

H-811.I2

6-Axis Miniature Hexapod

Fast, Compact, and Highly Precise



- Travel ranges to ± 17 mm / $\pm 21^\circ$
- Load capacity to 5 kg
- Repeatability to ± 0.06 μ m
- Velocity to 20 mm/s
- Superior lifetime
- Vacuum-compatible versions available

Parallel-kinematic design for six degrees of freedom making it significantly more compact and stiff than serial-kinematic systems, higher dynamic range, no moved cables: Higher reliability, reduced friction. Vacuum-compatible version to 10^{-6} hPa available.

Brushless DC motor (BLDC)

Brushless DC motors are particularly suitable for high rotational speeds. They can be controlled very accurately and ensure high precision. Because they dispense with sliding contacts, they run smoothly, are wear-free and therefore achieve a long lifetime.

Fields of application

Research and industry, standard and vacuum environments. For micromanufacturing, medical technology, tool control.

Ordering Information

H-811.I2

Miniature Hexapod Microrobot, Brushless DC motor, 5 kg Load capacity, 20 mm/s Velocity, 0.5 m cable length, including 3 m cable set

Ask about custom designs!

Specifications

Preliminary data	H-811.I2	Unit	Tolerance
Active axes	X, Y, Z, θ_x , θ_y , θ_z		
Motion and positioning			
Travel range* in X, Y, Z	$\pm 17, \pm 16$	mm	
Travel range* in Z	± 6.5	mm	
travel range* in θ_x , θ_y	$\pm 10, \pm 10$	°	
travel range* in θ_z	± 21	°	
Actuator design resolution	5	nm	
Min. incremental motion X, Y	0.2	μm	typ.
Min. incremental motion Z	0.08	μm	typ.
Min. incremental motion θ_x , θ_y , θ_z	2.5	μrad	typ.
Backlash X, Y	0.2	μm	typ.
Backlash Z	0.06	μm	typ.
Backlash θ_x , θ_y	4	μrad	typ.
Backlash θ_z	4	μrad	typ.
Repeatability X, Y	± 0.15	μm	typ.
Repeatability Z	± 0.06	μm	typ.
Repeatability θ_x , θ_y	± 2	μrad	typ.
Repeatability θ_z	± 3	μrad	typ.
Max. velocity X, Y, Z	20	mm/s	
Max. velocity θ_x , θ_y , θ_z	500	mrad/s	
Typ. Velocity X, Y, Z	10	mm/s	
Typ. Velocity θ_x , θ_y , θ_z	240	mrad/s	
Mechanical properties			
Stiffness X / Y	0.7	N/ μm	
Stiffness Z	8	N/ μm	
Load capacity (base plate horizontal / any orientation)	5 / 2.5	kg	max.
Holding force, de-energized (base plate horizontal / any orientation)	15 / 2.5	N	max.
Motor type	BLDC motor		
Miscellaneous			
Operating temperature range	0 to 50	°C	

Preliminary data	H-811.I2	Unit	Tolerance
Material	Stainless steel, aluminum		
Mass	2.2	kg	±5 %
Cable length	0.5 + 3	m	±10 mm

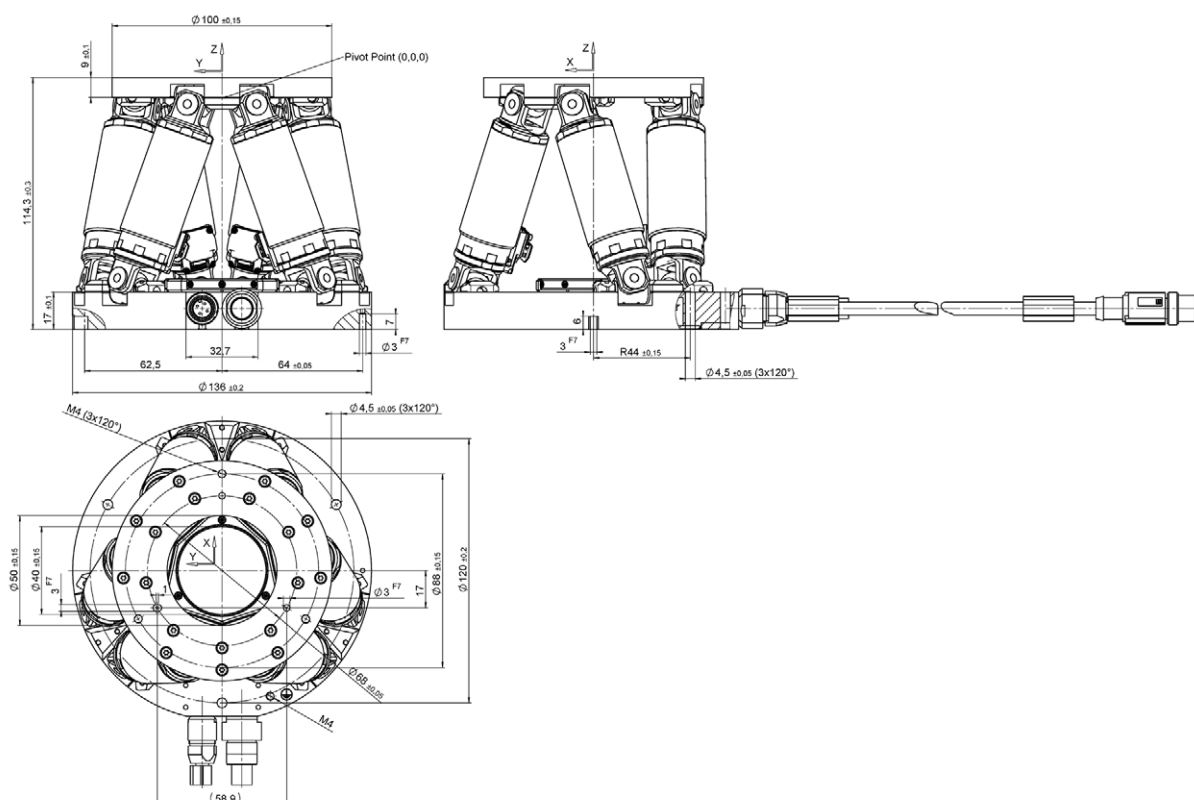
Specifications for vacuum versions can differ.

Technical data specified at 20 ± 3 °C.

Ask about custom designs!

* The travel ranges of the individual coordinates (X, Y, Z, θ_x , θ_y , θ_z) are interdependent. The data for each axis in this table shows its maximum travel range, where all other axes and the pivot point are at the reference position.

Drawings and Images



H-811, dimensions in mm

6- Axis Motion Hexapod

FAST AND COMPACT FOR HIGH DYNAMICS APPLICATIONS



H-811.S11

- + Travel ranges to 34 mm / 42°
- + Velocity to 25 mm/ s
- + Dynamics to 25 Hz over 0.1° travel range
- + Integrated wave generator
- + Developed for test stations for image stabilization
- + CIPA certified



Certificate of
Registration of
Vibratory Apparatus

Reference- class 6- axis positioning system

Parallel- kinematic design for six degrees of freedom making it significantly more compact and stiff than serial- kinematic systems, higher dynamic range, no moved cables: Higher reliability, reduced friction. Vacuum- compatible version to 10^{-6} hPa available

Direct drive with brushless DC motors (BLDC) and long- life ball screws

High precision, velocity and lifetime

H-811.S11 incl. 6D controller for Hexapods, plus two additional servo axes

- Digital I/ O interfaces for trigger signal emission
- Precise running of predefined motion profiles with high path accuracy

Powerful digital controller, open software architecture

User- defined, stable pivot point, software- selectable. Positions commanded in Cartesian coordinates. Macro programming. Open source LabVIEW driver set. Work space simulation software. Virtual Hexapod machine software. Optional: Collision avoidance software (external obstacles)

Fields of application

Research and industry, test systems, e.g. for image stabilization in cameras and mobile devices

Specifications

Preliminary data	H-811.S11	Unit	Tolerance
Active axes	X, Y, Z, θ_x , θ_y , θ_z		
Motion and positioning			
Travel range* X, Y, Z	± 17 , ± 16 , ± 6.5	mm	
Travel range* θ_x , θ_y , θ_z	± 10 , ± 10 , ± 21	°	
Single- actuator design resolution	80	nm	
Min. incremental motion X, Y	2	μm	typ.
Min. incremental motion Z	1	μm	typ.
Min. incremental motion θ_x , θ_y , θ_z	12	μrad	typ.
Repeatability X, Y	± 0.5	μm	typ.
Repeatability Z	± 0.2	μm	typ.
Repeatability θ_x , θ_y	± 8	μrad	typ.
Repeatability θ_z	± 15	μrad	typ.
Max. velocity X, Y, Z	25	mm/ s	
Max. velocity θ_x , θ_y , θ_z	325	mrads	
Typ. velocity X, Y, Z	10	mm/ s	
Typ. velocity θ_x , θ_y , θ_z	250	mrads	
Mechanical properties			
Load (base plate horizontal / any orientation)	1.5 / 0.3	kg	max.
Holding force, de- energized (base plate horizontal / any orientation)	15 / 2.5	N	max.
Motor type	Brushless DC Motor		
Miscellaneous			
Operating temperature range	0 to 50	°C	
Material	Stainless steel, aluminum		
Mass	2.2	kg	± 5 %
Cable length	2	m	± 10 mm

Technical data specified at 20 ± 3 °C.

* The travel ranges of the individual coordinates (X, Y, Z, θ_x , θ_y , θ_z) are interdependent. The data for each axis in this table shows its maximum travel, where all other axes are at their zero positions. If the other linear or rotational coordinates are not zero, the available travel may be less.

Order Information

Mechanics with controller

H-811.S11

Miniature Hexapod Microrobot for High- Dynamics Applications, Direct Drive, 25 mm/ s, 1.5 kg Load, 2 m Cable, with 6- D Hexapod Controller, Control of 2 Additional Servo- Motor Axes Included, TCP/ IP and RS-232 Interface, 19" Chassis

Controllers / Drivers / Amplifiers

[C-887.311 Hexapod Control with EtherCAT®](#)

Related Products

[H-840 6- Axis Hexapod](#)

[H-824 6- Axis Hexapod](#)

[H-820 6- Axis Positioner with Controller](#)

[H-860KMAG High- Dynamics Hexapod](#)

[H-811 6- Axis Miniature Hexapod](#)

Technology

[Hexapodspezifische Software von PI | Hexapoden erfordern aufgrund ihres parallelkinematischen Aufbaus eine besonders komplexe Ansteuerung. Weiterlesen ...](#)

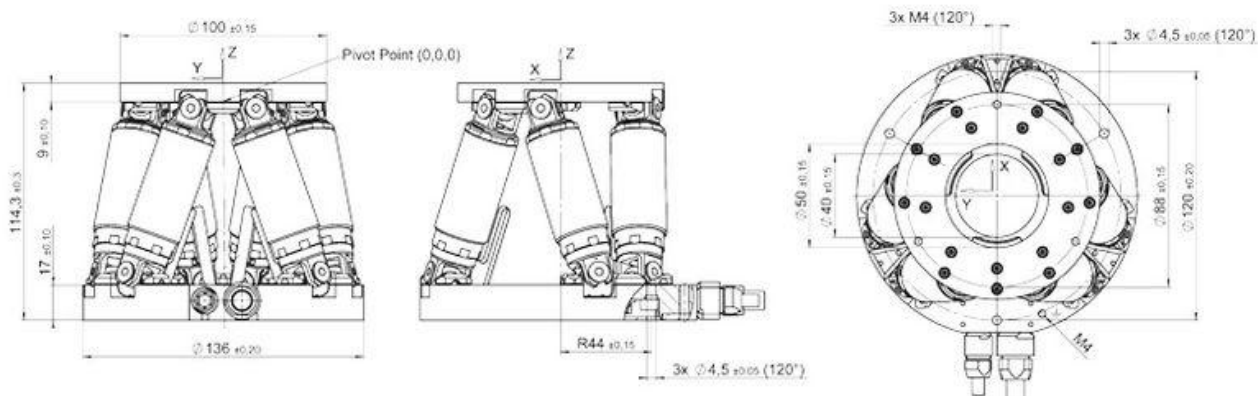
[Piezopositioniersysteme mit paralleler Kinematik | In einem Parallelkinematik- Mehrachsensystem gibt es nur eine bewegte Plattform, auf die alle Aktoren direkt einwirken. Weiterlesen ...](#)

[Hexapoden – Parallelkinematische Positioniersysteme | Ein Hexapod ist ein System für die Bewegung und Positionierung, Justierung und Verschiebung von Lasten in sechs Achsen im Raum, drei linearen und drei rotatorischen. Weiterlesen ...](#)

[Hexapod as Motion Simulator | Motion simulators have higher motion dynamics requirements \(shakers\). Learn more ...](#)

Drawings / Images

H-811, dimensions in mm



C-887.53x

Hexapod Motion Controller with EtherCAT

Control a 6-Axis Positioning System via Fieldbus Interface



- Synchronous clock for entire automation line
- Synchronous motion in 6 axes
- Cycle time 1 ms
- Commanding in Cartesian coordinates
- Analog interface and motion stop option

EtherCAT®

Digital controller with EtherCAT® fieldbus interface

Can be integrated seamlessly into automation systems in industry and research. Performs coordinate transformation for parallel kinematics. Motion controller for hexapod (6-axis parallel kinematics) with DC motors and two additional axes.

Customer requires a higher-level PLC control for position commanding and feedback in Cartesian coordinates (EtherCAT master with CoE protocol).

Supported operating modes

Reference move of the hexapod to the mid-position of all six axes. Absolute positioning in six Cartesian axes. Cyclic position commanding via PLC for synchronization with further automation components. Operation without PLC master via TCP/IP or RS-232 is possible. The controller then has the same functionality as the C-887.52x. Commanding of the hexapod is then done directly via the PI GCS.

Functions

Position input via Cartesian coordinates, coordinate transformation handled by the controller. To simplify integration of the hexapod, the reference system (Work, Tool) can be quickly and easily changed. The real-time operating system prevents jitter and therefore guarantees constantly low response times. Motion is vectored. Stable, virtual pivot point can be freely defined in space. Data recorder for recording operating parameters such as motor control, velocity, position or position errors. Macro command language. An autostart macro allows stand-alone operation. Connection of external input devices (HID) such as manual control unit. The controller supports motor brakes and absolute-measuring sensors with BiSS interface.



Example of a configuration: H-811.D2 miniature hexapod with C-887.532 motion controller with EtherCAT interfaces and motion stop. The EtherCAT master, in this case a Beckhoff controller, is provided and programmed by the customer *EtherCAT® is a registered trade mark and patented technology of Beckhoff Automation GmbH, Germany.*

27.09.2016
15:05

Interfaces

Ethernet for remote control and remote maintenance. RS-232. USB connection for external input devices (HID).

Additional interfaces

- Motion Stop: The supply voltage of the hexapod drive can be switched off using the external switch connected to the controller. The sensor technology remains active so that position information continues to be available and a reference move is not necessary when the drive is reactivated.
- Analog inputs

Optional

- Control via manual control unit
- Collision checking for restricted space with PIVeriMove software

Extensive software for commanding the hexapod directly

PIMikroMove user software. Common command set for all PI positioning systems. Dynamic libraries for Windows and Linux. Complete set of LabVIEW VI's. Graphical user interfaces, configuration software and graphically displayed scan routines.

Scope of Delivery

The order is made together with suitable hexapod mechanics. The scope of delivery includes the hexapod, controller with software package, cable set, and power supply. A PLC master controller is not in the scope of delivery!

Related and compatible products

Related products

C-887.52x Hexapod Motion Controller
C-885 PIMotionMaster
E-712 Digital Piezo Controller

Suitable mechanics

H-206 6-Axis Precision Alignment System
H-810 6-Axis Miniature Hexapod
H-811.D2 6-Axis Miniature Hexapod
H-811.S11 6-Axis Motion Hexapod
H-820 6-Axis Positioner with Controller
H-824 6-Axis Hexapod
H-840 6-Axis Hexapod
H-850 6-Axis Hexapod

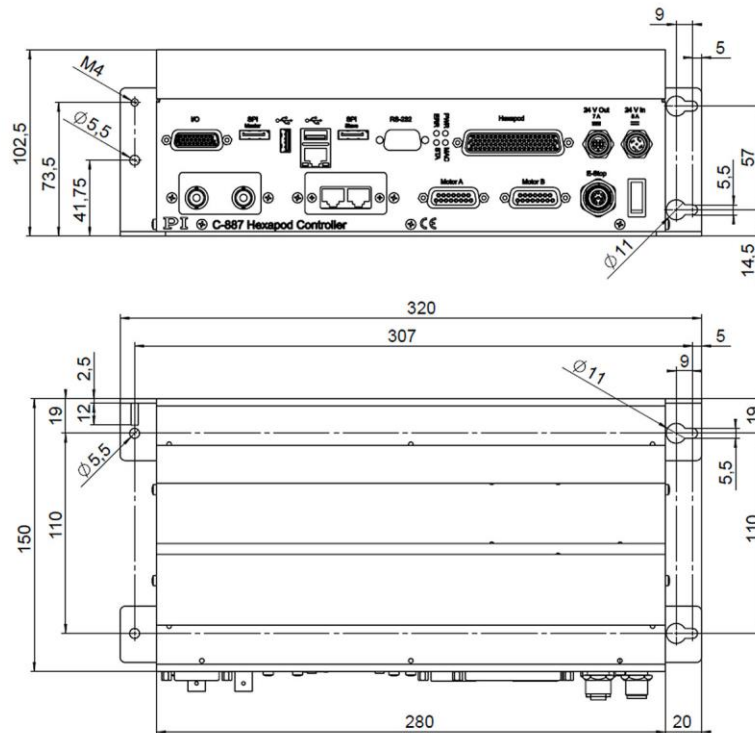
Specifications

	C-887.53 C-887.531 C-887.532 C-887.533
Function	6-axis controller for hexapods, incl. control of two additional single axes Compact benchtop device with EtherCAT Interface

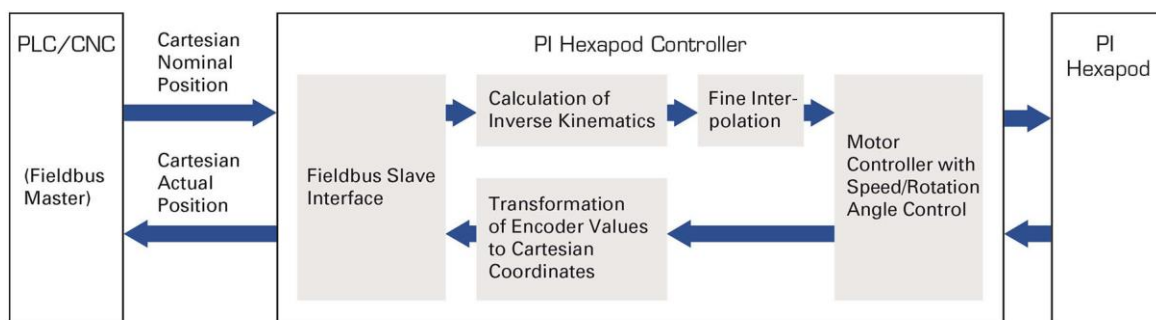
Drive type	Extending the functionality of C-887.53: C.887.531: Additional Analog Inputs C-887.532: Additional Motion Stop C-887.533: Additional Motion Stop and Analog Inputs DC motors (hexapod and single axes)
EtherCAT specifications	
Fieldbus protocol	EtherCAT® (CoE = CANopen over EtherCAT®)
Drive profile	CiA402 Drive Profile (IEC 61800-7-201)
Cycle time	1 ms
Supported modes of operation	Reference move (homing mode) Positioning mode with cyclical target position via the PLC (cyclic synchronous position mode) Configuration mode (initially for start-up)
Supported modes of synchronization	Distributed Clock (DC) mode; SyncManager (SM) mode
Motion and control	
Servo characteristics	32-bit PID controller
Trajectory profile modes	Jerk-controlled generation of dynamics profile with linear interpolation
Processor	Intel Atom dual core (1.8 GHz)
Servo cycle time	100 µs
Encoder input	AB (quadrature) differential TTL signal, 50 MHz BiSS
Stall detection	Servo off, triggered by position error
Reference point switch	TTL
Electrical properties	
Hexapod control	12-bit PWM signal, TTL, 24 kHz
Hexapod power source	24 V
Maximum output current	7 A
Interfaces and operation	
Interface / communication	2 x RJ45 for EtherCAT (In/Out) TCP/IP, RS-232 USB (HID, manual control unit)

Hexapod connection	HD Sub-D 78-pin (f) for data transfer M12 4-pin power supply
Connectors for single axes	Sub-D 15-pin (f)
I/O lines	HD Sub-D 26-pin (f): 4 × analog input (-10 to 10 V, via 12-bit A/D converter) 4 × digital input (TTL) 4 × digital output (TTL)
Analog inputs, only C.887.531, C-887.533	2 × BNC, -5 V to 5 V, via 16-bit A/D converter, 5 kHz bandwidth
Input for motion stop, only C-887.532 and C-887.533	M12 8-pin
Command set	PI General Command Set (GCS)
User software	PIMikroMove
Software drivers	LabVIEW driver, dynamic libraries for Windows and Linux
Manual operation	Optional: C-887.MC control unit for hexapods
Miscellaneous	
Operating voltage	24 V external power supply for 100 to 240 VAC, 50 / 60 Hz, in the scope of delivery
Maximum current consumption	8 A
Operating temperature range	5 to 40 °C
Mass	2.8 kg
Dimensions	280 (320) mm × 150 mm × 103 mm Power supply: 170 mm × 85 mm × 42.5 mm

Drawings and images



C-887.53x, dimensions in mm. version-dependent interfaces



Integration of the hexapod motion controller into an automation system

Ordering information

C-887.53

6-Axis Hexapod Controller, TCP/IP, RS-232, Benchtop Device, Control of Two Additional Servo-Motor Axes Included, EtherCAT Interface

C.887.531

6-Axis Hexapod Controller, TCP/IP, RS-232, Benchtop Device, Control of Two Additional Servo-Motor Axes Included, EtherCAT Interface, Analog Inputs

C-887.532

6-Axis Hexapod Controller, TCP/IP, RS-232, Benchtop Device, Control of Two Additional Servo-Motor Axes Included, EtherCAT Interface, Motion Stop

C-887.533

6-Axis Hexapod Controller, TCP/IP, RS-232, Benchtop Device, Control of Two Additional Servo-Motor Axes Included, EtherCAT Interface, Motion Stop, Analog Inputs

Accessories

C-887.MC

Manual control unit for hexapods, USB connection, 3 m Cable

C-887.VM1

PIVeriMove hexapod software for Collision Check

C-887.52x Hexapod Motion Controller

Compact Bench-Top Device for Controlling 6-Axis Systems



- Sophisticated controller using vector algorithms
- Commanding in Cartesian coordinates
- Changes of the reference system with a simple command
- Analog interfaces and Motion Stop
- Extensive software support

Digital controller for 6-axis parallel kinematics

High-performance digital controller for hexapods with DC motors. Additional control for two further single axes with integrated ActiveDrive.

Functions

Position input via Cartesian coordinates, coordinate transformation handled by the controller. To simplify integration of the hexapod, the reference system (Work, Tool) can be quickly and easily changed. The real-time operating system prevents jitter and therefore guarantees constantly low response times. Stable, virtual pivot point can be freely defined in space. Data recorder for recording operating parameters such as motor control, velocity, position or position errors. Macro command language. An autostart macro allows stand-alone operation. The controller supports motor brakes and absolute-measuring sensors with BiSS interface.

Ordering information

C-887.52

6-Axis Hexapod Controller, TCP/IP, RS-232, Benchtop Device, Control of Two Additional Servo-Motor Axes Included

C-887.521

6-Axis Hexapod Controller, TCP/IP, RS-232, Benchtop Device, Control of Two Additional Servo-Motor Axes Included, Analog Inputs

C-887.522

6-Axis Hexapod Controller, TCP/IP, RS-232, Benchtop Device, Control of Two Additional Servo-Motor Axes Included, Motion Stop

C-887.523

6-Axis Hexapod Controller, TCP/IP, RS-232, Benchtop Device, Control of Two Additional Servo-Motor Axes Included, Motion Stop, Analog Inputs

Accessories

C-887.MC

Manual control unit for hexapods, USB connection, 3 m Cable

C-887.VM1

PIVeriMove hexapod software for Collision Check

Interfaces

Ethernet for remote control and remote maintenance. RS-232. USB connection for external input devices (HID).

Additional interfaces (depending on version):

- Motion Stop: The supply voltage of the hexapod drive can be switched off using the external switch connected to the controller. The sensor technology remains active so that position information continues to be available and a reference move is not necessary when the drive is reactivated.
- Analog inputs

Optional

- Control via manual control unit
- Collision checking for restricted space with PIVeriMove software

Extensive software

PIMikroMove user software. Common command set for all PI positioning systems. Dynamic libraries for Windows and Linux. Complete set of LabVIEW VI's. Graphical user interfaces, configuration software and graphically displayed scan routines.

Scope of Delivery

The order is made together with suitable hexapod mechanics. Delivery comprises the Hexapod Motion Controller, an hexapod, a cable set, and a power supply as power source.

Related and compatible products

Related products

C-887.53x Hexapod Motion Controller with EtherCAT
C-885 PIMotionMaster
E-712 Digital Piezo Controller

Compatible mechanics

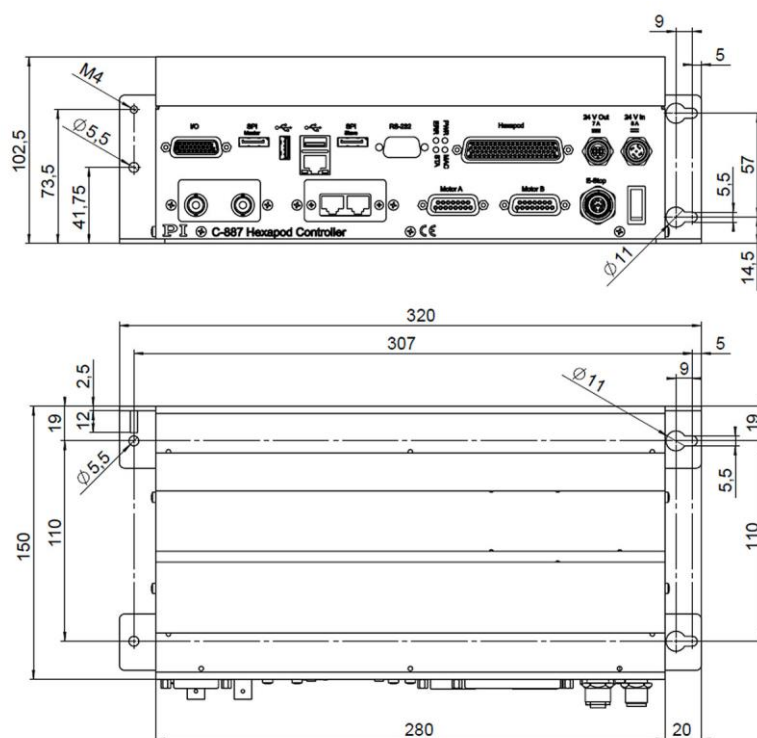
H-206 6-Axis Precision Alignment System
H-810 6-Axis Miniature Hexapod
H-811.D2 6-Axis Miniature Hexapod
H-811.S11 6-Axis Motion Hexapod
H-820 6-Axis Positioner with Controller
H-824 6-Axis Hexapod
H-840 6-Axis Hexapod
H-845 High-Load Hexapod
H-850 6-Axis Hexapod

Specifications

	C-887.52 C-887.521 C-887.522 C-887.523
Function	6-axis controller for hexapods, incl. control of two additional single axes Compact benchtop Extending the functionality of C-887.52: C-887.521: Additional Analog Inputs C-887.522: Additional Motion Stop C-887.523: Additional Motion Stop and Analog Inputs
Drive type	Servo motors (hexapod and single axes)
Motion and control	
Servo characteristics	32-bit PID controller
Trajectory profile modes	Jerk-controlled generation of dynamics profile with linear interpolation
Processor	Intel Atom dual core (1.8 GHz)
Servo cycle time	100 µs
Encoder input	AB (quadrature) differential TTL signal, 50 MHz BiSS
Stall detection	Servo off, triggered by position error
Reference point switch	TTL
Electrical properties	
Hexapod control	12-bit PWM signal, TTL, 24 kHz
Hexapod power source	24 V
Maximum output current	7 A
Interfaces and operation	
Interface / communication	TCP/IP, RS-232 USB (HID, manual control unit)
Hexapod connection	HD Sub-D 78-pin (f) for data transfer M12 4-pin (f) for power supply
Connectors for single axes	Sub-D 15-pin (f)
I/O lines	HD Sub-D 26-pin (f): 4 × analog input (-10 to 10 V, via 12-bit A/D converter) 4 × digital input (TTL) 4 × digital output (TTL)
Analog inputs, only C-887.521 and C-887.523	2 × BNC, -5 V to 5 V, via 16-bit A/D converter, 5 kHz bandwidth
Input for Motion Stop, only C-887.522 and C-887.523	M12 8-pin (f)
Command set	PI General Command Set (GCS)
User software	PIMikroMove
Software drivers	LabVIEW driver, dynamic libraries for Windows and Linux

Manual operation	Optional: C-887.MC manual control unit for hexapods
Miscellaneous	
Operating voltage	24 V external power supply for 100 to 240 VAC, 50 / 60 Hz, in the scope of delivery
Maximum current consumption	8 A
Operating temperature range	5 to 40 °C
Mass	2.8 kg
Dimensions	280 (320) mm × 150 mm × 103 mm Power supply: 170 mm × 85 mm × 42.5 mm

Drawings and Images



C-887.5xx, dimensions in mm. Interfaces depending on version.