

Ultra-Precision Direct Drive Linear Nanopositioning Stage

Ideal for Scanning, Measuring, Imaging, Alignment



V-574

- 160mm stage width
- Available travels of 60, 130, and 230mm
- 0.2 μ m absolute accuracy
- Direct drive motor for efficient, dynamic performance
- Crossed-roller bearings for true straightness and flatness
- Incremental (20 μ m & 4 μ m pitch) or absolute encoders for the best accuracy, repeatability, and safety (absolute)

Preliminary Datasheet

Product overview

The V-574 linear stages are designed for accuracy, precision, long life, ease of use, and can be mounted in any orientation. Note that a counterbalance is required for vertical operation.

Even though compact, V-574 nanopositioning stages offer superior travel accuracy, flatness, and performance compared to many larger linear translation stages. With a powerful, non-cogging, direct drive motor, and cross roller bearings, the V-574 family of linear stages performs well in high-throughput production environments.

The absolute encoder version provides not only 1nm resolution, but also the safest and most efficient operation and start, not requiring initialization or homing. Incremental encoder versions are also available.

The non-contact direct-drive linear motor provides high dynamics and maintenance-free, friction-free operation. The ultra-precision cross roller bearings are intended to guarantee excellent guiding precision and low maintenance for the life of the stage.

V-574 linear stages are designed for XY and XYZ mounting. The Z version comes with a brake for safety and a pneumatic counterbalance, ensuring minimal holding current on the linear motor and enhanced dynamic performance. Non-contact direct-drive for high dynamics and maintenance free, friction free operation.

Three phase motors for higher dynamics and friction-free, maintenance-free operation

The three-phase linear motors driving the V-574 stage family transfer their force directly and friction-free to the motion platform. This eliminates backlash and play that can result from mechanical components like gears and screws in the drivetrain. Ideal for high-velocity, high-acceleration applications, these motors feature a maintenance-free, frictionless design, ensuring longevity in demanding 24/7 operations. The controller's current limit settings allow easy motor disablement, preventing damage to the stage or the application.

Crossed roller bearings improve load capacity, accuracy and lifetime

Crossed roller bearings offer a superior level of smoothness, straightness, and flatness, close to air bearing performance. By replacing the point contact of ball bearings with a line contact, rollers become considerably stiffer, requiring less preload. This reduction in friction enables smoother running and higher accuracy. Crossed roller bearings can also support more direct loads and moment loads. The anti-creep mechanism prevents roller drift, enhancing reliability. Cleanroom grease is applied for low-maintenance operation.

Incremental and absolute encoder options

V-574 stages are equipped with linear encoders that measure position with utmost accuracy directly at the motion platform, enhancing linearity and ensuring immunity to mechanical play and elastic deformation of indirect measuring methods. Incremental encoders, relying on 1Vpp sine/cosine signals, require a home signal to initiate. For higher resolution and better in-position stability, an optional 4um pitch incremental encoder is available. In contrast, absolute measuring linear encoders offer explicit position information, enabling immediate determination of the position. This eliminates the need for referencing during switch-on, enhancing both efficiency and safety during operation.

Choosing the right precision linear stage and motion controller

Selecting the right linear stage is pivotal for optimal performance in high-precision motion applications, such as semiconductor inspection and photonics alignment. Factors such as resolution, guiding accuracy, and repeatability must be carefully considered. The V-574 linear stage family provides exceptional geometric accuracy (flatness, straightness, pitch, and yaw) along with 80 nanometers bi-directional repeatability. With high dynamic properties, featuring 1 g acceleration and 1000 mm/sec velocity, these fast and accurate motorized stages are ideal for automation of highly accurate positioning tasks required for the mass production of precision devices.

Together with PI's A-8xx series motion controllers, these stages achieve unparalleled motion performance. PI's EtherCAT®-based controllers offer remarkable flexibility, facilitating the seamless integration of third-party equipment compatible with EtherCAT®. Advanced algorithms in the A-8xx series motion controllers, such as PILOT allow for higher dynamics with reduced motor currents, virtually increasing the motor's force constant. Choose V-574 for precision, reliability, and efficiency in your motion applications.

Accessories and options

- Encoder type – 1Vpp Sin/Cos (20um or 4um) or Absolute BiSS output
- Brake and counterbalance for vertical use
- Single or multi-axis, ACS motion controllers and servo drives, integrated or distributed
- Cables compatible with the A-8xx series, ACS-powered controllers.
- Multi-axis XY- and XYZ-stage assemblies
- Granite support base

Application fields

Sample inspection. Precision micro-assembly. Research. Biotechnology. Semiconductor test and inspection. Metrology. General Automation. Device assembly. Laser Micro-processing. Pick and place. Alignment of optics, micromechanics and photonics components.

Specifications

Motion	V-574.060x1	V-574.130x1	V-574.230x1	Unit	Tolerance
Active axes	X - axis				
Travel range	60	130	230	mm	max.
Pitch ⁽¹⁾	30	45	60	μrad	max.
Yaw ⁽¹⁾	30	40	50	μrad	max.
Straightness ⁽¹⁾	1	1.2	1.5	μm	max.
Flatness ⁽¹⁾	1	1.2	1.5	μm	max.
Bidirectional repeatability	± 0.08	± 0.08	± 0.08	μm	max.
Positioning accuracy, calibrated ⁽²⁾	± 0.2	± 0.2	± 0.2	μm	max.

Mechanical	V-574.060x1	V-574.130x1	V-574.230x1	Unit	Tolerance
Bearing	Ultra-precision, cross-roller bearing				
Motion platform	220 x 160	290 x 160	450 x 160	mm	
Stage Height	50.5			mm	
Load capacity, ⁽³⁾	15			kg	max.
Moving mass, unloaded	2.6	3.5	5.3	kg	typ.
Overall mass	5.5	7.2	10.7	kg	typ.
Materials	Aluminum				

Drive properties	V-574.060x1	V-574.130x1	V-574.230x1	Unit	Tolerance
Drive type	3 phase ironless motor				
Intermediate circuit voltage	60	60	60	V DC	max.
Peak force	200	200	200	N	max.
Nominal force	58	58	58	N	max.
Force constant, RMS	19.9	19.9	19.9	N/Arms	typ.
Peak Current	10	10	10	A	max.
Nominal Current, RMS	2.9	2.9	2.9	A	max.
Resistance, phase-phase	5.6	5.6	5.6	Ω	±10%
Inductance, phase-phase	1.8	1.8	1.8	mH	±10%
Back EMF, phase-phase	16	16	16	V/m/s	±10%
# of Pole Pairs					
Magnet Pitch NN	30	30	30	mm	typ.
Linear Velocity ⁽³⁾	1	1	1	m/s	max.
Acceleration ⁽³⁾	10	10	10	m/s ²	max.

Measurement Sensor	V-574.xxxA1	V-574.xxxB1	Miscellaneous	V-574.xxxx1
Integrated sensor	Incremental enc.	Absolute encoder	Motor Connector	3W3 (male)
Sensor signal type	Sin/cos, 1Vpp	BiSS-C, 32 bit	Encoder Connector	DB15 (male)
Sensor resolution	1 nm	1 nm	Operating Temp Range	5 to 50 °C
Reference point switch	1 at middle of travel, 1Vpp	N/A	Recommended Controller	A-81x, A-82x Series
			Recommended Cables	A-851.Vx03

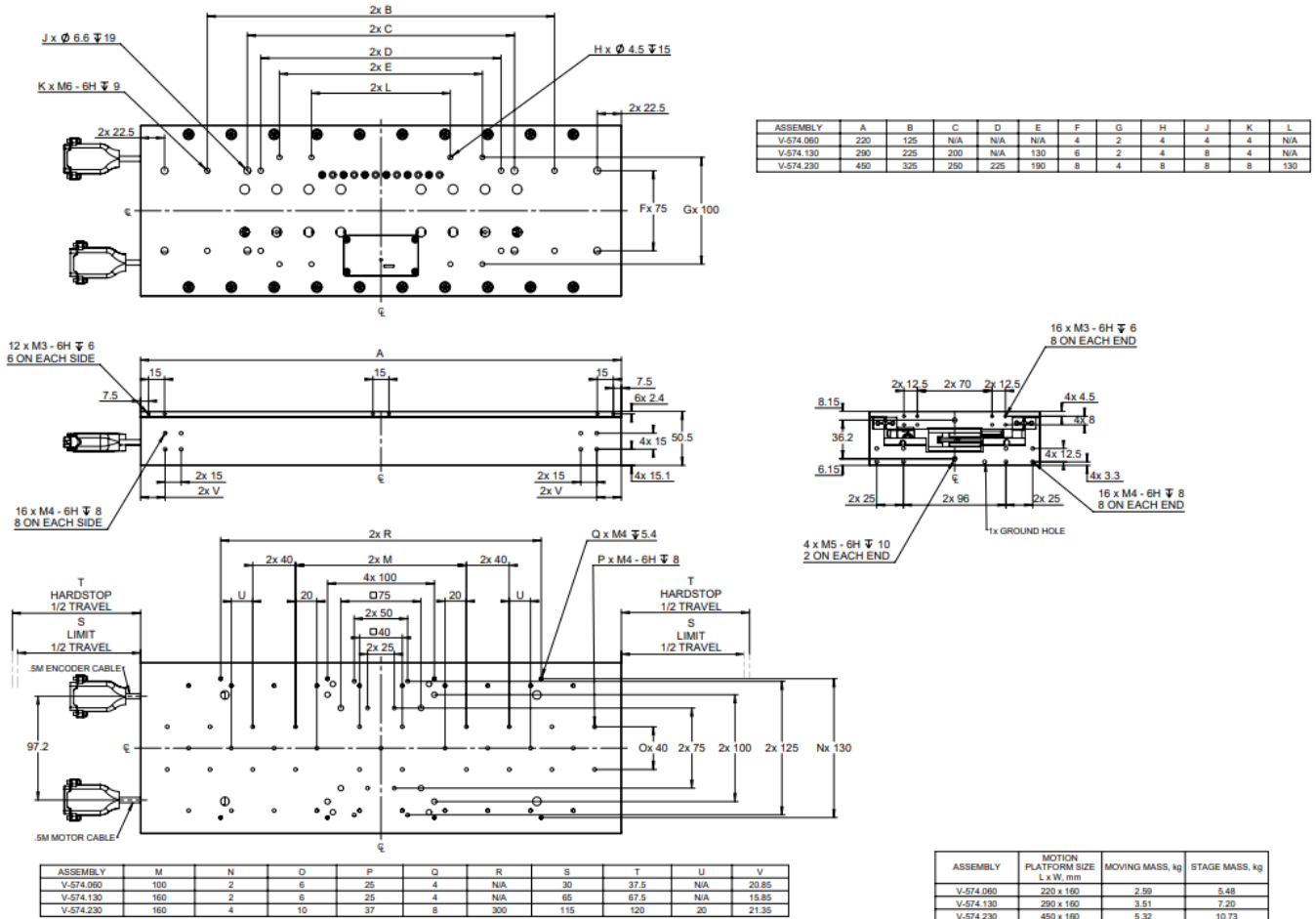
NOTES

⁽¹⁾ Dependent on the quality of the mounting surface, the payload, orientation, and external forces that act on the stage. Please contact PI for application-specific parameters. The specified values are static (no rotary motion during measuring) and without load.

⁽²⁾ The specified values are based on error compensation enabled by the PI controller. The positioner must be ordered with a controller from PI to reach these values. Accuracy values assume short-term duration and do not consider the long-term effects of thermal drift on the stage. The 4μm encoder will provide higher resolution and better in-position stability.

⁽³⁾ Can be limited by imbalance of the payload or the controller and the drive.

Drawings / Images



V-574, dimensions in mm

Ordering Information

For vertical applications, add BZ to the Part Number. Example: V-574.060B1BZ. This Part Number will include a brake and a pneumatic counterbalance.

Absolute Encoder Variants

V-574.060B1

PI linear stage, 60mm travel, cross roller bearing, 160mm wide motion platform, absolute encoder with BiSS-C signal transmission, brushless 3-phase direct-drive motor.

V-574.130B1

PI linear stage, 130mm travel, cross roller bearing, 160mm wide motion platform, absolute encoder with BiSS-C signal transmission, brushless 3-phase direct-drive motor.

V-574.230B1

PI linear stage, 230mm travel, cross roller bearing, 160mm wide motion platform, absolute encoder with BiSS-C signal transmission, brushless 3-phase direct-drive motor.

4µm Pitch Incremental Encoder Variants

V-574.060D1

PI linear stage, 60mm travel, cross roller bearing, 160mm wide motion platform, incremental sin/cos 1Vpp, 4µm glass scale encoder, brushless 3-phase direct-drive motor.

V-574.130D1

PI linear stage, 130mm travel, cross roller bearing, 160mm wide motion platform, incremental sin/cos 1Vpp, 4µm glass scale encoder, brushless 3-phase direct-drive motor.

V-574.230D1

PI linear stage, 230mm travel, cross roller bearing, 160mm wide motion platform, incremental sin/cos 1Vpp, 4µm glass scale encoder, brushless 3-phase direct-drive motor.

20µm Pitch Incremental Encoder Variants

V-574.060A1

PI linear stage, 60mm travel, cross roller bearing, 160mm wide motion platform, incremental sin/cos 1Vpp 20µm encoder, brushless 3-phase direct-drive motor.

V-574.130A1

PI linear stage, 130mm travel, cross roller bearing, 160mm wide motion platform, incremental sin/cos 1Vpp 20µm encoder, brushless 3-phase direct-drive motor.

V-574.230A1

PI linear stage, 230mm travel, cross roller bearing, 160mm wide motion platform, incremental sin/cos 1Vpp 20µm encoder, brushless 3-phase direct-drive motor.