

# USER HANDBOOK

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## PANDA



# INTERACTING & PROGRAMMING

- Direct human-robot interaction
- Creating a task in Desk
  - Desk overview
  - An app for everything
  - Configuring apps
- Executing the task
  - Manual unlocking of Arm and Hand in cases of emergency



# INTERACTING & PROGRAMMING

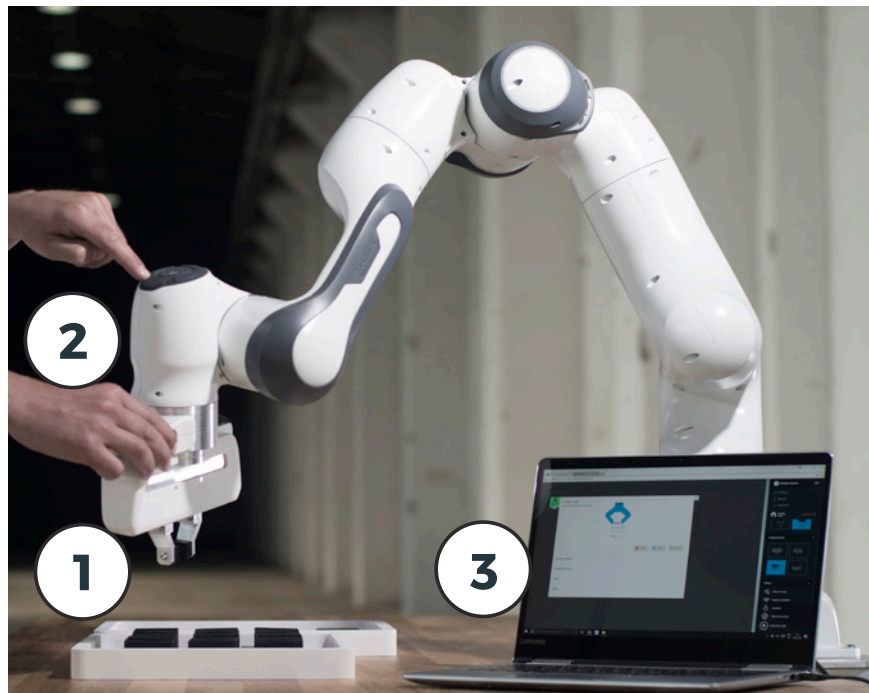
## Direct human-robot interaction

### Interaction concept

We provide several software and hardware components that interact smoothly with each other to offer you intuitive and effective usability for Panda. You can purchase robot apps in the Franka Store and arrange them in Desk to form Tasks. These Tasks can then be saved and archived. You can operate Desk directly on the computer or from the Pilot disc on the Arm.

### Pilot

The Pilot is the user interface integrated directly into the Arm for smooth interaction with Panda and Desk.



1. On the grip of the Pilot there are two grey buttons, one on each side. By pressing them, the guiding mode is activated. Once the buttons are released the Arm can no longer be moved.

**Note:** The left button is a three-stage enabling button and needs to be half-pressed for guiding. When pressed all the way Panda will stop the guiding mode and make the Arm immovable.

2. Using the disc on top of the Pilot, different entries for programming can be made. Disc can be used to navigate in Desk (3), select individual Apps and parametrize, e.g. by adjusting the slider or activating/deactivating certain functionalities. In addition, robot poses can be entered by manually guiding the Arm using the set button.

Note: You can also operate Desk directly via the touchscreen or using your mouse/keyboard.

3. Desk is the software used for programming and operating Panda.

When the guiding button and the enabling button are pressed on the grip, Panda is in guiding mode and can be moved manually. Once the buttons are released, guiding mode is deactivated and Panda can no longer be moved.

Guiding

white	<b>Interactive</b>	safe interaction with Panda is possible
blue	<b>Attention! Activated</b>	Attention: Panda is enabled for movement and could start any moment
green	<b>Automatic execution</b>	Panda is carrying out an automatic program and is moving independently
yellow	<b>Locked</b>	Panda is locked mechanically or cannot be used
pink	<b>Conflict</b>	Panda is receiving conflicting enable signals
red	<b>Error</b>	an error has occurred

Overview of the status indicators

# INTERACTING & PROGRAMMING

## Creating a task in Desk

Desk overview

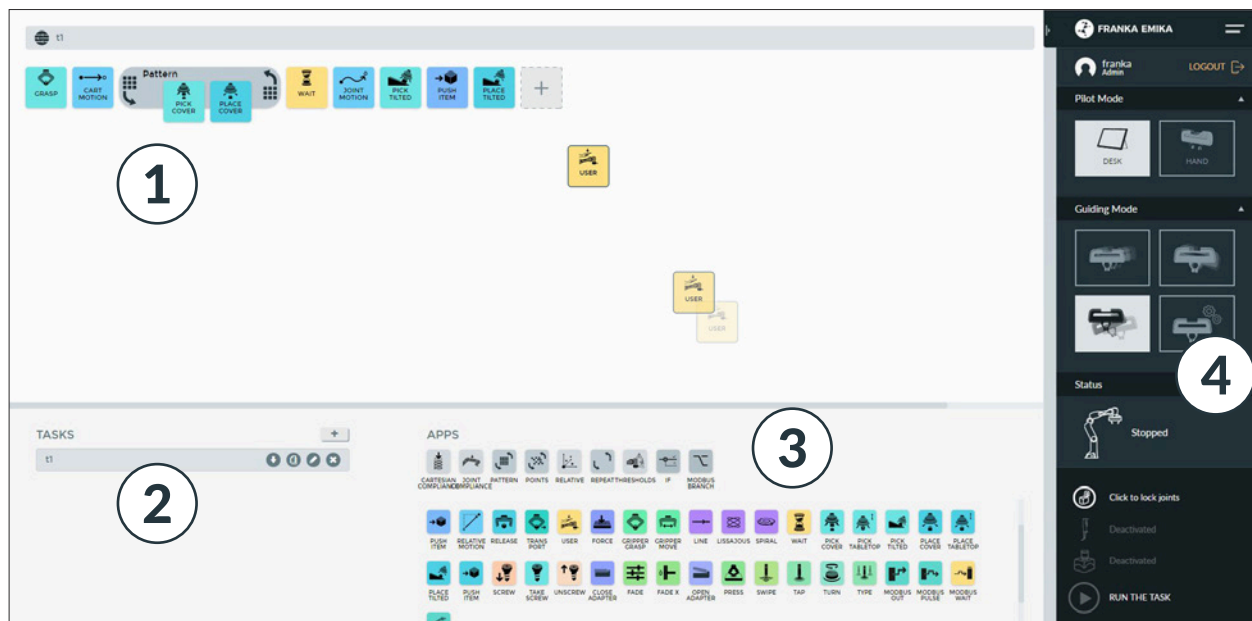
Panda is programmed using the web application Desk. This is opened by entering the URL <https://robot.franka.de>. Desk allows you to create Tasks. Tasks are program sequences and consist of a chronological sequence of Apps. Apps are the building blocks of a Task and describe the basic capabilities of Panda, such as “grip”, “put down”, “push button”. The Apps within a Task need to be parametrized, meaning that parameters such as poses, orientations, speeds etc. need to be set. This process is called “teaching”.

List of available apps, app packages and solutions

A list with a brief description of apps, app packages and solutions can be found at: <https://www.franka.de/apps/>

First steps

1. The timeline is the area in which you can line up your apps in order to program your task.
2. In the task area, you can store your programmed tasks, perform administration, or click on already-programmed tasks, in order to activate them.
3. The app area is to be found here, i.e. the collection of installed apps available to you for programming. You can simply drag them onto the timeline via Drag-and-Drop, in order to configure them for the next step.
4. In the side bar you can see which guiding mode Panda is in. In other words, whether, for example, translational or rotational movements are enabled in guiding Panda. Thereunder are situated important notices on Panda's status, such as, for example, whether the external activation switch is on or off, or whether there is an error.



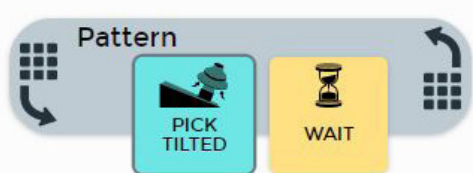
By clicking on the “+” symbol in the task area, a new task is created and selected. A new task is created with an empty timeline. Configuring a Task

The program procedure will then be created, in which apps are moved using Drag-and-Drop from the App Area (3) into the Timeline Area (2) to the desired position. The execution takes place from left to right.

Apps may be removed from the timeline by dragging an app from the timeline areas back into the app area. Re-arrangement of the task using Drag-and-Drop is equally possible.

### Groups

One particular variant of apps are so-called Groups, such as, for example, Pattern, Repeat or Relative. In contrast to normal apps, which implement certain functionalities, Groups modify the execution and teaching behavior of those apps contained within them. Firstly, a Group is dragged into the timeline area. Thereafter, other apps may be dragged into these. The “Repeat” Group executes, for example, all the apps contained in them repeatedly according to the Group configuration. Groups such as “Pattern” or “Points” allow the execution of the same app repeatedly at different points.

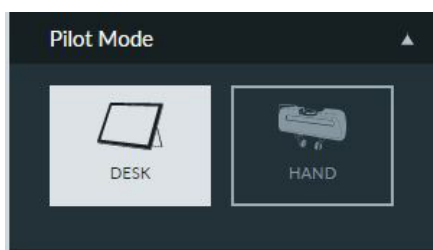


Hand mode: In this mode, the fingers of the Hand can be steered via the directional buttons of the Pilot's Disc:

Functionalities of Pilot's Disc

- keep the “left” button pressed to slowly open the Hand
- keep the “right” button pressed to slowly close the Hand
- press the “down” button once to open the Hand to full width
- press the “up” button once to make the Hand grasp something, meaning that it closes around a grasped object and holds it with its holding force.

Desk mode: using the direction buttons on the disc of the Pilot you can navigate in Desk and the context menus of Apps in the timeline.



# INTERACTING & PROGRAMMING

## Guiding mode

In guiding mode, movements of the Arm follow the corresponding guiding configuration, which is displayed in the sidebar. The guiding configuration can be changed by pressing the guiding mode button on top of the grip. You can also select the desired configuration from the sidebar.



- Translation: in guiding mode, the Arm can only be moved to change the Cartesian position of the end effector; its orientation remains as it was before entering the guiding mode
- Rotation: in guiding mode, the Arm can only be moved to change the Cartesian orientation of the end effector; its position remains as it was before entering guiding mode. The reference coordinate system for this rotation is the predefined coordinate system of the end effector
- Free: the Arm can be moved completely freely, all 7 joints can be moved freely
- User: the user can freely define the guiding behavior in this mode, meaning that it is possible to define for each Cartesian translation and rotation axis if it is movable or immovable





## An app for everything

Apps are modular robot programs, each representing a partial step of a robot task. They can be purchased in the Franka Store and can be parametrized in Desk to form entire automation tasks. These apps can encompass differing scopes from the highly complex to the very simple. When selected in Desk, each App opens a context menu in which the user is interactively lead through the process parameters.



## Configuring apps

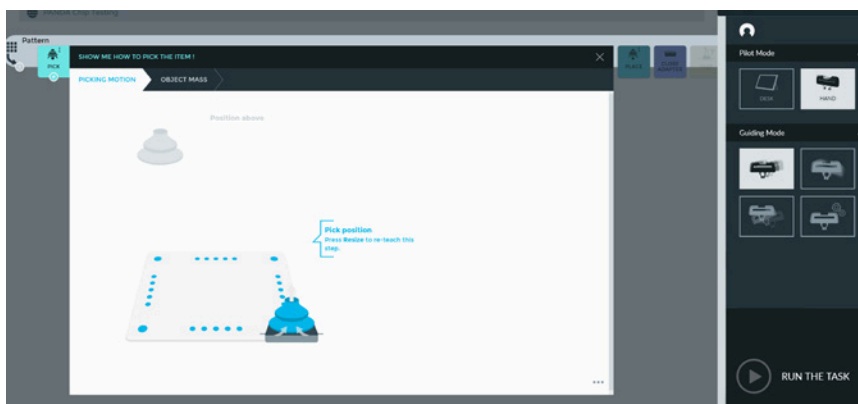
After creating a Task in Desk, all Apps need to be taught, this means that all necessary parameters of the Apps need to be configured so that Panda knows how to execute the App.

Teaching

If not all Apps of a Task have not yet been fully parametrized.

You can set the parameters for individual Apps in the context menu. The context menu of an App comprises one or several steps. Each step can be divided into sub-steps. For example, for many Apps where a pose is needed, usually two poses are taught. The actual pose for carrying out an activity and a transitional pose, which is used for assuring movement in the operating area without risk of collision. These two poses are normally taught in one step, yet they are individual sub-steps.

App dialog window



# INTERACTING & PROGRAMMING

## Executing the task



- Before letting Panda execute a task by way of trial, take note of the safety instructions in chapter: Safety concept/ (in particular: Step Back and check).
- In addition, the unlocking tool must be within immediate reach of the Arm. By no means may it stay inserted into the emergency unlock openings of the Arm!

### WARNING

The philosophy of step back and check ensures the safety of the user during execution of root movements by way of trial. It is based on the principle that humans are safely separated from possibly dangerous movements.

Therefore:

- The user has to leave the hazardous area during the execution of a robot movement and needs to also make sure that no other persons are within the Safety Area.
- The robot movement is to be triggered only when paying full attention to the movement.

Testing the settings  
(step back & check)

If all activated apps for a task have been taught completely, it can be executed out by pressing the “Play” button. This is only possible if the robot has been released via the external enabling device for movement (X4). The robot is lit blue if it has been enabled. After starting the task Panda starts to be lit green. The currently executable app is displayed with a green frame.

Speed

Change the speed for the Task execution by clicking on the Task name in the timeline.

Activating/  
de-activating apps

Right-clicking on one or several Apps opens a select menu, from which you can activate, deactivate or delete individual Apps. Only activated Apps are executed and need to have been taught.

Optimization and  
troubleshooting

If an error occurs, such as a collision, program execution is stopped. The failed App is bordered in blue and an error description is displayed. In this mode, the Arm can be moved using guiding and any causes of error can be eliminated. If an error stops program execution, further information on the error and how to eliminate it is displayed in the robot “traffic light” in the sidebar. By pressing the “Play” symbol on one of the apps, the task execution can carry on with the corresponding app or Group, or the task ended by pressing the “Stop” button.

## Manual unlocking of Arm and Hand in case of emergency

### WARNING

The Arm weighs approx. 18kg. With mounted end effector and objects in the end effector, the total weight can amount to 21kg. If unscrewed, the manipulator may tilt or fall, causing severe injury by crushing or cutting, in particular of hands, fingers and toes.

Therefore:

- Make sure that the Arm is held in place and cannot tilt or fall while unscrewing the Arm

### CAUTION

When unlocking the safety locking system, the dead weight of the Arm segment below the lock will lead to movement (especially sinking and dropping of the Arm). This movement may cause injuries by crushing or penetrating body parts.

Therefore:

- Arm segments below locks are to be supported manually before carrying out the emergency unlock.
- Never carry out an emergency unlock when the Arm is switched on – Panda must always be safely disconnected from the power supply before an emergency unlock

There are several possibilities to move the Arm even without a power supply in case of emergency. They are listed below in order of criticality of the hazardous situation:

- In case of acute mortal danger (e.g. person is severely crushed or can no longer breathe)
  - --> Action: immediately remove Arm manually
- In case of non-acute mortal danger and jamming of the Arm itself
  - --> Action: unlock safety locking system with the use of the unlocking key
  - --> Action: loosen the screws attaching the Arm to its base

See also chapter: Safety concept/ Manually moving the Arm in case of emergency

Manually moving the Arm in cases of emergency

### NOTICE

The Arm is equipped with an integrated safety mechanism, which allows it to be moved manually in emergency situations (by pushing away etc.). If this safety mechanism has been activated, the system is to be shut down afterwards and replaced.

# INTERACTING & PROGRAMMING

## NOTICE

The emergency unlock may only be used in exceptional circumstances. The unlocking tool included in the delivery is designed such as not to damage the mechatronics inside of the Arm. Inappropriate handling may damage the Arm.

Therefore:

- Only use the unlocking tool provided for an emergency unlock. The unlocking tool is to be inserted gently into the opening as not to damage the mechatronics.
- The safety locking system should unlock upon slight moderate pressure.

## CAUTION

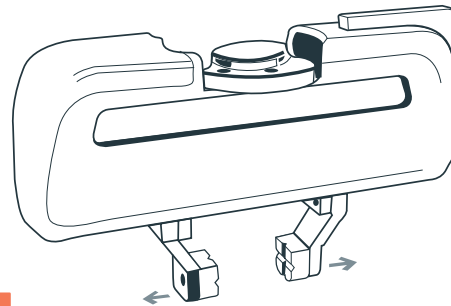
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Moving the fingers of the Hand without a power supply

When the device is turned off, the Hand is not supplied with power either. A jamming between the fingers of the Hand can be loosened by simply pulling the fingers open.



## WARNING

With manual opening of the gripper, grasped objects will fall out. These may fall on your hands/fingers or feet and thus cause severe injuries.

Therefore:

- support the object in the gripper, before the gripper is opened manually
- wear personal protective gear (safety footwear, etc.)