

V-106

Long-Travel, High-Dynamics Scanning System with Voice Coil Drives



V-106.11S and V-106.14S high-dynamics scanning stages with voice coil drives

- **Fast Scanning and Positioning**
- **Travel Ranges of 20 mm and 6 mm**
- **Linear Encoder Provides 0.1 μm Resolution, 0.2 μm Repeatability**
- **Scanning Frequency to Tens of Hz**
- **Velocity up to 270 mm/s**
- **PCI-Card Controller with On-Board Amplifiers Available**

QuickScan™ micropositioning stages of the V-106 series were designed for high-dynamics precision scanning and positioning applications, like those in biotechnology and fiber optics. They are based on zero-friction voice coil drives (linear motors), which, combined with high-precision linear encoders, offer a position resolution of 0.1 μm and minimal step size of 0.2 μm .

V-106 micropositioning stages achieve significantly higher dynamics than leadscrew-based units. The specially

designed voice coil drive system makes possible scanning frequencies of some tens of hertz. With an applied load of 90 grams, the scan frequency of the V-106.11S is still 20 Hz over a travel range of 1 mm. The excellent dynamic characteristics are advantageous not only for scanning applications: positioning tasks see them as short settling times like 75 ms for 5 mm with a 90 gram load.

Direct Drive and Direct Metrology—Precise Motion

The design of the V-106 is based on three key precision components:

- A frictionless voice-coil (linear motor) drive
- A non-contacting direct-motion metrology linear encoder for sub-micron repeatability
- Precision cross-roller bearings for ultra-straight and smooth motion

Unlike leadscrew-driven translation stages, the voice-coil lin-

ear-motor in the V-106 is frictionless, quiet and not subject to wear and tear. In addition, it provides higher dynamics, speed, acceleration and responsiveness (step-and-settle)—ideal features for high-throughput applications. The embedded drive also reduces the length considerably compared to conventional motor/screw-driven stages.

For highly repeatable motion, a non-contacting optical linear encoder with 0.1 μm resolution is mounted inside the stage and feeds position information back to the motion controller.

The integrated, non-contact reference switch increases versatility in automation applications.

Versatile PCI Board Controller

V-106 voice coil stages can be controlled by the C-843 digital controller in PCI plug-in-board format. C-843 controllers are equipped with on-board linear servo-amplifiers for precise control of up to four axes. This lowers system costs and simplifies setup by eliminating additional external amplifiers and cables.

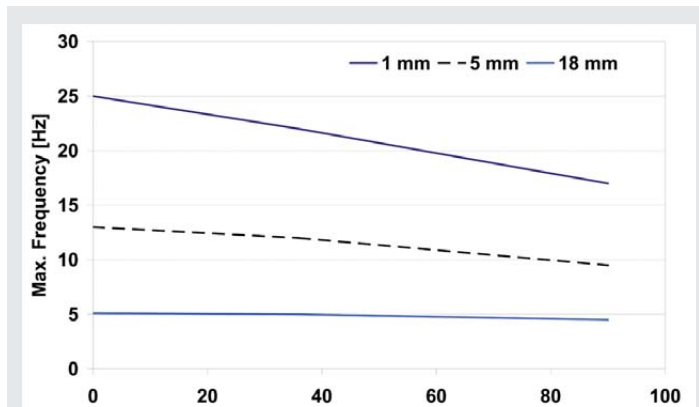
Ordering Information

- V-106.11S**
QuickScan Voice Coil Scanning Stage, 6 mm
- V-106.14S**
QuickScan Voice Coil Scanning Stage, 20 mm

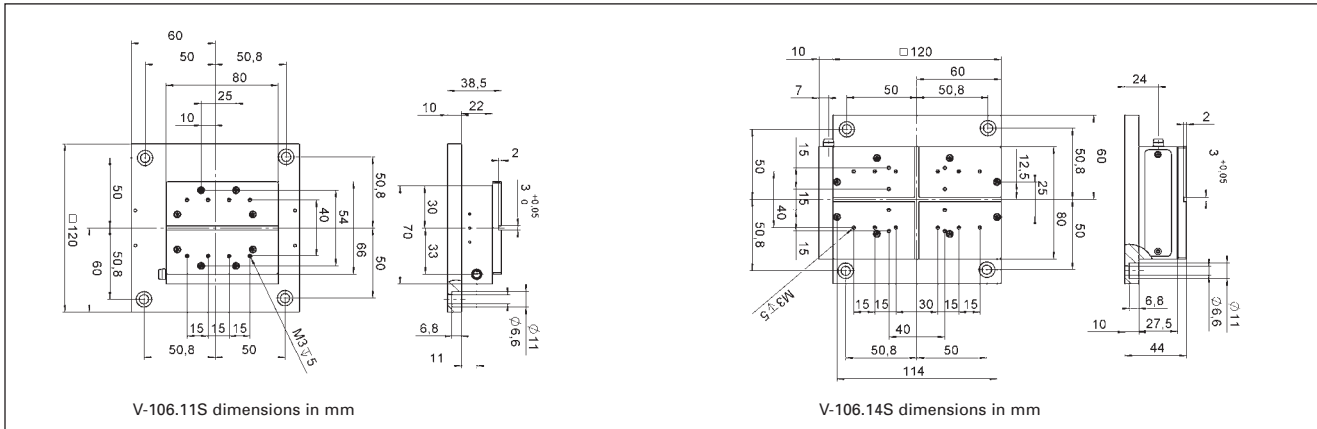
Frictionless Voice Coil Linear Drives

High-accuracy voice coil linear drives work on the same principle as electromagnetic loudspeakers. However, for precision positioning applications, they must provide much higher forces and high stability to hold a position without jitter. They must also be designed for closed-loop operation to allow for precise positioning.

These zero-friction magnetic linear drives, characterized by their excellent dynamics, are ideally suited for scanning applications requiring travel ranges in the millimeter to centimeter range. PI offers voice coil drives in V-106 standard systems; custom systems are available on request.



V-106.14S maximum scanning frequency for different loads and scan amplitudes for example 18 mm scans with up to 90 g load at >4 Hz frequency are feasible. The velocity is up to 270 mm/s



Technical Data

Models	V-106.11S	V-106.14S	Units	Tolerances
Active axes	X	X		
Motion and positioning				
Travel range	6	20	mm	
Integrated sensor	Linear encoder	Linear encoder		
Sensor resolution	0.1	0.1	μm	
Design resolution	0.1	0.1	μm	
Minimum incremental motion	0.2	0.2	μm	typ.
Backlash	0.2	0.2	μm	typ.
Unidirectional repeatability	0.2	0.2	μm	typ.
Pitch	50	50	μrad	typ.
Yaw	50	50	μrad	typ.
Max. velocity*	240	270	mm/s	
Reference repeatability	1	1	μm	typ.
Mechanical properties				
Mass moved	102	172	g	typ.
Load	36	81	N	max.
Push-/pull force**	5	3.3	N	max.
Push-/pull force with C-843**	2.3	1.5	N	max.
Lateral force	18	40	N	max.
Drive properties				
Drive type	Voice coil	Voice coil		
Continuous average current	0.42	0.42	A	nominal
Peak current	1.8	1.8	A	max. (3s)
Average force	1.2	0.8	N	nominal
Coil resistance	10	10	Ω	typ.
Coil inductance	100	100	μH	typ.
Force constant	2.88	1.92	N/A	
Voltage generation constant	36.1	24	Vs/m	
Miscellaneous				
Operating temperature range	0–55	0–55	°C	
Body material	Al	Al		
Mass (without cable)	800	1000	g	± 5%
Cable length	0.3	0.3	m	± 10 mm
Connectors	Sub-D 15 (m)	Sub-D 15 (m)		
Recommended controller / driver	C-843	C-843		

* With C-843 controller

** The C-843 controller provides 8 V and 0.8 A max. and therefore limits the push/pull force
See Notes (Technical Data) for further information page 7-106.