

# BionicTripod with FinGripper

**FESTO**



Flexible tripod with  
adaptive gripper

**Info**

## Energy-efficient movement and form-fit gripping



Adaptively gripped energy-efficient light bulb

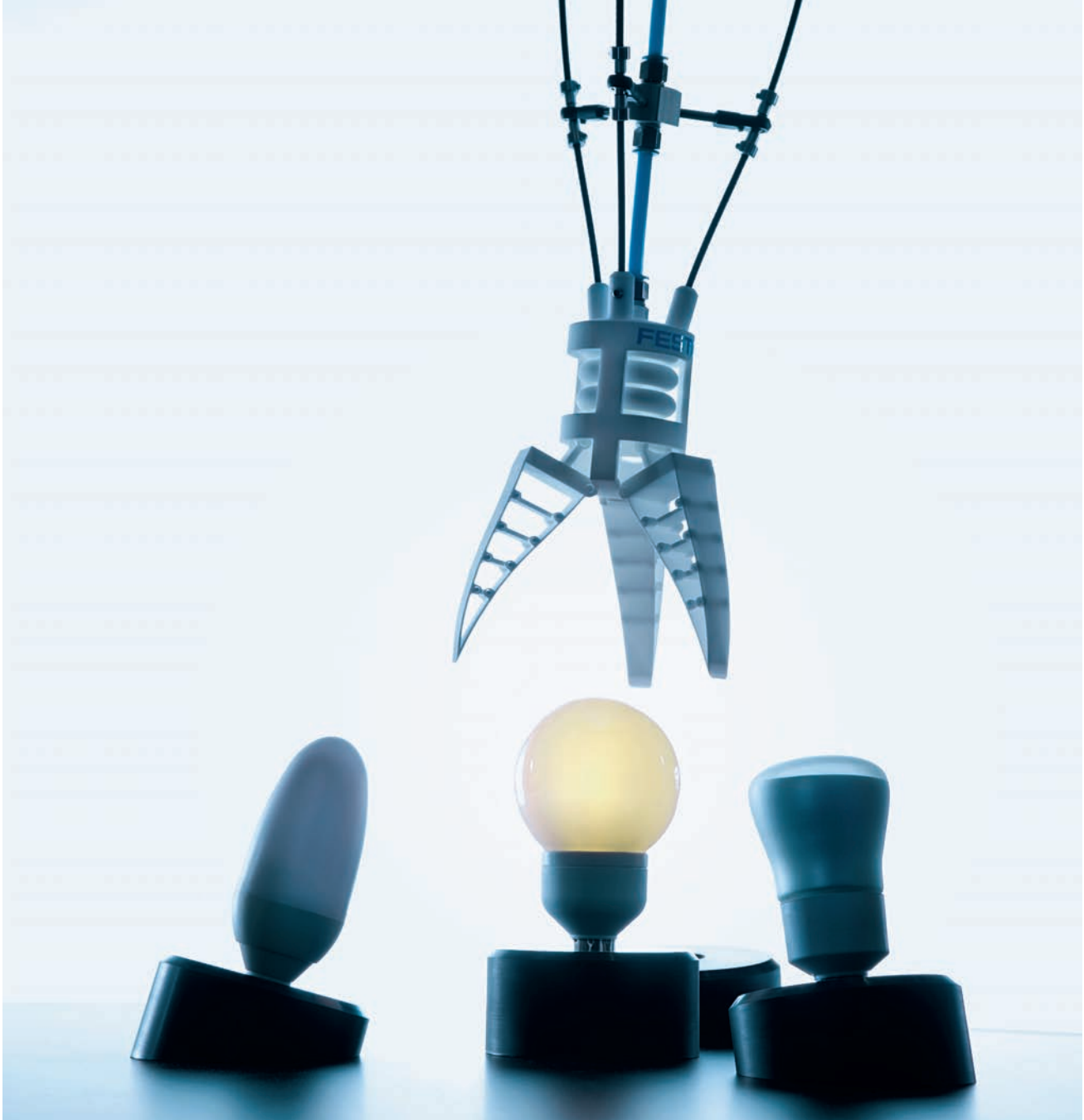
Flexibility, lightness in relation to the mass to be displaced and energy efficiency are acquiring increasing significance in automation. The BionicTripod demonstrates the possibility of rigorously adopting bionic design principles for efficient, versatile automation. In the BionicTripod, the bionic Fin Ray® principle has for the first time been effectively realised for the requirements of automation in manufacturing processes.

Nature shows the way. Thin material cross-sections and the stiffening of structures by means of lightweight stable interconnections are just as much part of its repertoire as are flexible, manoeuvrable structures. These principles are also followed with the Fin Ray Effect®, which was derived from the tail fin structure of fish.

The BionicTripod comprises three fibreglass rods arranged in a pyramid formation. The connecting links are spaced at regular intervals and make for a rigid construction. By drawing the rods together or spreading them apart, the construction can be oriented in any direction within a scope of 90 degrees. Precise control and orientation is provided by the EGC electric linear axis and EMMS electric drive unit from Festo.

Thanks to its design, a large operating range can be covered using a minimum of weight. Depending on the individual design and size, the BionicTripod can carry out a wide variety of automation tasks.

The unit is controlled by the CMXR robotics software that was already successfully installed in the tripod from Festo. It combines mechanics, electric drive and control technology into a complete kinematic system solution and coordinates the highly dynamic spatial movements. A further advantage of this type of control is that instead of displacement by mechanical means, positional coordinates can be determined on a computer.

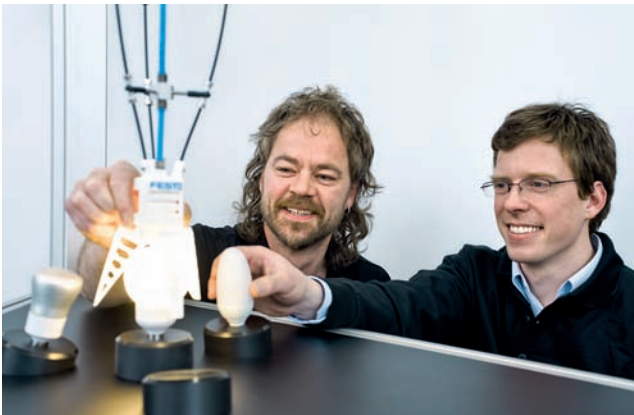


The interface between the BionicTripod and the workpiece is effected by an adaptive gripping device, the FinGripper, which comprises a pneumatic actuator in the form of a bellows and three gripping fingers that incorporate a Fin Ray® structure. This structure is based on two flexible bands which meet at their tips to form a triangle; the bands are connected by links spaced at regular intervals. By means of this flexible but fixed assembly, the gripping fingers can adapt to the contours of a workpiece while applying lateral force.

The FinGripper is produced in the selective laser sintering process, in which 0.1 millimetre layers of polyamide powder are successively applied and hardened to form a solid component.

With this method, the weight of the grasping unit can be reduced by 90 percent as compared with a conventional gripper of metal. Workpieces can thus be grasped and moved with a high degree of energy efficiency.

This adaptive gripping can be successfully applied in a wide range of different applications. In food production, this advantage can be used to sort products of varying sizes and contours. A particular characteristic of the Fin Ray Effect® is the structure's ability to adapt to different component contours. Pressure-sensitive workpieces, in particular, can be displaced and deposited without damage. The individual design and dimensioning of the FinGripper can be determined using the previously constructed data set on computer.



### Project partners

Project initiator:  
Dr. Wilfried Stoll, Chairman of the Supervisory Board, Festo AG

Project team:  
Dipl.-Ing. (FH) Markus Fischer, Dipl.-Des. Ruwen Kaminski,  
Christian Mangler, Uwe Neuhoff, Festo AG & Co. KG

Control technology:  
Roland Grau, Dipl.-Ing. Armin Hartmann, Dr. Rüdiger Neumann,  
Festo AG & Co. KG

3D printing:  
Dipl.-Ing. Klaus Müller-Lohmeier, Helmut Müller,  
Dipl.-Ing. (FH) Mattias-Manuel Speckle, Festo AG & Co. KG

Photos:  
Walter Fogel, Angelbachtal, Germany

Graphic design:  
Atelier Frank, Berlin, Germany

### Technical data

Maximum tripod extension

Horizontal: 1.1 m  
Z-lift: 0.27 m

Tripod material: Fibreglass rods, diameter 3.1 mm

Tripod drive

Linear axes: EGC-50-270-TB-KF\_oH-GK  
Electric drive: EMMS-AS-40-M-TMB

Tripod control: CMXR robotics software

Gripper weight: 0.080 kg

Gripper material: Polyamide

Gripper actuator force: 40 N

Gripper operating pressure: 3 bar

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

### Festo AG & Co. KG

Corporate Design  
Plieninger Straße 50  
73760 Ostfildern  
Germany  
www.festo.com/bionic  
Phone +49 711 / 347-38 80  
Fax +49 711 / 347-38 99  
fish@de.festo.com