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

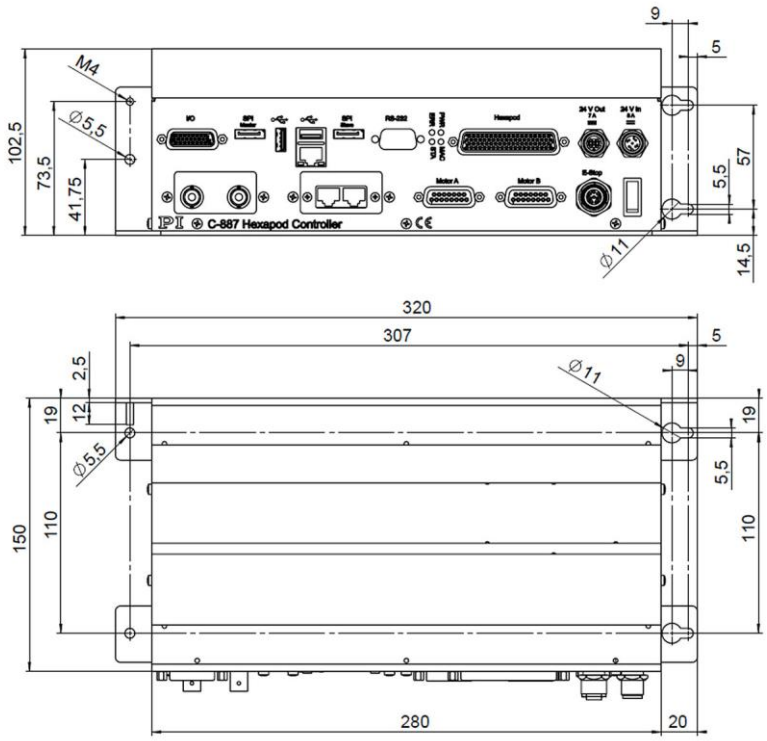
Compatible mechanics
H-206 6-Axis Precision Alignment System
H-810 6-Axis Miniature Hexapod
H-811.D2 6-Axis Miniature Hexapod
H-811.S11 6-Axis Motion Hexapod
H-820 6-Axis Positioner with Controller
H-824 6-Axis Hexapod
H-840 6-Axis Hexapod
H-845 High-Load Hexapod
H-850 6-Axis Hexapod

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.

Hexapod-Specific Software

Due to their parallel kinematic structure, Hexapods necessitate a particularly complex control system. The position coordinates, for example, are given in virtual Cartesian axes which are then converted into positioning commands for the individual actuators by the controller. PI supplies special software that allow the 6-axes positioners to be more convenient in operation and easier to integrate.

Determining the work space

The limits of the work space vary depending on the current position of the Hexapod (translation and rotation coordinates) and the current coordinates of the pivot point. A special software tool included with each PI Hexapod calculates these limits and displays them graphically.

Checking the permissible load

As with any multiaxis positioning system, the load limit of the Hexapod varies as a function of a number of factors such as orientation of the Hexapod, size and position of the payload, current position (translation and rotation coordinates) of the Hexapod platform, and forces and moments acting on the platform.

The Hexapod software package includes a PI simulation tool that calculates all forces and moments and compares them individually against the specified load limits of the corresponding Hexapod mechanics.

Preventing collisions with PIVeriMove

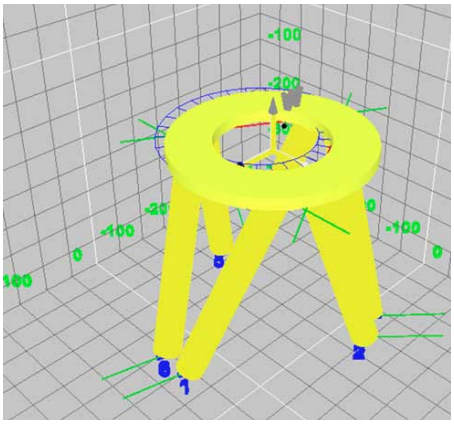
Another proprietary PI simulation software tool enables offline graphical configuration and simulation of the Hexapod motion in the application environment. CAD data of objects can be imported or approximated with simple shapes such as cylinders and cuboids. PIVeriMove then checks restrictions in the work space. Implemented in the controller firmware or the application software, this prevents the Hexapod from approaching positions where the platform, struts, or the mounted load would collide with the surroundings.

Emulation: The Hexapod system as a virtual machine

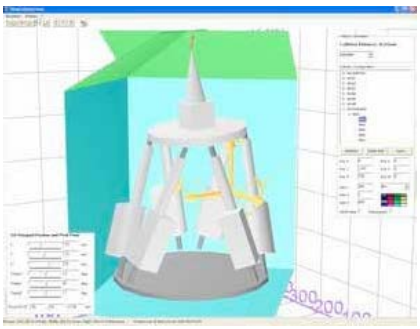
A virtual machine that can be installed on the customer's host PC is available to emulate a complete Hexapod systems (mechanics, controller and even peripherals). Application programs can then be developed and pre-tested, different load scenarios can be simulated and the work space can be determined before the system arrives, saving significant cost and development time.

HexaApp: PI Hexapod control via iPhone, iPad or iPod

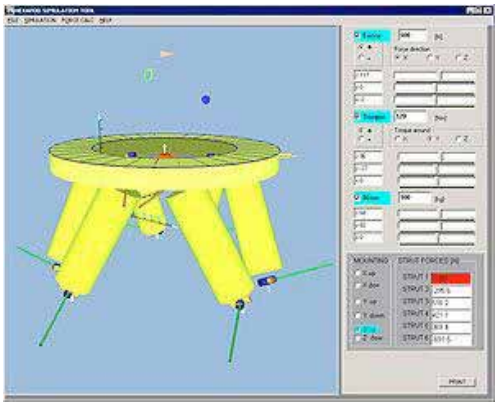
The Hexapod system can also be controlled wirelessly from mobile Apple iOS devices. A corresponding app enables command control of touchscreen, motion sensors or via a command input window.



The simulation software graphically displays the position and the available work space of the Hexapod model



Highly advanced digital controllers are also available for Hexapods with piezo stepping drives which are suitable for operation in strong magnetic fields or UHV environments

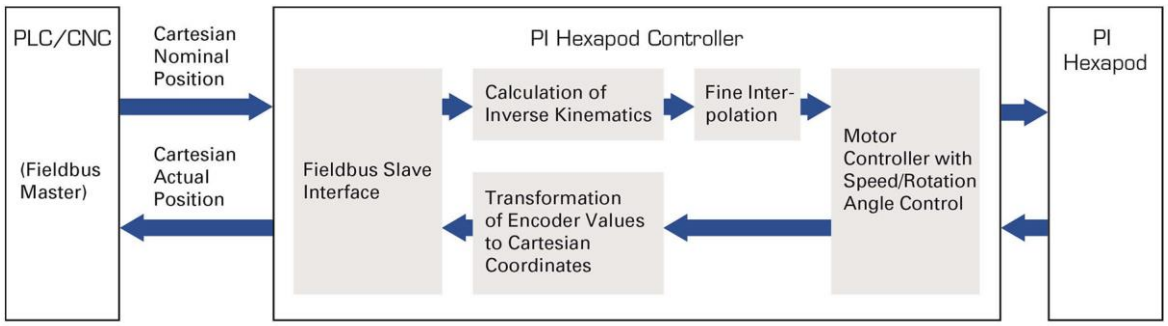


All PI Hexapod systems are delivered with an extensive software package. Included are simulation programs that calculate the working space of the Hexapod and the individual loads on each actuator depending on the Hexapod orientation in space

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



Integration of the hexapod motion controller into an automation system

EtherCAT® is a registered trade mark and patented technology of Beckhoff Automation GmbH, Germany.

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.

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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.

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

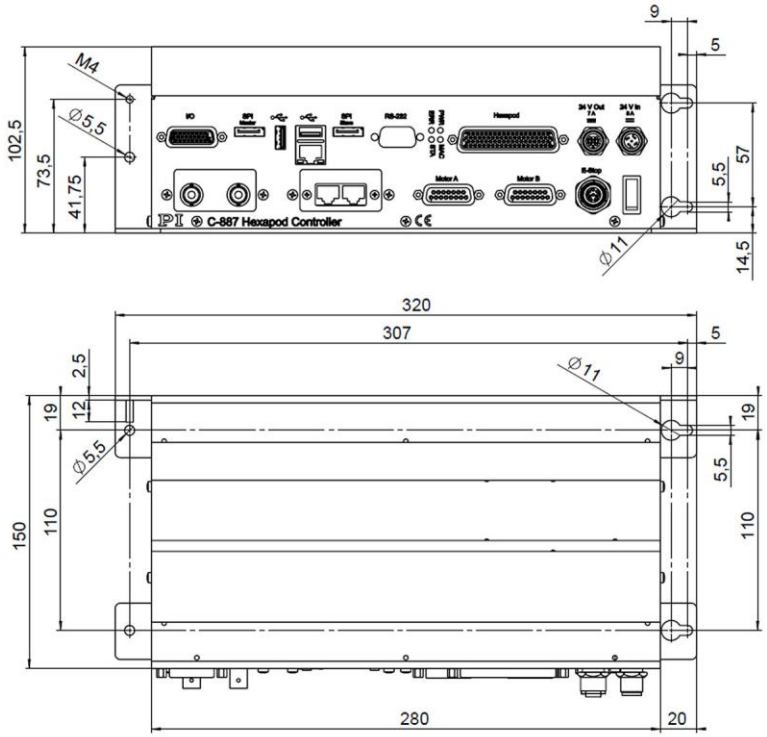
Example of a configuration: H-811.D2 miniature hexapod with C-887.532 motion controller with EtherCAT interfaces and motion stop. The EtherCAT master, in this case a Beckhoff controller, is provided and programmed by the customer

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
	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
Drive type	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 x 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

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