Servo & Stepper Controllers for Precision Actuators

Digital, Compact, Affordable
The latest generation Mercury C-863 servo motor controller is even more powerful and versatile than its predecessors. Easy data interchange with laptop or PC is possible via the USB interface. The RS-232 interface provides for easy integration in industrial applications. The compact design with its integrated amplifier makes it ideal for building high-performance, cost-effective micropositioning systems.

**Flexible Automation**

The Mercury offers a number of features to achieve automation and handling tasks in research and industry in a very cost-effective way. Programming is facilitated by the high-level mnemonic command language with macro and compound-command functionality. Macros can be stored in the non-volatile memory for later recall.

Stand-alone capability is provided by a user-programmable autostart macro to run automation tasks at power up (no runtime computer communication required!). For easy synchronization of motion with internal or external trigger signals four input and four output lines are provided.

**Multi-Axis Control**

Up to 16 Mercury class controllers can be networked and controlled over a single PC interface. Such daisy chain networks are flexible, can be extended at any time and are compatible with other PI controllers for DC servo-motors or stepper motors, PILine® ultrasonic piezomotor drives or piezo stepping drives.

**Easy Programming**

All servo and stepper motor controllers of the Mercury family can be operated using the PI general command set (GCS). PI-GCS allows networking of different controller units, both for piezo-based and motorized positioning units, with minimal programming effort.

**Cost-Saving Due to Integrated Amplifier and PWM Outputs**

The unique Mercury concept combines a high-performance motion controller and an integrated power amplifier in a small package. Additional PWM control outputs allow the direct operation of any DC-motor-driven PI micro-positioning system—even high-speed stages such as the M-500 ActiveDrive Translation Stages—reducing costs, increasing reliability and simplifying the setup.
## Technical Data

**Model**  
C-863.11

**Function**  
DC-servo-motor controller, 1 channel

### Motion and control

**Servo characteristics**  
P-I-D servo control, parameter change on-the-fly

**Trajectory profile modes**  
Trapezoidal, point-to-point

**Encoder input**  
AB (quadrature) single-ended or differential TTL signal, 20 MHz

**Stall detection**  
Servo off, triggered by programmable position error

**Input limit switch**  
2 x TTL (pull-up/pull-down, programmable)

**Input reference switch**  
1 x TTL

**Motor brake**  
1 x TTL, software controlled

### Electrical properties

**Output power**  
max. 30 W (PWM)

**Output voltage**  
0 to 15 V

**Current**  
80 mA + motor current (3 A max.)

### Interfaces and operation

**Communication interfaces**  
USB, RS-232 (9-pin [m] sub-D)

**Motor connector**  
15-pin (f) sub-D

**Controller network**  
Up to 16 units on single interface

**I/O ports**  
4 analog/digital in, 4 digital out (TTL)

**Command set**  
PI General Command Set (GCS)

**User software**  
PIMikroMove®

**Software drivers**  
LabVIEW drivers

**Supported functionality**  
Start-up macro, data recorder for recording parameters as motor input voltage, velocity, position or position error; internal safety circuitry: watchdog timer

**Manual control (optional)**  
2-axis joystick, Y-cable for 2D motion, pushbutton box

### Miscellaneous

**Operating voltage**  
15 to 30 V  
included: external power supply, 15 V / 2 A

**Operating temperature range**  
+5 to +50 °C

**Mass**  
0.3 kg

**Dimensions**  
130 x 76 x 40 mm

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**C-863 dimensions in mm**

![Dimensions Diagram]

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**PI**

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**PI EIO nanoPositioning**  
[www.pi.ws](http://www.pi.ws)
C-843 Servo-Motor Controller / Driver for Closed-Loop Actuators

Servo Motion Controller/Driver PCI Board for 2 or 4 Axes

The C-843 PCI motion control card drives up to 4 axes of micropositioning equipment. Because there is no need for external servo-amplifiers, this new card is a very cost-effective, easy-to-set-up solution.

On-Board Servo-Amplifiers
Unlike other PCI controller cards, the new C-843 comes with on-board, low-noise linear amplifiers for the small DC motors used in most compact micropositioning stages and actuators.

In addition, PWM outputs are available to drive more powerful equipment (all direct-drive translation and rotation stages from PI feature the integrated ActiveDrive™ PWM amplifiers, and also connect to the C-843 with no external power amplifiers).

The PWM mode and linear amplifier mode can be programmed individually for each of the 4 (or 2) channels.

High-Performance PID Control
The C-843 employs a fast DSP (digital signal processor) providing high-performance PID motion control with many options for trajectory generation and filter settings for superior positioning and tracking accuracy. Position, velocity, acceleration and several other motion parameters can be programmed individually for each axis on-the-fly. High-bandwidth counters (5 MHz) support differential encoder feedback (incremental rotary encoders or linear scales) for fast and accurate positioning.

I/O for Flexible Automation
In addition to 3 TTL inputs per channel for limit and reference signals, 16 more I/O lines are available for flexible automation tasks (trigger functions, etc.). The C-843 also features motor-brake output lines (e.g. for M-531.DDB stages).

High-Speed Buffering
The integrated 32 k-sample trace memory allows online buffering (read and write) at integer multiples of the servo-loop time of up to four independent system variables (positions, velocities, internal register contents, etc.) This allows the observation of the motion system and also performing customized trajectory profiles.

PI General Command Set (GCS)
The comprehensive command structure is based on the PI General Command Set (GCS). With GCS the development of custom application programs is simplified, because the commands for all supported devices are identical in syntax and function. PI controllers for nanopositioning systems, for piezomotors and servo or stepper motors can be commanded with GCS.

Software / Programming
In addition to the user software for setup, system optimization and operation, comprehensive LabVIEW and DLL libraries are provided. The user friendly PI MikroMove™ provides a convenient interface for stage operation including tuning tool, joystick operation, terminal and macro editor.

Ordering Information

<table>
<thead>
<tr>
<th>Ordering Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>C-843.21</td>
<td>DC-Motor Controller PCI PC Board, 2-Axis</td>
</tr>
<tr>
<td>C-843.41</td>
<td>DC-Motor Controller PCI PC Board, 4-Axis</td>
</tr>
<tr>
<td>C-843.JS</td>
<td>Joystick and PCI Interface Board for</td>
</tr>
<tr>
<td></td>
<td>C-843 Motor Controller</td>
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</tbody>
</table>

Two and Four Axis Version
Very Cost-Effective: Servo Amplifiers On-Board
Additional PWM Outputs for High-Power Motors
Trapezoidal Curve, S-Curve and Velocity Profile
32 kSamples RAM for High-Speed Buffer Operations
16 I/O Lines for Flexible Automation
Fast PCI Communication, 120 µs for Position Read
Motor-Brake Control Output
Extensive Software Support
General Command Set (GCS) Compatible

C-843.41 DC-motor controller board with M-110.DG linear stage, M-235.5DG heavy duty linear actuator, M-511.DD direct drive translation stage and M-601.1DG vertical stage. No external amplifier is required to drive any of these or other PI stages. Small motors are driven through the C-843’s onboard linear amplifiers, direct-drive PI stages (e.g. M-511.DD) employ ActiveDrive™ controlled off the C-843’s PWM outputs.
Technical Data

**Model**

C-843

**Function**

PC plug-in DC-servo-motor controller board, 32-bit plug-and-play PCI-bus interface, supported by main boards with 3.3 V and 5 V PCI bus connectors (universal card)

**Axes**

2 (C-843.21); 4 (C-843.41)

**Servo characteristics**

Programmable PID V-ff filter, parameter changes on-the-fly

**Profile modes**

Trapezoidal, S-curve, velocity profile

**Output power / resolution**

Analog 6 watts/channel (drawn directly from PC power supply), 12-bit D/A converters, PWM 10-bit, 24.5 kHz

**Current limitation**

500 mA per channel (short-circuit-proof)

**Encoder input**

AB (quadrature) differential TTL signals, 5 x 10^6 counts/s

**Stall detection**

Servo off, triggered by programmable position error

**Limit switches**

2 TTL / axis (active high/low, programmable)

**Reference switches**

1 TTL / axis (active high/low, programmable)

**I/O ports**

8 TTL inputs, 8 TTL outputs

**Motor connectors**

15-pin (f) sub-D per channel (2 on board + 2 on bracket for C-843.41)

**Interface/communication**

PC PCI bus

**Command set**

PI General Command Set (see p. A-11)

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PIMikroMove® tabular presentation of four connected axes with display of absolute and relative positioning input, current position, halt axis button, state and velocity setting.

The Tuning Tool which is integrated in PIMikroMove® demonstrates acquiring and displaying step and settle data of micropositioning systems. Controls allow adjustment of the PID parameters for best performance.
C-663 Stepper Motor Controller with Integrated Driver

1-Axis Networkable Stepper-Motor Controller

The newest release for data sheets is available for download at www.pi.ws. R1 11/01/12.0

C-663 Mercury Step stepper motor controller is the perfect solution for cost-effective and flexible motion control applications where a precision positioner is to be controlled by a PC or PLC (programmable logic controller). The C-663 supplements the successful C-863 Mercury servo motor controller.

Microstepping of 1/16 full step (up to 6400 steps/rev. with PI stepper motors) provides for ultra-smooth, high-resolution motion.

Flexible Automation

The C-663 offers a number of features to achieve automation and handling tasks in research and industry in a very cost-effective way. Programming is facilitated by the high-level mnemonic command language with macro and compound-command functionality. Macros can be stored in the non-volatile memory for later recall.

For easy synchronization of motion with internal or external trigger signals four input and four output lines are provided. A joystick can also be connected for manual control.

Stand-alone capability is provided by a user-programmable autostart macro to run automation tasks at power up (no runtime computer communication required!).

User-Friendly: Comprehensive Software Package and Two Interface Options

Easy data interchange with laptop or PC is possible via the USB interface. To facilitate industrial applications, an RS-232 interface is also standard.

The included software supports networking of multiple controller devices. LabVIEW drivers and Windows DLLs allow for easy programming and integration into your system. Mercury Step controllers can be operated using the PI General Command Set (GCS). PI-GCS allows networking of different PI-controllers such as piezo drivers and multi-axis servo controllers with minimal programming effort.

Contents of Delivery

Each Mercury Step comes with a wide-range power supply, RS-232 communications cables, a USB cable and a comprehensive software package.

Application Examples

- Flexible automation
- Handling
- Quality control
- Testing equipment
- Photonics applications
- Fiber positioning

High Performance at Low Cost
Stand-Alone Functionality
Network Capability for Multi-Axis Applications
Compatible and Networkable with Mercury DC-Motor Controllers
Joystick Port for Manual Control
Non-Volatile Macro Memory
Data Recorder
Parameters Changeable On-the-Fly

Ordering Information

| C-663.11 | Mercury Step Stepper Motor Controller with Wide-Range Power Supply, 24 V |
| C-819.20 | 2-Axis Analog Joystick for Mercury Controller |
| C-819.20Y | Y-Cable for Connecting 2 Controllers to C-819.20 |
| C-170.IO | I/O cable, 2 m, open end |
| C-170.PB | Push Button Box, 4 Buttons and 4 LEDs |
Technical Data

<table>
<thead>
<tr>
<th>Model</th>
<th>C-663.11</th>
</tr>
</thead>
<tbody>
<tr>
<td>Function</td>
<td>Stepper motor controller, stand-alone capability</td>
</tr>
<tr>
<td>Drive type</td>
<td>2-phase stepper motor</td>
</tr>
<tr>
<td>Channels</td>
<td>1</td>
</tr>
</tbody>
</table>

**Motion and control**
- Trajectory profile modes: Trapezoidal, point-to-point
- Microstep resolution: 1/16 full step
- Limit switches: 2 x TTL, programmable
- Reference switches: 1 x TTL, programmable
- Motor brake: 1 x TTL, programmable

**Electrical properties**
- Operating voltage: 15 to 30 V
- Current limitation per motor phase: 1000 mA

**Interface and operation**
- Interface/Communication: USB, RS-232 (bus architecture)
- Motor connector: Sub-D 15 (f)
- Controller network: Up to 16 units* on single interface
- I/O ports: 4 analog/digital in, 4 digital out
- Command set: PI General Command Set (GCS)
- User software: PIMikroMove®
- Software drivers: LabVIEW drivers
- Supported functionality: Start-up macro, data recorder for recording parameters as motor input voltage, velocity, position or position error
- Manual control: Joystick, Y-cable for 2D motion, pushbutton box

**Miscellaneous**
- Operating temperature range: 0 to 50 °C
- Mass: 0.3 kg
- Dimensions: 130 x 76 x 40 mm³

*16 with USB; 6 with RS-232 (depending on RS-232 output driver of PC)
Program Overview
- Piezo Ceramic Actuators & Motors
- Piezo Nanopositioning Systems and Scanners
- Active Optics / Tip-Tilt Platforms
- Capacitive Nanometry Sensors
- Piezo Electronics: Amplifiers and Controllers
- Hexapod 6-Axis Positioners / Robots
- Micropositioning Stages & Actuators
- Photonics Alignment Systems, Solutions for Telecommunications
- Motor Controllers
- Ultrasonic Linear Motors

Request or download the complete PI Nanopositioning & Piezo Actuator Catalog

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