FRANKA EMIKA

Panda research

TECHNICAL DATA [1, 2]

Arm	
degrees of freedom	7 DOF
payload	3 kg
sensitivity	joint torque sensors in all 7 axes
maximum reach	855 mm
joint position limits [°]	A1: -170/170, A2: -105/105, A3: -170/170, A4: -180/5, A5: -170/170, A6: -5/219, A7: -170/170
joint velocity limits [°/s]	A1: 150, A2: 150, A3: 150, A4: 150, A5: 180, A6: 180, A7: 180
Cartesian velocity limits	up to 2 m/s end effector speed
repeatability	+/- 0.1 mm (ISO 9283)
interfaces	▪ Ethernet (TCP/IP) for visual intuitive programming with Desk ▪ 1x input for external activation device ▪ Control connector ▪ Hand connector
interaction	buttons for: guiding, selection of guiding mode
mounting flange	DIN ISO 9409-1-A50
installation position	upright
weight	~ 18 kg
protection rating	IP30
ambient temperature	+15°C to 25°C (typical) +5°C to + 45°C (extended) [3]
air humidity	20% to 80% non-condensing
Control	
interfaces	▪ Ethernet (TCP/IP) for Internet /network connection ▪ power connector IEC 60320-C14 (V-Lock) ▪ Arm connector
controller size (19”)	355 x 483 x 89 mm (D x W x H)
supply voltage	100 V_{AC} - 240 V_{AC}
mains frequency	47- 63 Hz
power consumption	▪ max. 600 W ▪ average ~ 300 W
active power factor correction (PFC)	yes
weight	~ 7 kg
protection rating	IP20
ambient temperature and air humidity	see Arm
Pilot	
interaction and remote control	navigation pad and buttons for: Hand/Desk control mode, OK, SAVE, CANCEL

Hand	
parallel gripper	with exchangeable fingers
grasping force	force up to 70 N
travel (travel speed)	80 mm (30 mm/s)
Desk [4]	
platform	via browser on regular devices
architecture	distributed, service-oriented
programming	visual & intuitive, dialog-based
Apps	can be composed into complex workflows to create Tasks and Solutions
Panda research [5]	
Franka Control Interface (FCI)	General information ▪ Ethernet based communication up to 1 kHz [6] ▪ provided as C++ library Control modes ▪ gravity & friction compensated joint level torque command ▪ desired joint position or velocity command ▪ desired Cartesian position or velocity command ▪ Hand control Feedback data ▪ measured joint data ▪ low-level desired joint goals ▪ estimation of externally applied torques and wrenches ▪ various collision and contact information
Robot Model Library	▪ forward kinematics ▪ Jacobian matrix ▪ inertia, Coriolis and gravity terms
ROS support	▪ access to Franka Control Interface (FCI) from ROS ▪ URDF model of Panda research
license	non-commercial use only

[1] **technical data is subject to change**

[2] the user is responsible for the performance of a risk analysis and safe operation of the robot in accordance to its intended use and applicable standards and laws

[3] performance can be reduced when operating outside the typical temperature range

[4] Desk is deactivated when using the Franka Control Interface (FCI)

[5] view ANNEX for further information

[6] depending on computing equipment and network setup

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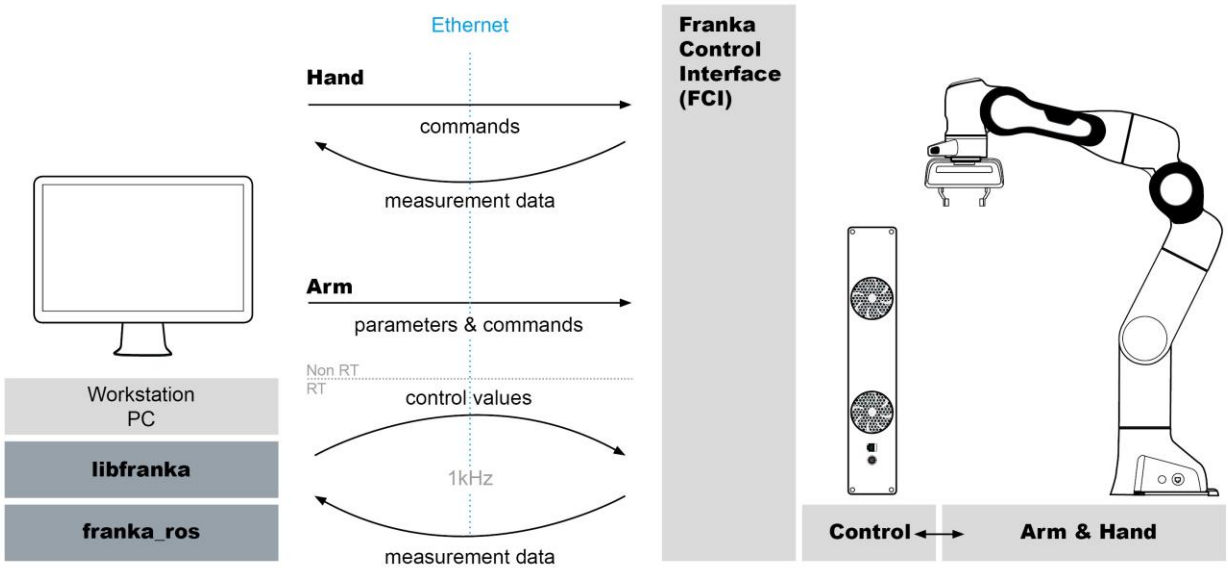
ANNEX[1]

Panda research provides a fast and direct low-level bidirectional connection to the Arm. This interface, specifically designed for the needs of researchers and scientists, offers a set of functionalities that allows you to remote-control the robot from within your own application. This can be done either by closing control loops or feeding desired motions among other things.

The **C++ library** is run remotely on a workstation PC. The connection to Control is established via a standard Ethernet connection. The interface provides high-speed measurements, internal data of the robot and accepts parameters and control values at an update frequency of up to 1 kHz.



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Franka Control Interface (FCI)

This interface is the central component of Panda research, providing data and enabling you to control the robot.

Control

The possibility to send real-time control-values allows executing custom robot behavior:

- gravity & friction compensated joint level torque command
- desired joint position or velocity command
- desired Cartesian position or velocity command

[1] This document is intended to provide the interested reader a better understanding of the TECHNICAL DATA

Feedback data

This interface provides access to following data:

- measured joint data (position, velocity, link side joint torque sensor signals)
- low-level desired joint goals
- estimation of externally applied torques and wrenches
- various collision and contact information

NOTE: While Franka Control Interface is active you have full control of the robot, but you cannot use Desk. This means that you cannot use Apps and the Franka Control Interface (FCI) at the same time.

Robot model library

The library provides you with following quantities:

- forward kinematics of all joints
- Jacobian matrix of all joints
- dynamics (inertia matrix, Coriolis and centrifugal vector and gravity vector)

Additionally, important parameters such as control-mode, joint/Cartesian stiffness or additional loads can be set from the C++ library**.** Furthermore, you can control the Hand.

The **ROS support** allows interfacing the Arm via your own ROS-nodes and make use of the entire ROS ecosystem. It also comes with a URDF model of the Arm, which allows for visualization and kinematic simulations.

Future Prospects

Panda research is constantly being further developed. New functionalities will be available in the future. **The Franka Community** will be launched soon, enabling you to develop your own **Apps** and share them with the community. As you can see there's a lot more to come …

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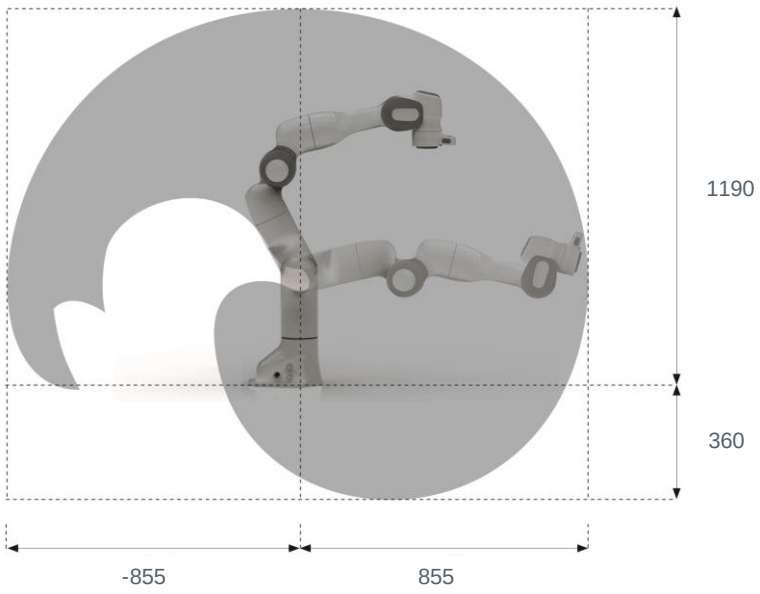
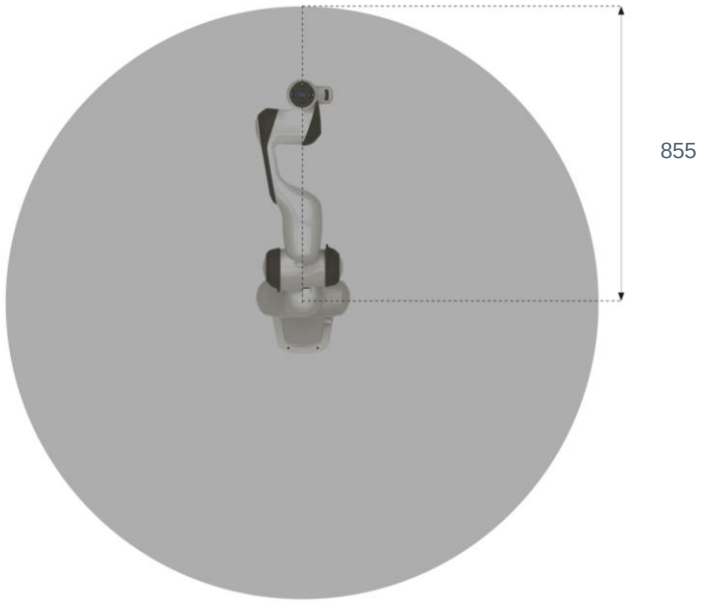
The following illustrations represent the workspace of the Arm. All dimensions in mm.



1. Arm workspace side view



2. Arm workspace top view

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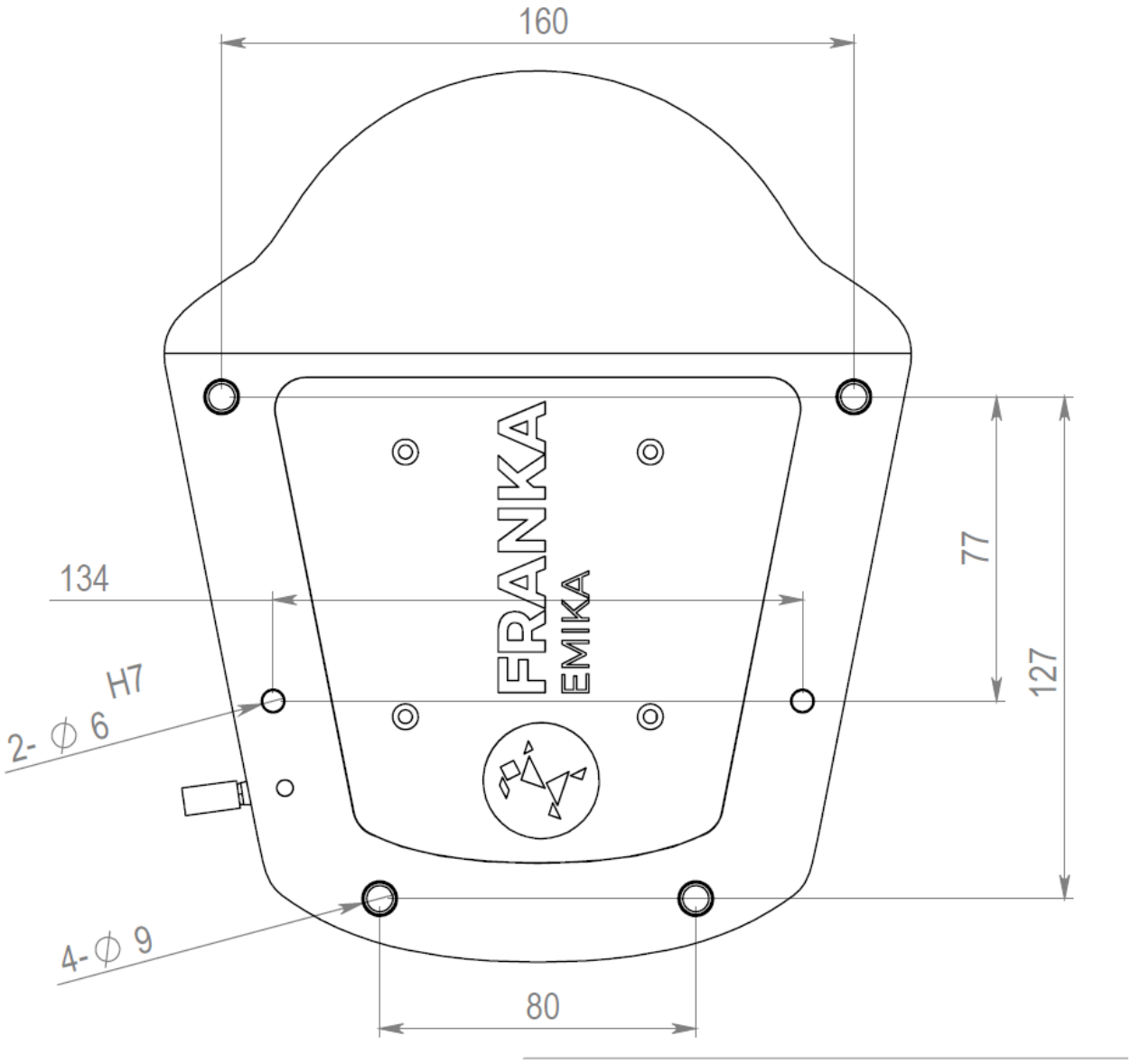

3. Arm footprint

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