Bionic Tripod 3.0

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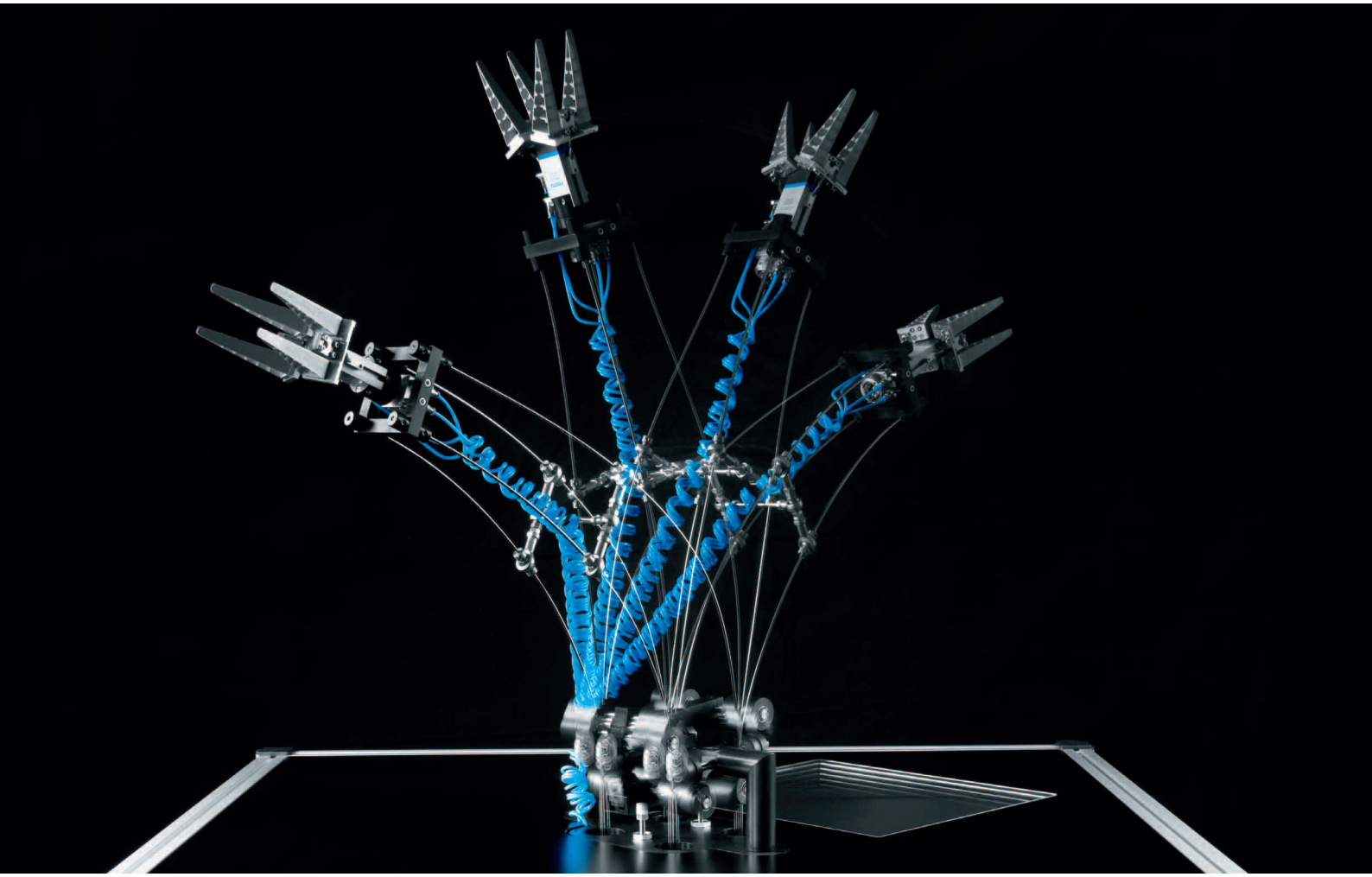
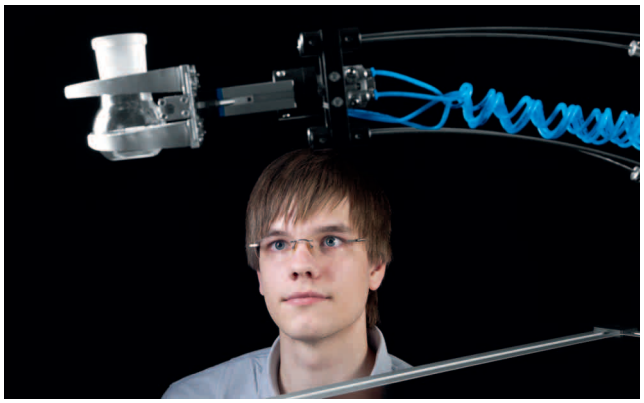


A highly dynamic
flexible tripod

Fresh ideas for automation technology

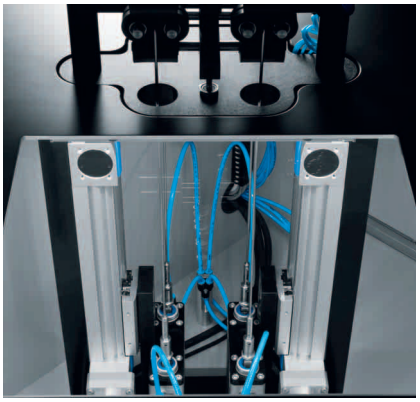


With the Bionic Tripod, Festo is adopting a new approach in handling technology as an alternative to the portal systems that are predominant in mechanical engineering. Unlike these designs, with Bionic Tripod 3.0 the drive unit and the handling system are entirely independent of each other. The working and drive levels are spatially separated by the work surface. The system's drive unit is safely located and protected beneath the work surface, while the controllable pyramid of rods is mounted vertically on top of it.

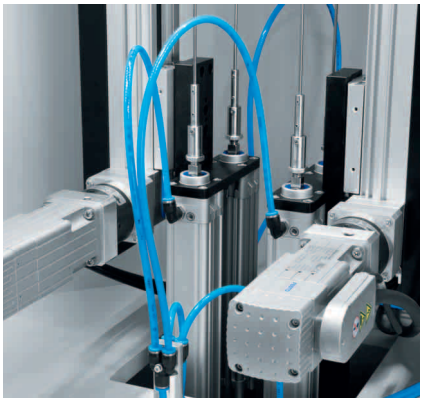
Energy-efficient, highly dynamic overhead grasping
Thanks to its low weight, this handling unit can be moved in an energy-efficient and highly dynamic manner. The low centre of gravity of the entire system provides additional stability for precise alignment with short travel. With its DHDG-W-80 adaptive gripping finger incorporating the Fin Ray Effect®, Bionic Tripod 3.0 can securely grasp objects of various shapes and contours located above it in a form-fitting manner and deposit them to the side. The flexible gripper arm can swivel up to 90 degrees in any spatial direction, which makes for a large scope of operation.

Lightweight design modelled on nature
As part of the Bionic Learning Network, Festo in cooperation with renowned universities, institutes and development companies transfers biological principles to technical applications such as the Bionic Tripod. The basic principle of the structure with Fin Ray Effect®, derived from the fish's fin, is applied several times over in Bionic Tripod 3.0 with its energy-efficient lightweight construction. The resulting flexibility and yielding ability make it ideal for tasks involving human-machine interaction, and its protective work surface is of advantage especially in dusty, dirty environments.

Lightweight rod pyramid:
precise working range



Protective work surface:
separation of work and drive levels



Electropneumatic drive:
a low centre of gravity for stable movement

Patented roller mechanism: precise, highly dynamic positioning

Drive unit located under the work surface
The drive unit consists of two mutually opposed EGC 70-160 electrical linear axes, which move the pyramid of spring steel rods with a stroke of 120 mm. The tripod can thus grasp and deposit objects. Two DNC 32-160 standard pneumatic cylinders are mounted on each of the two electric linear axes. Each pneumatic cylinder moves one of the four spring steel rods of the pyramid configuration. The rods have a diameter of 3 mm. The movement of the rod linkage by means of the four standard pneumatic cylinders describes a spherical surface.

The drive units are all located under the work surface. This arrangement separates the drive level from the working level, and the overall system thus has a very low centre of gravity. This gives the handling unit additional stability and enables highly dynamic working processes. The work surface protects the drive unit from external influences, which is of great advantage in dusty and dirty environments. This configuration is also a highly space-saving design for a handling system.

Roller mechanism for deflection of the rod pyramid
The roller mechanism, which serves to precisely guide the four spring steel elements of the rod kinematics system, comprises three independently seated levels. At each level, the spring steel rods move between freely mounted guide rollers. This allows the pyramid of rods to deflect by as much as 90 degrees in any direction. It is only this patented roller mechanism that enables the entire system to be displaced in a highly dynamic manner.

Linear axes EGC 70-160

Pneumatic standard cylinder DNC 32-160

Swivel module DSM 6

Adaptive gripper: form-fitting and gentle gripping thanks to the structure with Fin Ray Effect®

The handling unit in the working area

The kinematic rod pyramid is fixed vertically to the work surface. A reinforcement brace in the upper third, adjacent to the rotating/gripping unit, gives the pyramid additional stability and connects the four H-shaped spring steel elements with the six ball joints. This prevents the entire system from vibrating at high speeds and under high loads. The DSM 6 swivel module from Festo is attached to the receiving plate as a rotating unit at the end of the pyramid of rods.

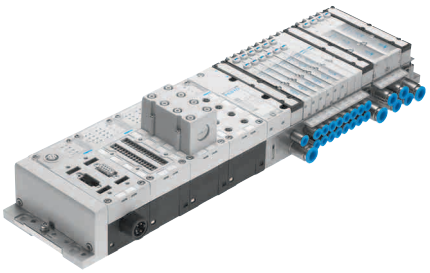
On each flange, the HGR-16-A radial gripper is fitted with two DHDG-W-80 adaptively gripping fingers, with which Bionic Tripod 3.0 can adaptively grasp variously shaped objects such as test tubes or light bulbs, and apples or onions. The gripping fingers have a structure modelled on the tail fin of a fish.

Hybrid control and regulation

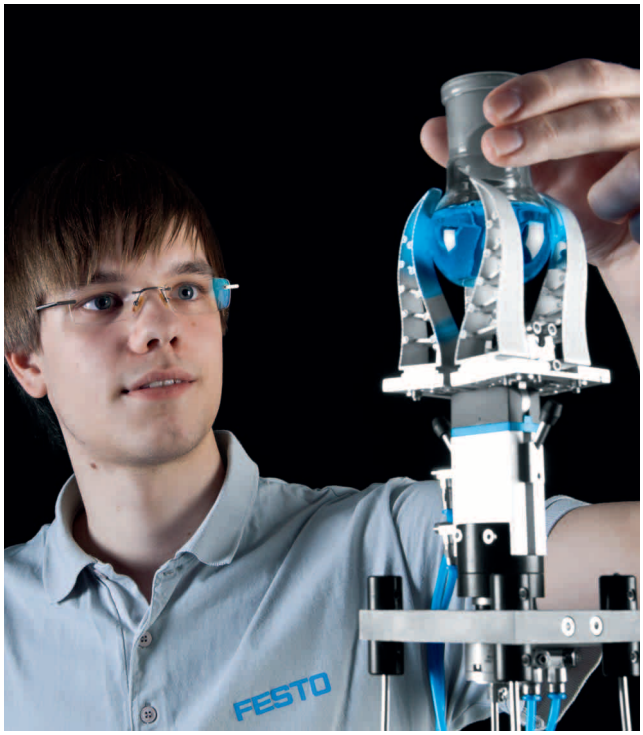
The six 5/2-way valves are controlled and regulated by the CPX/MPA valve terminals with an integrated CPX-CEC-C1 CoDeSys front end controller. Four 5/2-way valves move the four standard cylinders, one of the pivot modules and one of the grippers. The two EGC electric linear axes are also controlled and regulated by the valve terminal: pneumatics, electrics and motion control – all functionally integrated into the CPX/MPA solution package.

Radial gripper HGR-16-A

Gripping finger DHDG-W-80



CPX terminal



Rapid, flexible three-dimensional handling of small masses
Sorting, palletising and fitting: tripods are suitable for a wide variety of three-dimensional handling tasks, especially with small objects. This technology can be used wherever small masses are to be moved rapidly and flexibly.

What could be more suitable for this purpose than a lightweight, flexible structure that is nevertheless rigid and stable? Festo is inspired here by nature: a fish's fins do not bend back under pressure, but bulge out contrary to the direction in which the pressure is applied. The structure for the Fin Ray Effect® is based on this principle.

Consistent lightweight design for maximum flexibility
Ever since the structure with Fin Ray Effect® was first developed, Festo has been pressing ahead with the transfer of this biological principle to tripod technology. Consistent lightweight design will be crucial to automation in the future – with increasingly lower consumption of resources for moving objects.

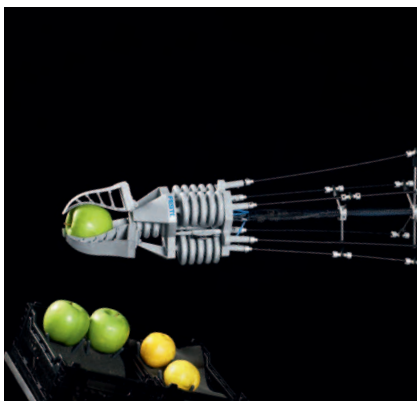
Evolution of the Bionic Tripod
Whether vertical or horizontal: with BionicTripod 3.0 and its two predecessors, Festo is demonstrating that the separation of drive and working levels in all configurations makes for solutions with maximum flexibility.

Bionic Tripod 1.0
Vertically suspended tripod, ideal for sorting pressure-sensitive objects of different shapes and sizes, e.g. in food production.

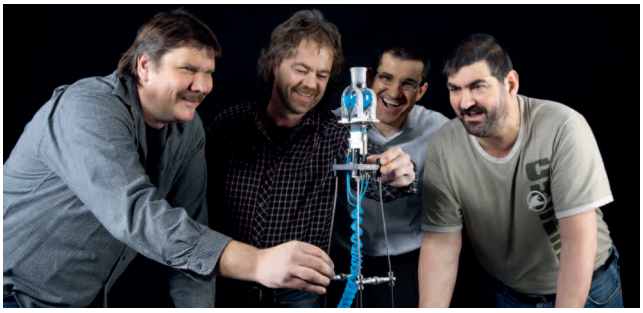
Bionic Tripod 2.0
Horizontal tripod for tasks involving human-machine interaction, e.g. for sorting fruit and vegetables in agriculture, for sorting recyclable materials in industry, or as a "third hand" and ideal helper.

Bionic Tripod 3.0
Vertically mounted tripod for facilitating difficult tasks involving overhead work. Its protected drive technology is of advantage in dusty environments such as dry construction, bakeries or carpenter's shops.


Bionic Tripod 1.0


Bionic Tripod 2.0


Bionic Tripod 3.0



Technical data:

Maximum displacement:
X-axis: 1000 mm
Y-axis: 1000 mm
Z-axis: 300 mm

Rod material:
4x steel spring rods, diameter 3 mm

Drive:
2x EGC 70-160 electric linear axes
2x DNC 32-160 standard pneumatic cylinders

Control:
CPX/MPA controls 6x 5/2-way valves for four pneumatic cylinders,
2x EGC electric linear axes

Maximum handling weight:
400 g

Rotation unit:
DSM-6-180 swivel module

Gripper:
HGR-16-A radial gripper

Gripping fingers:
Pairs of DHDG-W-80 adaptive gripping fingers with Fin Ray Effect®

Brands:
Fin Ray Effect® is a trademark of EvoLogics GmbH, Berlin

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