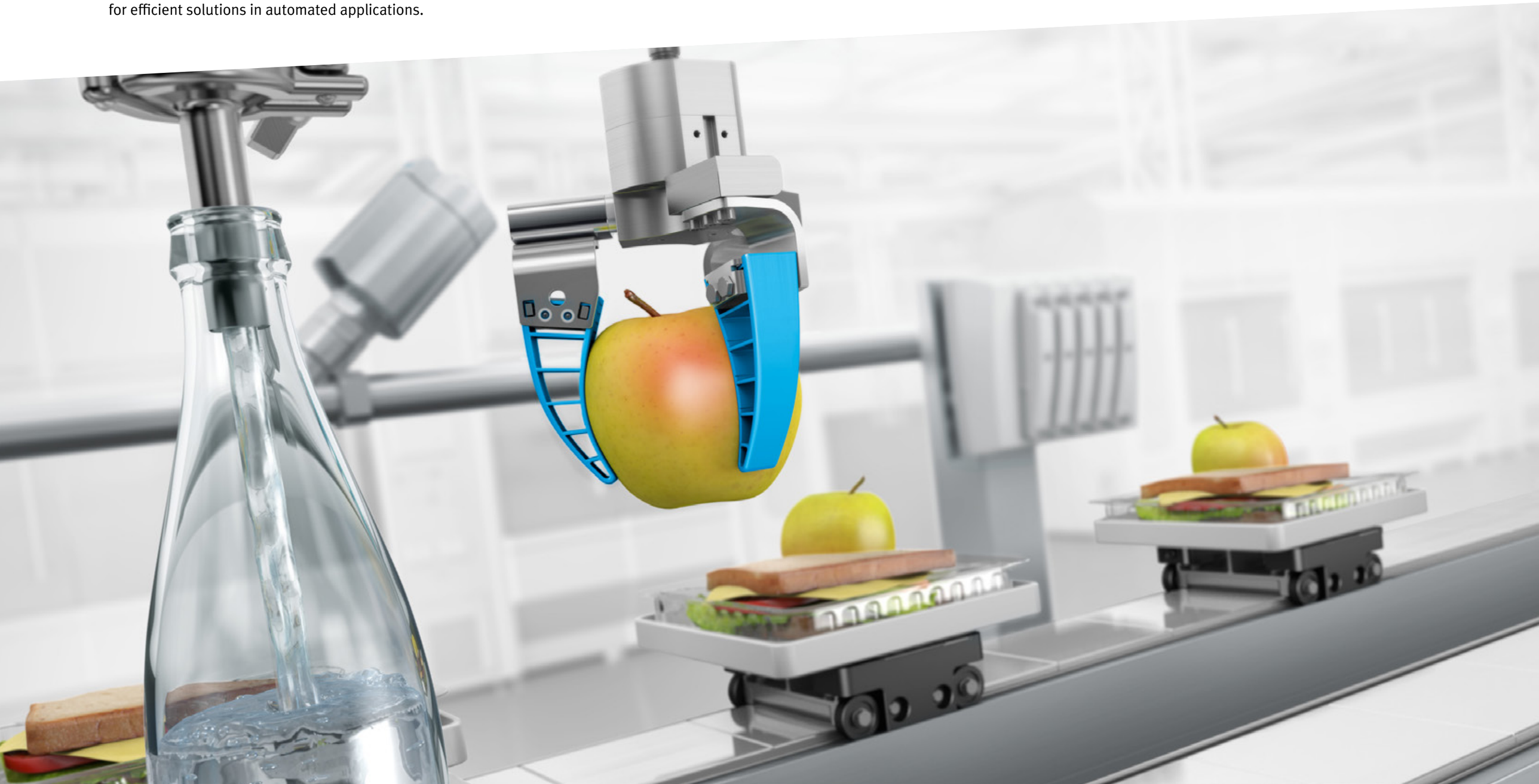
Simply better gripping

Discover current and upcoming gripper trends and technologies
for efficient solutions in automated applications.



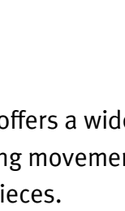
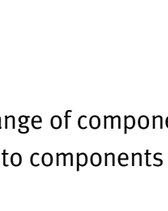
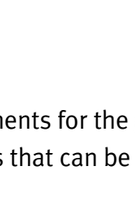
Contents

Introduction

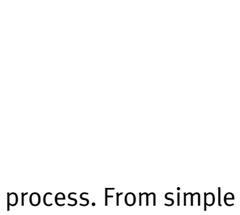
Grippers and robots belong together in the truest sense of the word. A gripper is a pneumatic or electric actuator that holds, positions and moves a workpiece. It is the crucial link between the workpiece and the industrial robot. With the advancement of robots, which are taking on increasingly difficult tasks and handling increasingly complex workpieces, you have more grippers to choose from than ever before. Some gripper systems have multiple fingers, some models work with suction power, while others have robust grips for machine tools, and specially developed systems offer maximum precision for handling sensitive electronic components. In addition to these general automation trends, labour shortages are forcing many manufacturers to use robots in new applications. This, in turn, creates a need for more versatile, powerful gripper designs. Together, these factors have led to an expansion in gripper technology. In addition to traditional mechanical and vacuum grippers, biologically inspired „soft“ grippers that adapt to the unique contours of a workpiece are gaining ground. On the way to the universal gripper – the holy grail of robotics – many new grippers also use controlled pneumatics, which offers the advantages of both pneumatics and electrical automation.
These solutions utilise the existing pneumatic infrastructure and offer an alternative to electrical actuation, combining innovative mechanics, electronics and software. This guide provides you with an overview of the current state of gripper technologies at festo.

Gripper portfolio

Festo offers a wide range of components for the gripping process. From simple gripping movements to components that can be used to rotate and reposition workpieces.

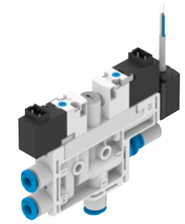





Standard



Precise

Bellow gripper

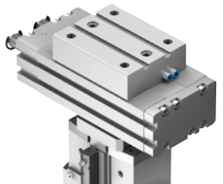
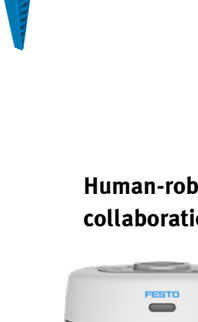


Vacuum

Electrical

Adaptive

Human-robot collaboration

Function combinations
Gripping fingers


Micro

Vacuum



Robust


Long stroke

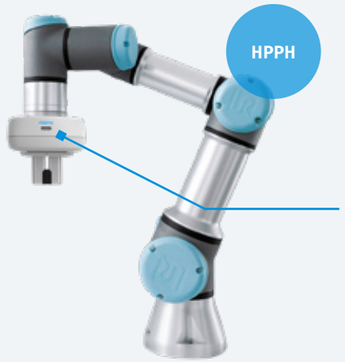

Sealed grippers

Pneumatic grippers

Festo‘s gripper technology offers solutions for a wide range of handling applications like handling systems, classic industrial robots or cobots. Mechanical grippers are moved by an internal drive and this movement is then converted into a gripping movement.

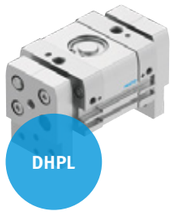
Gripper types
Festo distinguishes between four types of grippers. The right type is determined by the workpiece to be gripped:

- Parallel grippers
- Three-point grippers
- Angular/radial grippers
- Special grippers



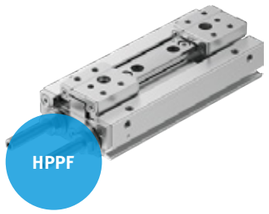
Our gripper technology is compatible with a wide range of industrial robots and cobots. Whether with an integrated mechanical robot interface, as with the HPPH, or with adapter kits.

Best Fit grippers: The latest series includes parallel, angular and radial grippers and features a particularly lightweight and compact design.



Applications requiring a long stroke

Extremely compact parallel gripper with impressive gripping force and gripping accuracy



Compact design in flat version

Compact radial gripper with high repeat accuracy and high torque

Compact angular gripper with high gripping force and low weight

Try it for yourself

Our customers and partners have the opportunity to test gripping applications at the Festo Experience Centern.

Product overview

Parallel gripper

DHPC

Elastic and precise ball guide

HPPF

Compact and flat design

DHPL

High torque resistance through guided gripping jaws

HGPM

Micro gripper: Small and compact design

DHPS

High gripping force with compact size

HGPP

High-precision gripper jaw guide

HGPT

Robust and powerful

HGPD

Sealed gripper jaws for harsh environmental conditions

HGPL

Longstroke, high forces and torques

HPPH

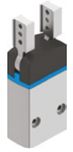
Gripper valve combination for HRC applications

Radial gripper

DHRC

Lateral gripper jaw support for high torque loads

DHRS



Lateral gripper jaw support for high torque loads

HGRT

Robust and precise kinematics for maximum torque resistance

Three-point gripper

DHDS

Highly resilient and precise Tslot guide for the gripper jaws

HGDD

Sealed gripper jaws for harsh environmental conditions

HGDT

Robust Three-point gripper

Angle gripper

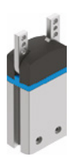
HGWM

Micro gripper: small and compact design

DHWC

Same text like DHRC

DHWS



Improved gripper jaw guidance

Electric grippers

EHPS

Electrically driven standard gripper

HEPP

Electrically driven universal gripper with adjustable gripping force and positionable gripping jaws

EHMD

Combination of gripper and rotary module for opening/closing laboratory samples for example

Special gripper

HGDS

Combination of parallel gripper and swivel module

DHAS

Gripper fingers adaptively adjust to a wide variety of workpiece geometries

DHEB

11 sizes for gripping diameters from 8 to 85 mm

DHEF

Gripping parts with undefined positions and shapes

Increase productivity with intelligent tools

Our goal is to increase your productivity – with powerful software tools that are continuously being developed. They unlock untapped potential along the entire value chain.

Our **grippper design tool** helps you find the optimal gripper quickly and accurately. Based on parameters such as object size, surface texture and finger length, you will receive three comparative calculations:
For maximum accuracy, maximum performance or best energy efficiency – including information on gripping force and operating efficiency. Suitable products can be added directly to your shopping basket.

Try it now

The right gripper for your application

Choosing the right gripper solution starts with the workpiece to be gripped. The steps in the diagram below show the path to the right gripper. The focus is on mechanical grippers, not vacuum or adaptive solutions.

Product shape

Could the product be gripped by a human hand?

No, there is only one contact surface

Vacuum gripper

Ball
Larger than gripper

Yes and no

With the whole hand

Straight
Square/rectangle/cylinder

Between thumb and index finger

Compact

Large/heavy

Various products

Yes, but the shape or environment is very irregular.

Roundings
Centring movement

With three fingers

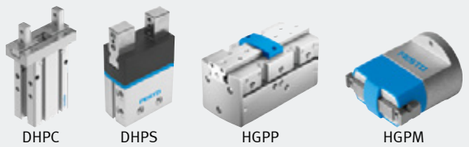
Adaptive gripper

Angular/radial gripper

DHRC DHWC

- Compact design in relation to gripping product
- Requires space at the sides
- Has longer cycle times than parallel grippers

Parallel gripper



DHPC DHPS HGPP HGPM

- Low space requirement around the product, high gripping force
- Short cycle times
- Often as large as the product to be gripped

Long-stroke gripper

DHPL HPPF HGPL

- Larger working range due to the long stroke
- Stroke reduction possible

Three-point gripper

DHDS HGDD HGDT

- For cylindrical products
- Low space requirement around the product, high gripping force
- Short cycle times

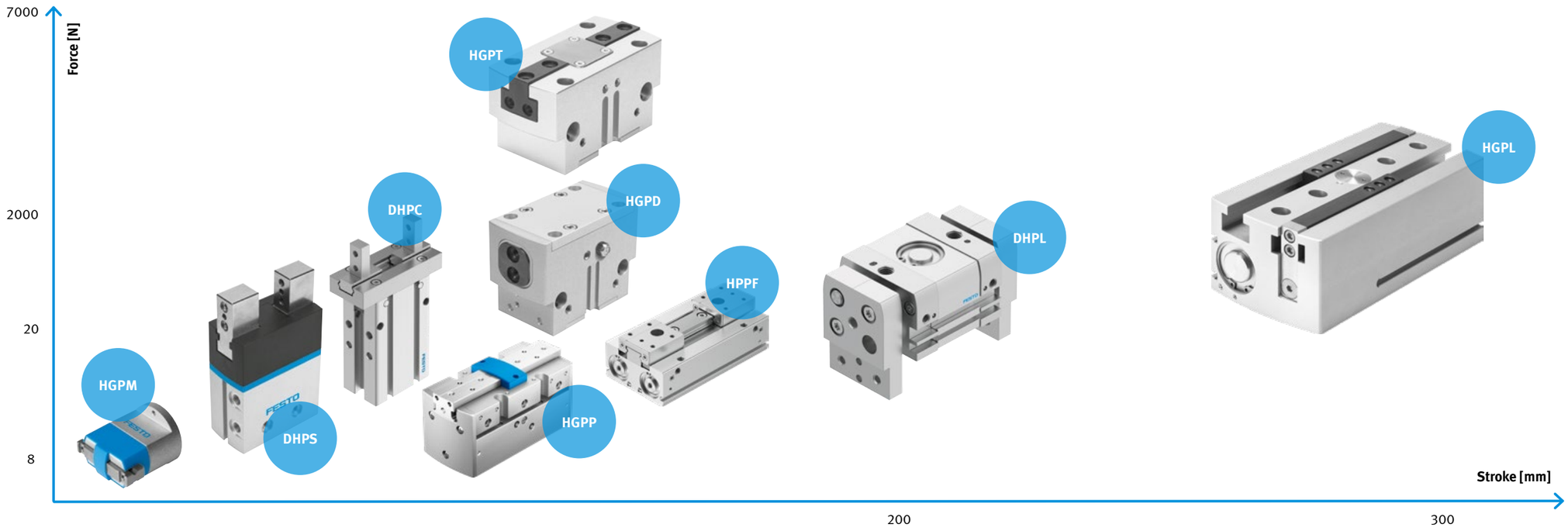
Pneumatic parallel grippers

Mechanical parallel grippers can be used for internal or external gripping. Standard parallel grippers are suitable for handling a wide variety of small parts in a clean environment. Festo offers robust grippers with resilient T-slot guides and/or a long stroke, which enables the gripper jaws to pick up heavy loads. Sealed grippers are suitable for use in harsh environmental conditions.

You can find the right gripper very quickly and easy using the engineering tool.

The HPPH parallel gripper valve combination was specially developed for human-robot collaboration and can be combined with many cobots or robots thanks to its universal robot interface. The low overall height with a low mass moment of inertia ensures high dynamics.

The following visualisation gives you a better overview of the classification of the Festo products.



Pneumatic radial and angular grippers

Angular grippers are available as grippers for small parts in clean environments. A robust design with a blocked air connection* enables higher forces to be absorbed. Angular grippers enable shorter cycle times due to their smaller opening angle. Radial grippers, on the other hand, have a large opening angle. The gripper fingers can thus be moved to the side. This allows the radial gripper to easily pass over interfering contours without the need for an additional axis. The choice of the correct gripper is determined by the maximum torque and maximum opening angle required to handle the workpiece.

Festo offers two types of angle-dependent grippers:

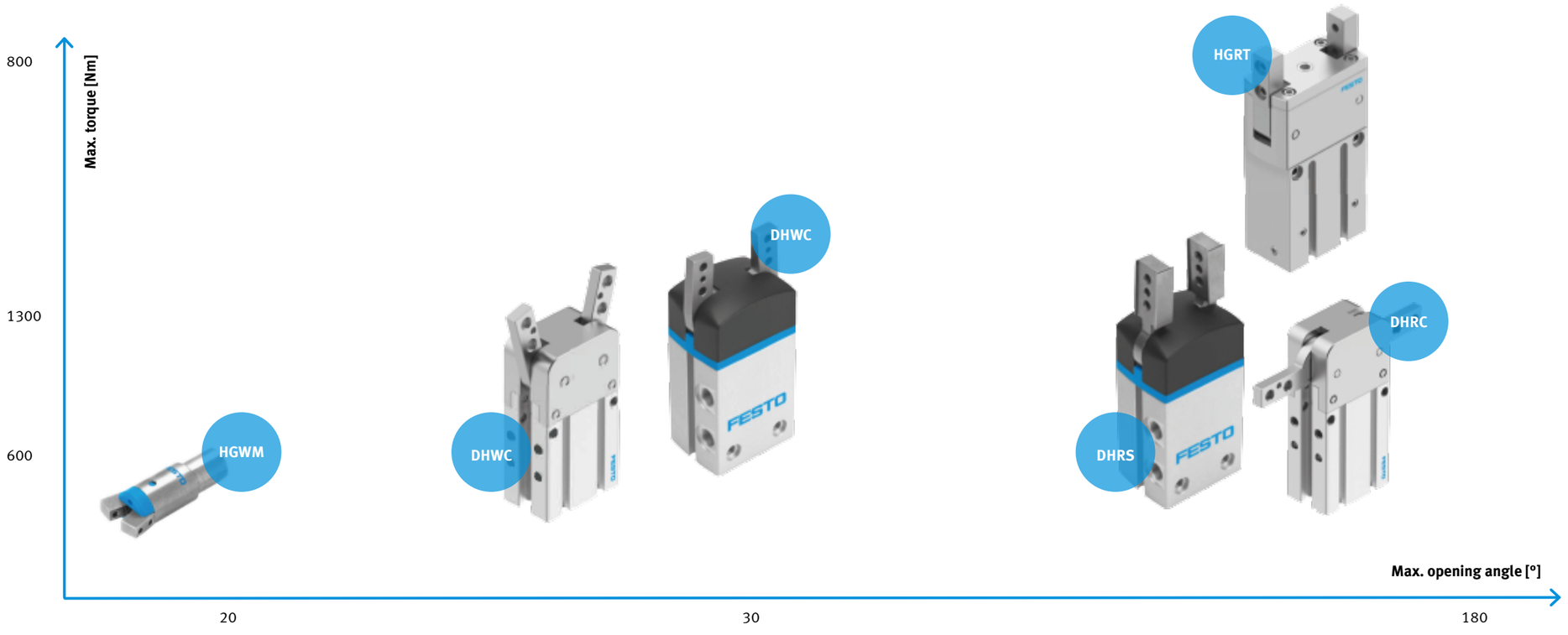
Angular grippers:

The fingers of the angle gripper open up to 20° per finger.

Radial gripper:

The fingers of the radial gripper open up to 90° per finger.

The following visualisation gives you a better overview of the classification of the Festo products.



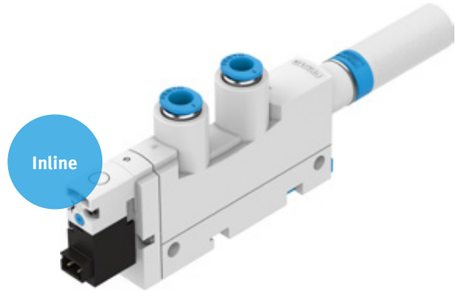
* „Blocked air“ in grippers refers to air that is supplied in a targeted manner to prevent dirt, dust or other particles from entering sensitive areas of the gripper. It is often used in vacuum grippers or pneumatic grippers, especially in environments with high levels of contamination or in applications with sensitive workpieces.

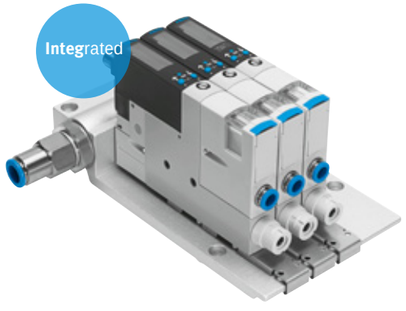
Gripping with vacuum

Vacuum is the perfect solution when mechanical and manual gripping methods are not practical. For example, when handling panels, large and/or irregularly shaped products. Vacuum can also be used to grip fragile products and secure workpieces.

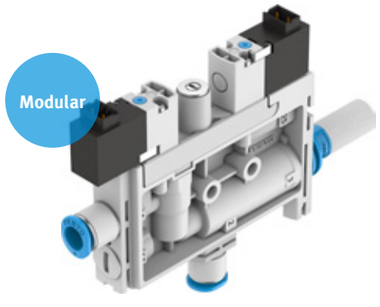
How does it work?
A vacuum can be easily created by passing compressed air through a small hole and then allowing it to flow into a larger pipe. As the moving air accelerates, the residual air absorbs so much ambient air that a negative pressure is created. This is also known as the Venturi principle.

Advantages
- Versatile
- High vacuum range at low flow
- No moving parts
- Compact and lightweight design
- Low acquisition costs, efficient and economical to operate





Applications
- For energy saving
- For porous and non-porous products
- For detecting and monitoring products
- With integrated IO-Link



Popular products

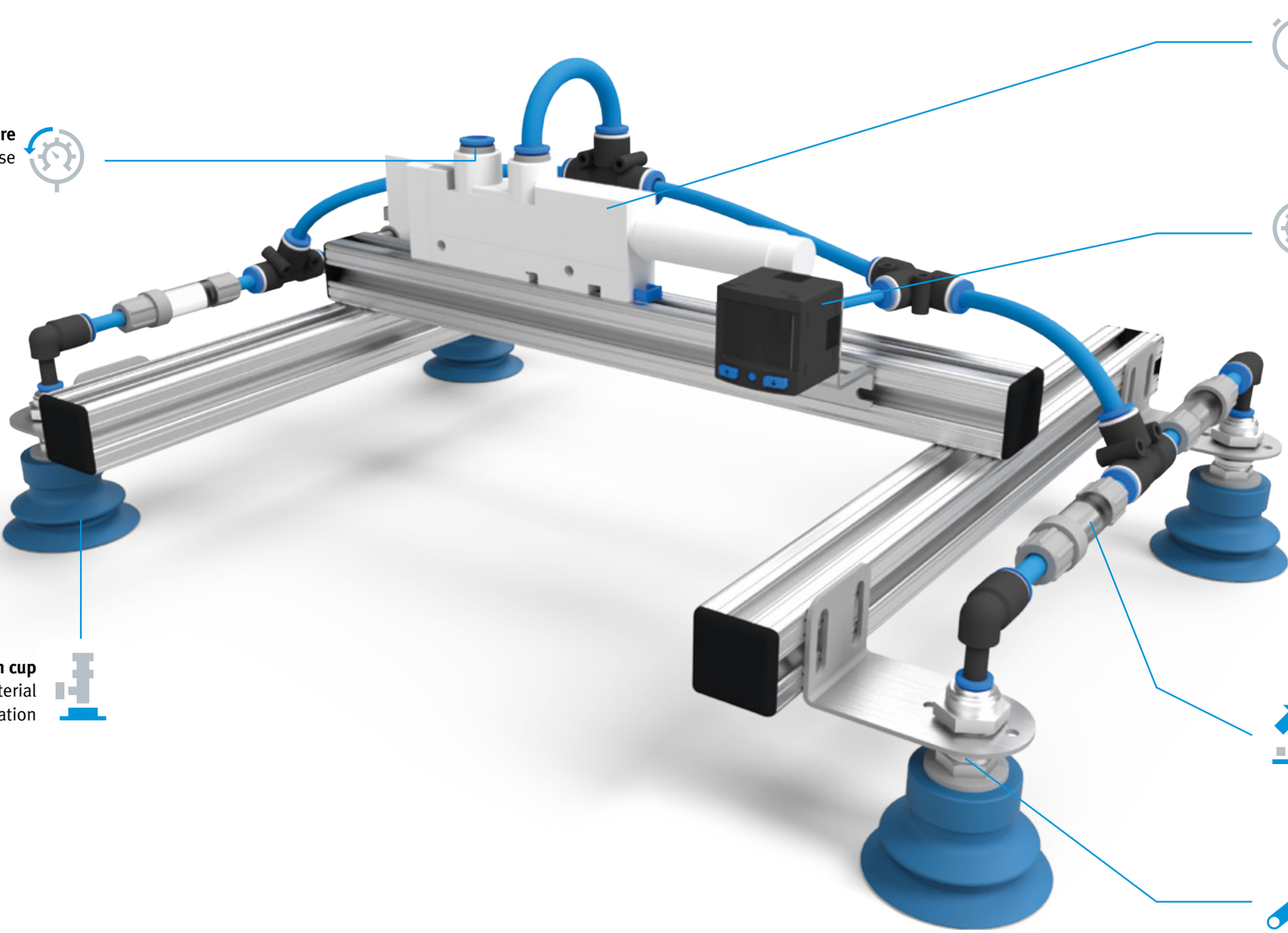
VN

VAS

OVEM

Vacuum system overview

A reliable and efficient vacuum system consists of several components with different functions. This overview shows how they are connected to each other.



Optimal operating pressure
Saves energy, reduces noise

Vacuum generator
With on/off and release pulse, energy-saving with high cycle times

Pressure sensor
Process monitoring Vacuum filter

Vacuum suction cup
shape, size and material suitable for the application

Vacuum filter
For maximum reliability

Connection material
Hoses, fittings and compensators suitable for the application

Vacuum concept in 5 steps

How do you select the right vacuum gripper for your specific application? These five steps will help you.

1

How much force is required?
Use -0.6 bar as a basis
Plan enough suction cups.
This will ensure stability.

Force

Required force (N):
Weight (kg) x acceleration (m/s²) x 1.5

Required force (N):
Weight (kg) x acceleration (m/s²) x 2

2

What shape is the product?
This determines the shape of the suction cup

Form

The product shape determines the suction cup shape, the product size determines the number of suction cups

Straight

Curved

Round

Elongated

3

What is the intended application?
Material, environment, requirements?

Application

The application determines the material of the suction cup
Available materials: silicone, PU, Vulkollan, nitrile rubber, fluorinated rubber and NBR.

4

How high should the flow rate be?
Based on the material and cycle time

Flow

Reference type
30 mm suction cups: 12 l/min
60 mm suction cups: 33 l/min
* Evacuation time 0.1 seconds

Generator type
Porous: Low vacuum, high flow (-0.3 - 0.6)
Non-porous: High vacuum, low flow (-0.6 - 0.9)

Tip: Place the generator as close as possible to the application

5

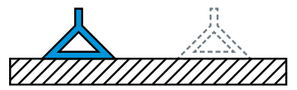
Optimise your system

Optimisation

Application-specific focus areas
» Tubes and fittings suitable for the application
» Filters
» Release pulse to reduce the vacuum and release the product
» Energy saving with vacuum monitoring and controlg

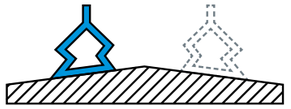
Standard or bellows?

Standard

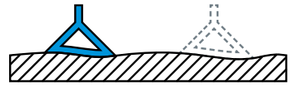


Straight surfaces

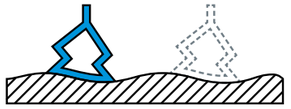
Bellows



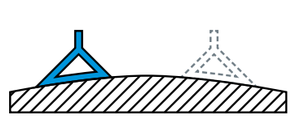
Sloping surfaces



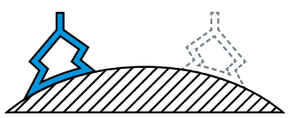
Slightly corrugated surfaces



Heavily corrugated surfaces



Slightly curved surfaces



Strongly curved surfaces

The most commonly used suction cup shapes are the flat suction cup and the bellows suction cup with 1.5 folds.

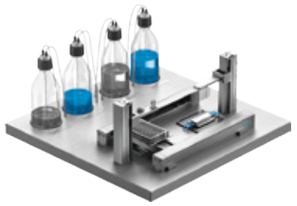
Calculating is good, testing is better!
In our Festo Experience Centres, you can test tailor-made applications and we will be happy to advise you.

Test our dimensioning tool for vacuum applications →

Selection guide for vacuum suction cup materials

When designing applications in which objects need to be gripped under vacuum, the environment and the specific application determine the choice of suction cup materials. The following overview summarises the options and features.

Food medicine



Silicones

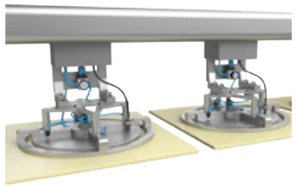
- Very flexible
- Temperature resistant
- Durable material
- Excellent sealing properties
- Chemical resistant
- Food safe

Packaging & Handling

PU

- Very durable
- Wear-free
- Strong hold
- High shear stability
- Cost-effective
- OVGN series: PU with softer edge for optimum grip

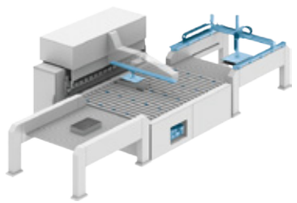
Packaging & Handling



Vulkollan

- Extremely rigid
- Minimal wear
- Long service life
- High load capacity
- Quick to reset
- With height adjustment

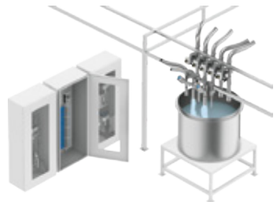
Metalworking



Nitrile rubber

- Oil resistant
- Wear-free
- Temperature resistant
- Good flexibility
- Chemical resistant
- Durable material

Chemistry



Fluorinated rubber

- Heat resistant
- Chemical resistant
- Oil resistant
- Durable material
- Wear-resistant
- Low compression set

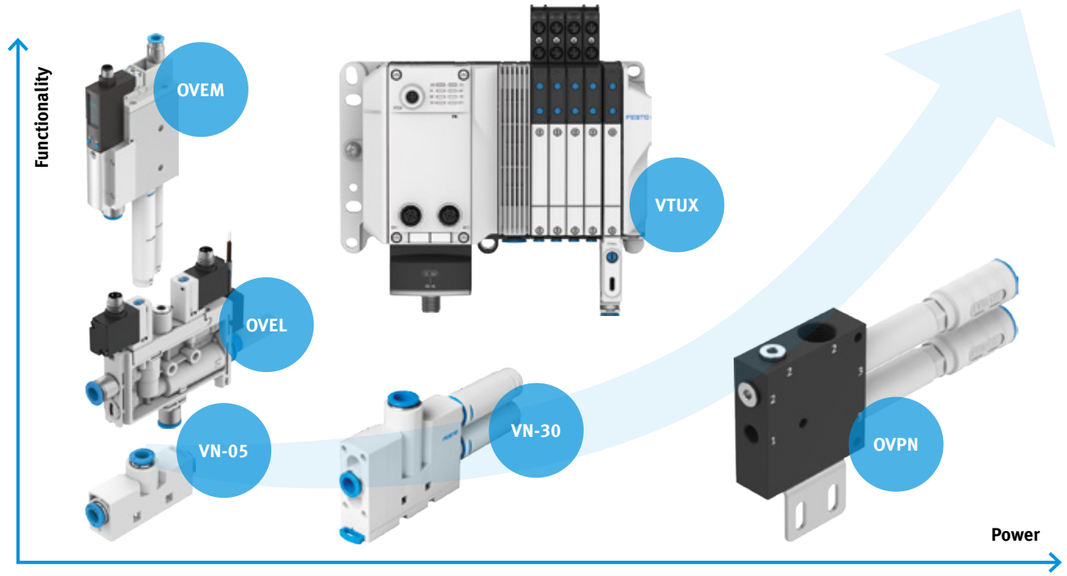
Semiconductors

NBR

- Antistatic
- Wear-free
- Temperature stable
- Good flexibility
- Chemical resistant
- Durable material

Selection guide for vacuum generators

Various aspects are crucial when selecting the most suitable generator. This overview serves as a guide.



VN → Wide range with many options
OVPN → High performance and efficient vacuum generation
OVEM → Energy-efficient and precise for the most demanding applications
OVEL → Compact and precise
VTUX → Efficiency and connectivity in one component

		VN	OVPN	OVEL	OVEM	VTUX
Performance (l/min)		**6-600**	**160-960**	**11–45**	**6–181**	
Available options:	Vacuum sensor with switching output	✓		✓	✓	✓
	Drop pulse	✓		✓	✓	✓
	Vacuum on/off	✓		✓	✓	✓
	Energy saving				✓	✓
	Digital IO			✓	✓	✓
	IO-Link			✓	✓	✓
	Bus connection					✓
	Multi-stage		✓			

Vacuum gripping with the VTUX valve terminal

Combine multiple vacuum generators and pneumatic valves into a compact solution.

Parallel or serial interlinking

Combine compressed air and vacuum in one solution

Choose between a mixing terminal consisting of pressure valves and vacuum generators or a pure vacuum valve terminal

Separate digital inputs possible

Drop pulse for short cycle times

Gives you maximum flexibility in machine design.

Energy-saving: vacuum only when needed

Lightweight and compact – perfect for end-of-arm tooling

Complete control thanks to integrated sensors

Overview of the features of the VTUX valve terminal

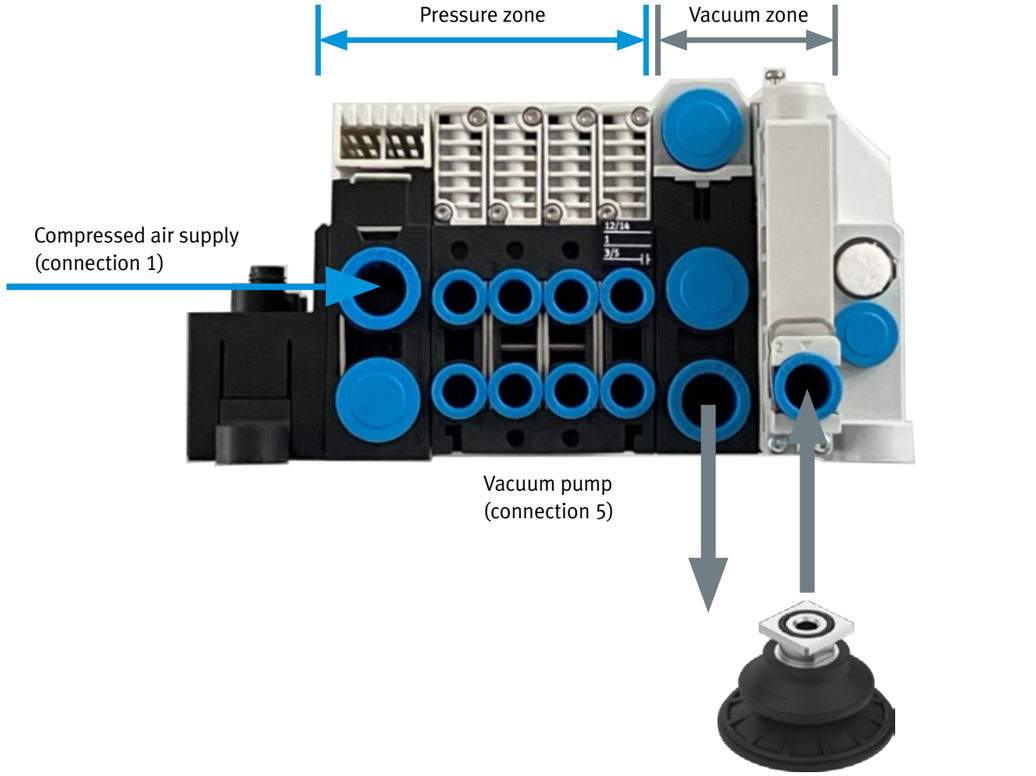
Combine several vacuum generators with valves and connections.

Vacuum integration / vacuum switching unit

In addition to direct vacuum generation using vacuum generators on the valve terminal, the vacuum switching unit can also be used to control the vacuum flows of external vacuum pumps.

Features and advantages:

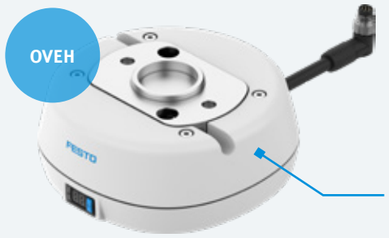
- Combination of valve technology and vacuum switching unit in one platform
- Only one valve for switching the external vacuum pump (on/off) and generating an adjustable release pulse
- Integrated sensor for continuous measurement of the overall vacuum level
- Integrated filter (40 µm) to protect the valve from dust



- Compressed air supply (connection 1) and internal control air supply the valves in the pressure zone.
- The control air for vacuum valves is also fed in via connection 1 (compressed air supply).

Gripper Kits for robots

The front end of a robot arm plays a crucial role in the automated picking up of workpieces. We offer a kit for almost all workpieces or applications, which is compatible with a wide range of robot manufacturers thanks to universal interfaces.



NEW: The compact OVEH vacuum generator with integrated sensor technology and valve control was developed specifically for human-robot collaboration (HRC) and can be combined with many cobots and robots thanks to its universal robot interface. Its low height and low weight ensure high dynamics.

The front end of a robot arm is crucial for enabling highly automated handling of workpieces. Robot grippers, also known as end effectors, are the part of a robot that is mounted at the end of the robot arm (EOA) and forms the connection to the workpiece, comparable to the human hand.

The end of arm (EOA) comprises both the mechanical interface and electrical or pneumatic components such as connecting cables.

We have the right robot gripper for every task and every type of workpiece in the field of robotics. Whether pneumatic grippers, electric grippers or vacuum grippers – we offer a kit for all these applications, which, thanks to its universal interface, is suitable for

many different industrial robots and collaborative robots, such as models from Universal Robots, Fanuc, ABB or KUKA.

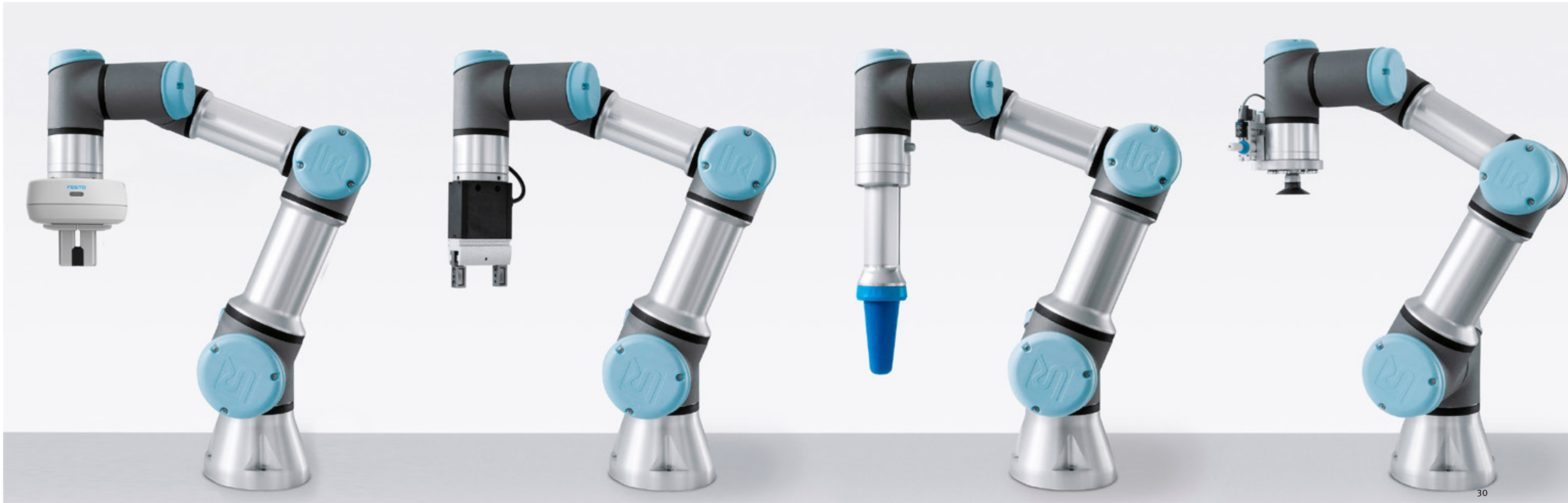
We also provide detailed information and instructions to help you install and commission the gripping systems quickly and easily. Get started now.

Our kits for robot grippers offer you the following advantages

» Plug & Work: With the help of suitable mechanical and electrical interfaces to many robots and collaborative applications, you can start working immediately.

» Universal plug-in: For quick and easy commissioning, reliable operation and simple programming of the robot with the various gripper solutions from Festo.

Get an overview of our kits on our webseite.



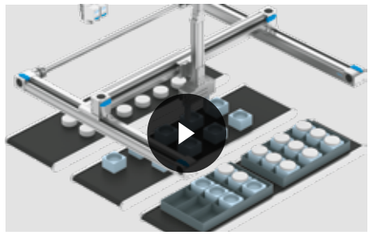
New technologies for gentle gripping

Many of the latest innovations in grippers are moving away from traditional mechanical jaws and vacuum suction cups and instead use soft designs that adapt to the unique shape and material of a workpiece. In many cases, these adaptive grippers are based on Festo‘s research in the field of bionics.

One example is a fish tail fin that curves around the pres- sure point when lateral pressure is applied, instead of bending in the direction of the force. The resulting FinRay Effect®gripper consists of two flexible polyurethane structures connected by intermediate bridges. Regardless of whether the gripper is arranged parallel or centrally, the fingers adapt to the contour of the workpiece and enable gentler and safer gripping of sensitive objects. Thanks to its rigidity over the length of the fingers, the gripper can also hold smaller objects with just its fingertips.

A second example of an adaptive gripper is based on the tongue of a chameleon. This bionic gripper, called FlexShape Gripper, consists of a double-acting cylinder with an elastic cap connected to the cylinder rod. The elastic silicone cap is subjected to slight air pressure, creating a flexible, encapsulated volume that can be moved by the double-acting cylinder. As soon as the cap comes into contact with the object to be gripped, the gripper is moved downwards towards the object while the double-acting cylinder is retracted. This causes the cap to wrap around the object.

A third example of an adaptive gripper is a gripper in connection with Controlled Pneumatics, which uses the same technology as the BionicSoftHand. This component, which supports digital pneumatics, contains proportional piezo valves that enable precise control of the fingers.



Gripping with controlled pneumatics

Watch video

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