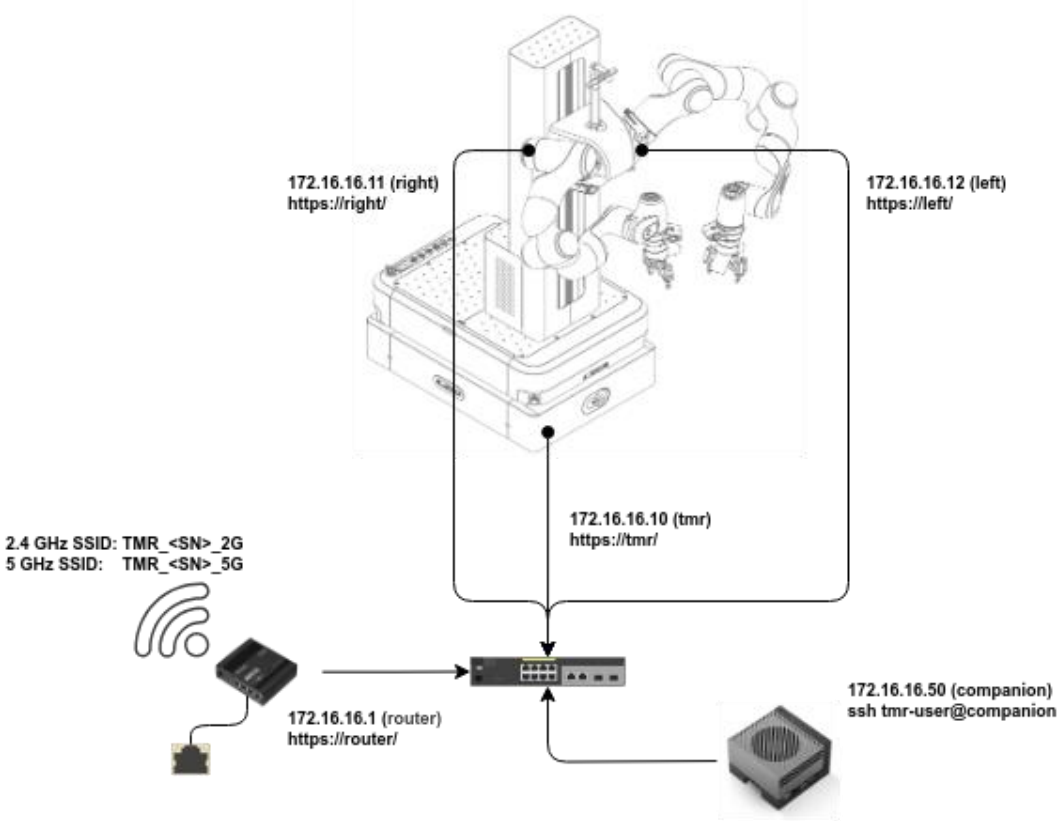


Figure 23: System Overview of FR3 DUO Setup

5.9.1 IP Address Allocation

RUTX10 Router:

  - IP: 172.16.16.1
  - DNS: router
  - Web UI: https://router/
- TMR Base:
  - IP: 172.16.16.10
  - DNS: tmr
  - DESK UI: https://tmr/

- Right Arm:
  - IP: 172.16.16.11
  - DNS: right
  - DESK UI: https://right/
- Left Arm:
  - IP: 172.16.16.12
  - DNS: left
  - DESK UI: https://left/
- User PC:
  - IP: 172.16.16.50
  - DNS: companion
  - SSH: ssh tmr-user@companion
- Front LIDAR
  - IP: 172.16.16.60
  - DNS: front-lidar
- Rear LIDAR
  - IP: 172.16.16.61
  - DNS: rear-lidar
- DHCP Range (Dynamic Allocation)
  - Any devices not listed above will be assigned an IP address from the following pool: 172.16.16.100 - 172.16.16.249

5.9.2 Wireless Configuration

The wireless network names (SSIDs) are derived from the Serial Number (SN) of the TMR unit.

- 2.4 GHz:
  - SSID: TMR_<SN>_2G (e.g., `TMR_12345678_2G`)
- 5 GHz:
  - SSID: TMR_<SN>_5G (e.g., `TMR_12345678_5G`)

5.9.3 Internet Access for internal components for Software Updates.

To update the robot software, you can use either (1) offline sync or (2) online sync.

5.9.3.1 (1) Offline Sync

Please follow the instructions of the Franka Robot Manual.

5.9.3.2 (2) Online Sync

Online sync requires the router's WAN port to be connected to a network with internet access, or the configuration of a WiFi WAN bridge. To locate the WAN port in the TMR.

For more information, refer to Chapter 5.3 (Physical User Interfaces).

Alternatively, you can use a WiFi WAN bridge. This procedure is described in the Teltonika manual, see https://wiki.teltonika-networks.com/view/WiFi_WAN_example.

Once the WAN connection is established, navigate to *Settings -> Software Update* in DESK (e.g., accessed through https://right/). If the configuration is correct, the Franka World status indicator will display *'connected'*. You can also verify the WAN connection from the user's PC. Proceed by following the instructions in the Franka Robot manual to install the update.

5.10 Working with User PC of TMR v0.2

The User PC serves as the interface for interacting with the TMR. It is an NVIDIA® Jetson AGX Orin™ Developer Kit with powerful onboard edge computation, combining GPU and CPU performance with CUDA cores for AI and vision algorithms. It features a real-time kernel.

5.10.1 System specifications

- Operating System: Ubuntu 22.04

- ROS Distribution: ROS 2 Humble
- Docker and Docker Compose installed.
- User: tmr-user (default password: user-TMR, sudo rights enabled)

5.10.2 Access methods

- Via Switch network (left/middle ethernet port on external ports panel or WiFi):
  - ssh tmr-user@172.16.16.50 or ssh tmr-user@companion
- Direct connection to User PC (right ethernet port on external ports panel):
  - ssh tmr-user@172.16.1.9
- Direct: Connect HDMI, mouse, and keyboard to the external ports on the top of the TMR

5.10.3 ROS 2 workspace setup

Create additional ROS 2 projects in /home/tmr-user/ros2_ws/src/. To build, navigate to /home/tmr-user/ros2_ws/ and execute colcon build.

5.10.4 Available Demos

Demo source code is located in /home/tmr-user/ros2_ws/src/.

5.10.5 Repositories

- franka_description (branch: humble) - URDF and meshes
- franka_ros2 (branch: humble) - ROS 2 packages

Updates are pushed to these branches and can be pulled via `git pull`. For access credentials, contact support@franka.de.

5.10.6 Gamepad Demo

Control the TMR using ROS 2 Humble and the included Xbox controller that is integrated via the Xone firmware.

Prerequisites:

- Ensure the robot is not blocked by safety.

5.10.7 Steps

1. Open terminal: Direct access (screen/mouse/keyboard) or ssh tmr-user@172.16.16.50
2. Run **screen** to create a detachable session
3. Run the demo:

Either directly executing **gamepad_demo** or running the following command from the ROS2 workspace:
ros2 launch franka_bringup mobile_teleop.launch.py controller_names:="mobile_cartesian_velocity_example_controller"

4. Power on Xbox controller (steady white light confirms pairing)
5. Detach session: Press CTRL-A then d
6. Reconnect to session if desired with screen –r

NOTICE

Ensure no other Xbox controllers or TMRs are powered to avoid connection disruption and potentially crashing the TMR. If connection or pairing issues persist, use a USB cable between the Xbox controller and the User PC USB-A port on the UI Panel.

5.10.8 Controls

- Hold RB button to enable control.
- Left joystick: Command linear velocities in x and y (translation).

- Right joystick: Command angular velocity in z (rotation). This joystick can only be moved sideways.
- Hold LB button to increase the maximum speed.

5.10.9 ROS 2 Sensors Demo

Visualize sensors, cameras, and LIDARs in RViz.

- Connect to User PC: Direct access (screen/mouse/keyboard) or **ssh -C -X** tmr-user@172.16.16.50
- Execute either sensors_demo or ros2 launch franka_mobile_sensors franka_mobile_sensors.launch.py

RViz displays the TMR model with LIDAR surroundings detection. Each camera output appears in a separate window. View all sensor topics with **ros2 topic list**.

6 FR3 DUO

(Type: Product Prototype)

The FR3 Duo is a prototype dual-arm system optimized for research in the areas of teleoperation, manipulation, and embodied AI. This system is intended to be used exclusively for use in research and development within industrial laboratory environments and/or for training and educational purposes related to industrial applications. It is not designed or approved for production use or safety-critical applications.

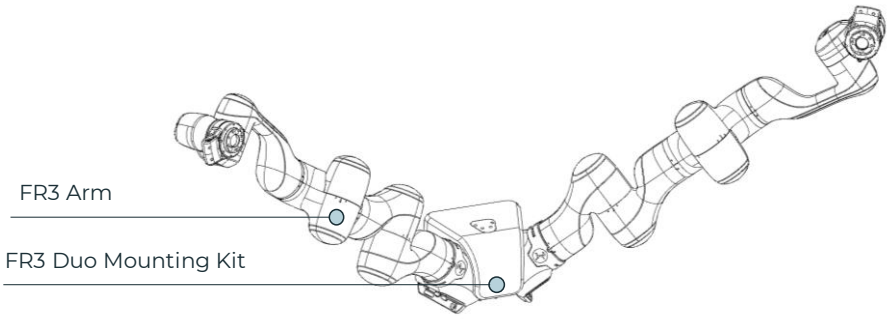


Figure 24: FR3 Duo

6.1 Datasheet

FR3 Duo	
Degrees of freedom	14
Max. payload	Each FR3 Arm: 3 kg
Weight	45

6.2 Scope of Delivery

The following items are included in the delivery of the FR3 Duo system. Optional accessories are listed separately.

System Components

- FR3 Duo Mounting Kit
- Franka Research 3

Currently, there are two options to mount and use the FR3 Duo system: using the Franka Spine or the Pedestal.

Optional Components

- Franka Spine
- Pedestal *
- FR3 Duo Vision and Manipulation *
    - Head Camera Bundle: with ZED Mini
    - Wrist Camera Bundle: with RealSense D405
    - Grippers Bundle: with Robotiq 2F-85 kit
- Franka Gello Duo §

NOTICE

Refer to Quick Guide for Installation FR3 Duo (Document Number: R04240) on Franka Product Documentation.

§ Refer to Quick Guide for Installation Franka GELLO Duo (Document number: R62040) on Franka Product Documentation.

7 TMR CHARGING STATION

(Type: Accessory Prototype)

The TMR Charging Station is the primary charging system intended for the TMR. The charging station consists of a wireless charger intended for nominal usage. The wired charger is intended to be used as a rescue charger to charge stranded TMRs with drained batteries.

Figure 25: TMR charging station

7.1 Datasheet

TMR Charging Station	
Dimensions	420 x 390 x 1000 mm
Weight	27 kg
Wireless Charger	Wiferion Wallbox & Sending Pad (SEPA)
Manual Charger	HEP- 600C

7.2 Scope of Delivery

The following items are included in the delivery of the Tactile Mobile Robot system. Optional accessories are listed separately.

System Components

- Tactile Mobile Robot – TMR (Mobile Platform)

Optional Accessories

- TMR Charging Station
- Franka Spine

7.3 Nominal Charging Sequence

During nominal use, the TMR is intended to be charged using the inductive wireless charger on the Charging Station.

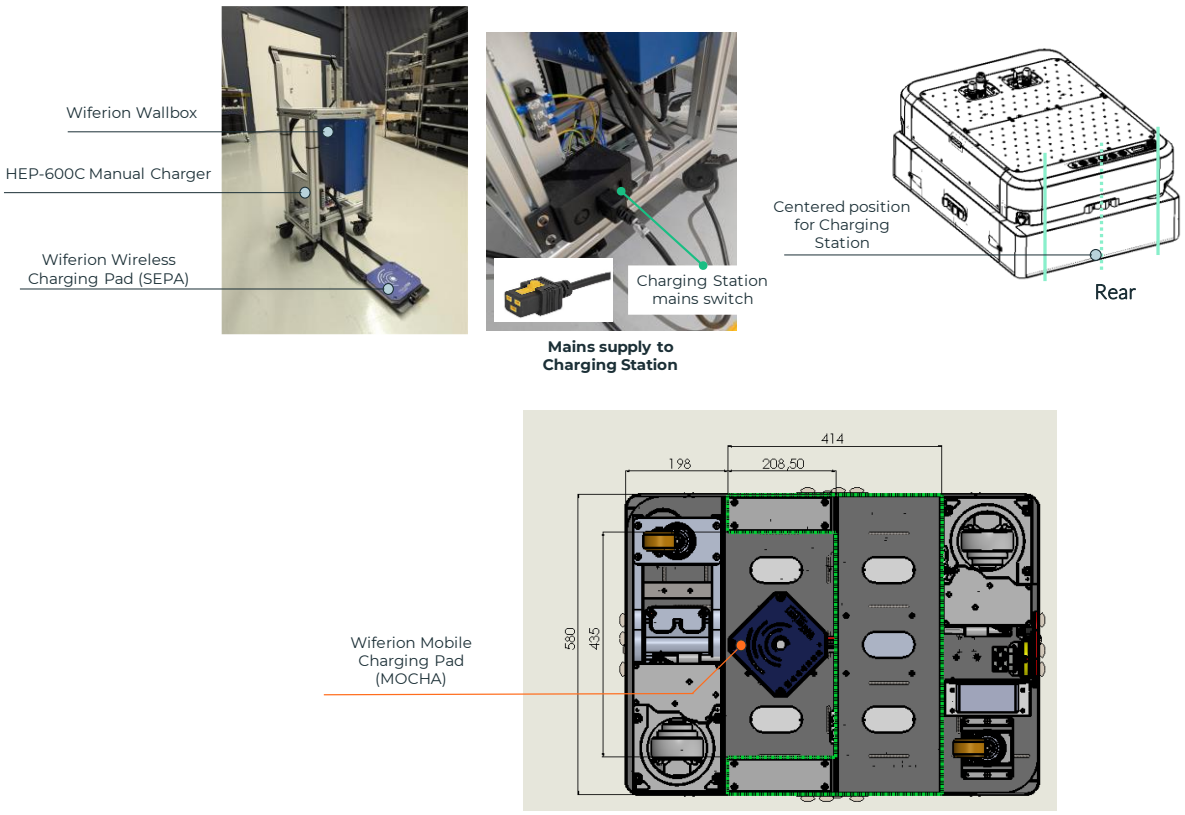


Figure 26: TMR nominal charging

SAFTEY-INSTRUCTIONS

Ensure that the Charging Station is connected to the mains supply and is turned off.

NOTICE

- Ensure that the TMR is enabled/powered on before wireless charging takes place.
- Wireless charging is not possible when the TMR is powered off.

Steps for wireless charging:

1. Pull open the wireless charging pad (SEPA) and lay it flat on the floor.
2. With the SEPA on the floor, move the Charging Station and position it approximately centered on the rear-side of the TMR. The SEPA should slide underneath the TMR.
3. The SEPA from must be aligned with the Mobile Charging Pad (MOCHA) underneath the TMR for the inductive charging to begin. The Wiferion inductive charging system allows a high positional tolerance between these charging pads.
4. Once correct positioning is ensured, turn on the Charging Station.
5. The SoC indicator on the UI Panel should show rising voltage to confirm that charging is taking place.

7.4 Rescue charging sequence.

When the TMR runs out of battery, wireless charging is not possible. This rescue charging sequence is intended, as the name suggests, to rescue the TMR from such situations. Once enough charge is provided, the user can revert to nominal charging sequence with the wireless charger.

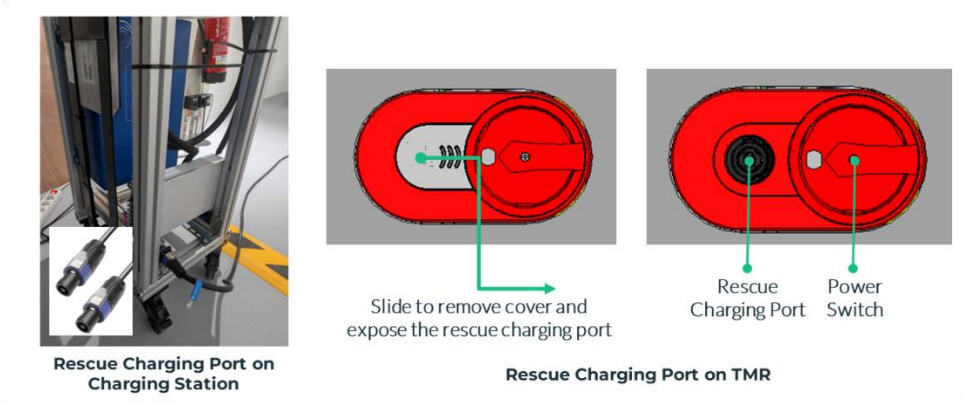


Figure 27: TMR rescue charging

SAFTEY-INSTRUCTIONS

1. Ensure that the Charging Station is connected to the mains supply and is turned off.
2. Ensure that the TMR is powered off.

Steps for manual rescue charging:

1. Connect the cables (with SPK connectors on both ends) to the charging station and to the TMR.
2. Turn on the Charging Station mains switch.
3. Turn on the TMR Power Switch

⚠ WARNING

Do not use the Wiferion wireless charger for charging the system overnight. If there is a need for overnight charging, for example to rebalance the batteries, use the wired charging system.

7.5 Software-Interfaces

The primary software interface for the TMR is libfranka, for operational tasks such as monitoring the battery status and managing charging (start/stop). The TMR User Interface (UI) offers dedicated controls within the Dashboard page.

8 FRANKA SPINE

(Type: Accessory Prototype)

The Franka Spine is a vertical lift design primarily to provide an additional degree of freedom during dual-arm manipulations.

It is compatible with:

- **TMR** – enabling integration with the Tactile Mobile Robot platform.
- **Spine Pedestal** (not yet available for users).

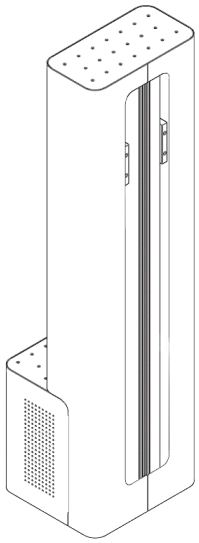


Figure 28: Franka Spine

8.1 Datasheet

Franka Spine				
Drive system	linear guideway and ball-screw		**Back-drive resistance**	300W 10Ω
Degrees of Freedom	1		**Lead**	20 mm/rev
Dimensions	300 x 275 x 1111 mm		**Stroke**	827 mm
Weight	45 kg		**Max Input Torque**	2.37 Nm
Max. Payload	50 kg		**Max Holding Torque**	1.91 Nm
Max. Speed	0.3 m/s			

8.2 Physical User Interfaces

8.2.1 Spine Back and Top Plate Mounting Holes

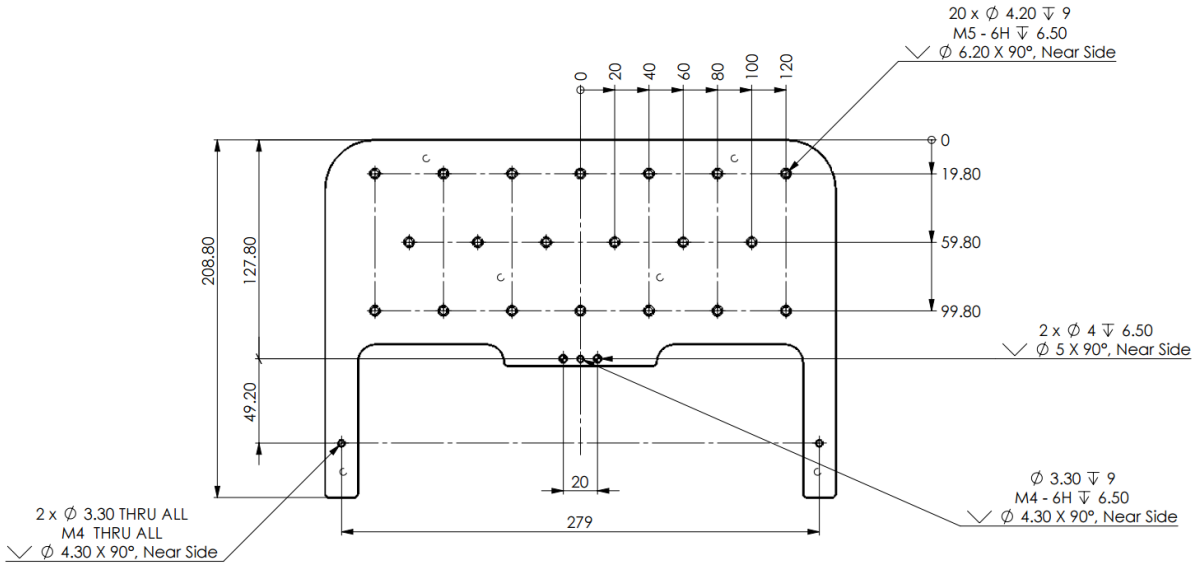


Figure 29: Spine back plate

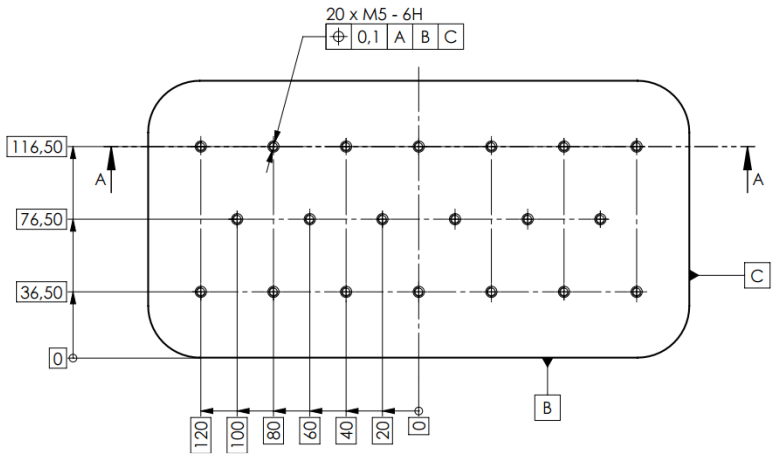


Figure 30: Spine top plate

8.3 Software Interfaces

The primary software interface for the TMR is libfranka, the same library used for controlling Franka Research 3 robots.

For operational tasks such as spine recovery and enabling/disabling the spine, the TMR user interface (UI) provides dedicated controls within the Dashboard page.

9 FR3 DUO MOUNTING KIT V0.3

(Type: Accessory Prototype)

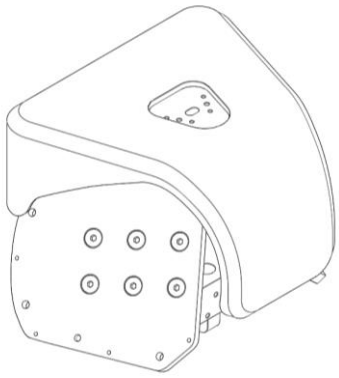


Figure 31: FR3 Duo Mounting Kit v0.3

9.1 Datasheet

FR3 Duo Mounting Kit v0.3	
Dimensions	290mm x 210mm x 250mm
Weight	5 kg
Maximum payload	50 kg
Degrees of freedom	0
Orientation of Arm Adapter	left Arm Adapter*: [Roll, Pitch, Yaw] = [-51.18507533, -10.00159382, -26.54771649] ° right Arm Adapter*: [Roll, Pitch, Yaw] = [+51.18507533, -10.00159382, +26.54771649] ° * As seen from the front view
Installation position	upright
Ambient temperature	+5 to +45 °C

Refer to the Quick Guide for Installation FR3 Duo (R04240) for more details.

10 FRANKA HEAD BRACKET V0.2

(Type: Accessory prototype)

The Franka Head Bracket v0.2 has a camera holder compatible only with the ZED Mini camera.

The bracket is compatible with being mounted on top of the FR3 Duo Mount v0.3.

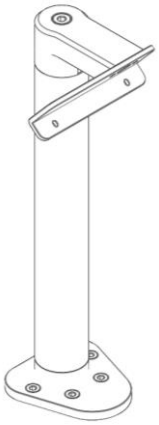


Figure 32: Franka Head Bracket v0.2

10.1 Datasheet

Franka Head Bracket v0.2	
Dimensions	250mm x 82mm x 80mm
Weight	~1 kg

Refer to the "Quick Guide for Installation FR3 Duo" (R04240) for more details.

11 HANDLING, TRANSPORT & MAINTENANCE

This section provides guidelines for the safe handling, transportation, and maintenance of the Tactile Mobile Robot (TMR). Proper handling is essential to prevent damage to the robot and ensure the operator's safety. The technical drawing below illustrates the dimensions and structural layout, which should be considered when planning lifting, transport, and maintenance activities.

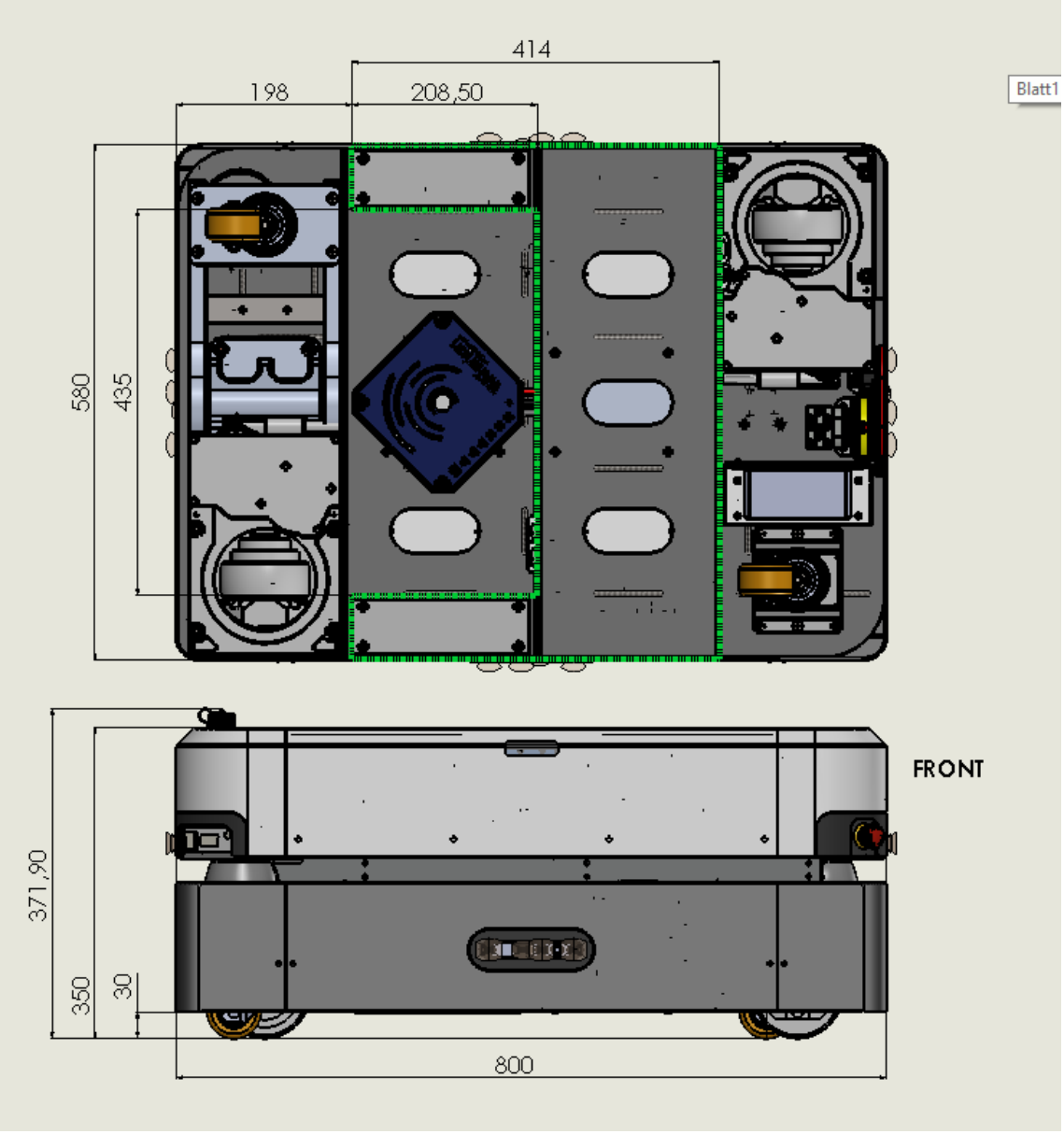


Figure 33: Technical illustration

11.1 Areas for Manual Handling without Special Equipment

The designated area for safely lifting the TMR manually by a minimum of 4 people is as shown below:

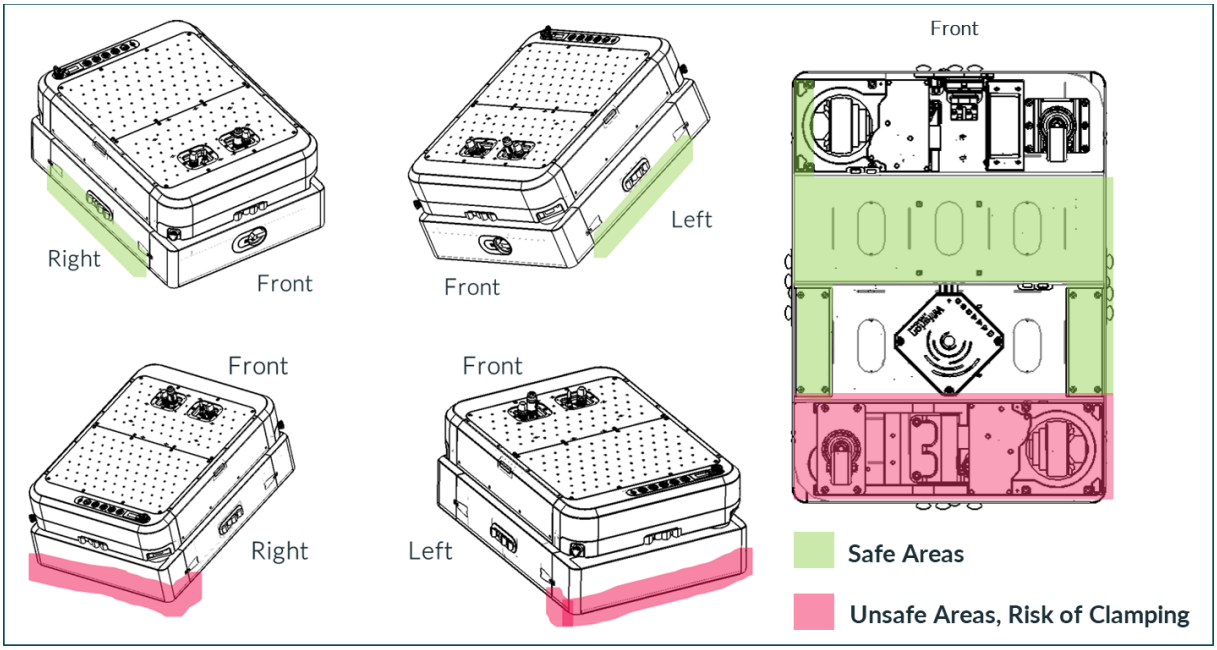


Figure 34: Designated Manual Handling Zones for TMR

NOTICE

The rear part of the TMR has a rear-axle which swivels about its axis. Lifting the TMR in this area poses a risk of clamping of fingers or hands.

11.2 Areas for Handling with Special Equipment

Still being defined.

12 FAQ

12.1 Desk Shows 500 Internal Server Error

Figure 35: Server showing a 500 Internal Server Error

This error indicates that the data on the disk of the TMR controller was corrupted during shutdown. It can be resolved by booting into the Rescue System and performing a Factory Reset.

NOTICE

Contact the Franka team for a clear description to troubleshoot this error.

The process of fixing the above error will delete your configuration and all installed features. These will need to be reinstalled.

13 TABLE OF FIGURES

Figure 1: TMR Type Label....7
Figure 2: Franka Spine Type Label....7
Figure 3: TMR Charging Station....7
Figure 4: Mobile FR3 Duo....8
Figure 5: Side and top views of the robot workspace, showing maximum reach and operating envelope dimensions. 9
Figure 6: ISO cube for FR3 Duo....9
Figure 7: Dual arm workspace. 10
Figure 8: Workspace relative to Franka Spine Position 10
Figure 9: Tactile Mobile Robot (TMR)....12
Figure 10: Power Switch and Rescue Charging....13
Figure 11: TMR onboard E-Stop 14
Figure 12: FORT Wireless E-Stop (WES-Tx)....14
Figure 13: FORT VSC-Rx Configuration Cable....14
Figure 14: UI Panel....15
Figure 15: Spine Connection Bays....16
Figure 16: Exposed Router WAN Port....16
Figure 17: TMR Top Plate Front - variant A 16
Figure 18: TMR Top Plate Front - variant B....17
Figure 19: Top Plate - variant A....18
Figure 20: Top Plate Rear - variant B 18
Figure 21: TMR Type Label 19
Figure 22: User Interface 20
Figure 23: System Overview of FR3 DUO Setup 21
Figure 24: FR3 Duo....25
Figure 25: TMR charging station....27
Figure 26: TMR nominal charging 28
Figure 27: TMR rescue charging....29
Figure 28: Franka Spine....30
Figure 29: Spine back plate 31
Figure 30: Spine top plate....31
Figure 31: FR3 Duo Mounting Kit v0.3....32
Figure 32: Franka Head Bracket v0.2....33
Figure 33: Technical illustration 34
Figure 34: Designated Manual Handling Zones for TMR....35
Figure 35: Server showing a 500 Internal Server Error 36

Franka Robotics GmbH
Koppstraße 12
81379 Munich
Germany

franka.de