

# Low-Cost Stepper Motion Controllers

## NI 733x

- Up to 4 axes of stepper motion
- 3D linear interpolation
- Up to 4 MHz stepper output rate
- Patented step generation technology for smooth stepper motion

### Operating Systems

- Windows Vista/XP/2000
- LabVIEW Real-Time

### Recommended NI Software

- LabVIEW
- NI Motion Assistant
- LabWindows™/CVI
- Measurement Studio

### Other Compatible Software

- Visual Basic
- C/C++

### Driver Software (included)

- NI-Motion



## Overview and Applications

NI 733x devices are low-cost stepper motion controllers for point-to-point applications. These low-cost motion controllers provide new solutions for machine builders who need simple, straightforward motion control without a lot of extra features. Unlike other low-cost motion controllers, NI 733x controllers have a variety of powerful features including:

- Linear interpolation for coordinating multiple axes
- Real-time system integration (RTSI) for directly communicating with data acquisition or image acquisition boards
- High-performance stepper generation for ensuring smooth motion at high velocities

## Software

NI 733x controllers are shipped with the NI-Motion driver, which includes a VI library for NI LabVIEW software and functions for NI LabWindows/CVI, C, and Visual Basic. For other languages, you can execute all setup and motion control functions by calling into a dynamic link library (DLL). The NI-Motion VI library implements the full API, along with a useful set of example programs. The NI-Motion software also includes a series of example programs for use with ANSI C-based LabWindows/CVI. NI Motion Assistant offers a point-and-click interface for creating motion control sequences quickly and easily. When you have created a motion task, you can use NI Motion Assistant to generate the task in LabVIEW or C code or code recipes to speed up development.

## Integration Capabilities

Like other NI motion controllers, NI 733x controllers offer powerful integration capabilities with both data acquisition and machine vision. You can achieve this by using the RTSI bus or PXI trigger bus capability to communicate directly with other devices without extra wiring and without consuming bandwidth on the host bus. An NI 733x is ideal when using stepper motors for applications where only simple motion is required.

Feature	NI 733x
Number of Axes	2, 4
PAC Platforms	PCI, CompactPCI/PXI
Linear, Circular, Spherical, and Helical Interpolation; Blending	✓
Trapezoidal, S-Curve Profiles	✓
Closed-Loop Stepper Control	✓
Contouring, Electronic Gearing, Onboard Programming	✓
Sinusoidal Commutation for Brushless Servo Motors	–
Buffered Breakpoints, Buffered High-Speed Capture, 4 MHz Periodic Breakpoints	–
Number of Axes per 62.5 $\mu$ s PID Rate	1
PWM Lines/DIO Lines/Analog Input Resolution	2/32/12-bit
Maximum Step Output Rate/Encoder Input Rate	4 MHz/20 MHz
Programming API	NI-Motion Driver
Software	NI Motion Assistant, NI LabVIEW, C, Visual Basic

## NI 7330 Connector Pinouts

(two 68-pin VHDCI connectors)

Axis 1 Dir (CCW)	1	35	Axis 1 Step (CW)
Digital Ground	2	36	Axis 1 Encoder Phase A
Digital Ground	3	37	Axis 1 Encoder Phase B
Axis 1 Home Switch	4	38	Axis 1 Encoder Index
Trigger 1	5	39	Axis 1 Forward Limit Switch
Axis 1 Inhibit	6	40	Axis 1 Reverse Limit Switch
Axis 2 Dir (CCW)	7	41	Axis 2 Step (CW)
Digital Ground	8	42	Axis 2 Encoder Phase A
Digital Ground	9	43	Axis 2 Encoder Phase B
Axis 2 Home Switch	10	44	Axis 2 Encoder Index
Trigger 2	11	45	Axis 2 Forward Limit Switch
Axis 2 Inhibit	12	46	Axis 2 Reverse Limit Switch
Axis 3 Dir (CCW)	13	47	Axis 3 Step (CW)
Digital Ground	14	48	Axis 3 Encoder Phase A
Digital Ground	15	49	Axis 3 Encoder Phase B
Axis 3 Home Switch	16	50	Axis 3 Encoder Index
Trigger 3	17	51	Axis 3 Forward Limit Switch
Axis 3 Inhibit	18	52	Axis 3 Reverse Limit Switch
Axis 4 Dir (CCW)	19	53	Axis 4 Step (CW)
Digital Ground	20	54	Axis 4 Encoder Phase A
Digital Ground	21	55	Axis 4 Encoder Phase B
Axis 4 Home Switch	22	56	Axis 4 Encoder Index
Trigger 4	23	57	Axis 4 Forward Limit Switch
Axis 4 Inhibit	24	58	Axis 4 Reverse Limit Switch
Digital Ground	25	59	Host +5 V
Breakpoint 1	26	60	Breakpoint 2
Breakpoint 3	27	61	Breakpoint 4
Digital Ground	28	62	Shutdown
Analog Output	29	63	Analog Output
Analog Output	30	64	Analog Output
Analog Output Ground	31	65	Reserved
Analog Input 1	32	66	Analog Input 2
Analog Input 3	33	67	Analog Input 4
Analog Reference (Output)	34	68	Analog Input Ground

*Motion I/O Connector*

+5 V	1	35	Digital Ground
PCLK	2	36	Digital Ground
Reserved	3	37	Digital Ground
Reserved	4	38	DPull
PWM1	5	39	Digital Ground
Reserved	6	40	Reserved
Reserved	7	41	Digital Ground
Reserved	8	42	Digital Ground
PWM2	9	43	Digital Ground
Port 1:bit 0	10	44	Port 1:bit 1
Digital Ground	11	45	Port 1:bit 2
Port 1:bit 3	12	46	Digital Ground
Port 1:bit 4	13	47	Port 1:bit 5
Digital Ground	14	48	Port 1:bit 6
Port 1:bit 7	15	49	Digital Ground
Port 2:bit 0	16	50	Digital Ground
Port 2:bit 1	17	51	Port 2:bit 2
Digital Ground	18	52	Port 2:bit 3
Digital Ground	19	53	Port 2:bit 4
Digital Ground	20	54	Port 2:bit 5
Port 2:bit 6	21	55	Digital Ground
Port 2:bit 7	22	56	Digital Ground
Port 3:bit 0	23	57	Port 3:bit 1
Digital Ground	24	58	Port 3:bit 2
Port 3:bit 3	25	59	Digital Ground
Port 3:bit 4	26	60	Port 3:bit 5
Digital Ground	27	61	Port 3:bit 6
Port 3:bit 7	28	62	Digital Ground
Port 4:bit 0	29	63	Port 4:bit 1
Digital Ground	30	64	Port 4:bit 2
Port 4:bit 3	31	65	Digital Ground
Port 4:bit 4	32	66	Port 4:bit 5
Digital Ground	33	67	Port 4:bit 6
Port 4:bit 7	34	68	Digital Ground

*Digital I/O Connector*

### Ordering Information

NI PCI-7332 (2-axis) .....	778924-02
NI PCI-7334 (4-axis) .....	778417-01
NI PXI-7332 (2-axis) .....	779035-02
NI PXI-7334 (4-axis) .....	778444-01

Includes NI-Motion software libraries and examples.

### Accessories

NI Motion Assistant .....	778553-01
Wiring Interfaces	
NI UMI-7764 .....	777978-02
NI UMI-7772 .....	778556-01
NI UMI-7774 .....	778558-01

### Power Drives

NI MID-7604 .....	777936-01
NI MID-7602 .....	778003-01
NI MID-7654 .....	778005-01
NI MID-7652 .....	778004-01
P70530 .....	780097-01
P70360 .....	780098-01

### BUY NOW!

For complete product specifications, pricing, and accessory information, call 800 813 3693 (U.S.) or go to [ni.com/info](http://ni.com/info) and enter **ni7330**.

# Low-Cost Stepper Motion Controllers

## Specifications

### Performance

Trajectory update rate range .....	62.5 to 500 $\mu$ s/sample
Maximum update rate .....	62.5 $\mu$ s/axis
4-axis update rate .....	250 $\mu$ s total
Multiaxis synchronization .....	<1 update sample
Trajectory parameters	
Position range .....	$\pm 2^{31}$ steps
Maximum relative move size .....	$\pm 2^{31}$ steps
S-curve time range .....	1 to 32,767 samples
Following error range .....	0 to 32,767 counts
Velocity range .....	1 to 4,000,000 steps/s
Acceleration/deceleration .....	244 to 512,000,000 steps/s <sup>2</sup> at a PID update rate of 250 $\mu$ s

### Stepper outputs

Maximum pulse rate .....	4 MHz (full, half, and microstep)
Minimum pulse width .....	120 ns at 4 MHz
Step output mode .....	Step and direction or CW/CCW
Voltage range .....	0 to 5 V

### System Safety

Watchdog timer function .....	Resets board to startup state
Shutdown input .....	Disable all axes and command outputs

### Motion I/O

Encoder inputs .....	Quadrature, incremental, single-ended
Maximum count rate .....	20 MHz
Forward, reverse, and home inputs	
Number of inputs .....	3 per axis
Control .....	Individual enable/disable, stop on input, prevent motion, find reference
Trigger (position capture) inputs .....	
Maximum repetitive capture rate ..	4 (one per axis) 100 Hz
Breakpoint (position compare) outputs ..	
Maximum repetitive rate .....	4 (one per axis), programmable polarity 100 Hz
Inhibit/enable output .....	4 (one per axis), programmable polarity
Analog inputs .....	
	12-bit resolution, $\pm 10$ V range, 25 $\mu$ s scan rate/enabled channel

### Digital I/O

Ports .....	4, 8-bit TTL ports, bit configurable, sink or source 24 mA outputs
Open-loop PWM outputs	
Number of PWM outputs .....	2
Clock sources .....	Internal or external

### Power Requirements

+5 VDC ( $\pm 5\%$ ) .....	1 A
+12 VDC ( $\pm 5\%$ ) .....	30 mA
-12 VDC ( $\pm 10\%$ ) .....	30 mA
Power consumption .....	5.7 W, maximum

### Physical

#### Dimensions (not including connectors)

PCI .....	17.5 by 9.9 cm (6.9 by 3.9 in.)
PXI .....	16 by 10 cm (6.3 by 3.9 in)

#### Connectors

Motion I/O connector .....	68-pin female high-density VHDCI type
Digital I/O connector .....	68-pin female high-density VHDCI type

### Environment

Operating temperature .....	0 to 55 $^{\circ}$ C
Storage temperature .....	-20 to 70 $^{\circ}$ C
Relative humidity range .....	10 to 90% (noncondensing)

# NI Services and Support



NI has the services and support to meet your needs around the globe and through the application life cycle – from planning and development through deployment and ongoing maintenance. We offer services and service levels to meet customer requirements in research, design, validation, and manufacturing. Visit [ni.com/services](http://ni.com/services).

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We also offer service programs that provide automatic upgrades to your application development environment and higher levels of technical support. Visit [ni.com/ssp](http://ni.com/ssp).

## Hardware Services

### NI Factory Installation Services

NI Factory Installation Services (FIS) is the fastest and easiest way to use your PXI or PXI/SCXI combination systems right out of the box. Trained NI technicians install the software and hardware and configure the system to your specifications. NI extends the standard warranty by one year on hardware components (controllers, chassis, modules) purchased with FIS. To use FIS, simply configure your system online with [ni.com/pxiadvisor](http://ni.com/pxiadvisor).

### Calibration Services

NI recognizes the need to maintain properly calibrated devices for high-accuracy measurements. We provide manual calibration procedures, services to recalibrate your products, and automated calibration software specifically designed for use by metrology laboratories. Visit [ni.com/calibration](http://ni.com/calibration).

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