

Modular Robotics

The modules of the PowerCube series provide the basis for flexible combinatorics in automation. Complex systems and multiple-axis robot structures with several degrees of freedom can be achieved with minimum time and expenditure spent on design and programming.

Your advantages and benefits

Modular

- Standardized interfaces for mechatronics and control for rapid and simple assembly without complicated designs
- Cube geometry with diverse possibilities for creating individual solutions from the modular system

Integrated

- The control and power electronics are fully integrated in the modules for minimal space requirements and interfering contours
- Single-cable technology combines data transmission and the power supply for minimal assembly and start-up costs

Intelligent

- Integrated high-end microcontroller for rapid data processing
- Decentralized control system for digital signal processing
- Universal communication interfaces for rapid incorporation in existing servo-controlled concepts



Module overview

The innovative technology of the PowerCube modules already forms the basis of numerous applications in the fields of measuring and testing systems, laboratory automation, service robotics and flexible robot technology.



PG

Servo-electric
2-Finger Parallel Gripper



PR

Servo-electric
Rotary Actuators



PW

Servo-electric
Rotary Pan Tilt Actuators



PSM

Servo-motors with
integrated position control



PDU

Servo-positioning motor
with precision gears



PLS

Servo-electric
Linear Axes with
ball-and-screw spindle drive

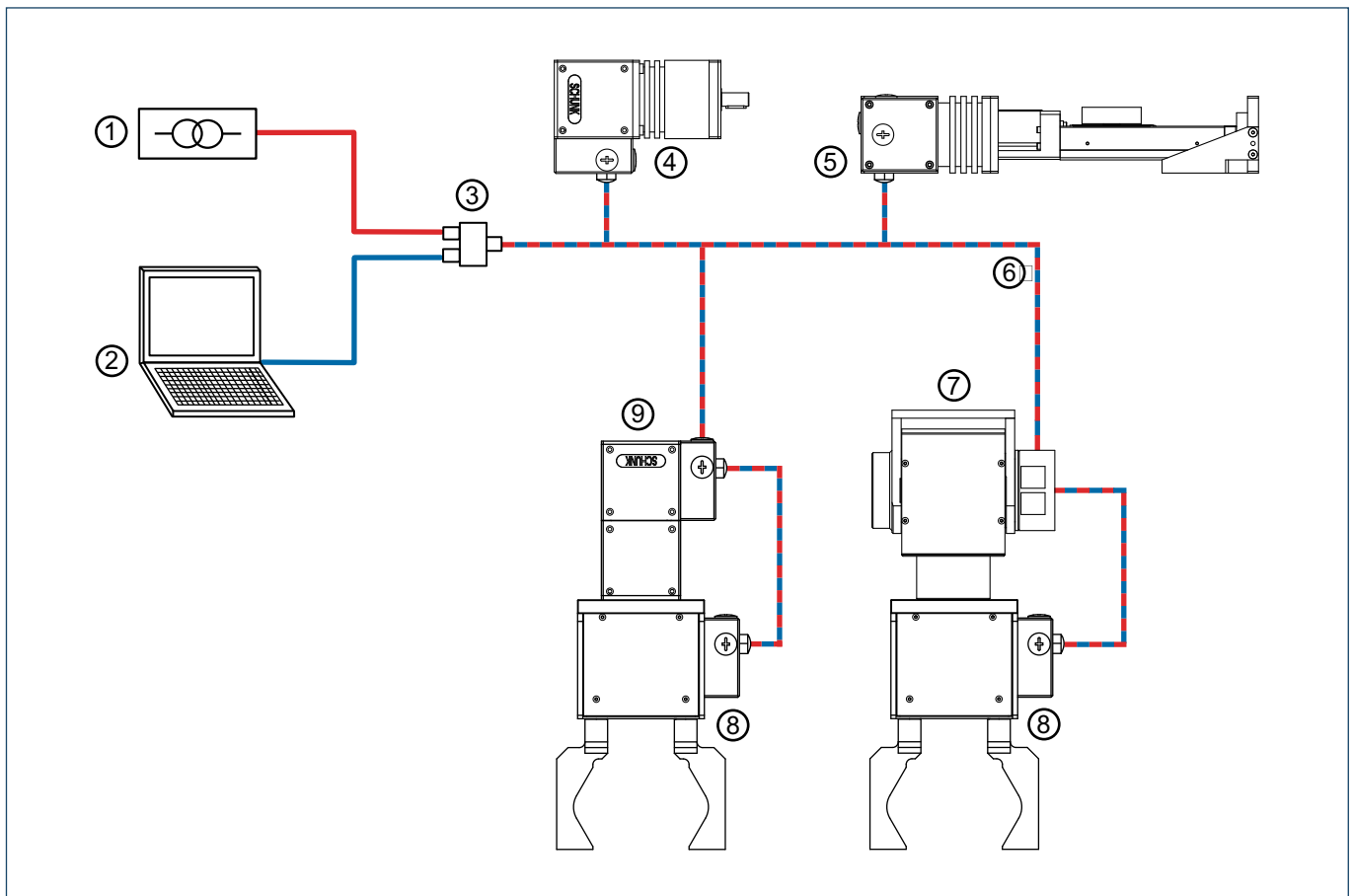
Method of actuation

The PowerCube modules work completely independently. The master control system is only required for generating the sequential program and sending it step by step to the connected modules. Therefore, only the current sequential command is ever stored in the modules, and the subsequent command is stored in the buffer. The current, rotational

speed and positioning are controlled in the module itself. Likewise, functions such as temperature and limit monitoring are performed in the module itself. Real-time capability is not absolutely essential for the master control or bus system.

Control version	A	B	C
Hardware	Control with SPC (S7)	Control with PC	Control with PC
Interface	Profibus DP	CAN bus / RS-232	CANopen
Software	PowerCube standard software (gsd file, programming examples)	Windows operating system PowerCube standard software	LINUX operating system Development platforms (LabView, Diadem) on request on request on request (e.g. Eckelmann CNC 55)

- ① Included with the "PowerCube Standard Software" CD-ROM (ID 0307700): Assembly and operating manual with manufacturer's declaration, quick-step software, demo and diagnostic program plus various driver files.



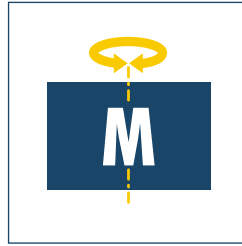
- ① 24 VDC / 48 VDC power supply provided by the customer
- ② Control system provided by the customer (see control versions A, B and C)
- ③ PAE 130 TB terminal block for connecting the voltage supply, the communication and the hybrid cable
- ④ PDU servo-motor
- ⑤ Linear axis with PLS ball-and-screw spindle drive and PSM servo-motor
- ⑥ Hybrid cable (single-cable technology) for connecting the PowerCube modules (voltage supply and communication)
- ⑦ PW Servo-electric Rotary Pan Tilt Actuator
- ⑧ PG Servo-electric 2-Finger Parallel Gripper
- ⑨ PR Servo-electric Rotary Actuator



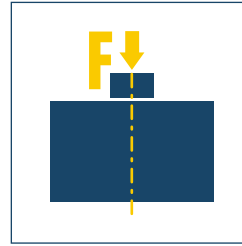
Sizes
70 .. 90



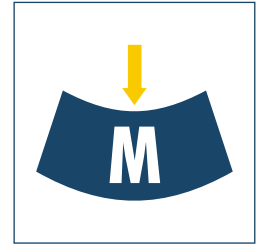
Weight
1.8 kg .. 3.4 kg



Torque
Axis 1: 12 Nm .. 23 Nm
Axis 2: 2 Nm .. 12 Nm



Axial force
80 N .. 200 N



Bending moment
8 Nm .. 12 Nm

Application example



7-DOF light-weight arm and gripping hand
for applications in research and
development and in service robotics

- 1 SGH Servo-electric Gripping Hand
- 2 PW 70 Rotary Tilt Unit

- 3 LWA 2 Light-weight Arm

Pan Tilt Actuator

Servo-electric pan tilt actuator with two rotating axes for precise positioning

Area of application

Pan tilt actuator for cameras, laser scanners and other sensors for positioning during measuring and testing operations. Pan-tilt module and extension axes for service or standard robots and handling tasks in clean room environment

Your advantages and benefits

Two independently moving axes integrated in a single housing

for complete flexibility in the rotating movement, despite the compact design

High torques and speeds

for rapid acceleration and short cycle times

Fully integrated control and power electronics

for creating a decentralized control system

Versatile actuation options

for simple integration in existing servo-controlled concepts via Profibus DP, CAN bus or RS-232

Standard connecting elements and uniform control concept

for extensive combinatorics with other PowerCube modules (see explanation of the PowerCube system)

Single-cable technology for data transmission and voltage supply (plug & play)

for low assembly and start-up costs



POWER  **CUBE**

Information about the series

Working principle

with Harmonic Drive® gear driven by a brushless DC servo-motor

Housing material

Aluminum alloy, hard-anodized

Actuation

servo-electric, with two brushless DC servo-motors and two incremental encoders for position and speed control

Warranty

24 months

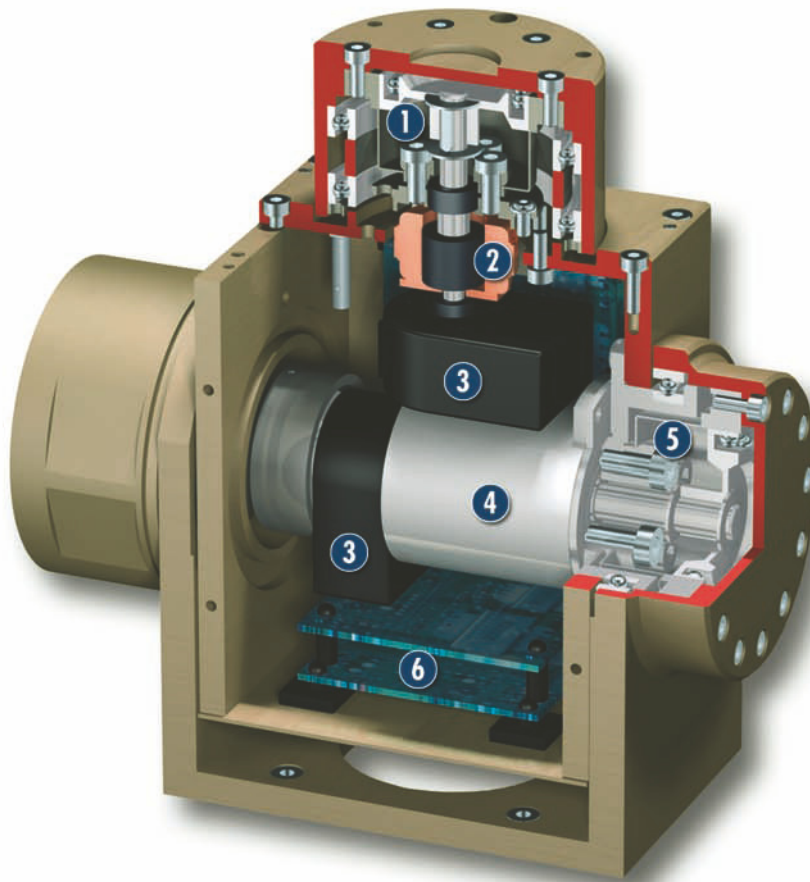
Scope of delivery

"PowerCube Standard Software" CD-ROM, containing assembly and operating manual with manufacturer's declaration, quick-step software, demo and diagnostic programs and various driver files (see explanation of PowerCube system).

Further possible uses

Module suitable for use in clean room environment

Sectional diagram



- 1** **Axis 2**
for endless rotations
- 4** **Servo-motor axis 1**
for maximum torques
- 6** **Control electronics**
integrated control and power electronics
- 2** **Servo-motor axis 2**
- 5** **Axis 1**
for rotations up to $\pm 120^\circ$
- 3** **Encoder**
for position evaluation

Function description

The pan tilt actuator accommodates two self-contained servo axes in an extremely compact housing. Both axes are actuated and moved by the separately integrated control electronics completely independent from one another. Each axis features a Harmonic Drive® precision gear, which is driven directly by a brushless DC servo-motor.

Electrical actuation

The PW pan tilt actuator is electrically actuated by the fully integrated control and power electronics. In this way, the module does not require any additional external control units.

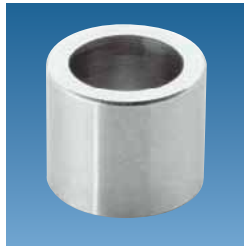
A varied range of interfaces, such as Profibus DP, CAN-Bus or RS-232 are available as methods of communication. This enables you to create industrial bus networks, and ensures easy integration in control systems. You can make use of our hybrid cables for conveying the supply voltage and for communication.

If you wish to create combined systems (e.g. a rotary gripping module), various other modules from our PowerCube series are at your disposal.

Accessories

Accessories from SCHUNK — the suitable complement for the highest level of functionality, reliability and controlled production of all automation components.

Centering sleeves



Interfaces

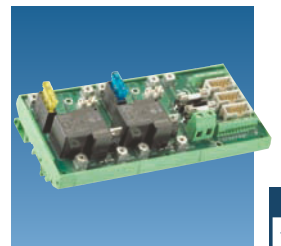
CAN-Bus	RS-232
Profibus-DP	



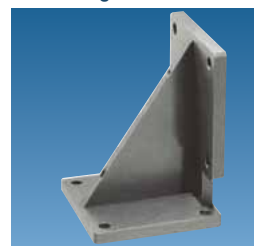
Hybrid cable



Electrical accessories PAE terminal block



PAM standard connecting elements



① For the exact size of the required accessories, availability of this size and the designation and ID, please refer to the additional views at the end of the size in question. You will find more detailed information on our accessory range in the „Accessories“ catalog section.

General information on the series

Repeat accuracy

Repeat accuracy is defined as the spread of the limit position after 100 consecutive swiveling cycles.

Axis positions

The position of the axes is always shown in the drawing in the zero position (0°). From here, it can be rotated clockwise and anti-clockwise in the "radius of action with end position switch" — software end positions (basic position on delivery). If the basic parameters are changed (software end positions are deactivated), axis 2 of the module can be swiveled until the memory for the position value in the control electronics overflows.

Swiveling time

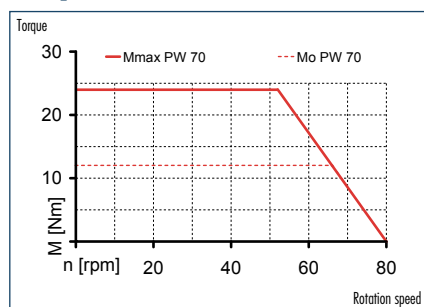
Swiveling times are purely the rotation times of the axes. Relay switching times or SPC reaction times are not included in the above times and must be taken into consideration when determining cycle times. Load-dependent rest periods may have to be included in the cycle time.

Mean attached load

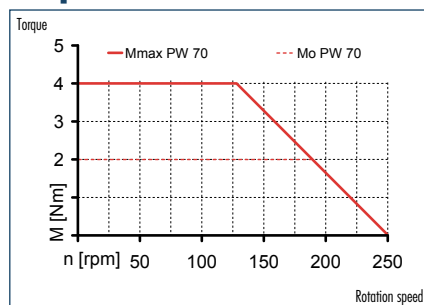
The mean attached load should constitute a typical load. It is defined as the half of the max. possible moment of inertia that can be swiveled without bouncing or hitting, with a centric load and a vertical rotating axis.



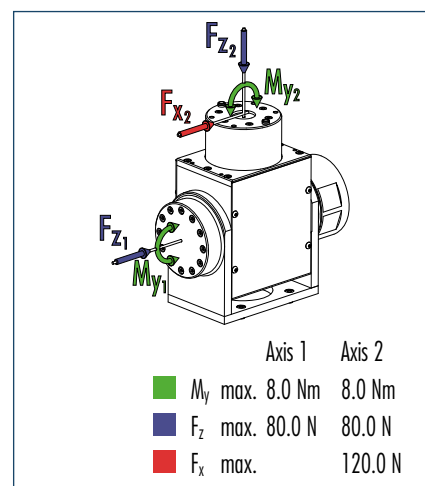
Torque characteristic axis 1



Torque characteristic axis 2



Forces and moments



① Moments and forces may occur simultaneously.

Technical data

Description	PW 70	
	ID	0306603
IP class		54
Weight	[kg]	1.8
Min. ambient temperature	[°C]	5.0
Max. ambient temperature	[°C]	55.0
Mechanical operating data		
	Axis 1	Axis 2
Nominal torque	[Nm]	12.0
Peak torque	[Nm]	24.0
Angle of rotation (1:±/2:>)	[°]	120.0
Swiveling time (90°) with mean attached load	[s]	0.65
Repeat accuracy*	[°]	0.04
Max. angular velocity	[°/s]	240.0
Max. acceleration	[°/s²]	960.0
Gear ratio		121:1
Magnetic brake	Yes	No
Resolution	[arcsec]	5.0
Electrical operating data		
Nominal voltage	[VDC]	24.0
Nominal power current	[A]	4.0
Max. current	[A]	8.0
Control electronics		
Integrated electronics		Yes
Voltage supply	[VDC]	24.0
Nominal power current	[A]	0.5
Sensor system		Encoder
Interface		RS-232; Profibus-DP; CAN-Bus

① The peak torques act as a temporary drive reserve on acceleration and braking.

* Higher accuracy on request

Technical drawing of a 1000W three-phase asynchronous motor, showing four views: front, top, side, and rear.

Front View (Top Left): Shows the motor's front face with a circular terminal box. Dimensions include a total width of 165.1, a terminal box width of 70, and a terminal box height of 70. The terminal box has a diameter of $\varnothing 64$. Callouts 1, 3, and 71 point to specific features.

Top View (Bottom Left): Shows the motor's top face. Dimensions include a total length of 159.5, a terminal box length of 107, and a terminal box width of 70. The terminal box has a diameter of $\varnothing 66$. Callouts 1, 3, and 71 point to specific features.

Side View (Middle): Shows the motor's side profile. Dimensions include a total height of 95.1, a terminal box height of 37.7, and a terminal box width of 70. The terminal box has a diameter of $\varnothing 64$. Callouts 1, 3, and 71 point to specific features.

Rear View (Bottom Right): Shows the motor's rear face. Dimensions include a total width of 165.1, a terminal box width of 70, and a terminal box height of 70. The terminal box has a diameter of $\varnothing 64$. Callouts 1, 3, and 71 point to specific features.

Callouts:

- 1: Points to the terminal box.
- 3: Points to the terminal box mounting holes.
- 71: Points to the terminal box mounting holes.
- 2: Points to the terminal box mounting holes.
- Ø6 (2x): Points to the terminal box mounting holes.
- M4 (6x): Points to the terminal box mounting holes.
- 3 (2x): Points to the terminal box mounting holes.
- Ø19.5 (2x): Points to the terminal box mounting holes.
- Ø70: Points to the terminal box mounting holes.
- 7: Points to the terminal box mounting holes.
- 3: Points to the terminal box mounting holes.
- M4 (4x): Points to the terminal box mounting holes.
- Ø6 (2x): Points to the terminal box mounting holes.
- 1: Points to the terminal box mounting holes.

- ① Connection of actuator
- ② Attachment connection
- ⑦1 M16x1.5 for cable gland

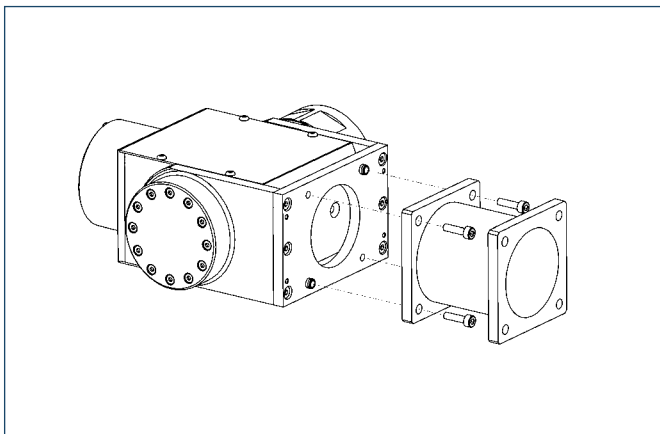


The diagram illustrates the experimental setup. A laptop (2) is connected to a power supply (1) and a motor driver (3). The power supply (1) is connected to the motor driver (3) via a red wire. The laptop (2) is connected to the motor driver (3) via a blue wire. The motor driver (3) is connected to a motor (4) which is part of a robotic arm assembly. The motor (4) is connected to the motor driver (3) via a red wire. The motor (4) is also connected to a sensor (5) which is part of the robotic arm assembly. The sensor (5) is connected to the motor (4) via a red wire.

- | Description | ID | Length |
|--|---------|--------|
| PowerCube Hybrid cable, coiled | 0307753 | 0.3 m |
| PowerCube Hybrid cable, coiled | 0307754 | 0.46 m |
| PowerCube Hybrid cable, straight (per meter) | 9941120 | |
| Terminal block PAE 130 TB | 0307725 | |

You can find further cables in the „Accessories“ catalog section.

Mechanical accessories

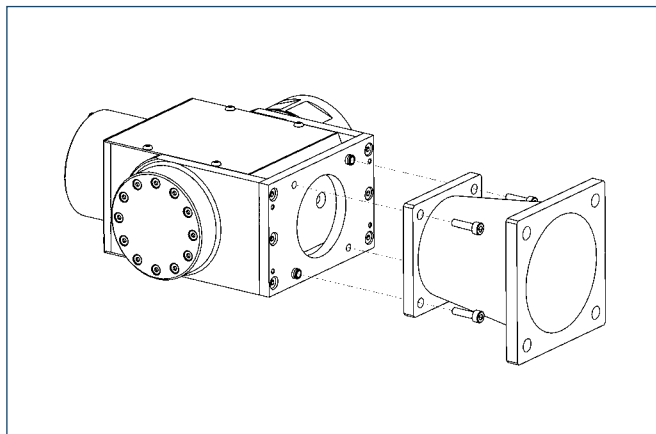


Straight connecting element

Straight standard element for connecting size 70 PowerCube modules with complete repeat accuracy

Description	ID	Dimensions
PAM 100	0307800	70x70/35/70x70 mm
PAM 101	0307801	70x70/70/70x70 mm

Special lengths on request

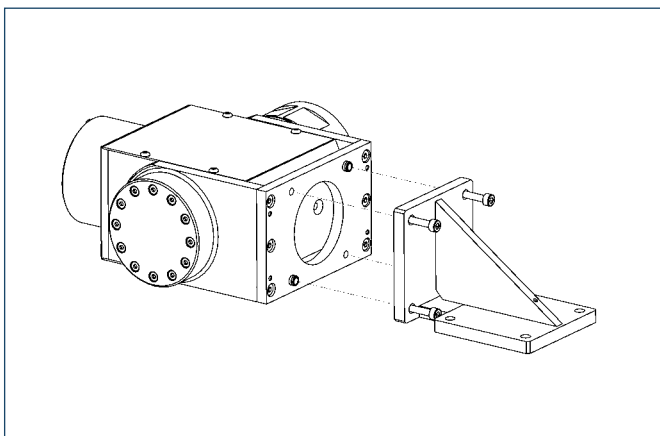


Conical connecting element

Conical standard element for connecting size 70 and 90 PowerCube modules with complete repeat accuracy

Description	ID	Dimensions
PAM 110	0307810	90x90/45/70x70 mm
PAM 111	0307811	90x90/90/70x70 mm

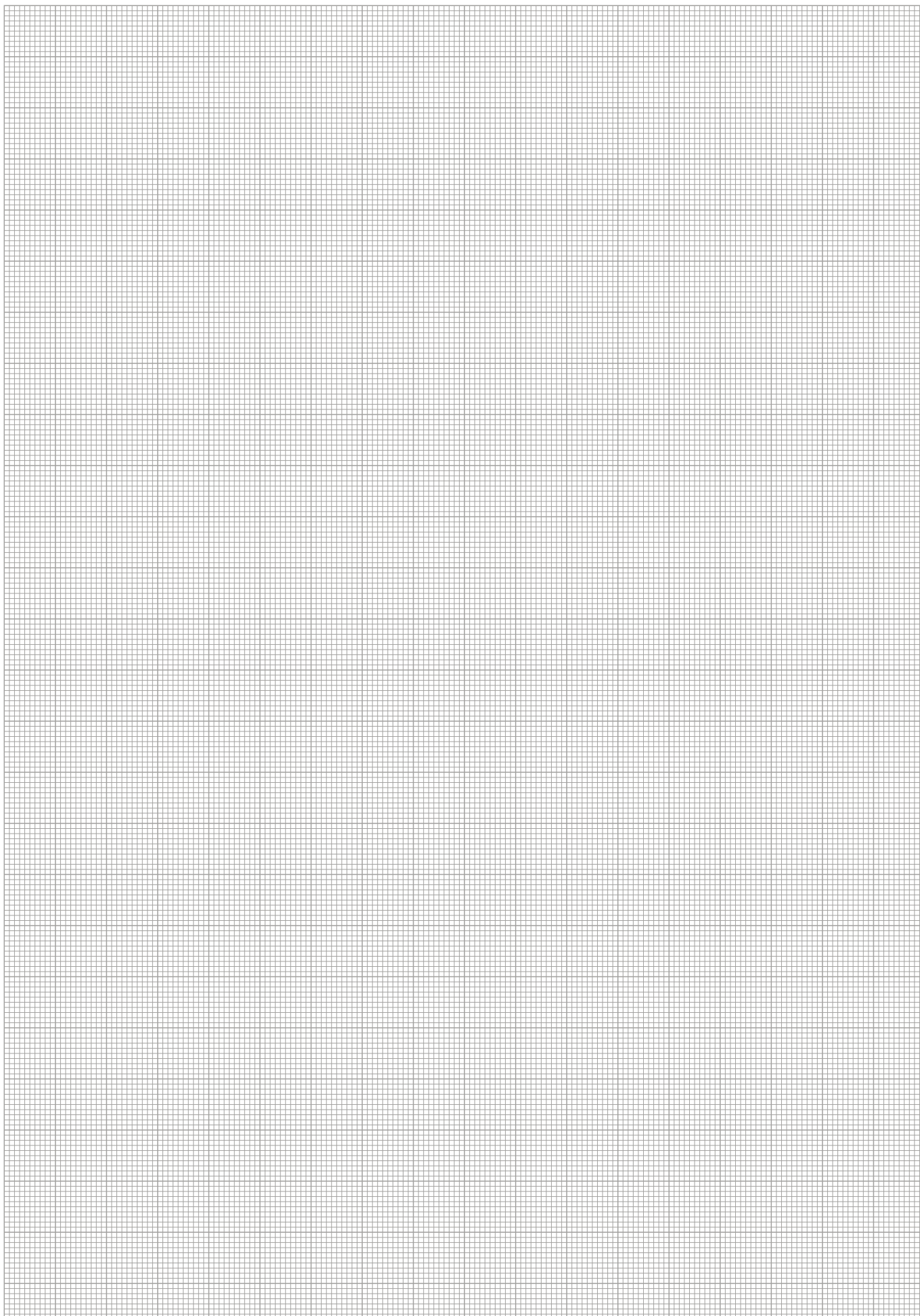
Special lengths on request



Right-angle connecting element

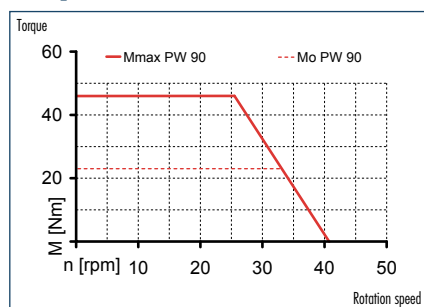
Right-angle standard element for connecting size 70 PowerCube modules with complete repeat accuracy

Description	ID	Dimensions
PAM 120	0307820	90°/70.5x98

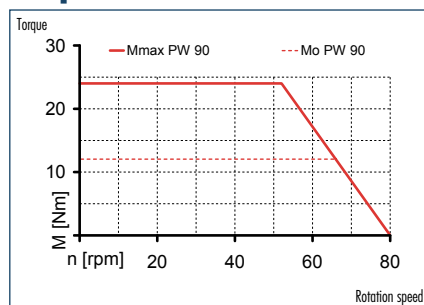




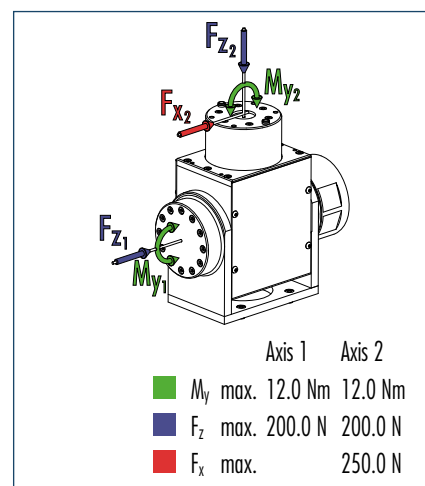
Torque characteristic axis 1



Torque characteristic axis 2



Forces and moments



① Moments and forces may occur simultaneously.

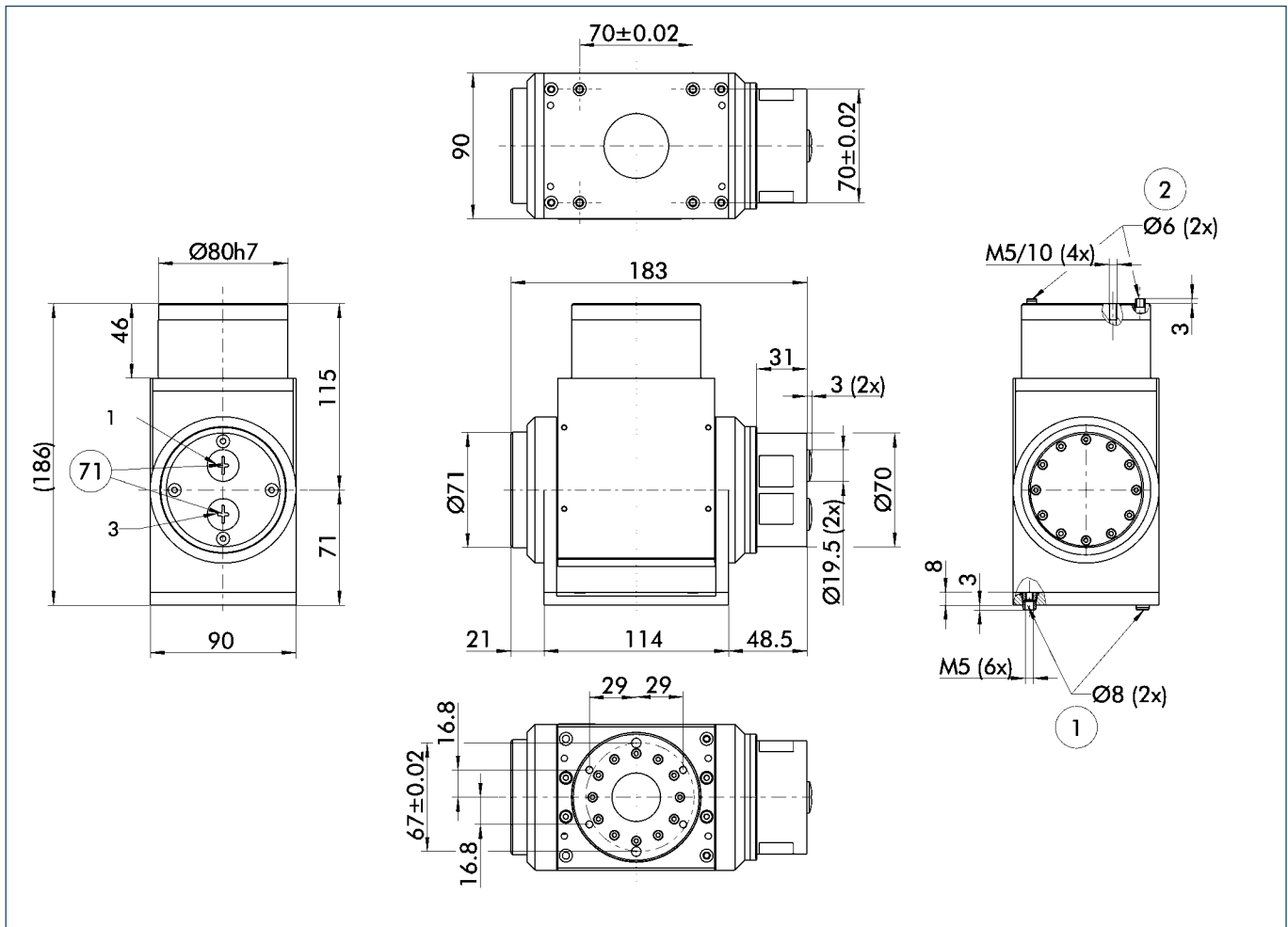
Technical data

Description	PW 90	
	ID	0306613
IP class		54
Weight	[kg]	3.4
Min. ambient temperature	[°C]	5.0
Max. ambient temperature	[°C]	55.0
Mechanical operating data		
	Axis 1	Axis 2
Nominal torque	[Nm]	23.0
Peak torque	[Nm]	46.0
Angle of rotation (1:±/2:→)	[°]	120.0
Swiveling time (90°) with mean attached load	[s]	0.85
Repeat accuracy*	[°]	0.04
Max. angular velocity	[°/s]	150.0
Max. acceleration	[°/s²]	600.0
Gear ratio		161:1
Magnetic brake	Yes	No
Resolution	[arcsec]	4.0
Electrical operating data		
Nominal voltage	[VDC]	24.0
Nominal power current	[A]	4.0
Max. current	[A]	8.0
Control electronics		
Integrated electronics		Yes
Voltage supply	[VDC]	24.0
Nominal power current	[A]	0.5
Sensor system		Encoder
Interface	RS-232; Profibus-DP; CAN-Bus	

① The peak torques act as a temporary drive reserve on acceleration and braking.

* Higher accuracy on request

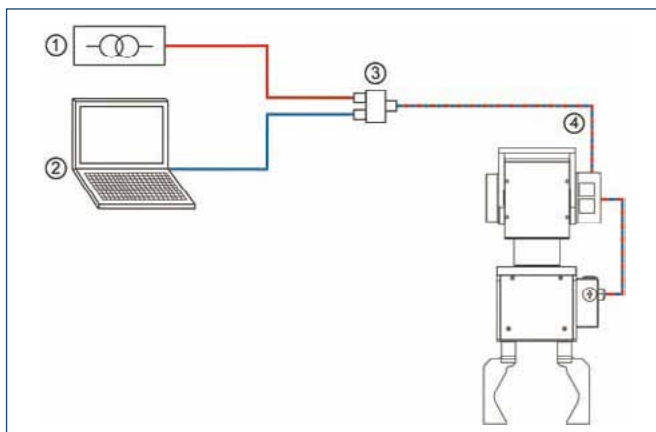
Main views



The drawing shows the rotary actuator with damp-proof cap in the basic version, the dimensions do not include the options described below.

- ① Connection of actuator
- ② Attachment connection
- ⑦1 M16x1.5 for cable gland

Actuation



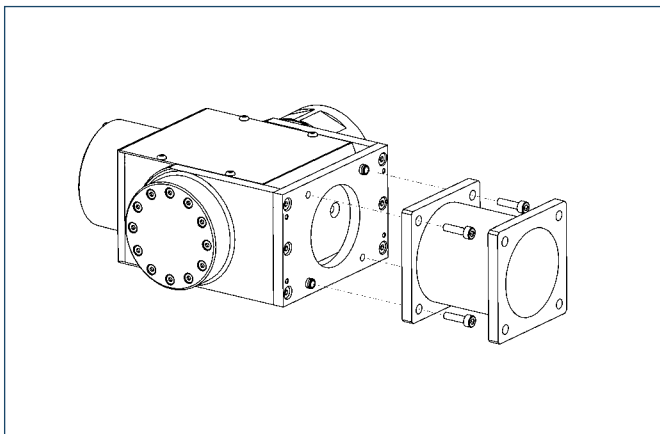
- ① 24 VDC voltage supply provided by customer
- ② Control (SPC, etc.) provided by customer
- ③ PAE 130 TB terminal block for connecting the voltage supply, the communication and the hybrid cable
- ④ Hybrid cable for connecting the PowerCube modules

Electrical accessories

Description	ID	Length
PowerCube Hybrid cable, coiled	0307753	0.3 m
PowerCube Hybrid cable, coiled	0307754	0.46 m
PowerCube Hybrid cable, straight (per meter)	9941120	
Terminal block PAE 130 TB	0307725	

You can find further cables in the „Accessories“ catalog section.

Mechanical accessories

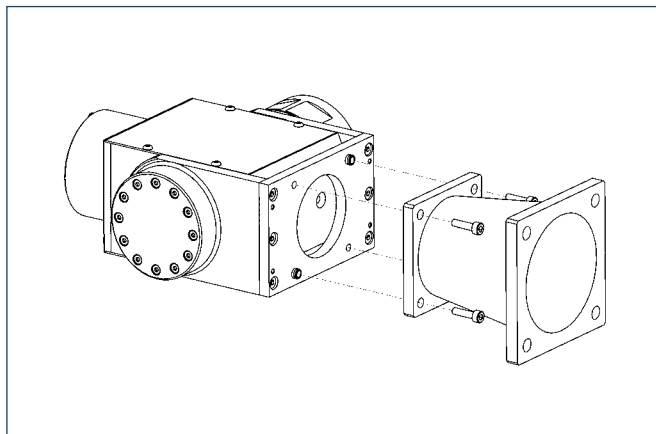


Straight connecting element

Straight standard element for connecting size 90 PowerCube modules with complete repeat accuracy

Description	ID	Dimensions
PAM 102	0307802	90x90/45/90x90 mm
PAM 103	0307803	90x90/90/90x90 mm

Special lengths on request

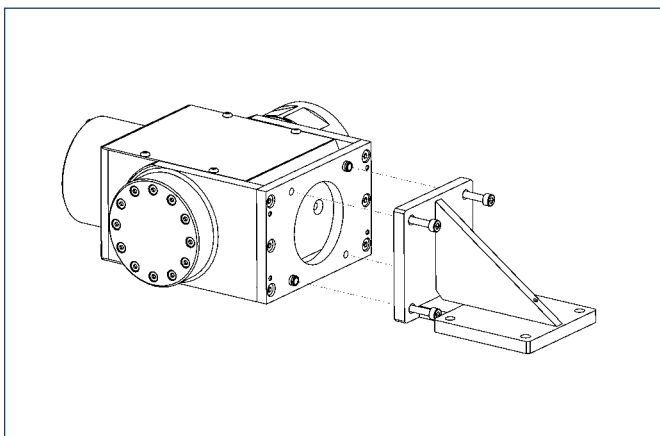


Conical connecting element

Conical standard element for connecting size 70, 90 and 110 PowerCube modules with complete repeat accuracy

Description	ID	Dimensions
PAM 110	0307810	90x90/45/70x70 mm
PAM 111	0307811	90x90/90/70x70 mm
PAM 112	0307812	110x110/55/90x90 mm
PAM 113	0307813	110x110/110/90x90 mm

Special lengths on request



Right-angle connecting element

Right-angle standard element for connecting size 90 PowerCube modules with complete repeat accuracy

Description	ID	Dimensions
PAM 121	0307821	90°/90.5x122



You can find more detailed information and individual parts of the above-mentioned accessories in the „Accessories“ catalog section.

