



# FRANKA EMIKA CONNECTS.

## Redefining Robotics

At Franka Emika – a deep-tech company from Munich, Germany – we redefined robotics with the world's most advanced robotic system Panda Powertool. In pursuit of high-performance and accessibility, we have combined human-centered design with trustworthy German engineering, giving rise to a masterpiece of technology. Highest mechatronic integration, exceptional soft-robot performance, as well as advanced and extendable functionalities unleashed unprecedented usability, best affordability and unlimited scalability.

## Establishing a community

Having set the groundwork by redefining robotics, a broad spectrum of users gained access to an empowering technology. With decades of experience in world leading soft-robotics research, in 2017 we started shipping to experts worldwide to share our breakthrough. Besides elevating robotics and control research, our AI-enabled robot platform is being used by the most renowned Machine Learning and Artificial Intelligence research institutes and enterprises as well as in health care and education. We then established a global partner network of software and hardware developers, distributors and solution providers to transfer our technology into elegant, robust and profitable robot-assisted automation solutions. Panda Powertool thus became the fastest selling industry-suited robotic system within the first year of delivery. Since then, users – from highly-skilled robotics professionals to factory workers of small medium businesses as well as global enterprises – are benefiting from this novel easy-to-use, flexible, cost-efficient and scalable approach.

## Introducing Franka World

After redefining robotics and establishing a community, we launched a novel digital robotics platform to interconnect the digital with the physical world. Franka World enables community interaction between researchers, partners, customers, developers, suppliers and... robots to push the frontiers of Industrie 4.0. Besides communication, everyone is able to easily gain integrated access to products, services and management of entire robot fleets, independent of their physical location.

We are committed to create novel robotics platform technologies, improve performance and accessibility for everyone to overcome one of the biggest challenges of modern society, relieving an entire generation of tedious, potentially dangerous, vastly time-consuming and monotonous labor. We strive for a world where everyone can use a robot and we can reach that by connecting the world.

Franka Emika – designed, developed and made in Germany.

Keep creating and think beyond!

Simon

CEO & Co-Founder

# PANDA SOLUTION

## Groundbreaking innovation for cost-efficient and scalable solutions

We redefined robotics with the world's most advanced robotic system Panda Powertool, the fastest selling industry-suited robotic system. Our customers – from SMBs to global enterprises – profit from this novel easy-to-use, flexible, cost-efficient and scalable solution.



### **VERSATILE TO FIT YOUR BUSINESS**

Panda can serve mass production, as well as high-mix low-volume production runs. This requires flexibility, from the setup of new workstations to adjustments of existing tasks. Panda's soft-robot performance allows production processes that require precision, force application and sensitive handling. Thus, Panda perfectly fits the 3C industry across all types of applications, especially testing, inspection, handling, packaging and assembly.



### **INDUSTRY-READY AND IMMEDIATE TO INTEGRATE**

Panda can be integrated quickly into an existing production infrastructure and supports modern and commonly employed industrial communication protocols. With its small footprint and 7 axes, Panda can reach far-off as well as very close to its own base, an ideal capability for constrained environments. The entire system comes in one box delivery, can be powered up by general-purpose power outlets and is ready to use within minutes. With the launch of Franka World, you can push the frontiers of Industrie 4.0 and its advantages, gaining integrated access to products, services and management of entire robot fleets, independent of their physical location.



### **ACCESSIBLE FOR EVERYONE**

Panda offers the easiest and fastest workflow-based user experience. Robot apps represent modular building blocks of production processes such as grasping, plugging, insertion and screwing which can be arranged to create entire tasks in no time. These tasks can quickly be deployed on multiple robots to remarkably reduce setup costs. Additionally, a broad spectrum of users – from highly-skilled robotics professionals to factory workers – can be trained quickly without any prior know-how of Panda.



### **HIGHEST ROI IN THE MARKET**

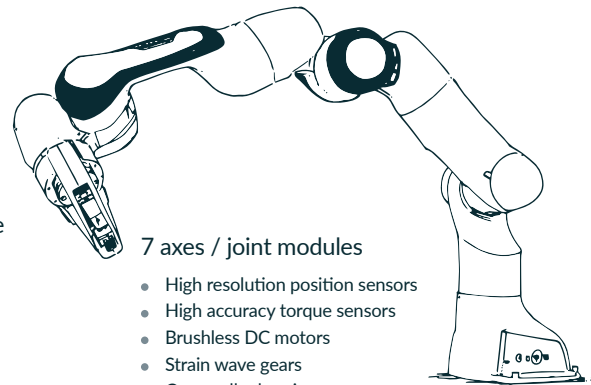
The outstanding soft-robot performance unleashed by Panda, Franka Emika's masterpiece of technology, is stunningly affordable due to proprietary technology, optimized design, and mass production. Besides that, versatility, industry-readiness, easy-integration and accessibility ensure the highest return on investment for your company.



# PANDA POWERTOOL

Human-centered design combined with trustworthy German engineering

Panda has been designed to be lightweight and manufactured in large quantities. It incorporates the highest mechatronic integration and is equipped with more than a hundred sensors. Our payload to moving mass ratio of 1 to 4 was achieved by diligent mechanical design and development all the way from system to component level. As a global product with local roots, Bavaria is home to Panda's manufacturing site and our supply chain is nearly 90% European.



## 7 axes / joint modules

- High resolution position sensors
- High accuracy torque sensors
- Brushless DC motors
- Strain wave gears
- Cross roller bearings

## Soft-robot performance

### MOTION



Panda incorporates the features of a classical stiff industrial robot with a pose repeatability of +/- 0.1 mm and a negligible path deviation even at high velocities of up to 2 m/s. This allows precise, robust and fast execution of manufacturing processes.

### FORCE



#### Sensing

Inspired by the human sense of touch, Panda is equipped with link-side torque sensors in all 7 axes. Outstanding resolution, accuracy and repeatability allow the robot to dynamically sense the surrounding environment, even exceeding the performance of most purpose-made force sensors.



#### 1 kHz Control

Panda can be used to apply forces with a minimum of 0.05N in order to conduct delicate tasks, for instance pressing, insertion, and screwing. Continuous and accurate fine-tuning of forces is also a prerequisite for applications such as contour tracking, polishing and grinding.

### INTERACTION



Panda features adjustable guiding modes that compensate gravity and friction to reduce the perceived weight up to a factor of 60, ensuring smooth and elegant physical interaction between human and machine. Our sophisticated sensors, control algorithms and internal model allow prompt detection and reaction upon unwanted collisions within milliseconds. Besides that, Panda's flexible torque-controlled joints can act compliant or stiff in the same way humans contract or relax their muscles to adapt to a task or the environment.

# PANDA - DATASHEET <sup>1</sup>

May 2019

## HARDWARE

### Arm

Degrees of freedom	7
Payload	3 kg
Workspace	see backside
Maximum reach	855 mm
F/T Sensing	link-side torque sensors in all 7 axes
Expected nominal lifetime <sup>3,4</sup>	20,000 h
Joint position limits [°]	A1, A3, A5, A7: -166/166 A2: -101/101 A4: -176/-4 A6: -1/215
Mounting flange	DIN ISO 9409-1-A50
Installation position	upright
Weight	~ 17.8 kg
Moving mass	~ 12.8 kg
Protection rating	IP30
Ambient temperature <sup>2</sup>	15 – 25 °C (typical) 5 – 45 °C (extended)
Air humidity	20 – 80 % non-condensing
Power consumption	<ul style="list-style-type: none"> <li>max. ~ 350 W</li> <li>typical application ~ 60 W</li> </ul>
Interfaces	<ul style="list-style-type: none"> <li>ethernet (TCP/IP) for visual intuitive programming with Desk</li> <li>input for external enabling device</li> <li>input for external activation device or safeguard</li> <li>Control connector</li> <li>Connector for end-of-arm tooling</li> </ul>

### Control

Controller size (19")	355 x 483 x 89 mm (D x W x H)
Supply voltage	100 – 240 V <sub>ac</sub>
Mains frequency	47 – 63 Hz
Power consumption	~ 80 W
Active power factor correction (PFC)	yes
Weight	~ 7 kg
Protection rating	IP20
Ambient temperature	15 – 25 °C (typical) 5 – 45 °C (extended)
Air humidity	20 – 80 % non-condensing
Interfaces	<ul style="list-style-type: none"> <li>ethernet (TCP/IP) for internet and/or shop-floor connection</li> <li>power connector IEC 60320-C14 (V-Lock)</li> <li>Arm connector</li> </ul>

## SOFT-ROBOT PERFORMANCE

### Motion

Joint velocity limits [°/s]	A1, A2, A3, A4: 150 A5, A6, A7: 180
Cartesian velocity limits	up to 2 m/s end effector speed
Pose repeatability	< +/- 0.1 mm (ISO 9283)
Path deviation <sup>3</sup>	< +/- 1.25 mm

### Force

#### Sensing <sup>3</sup>

Force resolution	<0.05 N
Relative force accuracy	0.8 N
Force repeatability	<0.15 N
Force noise (RMS)	<0.035 N
Torque resolution	<0.02 Nm
Relative torque accuracy	0.15 Nm
Torque repeatability	<0.05 Nm
Torque noise (RMS)	<0.005 Nm

#### 1 kHz Control <sup>3</sup>

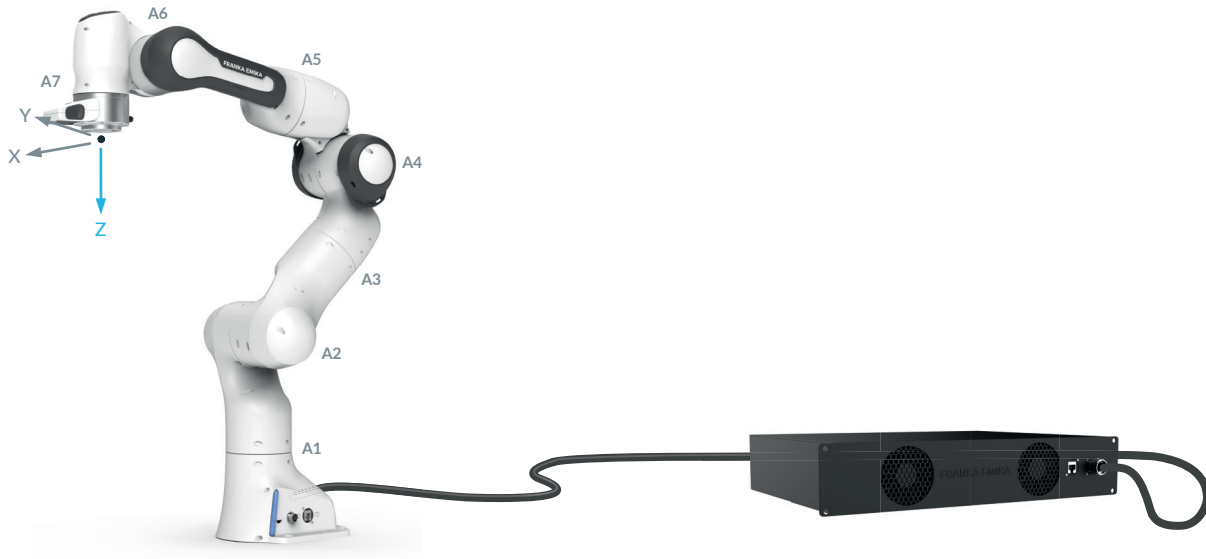
Minimum controllable force (Fz)	0.05 N	
Force controller bandwidth (-3 dB)	10 Hz	
Force range [N]	Nominal case	Best case
Fx	-125 – 95	-150 – 115
Fy	-100 – 100	-275 – 275
Fz	-50 – 150	-115 – 155
Torque range [Nm]	Nominal case	Best case
Mx	-10 – 10	-70 – 70
My	-10 – 10	-16 – 12
Mz	-10 – 10	-12 – 12

### Interaction

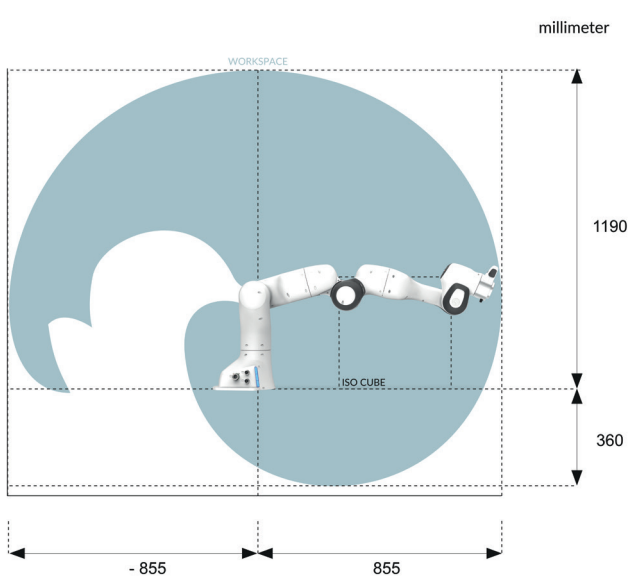
Guiding force	~ 2 N
Collision detection time	<2 ms
Nominal collision reaction time <sup>3,4</sup>	<50 ms
Worst case collision reaction time <sup>3</sup>	<100 ms
Adjustable translational stiffness	0 – 3000 N/m
Adjustable rotational stiffness	0 – 300 Nm/rad
Monitored signals	Joint position, velocity, torque Cartesian position, velocity, force

## ADD-ONS

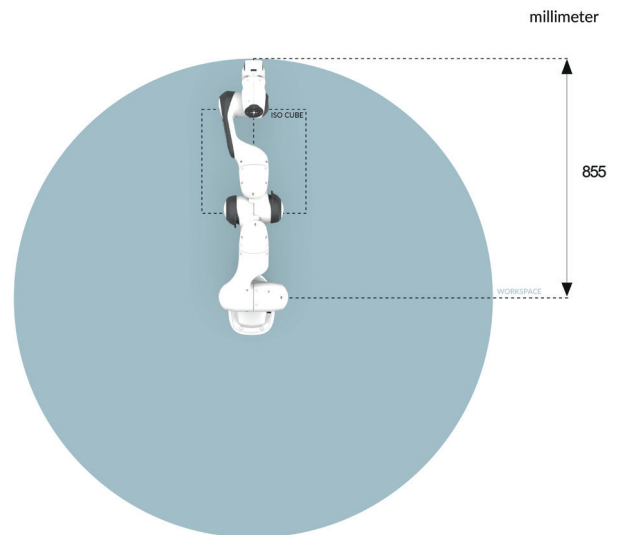
Safety retrofit option with safety-rated PLC	PLd Cat. 3 <ul style="list-style-type: none"> <li>Safe torque off (STO)</li> <li>Safe OSSD inputs</li> </ul>
Fully integrated end effectors	<ul style="list-style-type: none"> <li>2-finger gripper</li> <li>Vacuum gripper</li> </ul>
Fast mounting	Paw
Demonstration	Pop-up Box
Research interface	1kHz Franka Control Interface
Fieldbuses	Modbus/TCP, OPC UA, Profinet



Arm & Control



Workspace side-view



Workspace top-view

1. Technical data are subject to change.
2. Lifetime and performance can potentially be reduced when operating outside the typical temperature range.
3. Based on ISO 9283 (Annex A), specified values refer to a workspace of 0.4 x 0.4 x 0.4 m centered at [0.515, 0.0, 0.226] m, with the Z-Axis of the flange oriented parallel to earth-gravity and the elbow positioned upwards.
4. Nominal conditions (66% load).

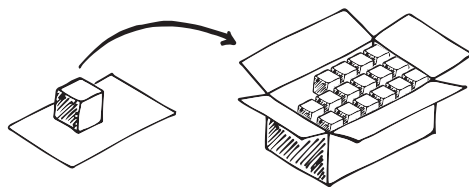
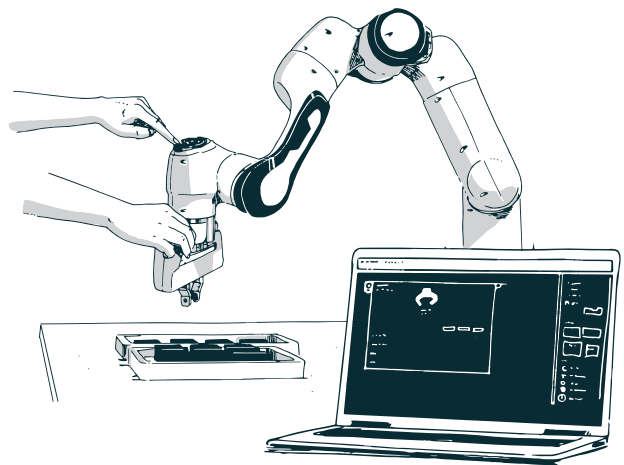
# WORKING WITH PANDA

## Workflow-based programming

Panda offers the easiest and fastest workflow-based programming experience. Robot apps incorporate the entire complexity of the system and represent modular building blocks of a production process such as grasping, plugging, insertion and screwing. Using Desk – Franka Emika’s browser based interface – apps can be arranged to create entire tasks in no time. These tasks can quickly be adapted, reused or deployed on multiple robots to remarkably reduce setup costs. Individual apps and tasks can be parameterized by means of showing Panda poses by demonstration, or adding context relevant parameters such as speed, duration, forces, and triggering actions.

## Developing apps and services

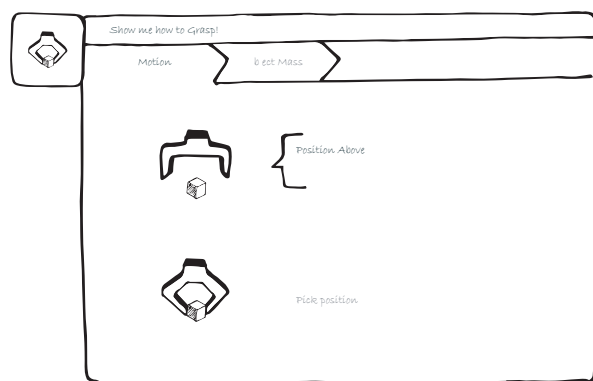
Our programming paradigm offers the possibility to develop new apps with customized interfaces, user dialogues, as well as specific and extended functionalities. Besides, services can easily be created to seamlessly integrate software and hardware extensions. Apps and services can then be deployed through Franka World in order to reach a large community, accelerating the distribution of your solution and multiplying your business case.



A. Set up the task that you would like to automate.



B. Arrange your apps into a sequence to recreate the workflow.



C. Teach Panda and parameterize each app via dialog-based interaction.

## Franka World connects

Franka World is an online platform that interconnects Franka Emika's customers, partners, developers and robots!

By bringing Pandas into the cloud, all parties can mutually benefit from each other's interaction, and gain integrated access to the products and services provided by Franka Emika and our network of qualified partners.



## The benefits of Franka World

Franka World provides customers with centralized and remote management of their fleets of Franka Emika robots, and the possibility to access the store, to browse a continuously growing portfolio of accredited software and hardware extensions. Franka World also draws together an active and passionate community of professionals who will contribute to your success with integration services and support.

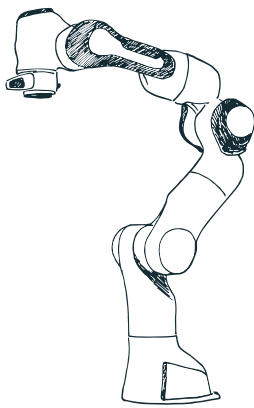
- Register robots
- Browse Store
- Try out apps and features
- Purchase robots, end-effectors, apps and features
- Install apps and features on robots
- Move apps and features between robots
- User role management
- Overview of registered robots
- Robot system updates
- Share tasks between robots
- Robot task status dashboard
- Robot live data dashboard
- Upload apps
- Access support and integration services



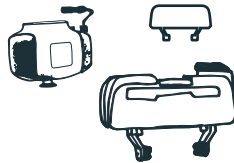
# MODULAR PRICING

See how you could solve your automation challenges and save costs with us!

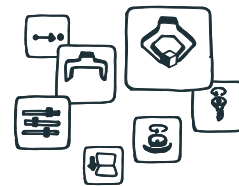
Our ready-to-go solutions are a perfect fit for common applications, as well as can be a great starting point to build upon a more complex automation case. Once you have identified an automation need, contact our sales team at [sales@franka.de](mailto:sales@franka.de) and they will guide you through the process that includes the following steps:



A. Purchase Panda.



B. Choose your end effector.



C. Choose your software.

## Add value with consulting and integration services.

If your automation project is more complex and requires a personalized solution, the integration and development costs of our partners will be added. Please talk to our sales team and they will connect you to one of our partners, who will assist in designing the best solution for you and in determining if unique software and hardware extensions are required.

Partners' services include:

- reselling and distributing Panda robots locally or globally
- consulting customers about the best robot-application fit
- consulting about risk assessment prior to integration
- integrating Panda into existing production lines accordingly
- developing solutions which might include both custom hardware and software
- troubleshooting and assisting the customer with first line support
- providing training and education services



Product Developers



App Developers



Solution Providers



Resellers



Education Providers

For more details on our partners and to choose the right one, visit our webpage <https://franka.de/partners> or send us an email to [sales@franka.de](mailto:sales@franka.de), and our team will promptly redirect the lead to the most suitable partner.

Are you interested in becoming a partner company? Consult our CONTACTS page and connect to our partner managers.

# CONTACTS

We are thrilled you want to get in touch!

We've put together an easy directory to help you find the right department to reach out to.

## Sales

If you are considering purchasing a Panda robot, please send an email to [sales@franka.de](mailto:sales@franka.de). We will work with you directly, or connect you to one of our authorized partners ([www.franka.de/partners](http://www.franka.de/partners)).

## Become a partner

If you are an expert in one of these automation services, and enthusiastic about becoming a partner, we are looking forward to discussing ideas and opportunities together! Feel free to contact our partner managers:

KIM ZANTHOFF	<a href="mailto:kim.zanthoff@franka.de">kim.zanthoff@franka.de</a>	America
MICHAEL HIEBINGER	<a href="mailto:michael.hiebinger@franka.de">michael.hiebinger@franka.de</a>	Germany
CHRISTOPHER WALTHER	<a href="mailto:christopher.walther@franka.de">christopher.walther@franka.de</a>	Western / Middle Europe and Nordics
STEPHAN QUADE	<a href="mailto:stephan.quade@franka.de">stephan.quade@franka.de</a>	Middle / Eastern Europe and Turkey
SÖREN TEICHMANN	<a href="mailto:soeren.teichmann@franka.de">soeren.teichmann@franka.de</a>	Asia-Pacific

## Press

Are you a media representative who wants to make an editorial or feature with Franka Emika or an interview with one of our team members? Download our press kit from [www.franka.de](http://www.franka.de), or reach out to Anna Sharova at [press@franka.de](mailto:press@franka.de)

## Marketing

If you would like to discuss an exciting collaboration, inquire about a commercial partnership or chat about a presentation at an event – send our Marketing Manager Anna Sharova a line to [marketing@franka.de](mailto:marketing@franka.de)

## Work with us

You fell in love with our team and products and want to work with us? Reach out to our Head of HR Gaby Müller, by sending your CV, motivation letter and supporting documents to [work@franka.de](mailto:work@franka.de)

## General

Have any common questions left? Contact our kind office team Saliha Suelez or Ines Derman with your enquiry at [info@franka.de](mailto:info@franka.de)

## Technical collaborations

Would you like to discuss a partnership and create together new hardware and software extensions? Send all your ideas to [ecosystem@franka.de](mailto:ecosystem@franka.de)

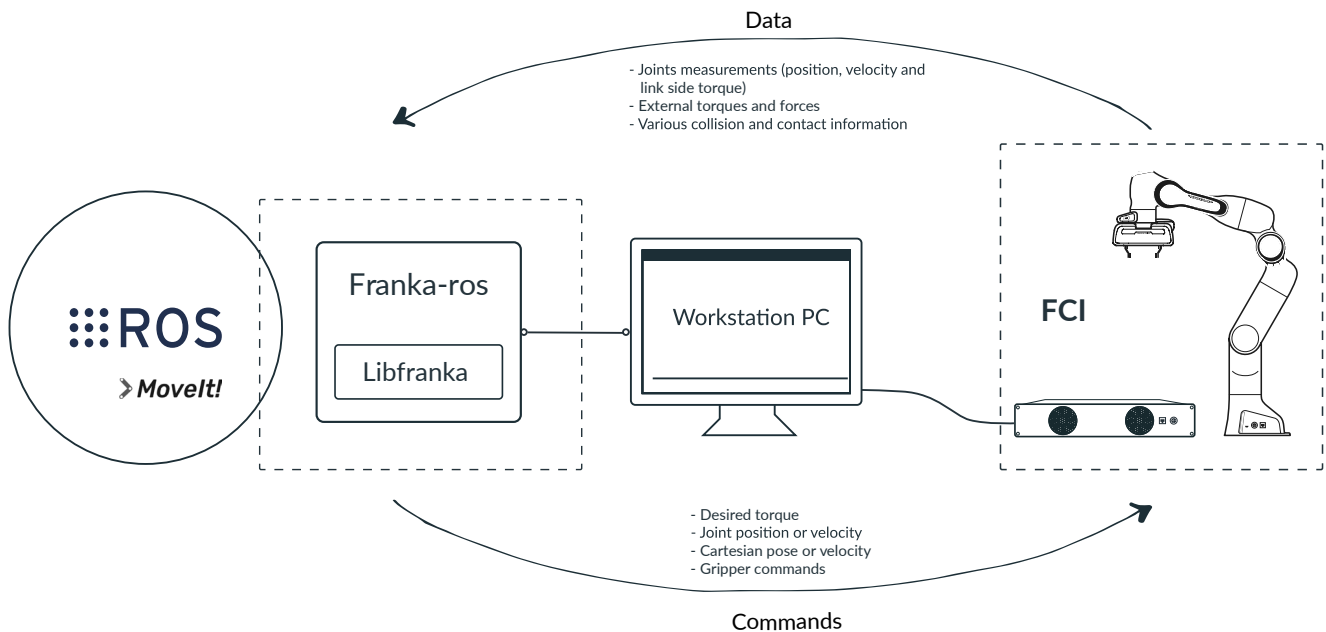
# PANDA FOR RESEARCHERS

## The ideal platform for research

Panda is the ideal platform to conduct research on and test e.g. control and motion algorithms, grasping strategies, interaction scenarios and machine learning, as it features the add-on Franka Control Interface (FCI). FCI allows a fast low-level bidirectional connection to the robot's Arm and Hand.

## Franka Control Interface (FCI)

Activating the FCI\* unlocks the possibility to connect your workstation PC to the Panda system, using a fast and direct low-level bidirectional communication. It provides the current status of the robot and enables its direct control (1 kHz).



Documentation about Franka Control Interface and how to use it can be found at <https://support.franka.de>, which also includes source code and documentation of the open source packages `libfranka` and `franka_ros`.

`libfranka` provides a C++ interface which can run on a workstation PC. It enables you to connect your own applications via standard Ethernet to a Panda with activated FCI.

`franka_ros` connects Panda with the entire ROS ecosystem. It integrates `libfranka` into ROS Control, and includes URDF models and detailed 3D meshes of our robots and end effectors, which allows visualization (e.g. RViz) and kinematic simulations. Additionally, MoveIt! integration makes it easy to move the robot and control the gripper.

*\* FCI cannot be used for commercial purposes. If your plan is to deploy robots for commercial purposes, then Panda in combination with suitable App Packages is your ideal power tool.*

# FRANKA EMIKA AI PLATFORM

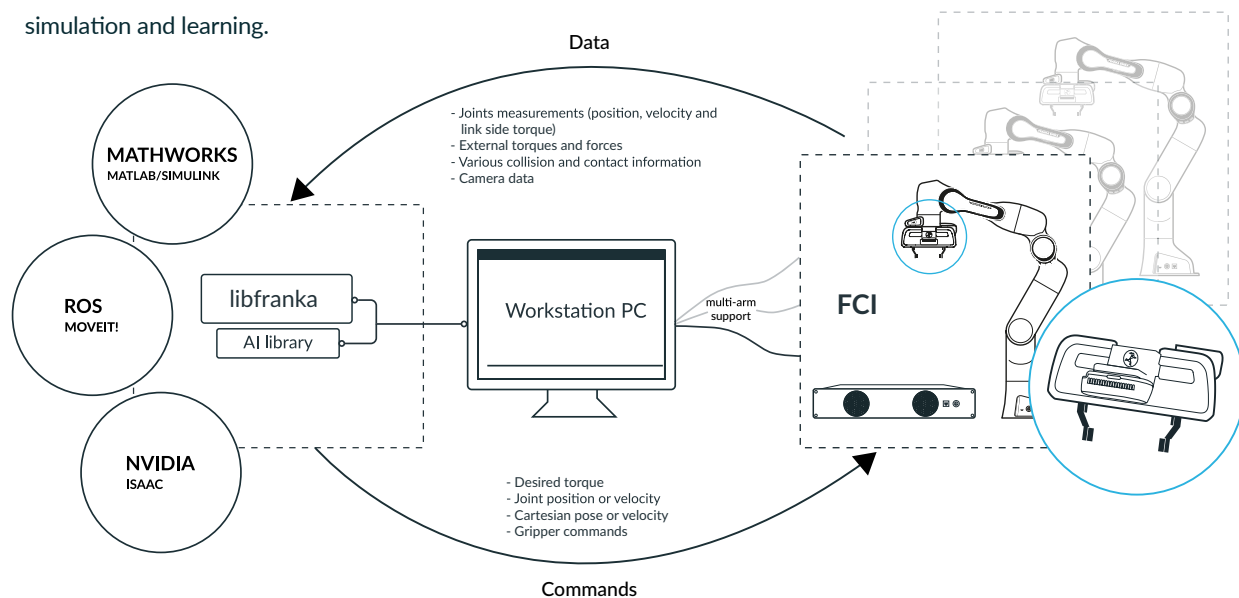
## The ideal embodiment of robotics research

The Franka Emika AI Platform is the perfect setup to explore new control paradigms, optimization and planning approaches, computer vision algorithms or machine learning methods. By combining the accurate torque sensing technology and torque control capabilities of the Panda system together with a vision sensor such as the Intel RealSense D435i, the Franka Emika AI Platform is capable of performing challenging industrial manipulation tasks such as shaft insertion, gear assembly, box stacking, key insertion or cabling. Service robotic tasks such as vision-based grasping or clothing are also perfect scenarios to be explored with this platform.

## Do research out of the box with your favorite framework

Thanks to the platform's integration into the main programming frameworks you will be able to start your research right out of the box. The Franka Emika AI Platform provides in-house support for:

- MATLAB Simulink, the de facto solution for control engineers. You will get full access to all real-time interfaces and dynamic model parameters in our Simulink Toolbox.
- ROS, the most popular robotics framework, including integration into the MoveIt! planning framework, from which Panda is the standard tutorial robot. We provide additional support for multi-arm configurations, external grippers and vision, including intuitive examples for every feature.
- The NVIDIA Isaac SDK, which aims for accelerating robotic AI-based solutions, with a strong emphasis on simulation and learning.



At the lowest level, all these frameworks rely on libfranka, our robust and reliable C++ library that enables a 1 kHz realtime control loop to the Panda Arm. It offers joint position/velocity, Cartesian pose/velocity and desired torque interfaces as well as access to the robot dynamic parameters and real-time measurements from encoders, torque sensors and their respective derivatives. It also provides a command-based interface to the Panda Hand for grasping or moving with a specific grasp force and/or velocity. Check <https://github.com/frankaemika> for code, CAD files for the camera mount, references, models and examples of our platform. Additional support is provided through the lively discussion forum for the research community at <https://www.franka-community.de/>.



