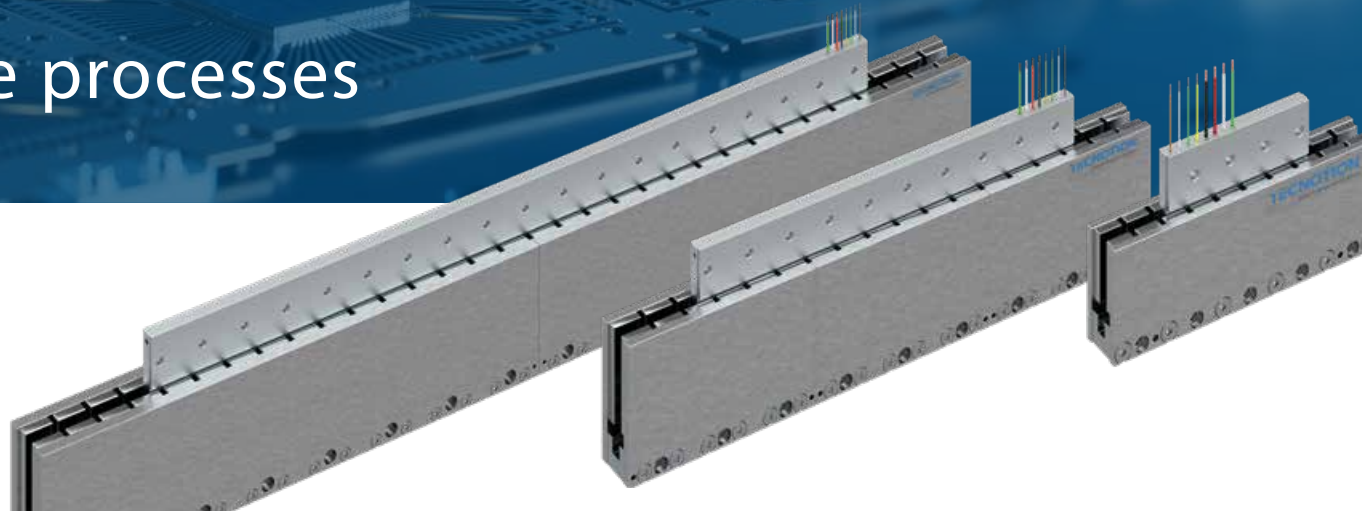


TECNOTION®

direct drive in motion

IRONLESS VACUUM MOTOR SERIES Generation 2

For powerful and precise processes





G
2





THE NEW BENCHMARK IN VACUUM MOTORS

Generation 2 vacuum ironless linear motor series is designed with the unique challenges of vacuum applications in mind and based on years of collaboration with high-end semiconductor manufacturers. The portfolio is suitable for even the strictest vacuum requirements with a large force range.

Optimal thermal properties, added safety, excellent RGA performance, lower outgassing and flexibility to install make the Generation 2 vacuum motor series the benchmark for motion in vacuum applications. With multiple winding types and coil unit sizes available, the Vacuum Generation 2 Series always offers the right direct drive motor.

We direct drive your motion technology

Tecnotion direct drive motors are seamlessly integrated in a wide range of applications such as semiconductors, machine tooling, robotics, display applications and printing industry. Being an independent supplier of linear- and torque motors Tecnotion provides specialized motor technology to place in customers motion solutions. As global technology leader with almost 30 years of experience we always offer the best motor solution for your motion needs, whether it is catalogue or custom. With a wealth of experience, we are accustomed to design and build any motion question.

Ironless vacuum motors

Powerful and precise processes

To minimize the chance of unwanted chemical reactions or pollution of the process or surrounding equipment, more and more high-tech applications require vacuum solutions, such as:

- › Lithography
- › Inspection
- › Display
- › Science & aerospace

One of the biggest challenges in a vacuum environment is heat transfer and motion. The closed design of the Generation 2 vacuum motors is optimized for low heat dissipation and optimal mounting. These features allow an easy system design which is suited for integration of multiple motors in one system.

Cost of ownership

Linear vacuum rated motors have no moving parts and are frictionless, making the motors maintenance free. Tecnotion's vacuum ironless motors can be placed in high vacuum as a whole and therefore require no feedthrough resulting in saving costs. The initial investment of vacuum linear motors can be higher than other drive systems but because of low maintenance costs, the total cost of ownership is reduced.

Extremely low outgassing

The production process can be affected by outgassing of the motion system. The vacuum ironless linear motors are specially designed coil units and magnetic yokes for use in high vacuum, up to 10^{-8} mbar, and offer the lowest achievable outgassing for a series product*.

* Specifications concerning outgassing of the vacuum motor series are available. The outgassing values depend on materials and environmental conditions. Please contact us directly for advise in the specific application.





UXXV - G2 Series

Fp1340 - 4020 N | Fc 233 - 698 N

The UXXV coil is the most powerful and efficient coil in the vacuum rated linear motor series. The UXXV series is ideal for heavy duty applications, such as display production, that demand ultra-precision and maximum force output. With the longest available coil unit, the UXXV18 is perfectly suitable for long strokes.

Its efficiency and high motor constant allow for a low heat output while generating a high force.

ULV - G2 Series

Fp 720 N | Fc 165 N

The ULV coils are the medium size series in the high end vacuum rated linear motor series. The ULV series is commonly used for applications demanding peak force or low heat output, such as lithography and inspection.

In longer strokes ULV coils can be combined to save magnet material but still achieve high performance.

UMV - G2 Series

Fp 100 - 401 N | Fc 22 - 87 N

The UMV coils are the smallest coils in the vacuum rated linear motor series. Specifically suitable for low loads and tight spaces because of the short length.

This series is ideal for positioning, e.g. in science and aerospace, gantries, or other high dynamic, lightweight applications which require extreme accuracy.

Features

Ironless vacuum motor series



Design

The stainless steel strip on the body of the coil unit makes installation easy, reliable and repeatable. Together with the standard flying leads, this give the opportunity to design the wire management most suited for your application.

Bolt holes at the short side of the yoke allow for easy installation of optional shielding to lower stray fields. This ensures minimal interference in e-beam applications.



Capabilities and outgassing

- › Coil unit and yoke are completely vacuum compatible
- › Minimum pressure down to 10^{-8} mbar
- › Typical total outgassing of 10^{-5} mbar*/l/s
- › Typical C_xH_x outgassing of 10^{-8} mbar*/l/s

RGA performance is excellent, because the coil units are fully enclosed in vacuum compatible stainless steel. The corresponding magnet yokes have vacuum compatible nickel coating. All other materials used that are exposed to the vacuum have been selected to minimize outgassing. The lower outgassing values result in shorter bake-out and pumping time.



Connection and sensors

Monitoring and overheating protection of the coil is possible at all times because they are equipped with temperature measurement and cut-off sensors. Each phase is equipped with a NTC temperature sensor to monitor temperature levels. The sensors and three phases of the coil units are connected via vacuum compatible cables.

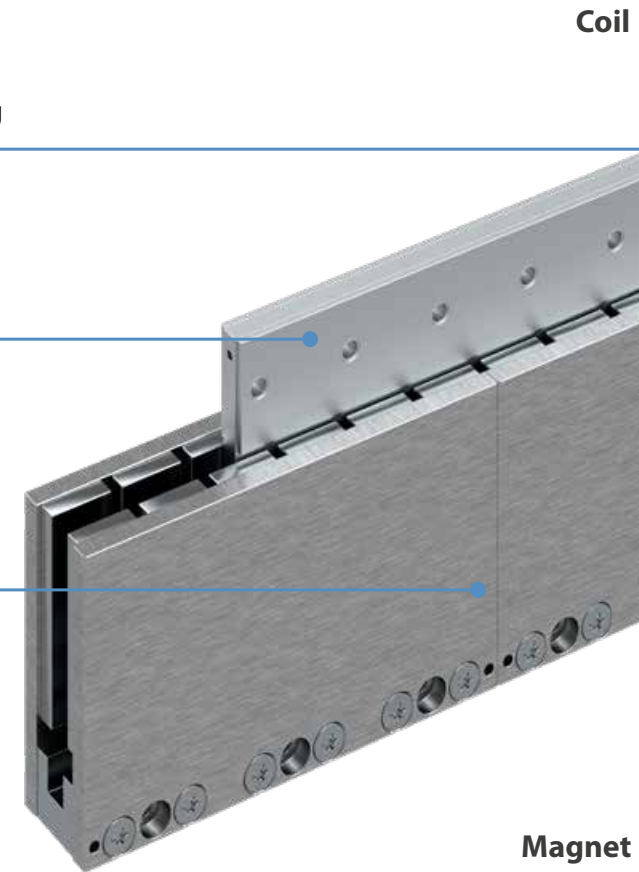
Unique design

Fully enclosed to prevent outgassing

Thermal management

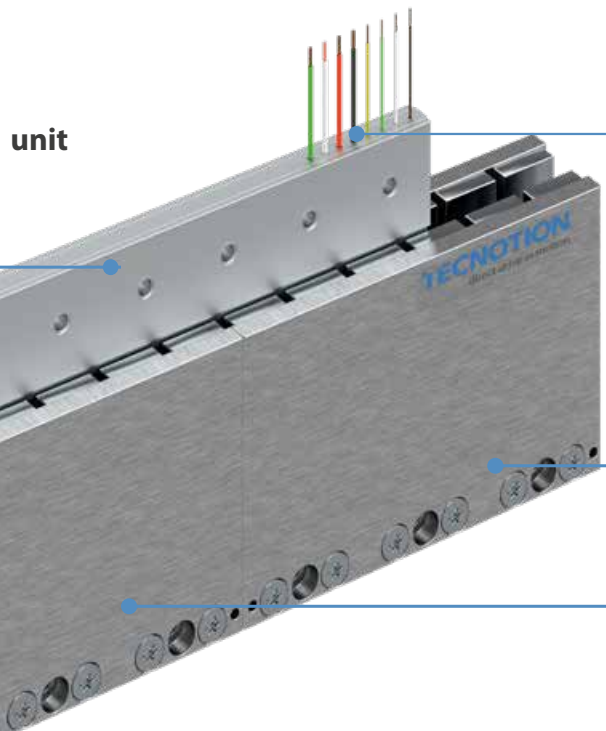
Low thermal resistance (R_{th})

Completely vacuum compatible



Coil

Magnet



unit

yoke

Power

Vacuum compatible lead wires

Sensor

Temperature measurement and cut-off sensor

Lifetime

Proven high durability due to in-house lifetime testing

Produced inside our own cleanroom

Cleanliness



Tecnotion follows a strict production and cleaning protocol to ensure a high level of cleanliness is achieved when the vacuum motors are shipped. All products are subjected to a final inspection to assure they meet the stringent cleanliness levels. Once approved all products are packed securely to assure cleanliness up until the moment of installation.

Thermal characteristics



The enclosed coil units have an additional temperature sensor and improved thermal resistance (R_{th}). These measures ensure that the temperature increase of the coil unit is minimized and the heat flow away from the application is optimized. This is paramount to minimize thermal expansion and thus maintain accuracy and repeatability. The stainless strip further facilitates heat flow away from the coil unit and lowers variation in thermal resistance.



UMV3 G2 coil unit in 150mm magnet yoke

UMV - G2 ironless vacuum series

Parameter	Remarks	Symbol	Unit	UMV3 G2	UMV6 G2	UMV12 G2	
Performance	Winding type			S	S	N S	
	Motor type, max voltage ph-ph	3-phase synchronous	$V_{acrms} (V_{dc})$	230 (325)			
	Peak force @ 20°C/s increase	magnet @ 25°C	F_p	N	100	200	400
	Continuous force passive cooled*	@ T_{max}	F_c	N	5.9	10.8	20
	Continuous force active cooled**	@ T_{max}	F_c	N	22	44	86
	Maximum speed***	@ 325 V	v_{max}	m/s	18.5	18.5	7.0
	Motor force constant	coils @ 25°C	K	N/A _{rms}	20.0	20.0	47.8
	Motor constant	coils @ 25°C	S	N ² /W	23	46	89
Electrical	Peak current	magnet @ 25°C	I_p	A _{rms}	5.0	10.0	8.4
	Max. cont. current passive cooled*	coils @ T_{max}	I_c	A _{rms}	0.30	0.54	0.42
	Max. cont. current active cooled**	coils @ T_{max}	I_c	A _{rms}	1.09	2.18	1.79
	Back EMF phase-phase		B_{emf}	V _{dc} / m/s	16	16	39
	Resistance per phase	coils @ 25°C ex. cable	R_{ph}	Ω	5.8	2.9	8.5
	Induction per phase	$l < 0.6 l_p$	L_{ph}	mH	1.9	1.0	2.8
	Electrical time constant	coils @ 25°C	τ_e	ms	0.3	0.3	0.3
	Maximum continuous power loss	all coils	P_c	W	25	50	100
Thermal	Maximum coil temperature		T_{max}	°C	80		
	Thermal resistance	coils to mount. sfc.	R_{th}	°C/W	2.4	1.2	0.60
	Thermal time constant*	up to 63% max coil temp.	τ_{th}	s	47		
	Temperature cut-off / sensor				3xPTC + 1xNTC		
Mechanical	Coil unit weight	ex. cables	W	kg	0.19	0.33	0.61
	Coil unit length	ex. cables	L	mm	81	141	261
	Motor attraction force		F_a	N	0		
	Magnet pitch NN		τ	mm	30		
	Lead wire weight	all wires	m	g	41		
	Lead wire type (Power, 4x)	length 1.0m	d	mm (AWG)	1.5 (20)		
Lead wire type (Sensor, 4x)	length 1.0m	d	mm (AWG)	0.8 (26)			

Explanation of name

U = Ironless

MV = Series type/vacuum

3 / 6 / 12 = Number of coils

N / S = Winding type

UMV G2	3	N
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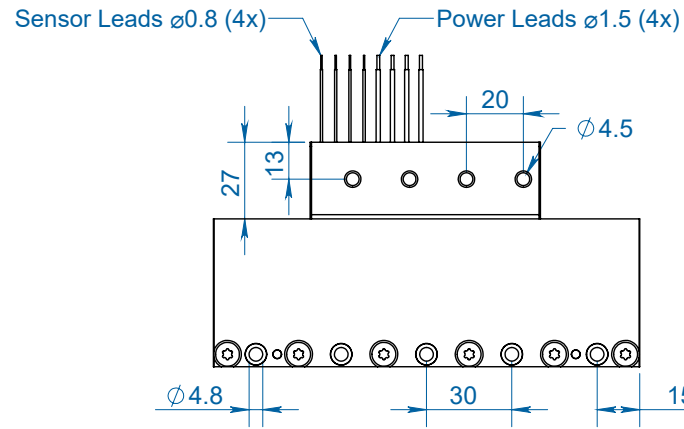
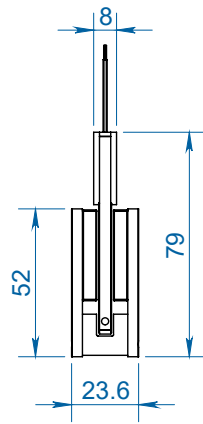
* Depends on environmental conditions in the application. Continuous force noted has been determined with a typical thermal resistance value for passive cooling, and a vacuum chamber wall of 40°C.

** Depends on environmental conditions in the application. Continuous force noted has been determined with a thermal resistance of 0.02 K/W and a mounting surface of 20°C when the motor is driven at max. continuous current.

*** Actual values depend on bus voltage.

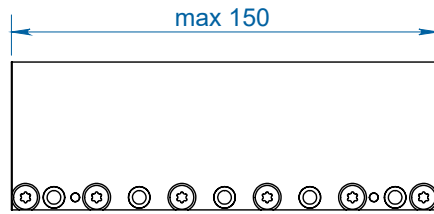
All specifications ±10%

Motor

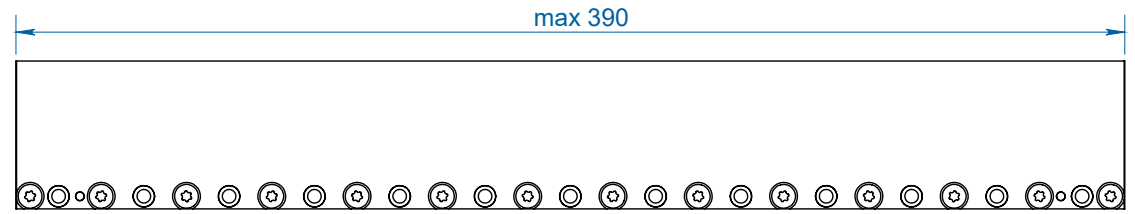


UMV Magnet yoke dimensions		
Le (mm)	150	390
M4 bolts	5	13
Mass (kg/m)	6.7	
<i>Magnet yokes can be butted together.</i>		

Magnet yokes

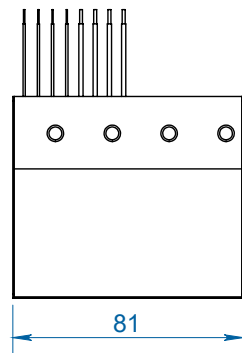


MAGNET YOKE UMV 150mm G2

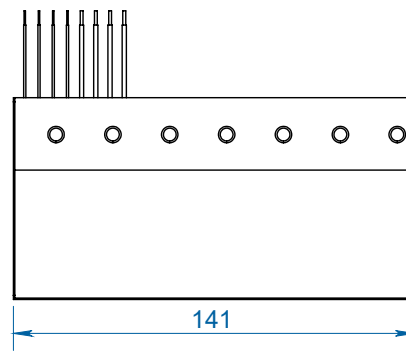


MAGNET YOKE UMV 390mm G2

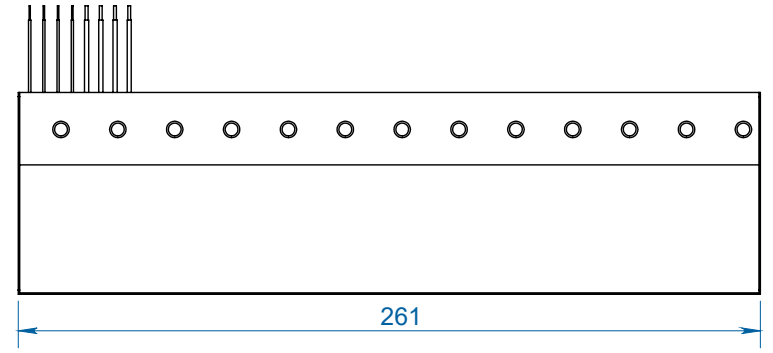
Coil units



COIL UNIT UMV3 G2



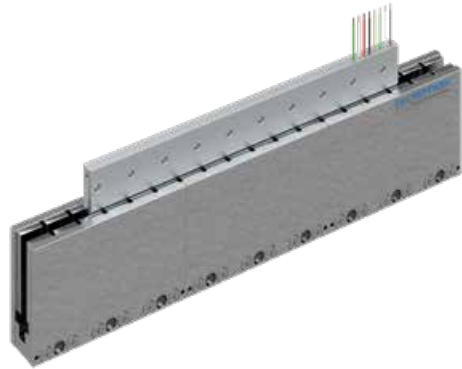
COIL UNIT UMV6 G2



COIL UNIT UMV12 G2

Mounting instructions and flatness or parallelism requirements can be found in the [Vacuum installation manual](#). 3D CAD files can be downloaded from our website.

* All sizes are in mm



ULV9 G2 coil unit in 126mm magnet yokes

ULV - G2 ironless vacuum series

Parameter	Remarks	Symbol	Unit	ULV9 G2	ULV9 G2
Winding type				N	S
Motor type, max voltage ph-ph	3-phase synchronous		$V_{acrms} (V_{dc})$	230 (325)	
Peak force @ 20°C/s increase	magnet @ 25°C	F_p	N	720	719
Continuous force passive cooled*	@ T_{max}	F_c	N	41	41
Continuous force active cooled**	@ T_{max}	F_c	N	164	165
Maximum speed***	@ 300 V	v_{max}	m/s	5.0	13.6
Motor force constant	coils @ 20°C	K	N/A _{rms}	68.0	27.3
Motor constant	coils @ 25°C	S	N ² /W	275	278
Peak current	magnet @ 25°C	I_p	A _{rms}	10.6	26.3
Max. cont. current passive cooled*	coils @ T_{max}	I_c	A _{rms}	0.61	1.52
Max. cont. current active cooled**	coils @ T_{max}	I_c	A _{rms}	2.42	6.05
Back EMF phase-phase		B_{emf}	V _{dc} / m/s	56	22
Resistance per phase	coils @ 25°C ex. cable	R_{ph}	Ω	5.6	0.9
Induction per phase	$l < 0.6 l_p$	L_{ph}	mH	4.4	0.7
Electrical time constant	coils @ 25°C	τ_e	ms	0.8	
Maximum continuous power loss	all coils	P_c	W	120	
Maximum coil temperature		T_{max}	°C	80	
Thermal resistance	coils to mount. sfc.	R_{th}	°C/W	0.50	
Thermal time constant*	up to 63% max coil temp.	τ_{th}	s	88	
Temperature cut-off / sensor				3xPTC + 1xNTC	
Coil unit weight	ex. cables	W	kg	1.10	
Coil unit length	ex. cables	L	mm	273	
Motor attraction force		F_a	N	0	
Magnet pitch NN		τ	mm	42	
Lead wire weight	all wires	m	g	41	
Lead wire type (Power, 4x)	length 1.0m	d	mm (AWG)	1.5 (20)	
Lead wire type (Sensor, 4x)	length 1.0m	d	mm (AWG)	0.8 (26)	

Explanation of name

U = Ironless

LV = Series type/vacuum

9 = Number of coils

N / S = Winding type

ULV G2	9	N
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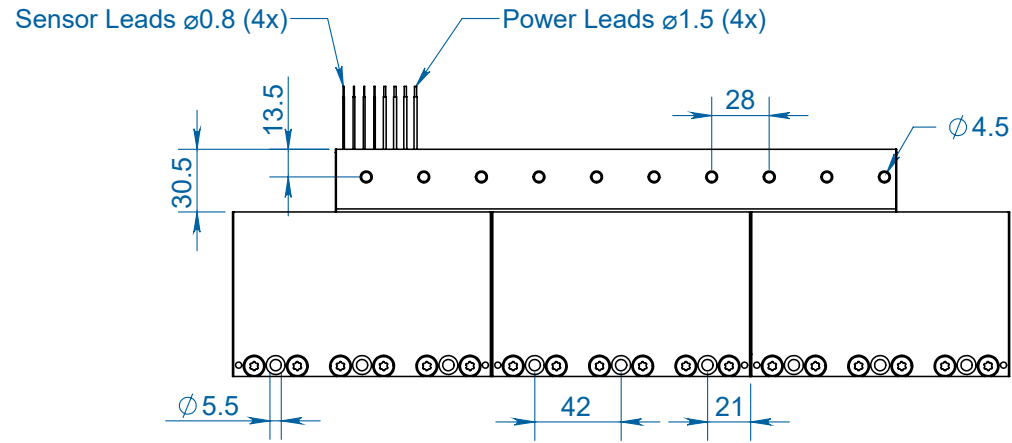
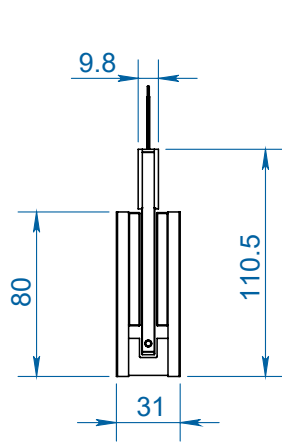
* Depends on environmental conditions in the application. Continuous force noted has been determined with a typical thermal resistance value for passive cooling, and a vacuum chamber wall of 40°C.

** Depends on environmental conditions in the application. Continuous force noted has been determined with a thermal resistance of 0.02 K/W and a mounting surface of 20°C when the motor is driven at max. continuous current.

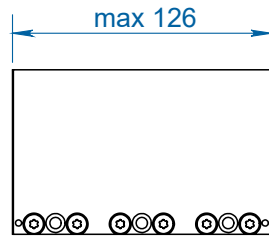
*** Actual values depend on bus voltage.

All specifications ±10%

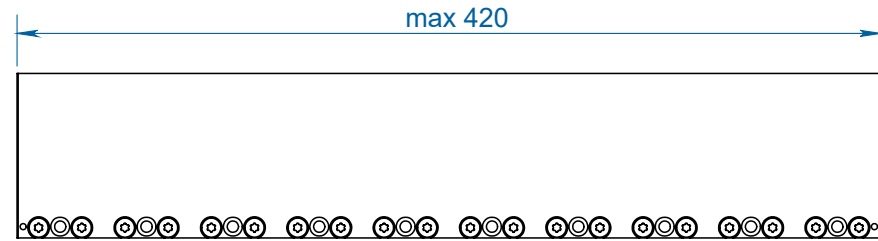
Motor



Magnet yokes

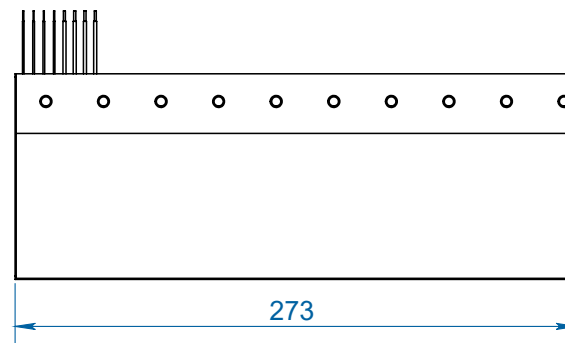


MAGNET YOKE ULV 126mm G2



MAGNET YOKE ULV 420mm G2

Coil units



COIL UNIT ULV9 G2

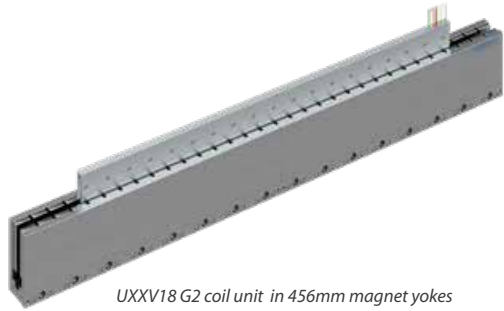
ULV Magnet yoke dimensions

Le (mm)	126	420
M5 bolts	3	10
Mass (kg/m)	12.3	
<i>Magnet yokes can be butted together.</i>		

Mounting instructions and flatness or parallelism requirements can be found in the [Vacuum installation manual](#). 3D CAD files can be downloaded from our website.

* All sizes are in mm

UXXV - G2 ironless vacuum series



UXXV18 G2 coil unit in 456mm magnet yokes

Parameter	Remarks	Symbol	Unit	UXXV6 G2	UXXV9 G2	UXXV18 G2		
Performance	Winding type			N	N	S	N	
	Motor type, max voltage ph-ph	3-phase synchronous		$V_{acrms} (V_{dc})$	230 (325)			
	Peak force @ 20°C/s increase	magnet @ 25°C	F_p	N	1340	2010	2012	4020
	Continuous force passive cooled*	@ T_{max}	F_c	N	64	94	94	184
	Continuous force active cooled**	@ T_{max}	F_c	N	233	349	350	698
	Maximum speed***	@ 300 V	v_{max}	m/s	2.8	2.8	7.7	2.8
	Motor force constant	coils @ 20°C	K	N/A _{rms}	117.5	117.5	47.7	117.5
	Motor constant	coils @ 25°C	S	N ² /W	562	843	847	1686
Electrical	Peak current	magnet @ 25°C	I_p	A _{rms}	11.4	17.1	42.2	34.2
	Max. cont. current passive cooled*	coils @ T_{max}	I_c	A _{rms}	0.55	0.80	1.98	1.56
	Max. cont. current active cooled**	coils @ T_{max}	I_c	A _{rms}	1.98	2.97	7.34	5.94
	Back EMF phase-phase		B_{emf}	V _{dc} / m/s	96	96	39	96
	Resistance per phase	coils @ 25°C ex. cable	R_{ph}	Ω	8.2	5.5	0.9	2.7
	Induction per phase	$l < 0.6 l_p$	L_{ph}	mH	14.2	9.5	1.6	4.7
	Electrical time constant	coils @ 25°C	τ_e	ms		1.7		
	Maximum continuous power loss	all coils	P_c	W	118	176		353
Thermal	Maximum coil temperature		T_{max}	°C		80		
	Thermal resistance	coils to mount. sfc.	R_{th}	°C/W	0.51	0.34	0.17	
	Thermal time constant*	up to 63% max coil temp.	τ_{th}	s		153		
	Temperature cut-off / sensor					3xPTC + 1xNTC		
Mechanical	Coil unit weight	ex. cables	W	kg	1.74	2.54	4.95	
	Coil unit length	ex. cables	L	mm	251	365	707	
	Motor attraction force		F_a	N		0		
	Magnet pitch NN		τ	mm		57		
	Lead wire weight	all wires	m	g		55		
	Lead wire type (Power, 4x)	length 1.0m	d	mm (AWG)		1.75 (18)		
Lead wire type (Sensor, 4x)	length 1.0m	d	mm (AWG)		0.8 (26)			

Explanation of name

U = Ironless

XXV = Series type/vacuum

6 / 9 / 18 = Number of coils

N / S = Winding type

UXXV G2 18 N

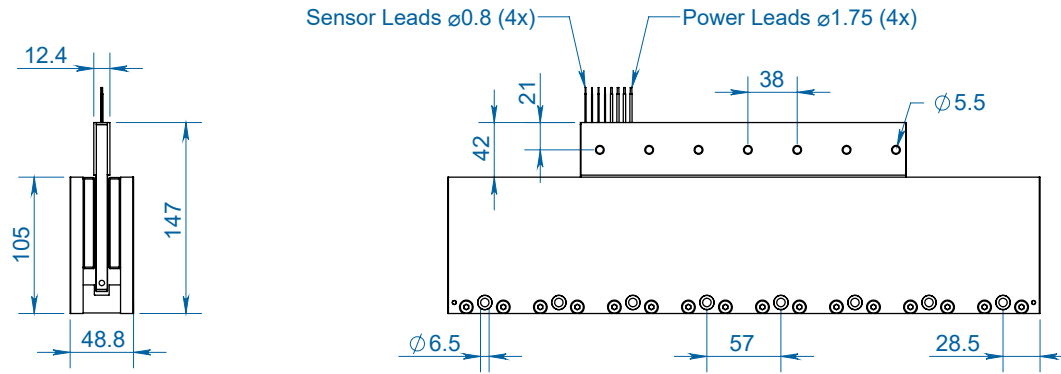
* Depends on environmental conditions in the application. Continuous force noted has been determined with a typical thermal resistance value for passive cooling, and a vacuum chamber wall of 40°C.

** Depends on environmental conditions in the application. Continuous force noted has been determined with a thermal resistance of 0.02 K/W and a mounting surface of 20°C when the motor is driven at max. continuous current.

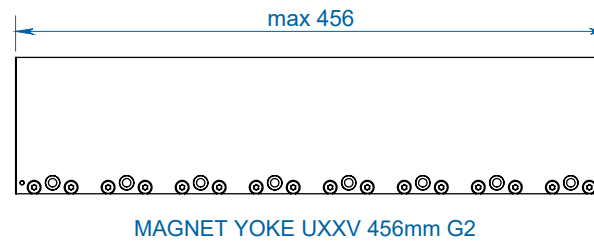
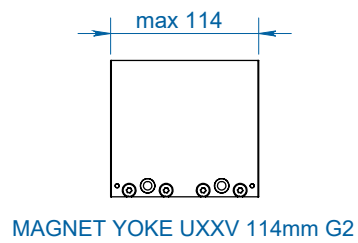
*** Actual values depend on bus voltage.

All specifications ±10%

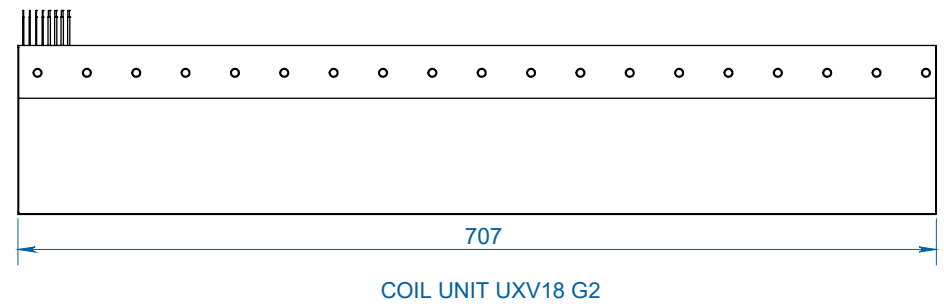
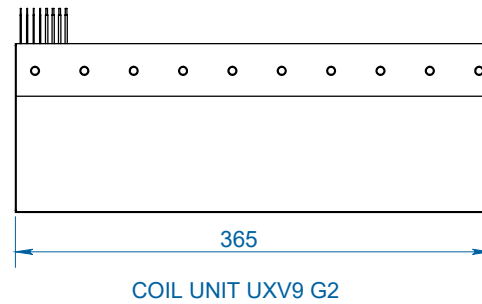
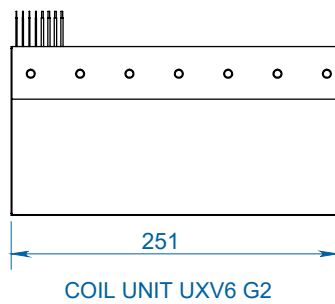
Motor



Magnet yokes



Coil units



UXXV Magnet yoke dimensions

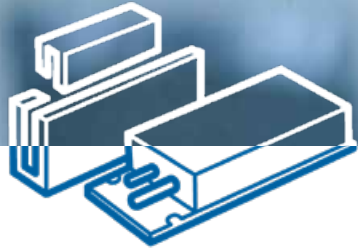
Le (mm)	114	456
M6 bolts	2	8
Mass (kg/m)	26	

Magnet yokes can be butted together.

Mounting instructions and flatness or parallelism requirements can be found in the [Vacuum installation manual](#). 3D CAD files can be downloaded from our website.

* All sizes are in mm

We direct drive your motion technology



Linear motors

Iron core & ironless motor series

Unmatched acceleration and dynamic movements

Tecnotion's linear motor series excel in their force density ratings. They offer continuous force in a range of 10 Newton to 3000 Newton in a surprisingly small package.

Tecnotion provides linear solutions for most applications requiring a strong iron core linear motor or a highly dynamic ironless linear motor.

www.tecnotion.com/linear



Torque motors

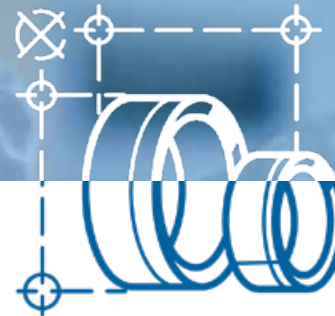
Tu 0.64-2202 Nm Tc 0.27-907 Nm

Increased accuracy and dynamic performance of your application

Tecnotion torque motor series features superior force density, low thermal resistance, low cogging and housed design.

The torque series consists of different outer diameters ranging from 65mm to 485mm for the largest motor and various building heights ranging from 17mm up to 105mm.

www.tecnotion.com/torque



Custom motors

Motor solutions

Adapt standard motor series to meet your needs

In case the standard motor series are not sufficient for your application, it is also possible to have these motors customized in a variety of ways. Customization can range from simple modifications, like adding a connector, to fully tailor-made motors designed from scratch.

Some examples: custom windings, cable confection, additional sensors, additional certifications and customization for vacuum applications. For more information please contact Tecnotion. www.tecnotion.com/custom



Motor simulation tool

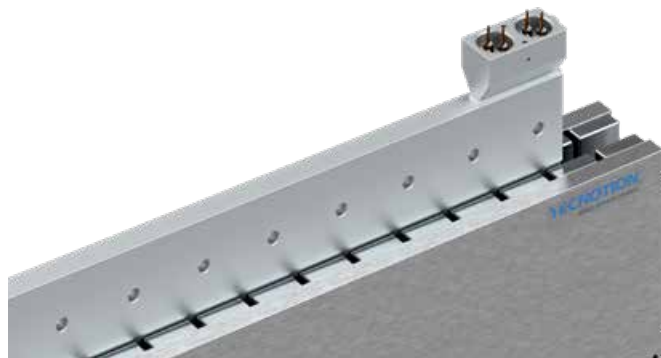
Analyze your application

Size your application with the motor selection and simulation tool

Online motor simulation software helps you find the best motor for the application and generate reports within seconds, without having to make time consuming calculations by hand.

The motor sizing simulation tool helps to select the right torque or linear motor, using your application characteristics.

The tool will provide you with diagrams for position, velocity, acceleration, jerk, torque, power, voltage, current, temperature and torque vs. velocity. www.tecnotion.com/simtool



Custom ironless vacuum motor series

Generation 2 vacuum motor series are prepared for feedthrough instead of lead wires.

Contact us if your application is more demanding and has stricter outgassing requirements.

Article numbers

Series	Article	Article code
VACUUM Generation 2	Coil unit UMV3S G2	114360
VACUUM Generation 2	Coil unit UMV6S G2	117288
VACUUM Generation 2	Coil unit UMV12N G2	117289
VACUUM Generation 2	Coil unit UMV12S G2	117290
VACUUM Generation 2	Magnet yoke UMV 150mm G2	114416
VACUUM Generation 2	Magnet yoke UMV 390mm G2	117295
VACUUM Generation 2	Coil unit ULV9N G2	117291
VACUUM Generation 2	Coil unit ULV9S G2	115773
VACUUM Generation 2	Magnet yoke ULV 126mm G2	117296
VACUUM Generation 2	Magnet yoke ULV 420mm G2	117297
VACUUM Generation 2	Coil unit UXXV6N G2	117292
VACUUM Generation 2	Coil unit UXXV9N G2	117293
VACUUM Generation 2	Coil unit UXXV9S G2	117294
VACUUM Generation 2	Coil unit UXXV18N G2	114389
VACUUM Generation 2	Magnet yoke UXXV 114mm G2	117298
VACUUM Generation 2	Magnet yoke UXXV 456mm G2	114411

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