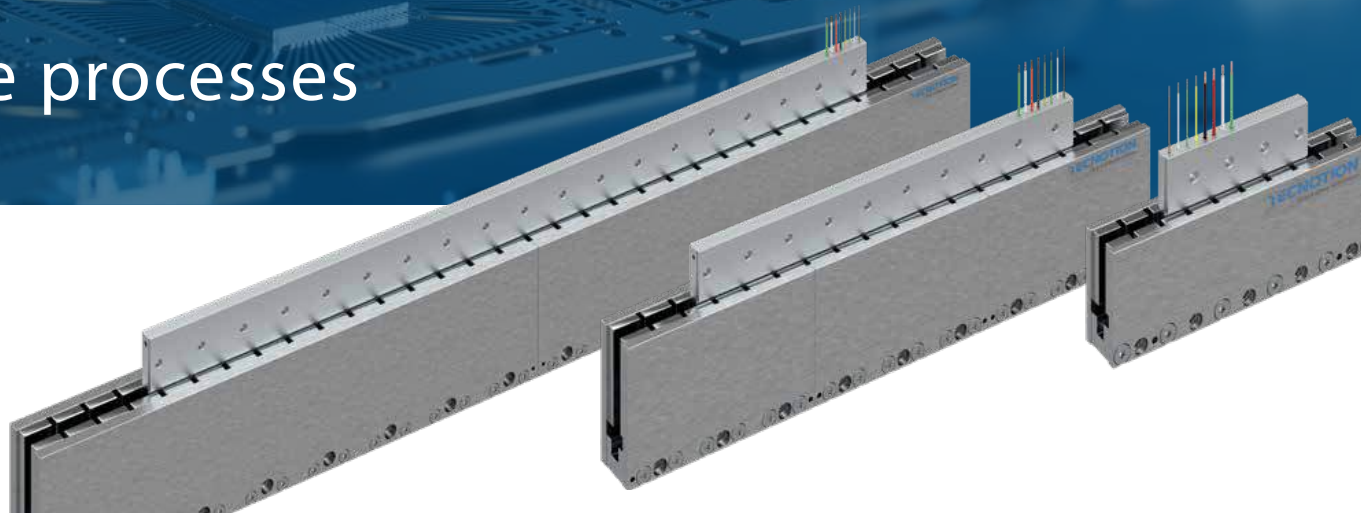
TECNOTION®

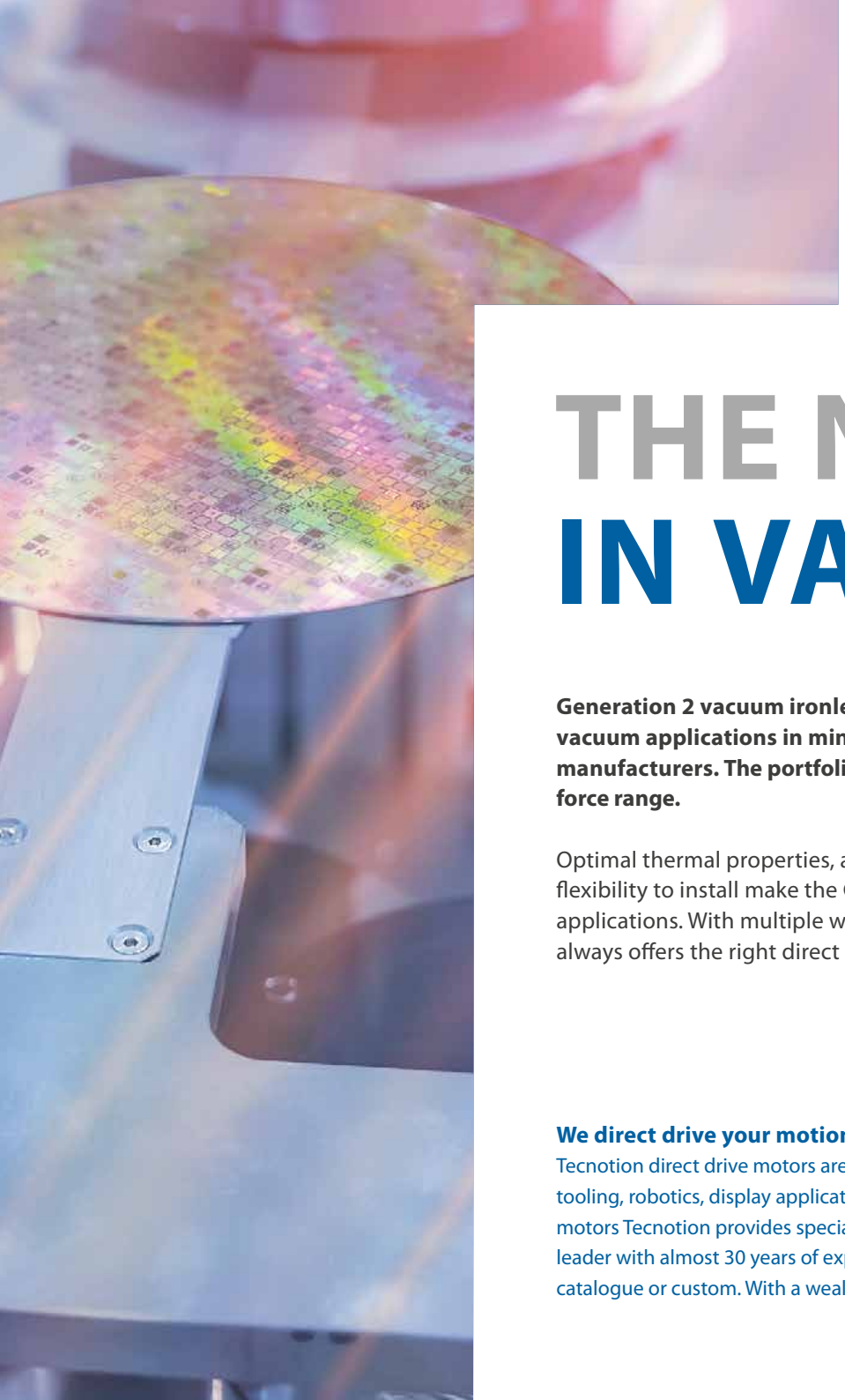
direct drive in motion

IRONLESS VACUUM MOTOR SERIES Generation 2

For powerful and precise processes



G2



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 good 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.

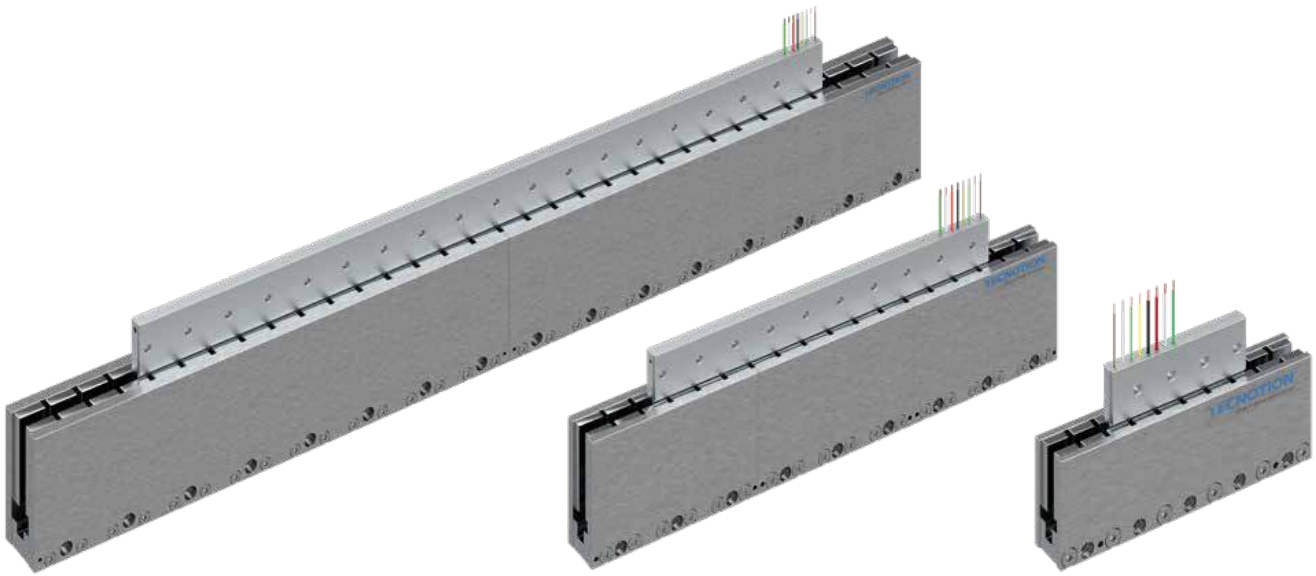
Extremely low outgassing

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.

U	M V	6 12	S N

U = Ironless
M V = Series type/vacuum
6 12 = Number of coils
S N = Winding type



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

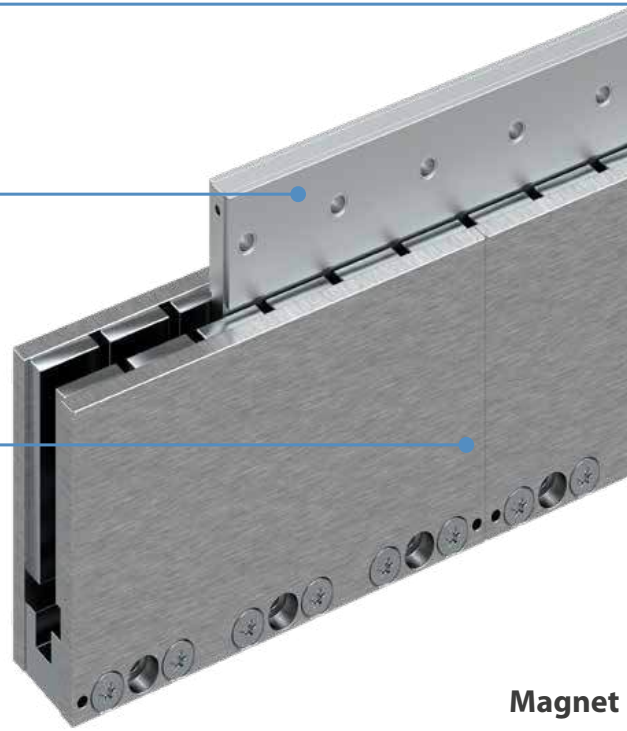
The stainless steel strip on the body of the coil unit makes installation easy, reliable and repeatable. Together with the standard flying leads, this gives the opportunity to design the wire management most suited for your application.

Capabilities and outgassing

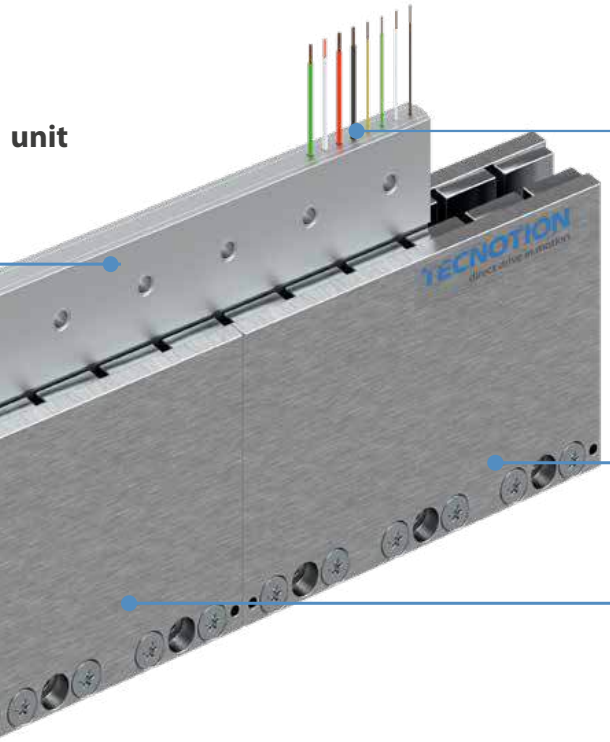
- Coil unit and yoke are completely vacuum compatible
- Minimum pressure down to 10^{-8} mbar
- Typical CxHx outgassing between 10^{-7} and 10^{-8} mbar*l/s. Depending on type and configuration
- Inhouse RGA and vacuum bake out is available on request. Inform for further capabilities at Tecnotion.

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.

Tecnotion has more vacuum product capabilities depending on various application needs. Please challenge us if you have any request for specific requirements on performance or outgassing.



TECNOTION® direct drive in motion



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

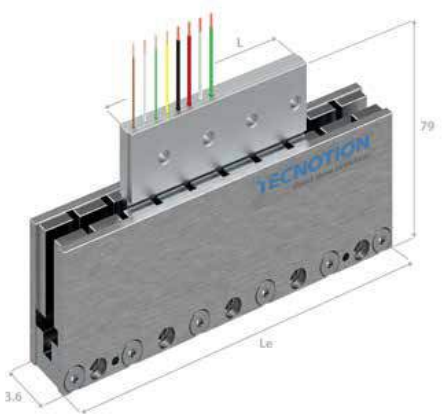
Tecnotion follows a strict production and cleaning protocol to ensure a high level of cleanliness is achieved when the vacuum motors are shipped. All products are subjected to a final inspection to assure they meet the stringent cleanliness levels. Once approved all products are packed securely to assure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

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 an NTC temperature sensor to monitor temperature levels. The sensors and three phases of the coil units are connected via vacuum compatible cables.



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	U_{max}	$V_{ac\ rms}$ (V_{dc})	230 (325)			
	Peak force @ 20 K/s increase	magnets @ 25°C	F_p	N	100	200	400	401
	Continuous force passive cooled[1]	coils @ T_{max}	F_c	N	5.9	10.8	20	20
	Continuous force active cooled[2]	coils @ T_{max}	F_c	N	22	44	86	87
	Maximum speed[3]	@ U_{max} @ F_c	v_{max}	m/s	18.5	18.5	7.0	18.5
	Motor force constant	$I \leq I_c$	K_f	N/A_{rms}	20.0	20.0	47.8	20.0
	Motor constant	coils @ 25°C	S	N^2/W	23	46	89	93
Electrical	Peak current	magnets @ 25°C	I_p	A_{rms}	5.0	10.0	8.4	20.1
	Continuous current passive cooled[1]	coils @ T_{max}	I_c	A_{rms}	0.30	0.54	0.42	1.02
	Continuous current active cooled[2]	coils @ T_{max}	I_c	A_{rms}	1.09	2.18	1.79	4.36
	Back EMF ph-ph_{peak}		K_e	V_{dc} /m/s	16	16	39	16
	Resistance per phase	coils @ 25°C ex. cable	R_{ph}	Ω	5.8	2.9	8.5	1.4
	Induction per phase		L_{ph}	mH	1.9	1.0	2.8	0.5
	Electrical time constant		τ_e	ms	0.3	0.3	0.3	0.3
Thermal	Continuous power loss[2]	coils @ T_{max}	P_c	W	25	50	100	
	Maximum coil temperature		T_{max}	°C	80			
	Thermal resistance	coils to mount. sfc.	R_{th}	K/W	2.4	1.2	0.60	
	Thermal time constant		τ_{th}	s	47			
	Temperature sensor				3xPTC + 1xNTC			
Mechanical	Coil unit mass	ex. cables	m	kg	0.19	0.33	0.61	
	Coil unit length	ex. cables	L	mm	81.5	141.5	261.5	
	Motor attraction force	rms @ 0 A	F_a	N	0			
	Magnet pitch NN		τ	mm	30			
	Lead wire mass	all wires		g	41			
	Lead wire type (power, 4x)	length 1 m	d	mm (AWG)	1.5 (20)			
	Lead wire type (sensor, 4x)	length 1 m	d	mm (AWG)	0.8 (26)			

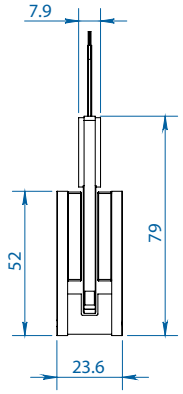
All specifications ±10%

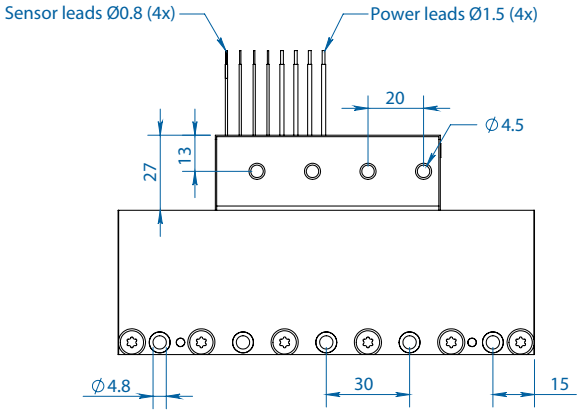
1 Depends on environmental conditions in the application. Continuous force noted has been determined with a typical thermal resistance value for passive cooling, and a vacuum chamber wall of 40°C.
2 Depends on environmental conditions in the application. Continuous force noted has been determined with a thermal resistance of 0.02 K/W and a mounting surface of 20°C when the motor is driven at continuous current.
3 Actual values depend on bus voltage.

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

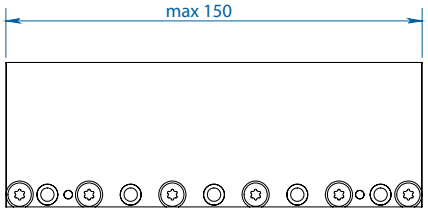
Approvals

Motor

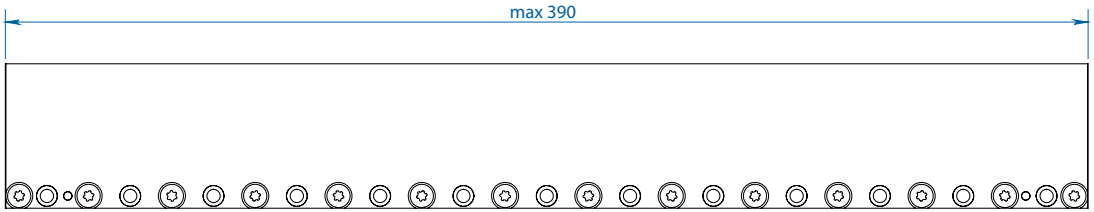




Magnet yokes

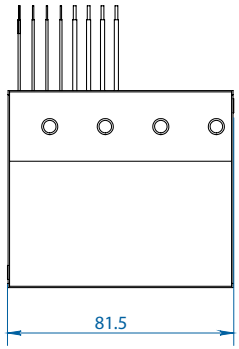


MAGNET YOKE UMV 150mm G2

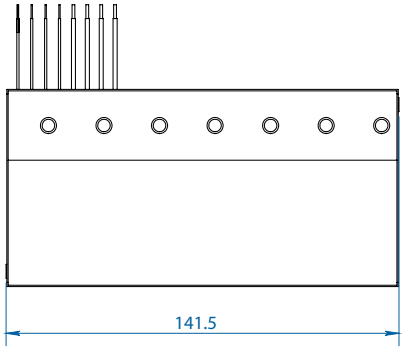


MAGNET YOKE UMV 390mm G2

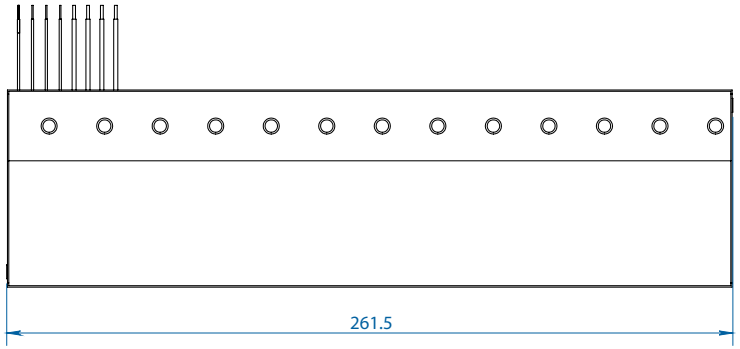
Coil units



COIL UNIT UMV3 G2



COIL UNIT UMV6 G2

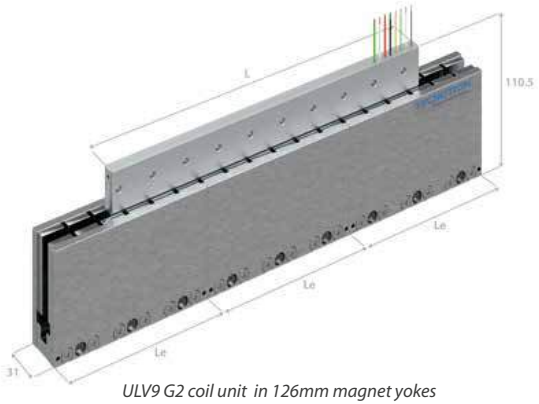


COIL UNIT UMV12 G2

*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*

ULV - G2 ironless vacuum series



ULV9 G2 coil unit in 126mm magnet yokes

	Parameter	Remarks	Symbol	Unit	ULV9 G2	ULV9 G2
Performance	Winding type				N	S
	Motor type, max voltage ph-ph	3-phase synchronous	U_{max}	$V_{ac\,rms}$ (V_{dc})	230 (325)	
	Peak force @ 20 K/s increase	magnets @ 25°C	F_p	N	720	719
	Continuous force passive cooled[1]	coils @ T_{max}	F_c	N	41	41
	Continuous force active cooled[2]	coils @ T_{max}	F_c	N	164	165
	Maximum speed[3]	@ U_{max} @ F_c	v_{max}	m/s	5.0	13.6
	Motor force constant	$I \leq I_c$	K_f	N/A_{rms}	68.0	27.3
	Motor constant	coils @ 25°C	S	N^2/W	275	278
Electrical	Peak current	magnets @ 25°C	I_p	A_{rms}	10.6	26.3
	Continuous current passive cooled[1]	coils @ T_{max}	I_c	A_{rms}	0.61	1.52
	Continuous current active cooled[2]	coils @ T_{max}	I_c	A_{rms}	2.42	6.05
	Back EMF ph-ph_{peak}		K_e	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_{ph}	mH	4.4	0.7
	Electrical time constant		τ_e	ms	0.8	
Thermal	Continuous power loss[2]	coils @ T_{max}	P_c	W	120	
	Maximum coil temperature		T_{max}	°C	80	
	Thermal resistance	coils to mount. sfc.	R_{th}	K/W	0.50	
	Thermal time constant		τ_{th}	s	88	
	Temperature sensor				3xPTC + 1xNTC	
Mechanical	Coil unit mass	ex. cables	m	kg	1.10	
	Coil unit length	ex. cables	L	mm	273.5	
	Motor attraction force	rms @ 0 A	F_a	N	0	
	Magnet pitch NN		τ	mm	42	
	Lead wire mass	all wires		g	41	
	Lead wire type (power, 4x)	length 1 m	d	mm (AWG)	1.5 (20)	
	Lead wire type (sensor, 4x)	length 1 m	d	mm (AWG)	0.8 (26)	

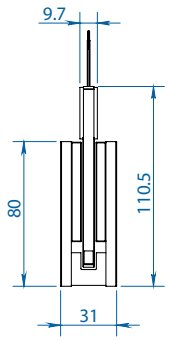
All specifications ±10%

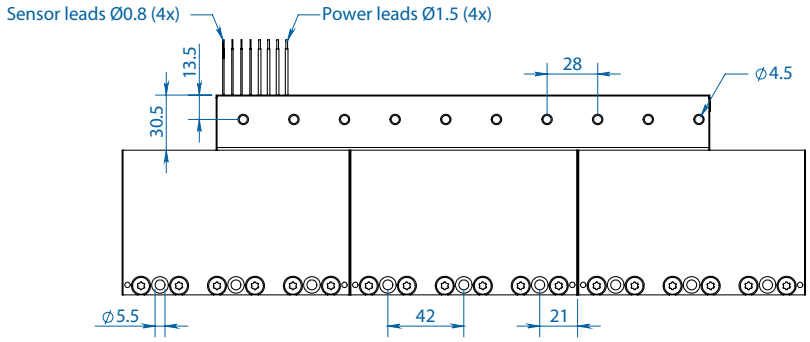
1 Depends on environmental conditions in the application. Continuous force noted has been determined with a typical thermal resistance value for passive cooling, and a vacuum chamber wall of 40°C.
2 Depends on environmental conditions in the application. Continuous force noted has been determined with a thermal resistance of 0.02 K/W and a mounting surface of 20°C when the motor is driven at continuous current.
3 Actual values depend on bus voltage.

ULV Magnet yoke dimensions		
Le (mm)	126	420
M5 bolts	3	10
Mass (kg/m)	12.3	
Magnet yokes can be butted together.		

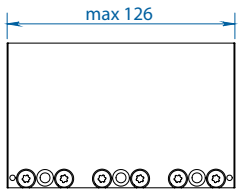
Approvals

Motor

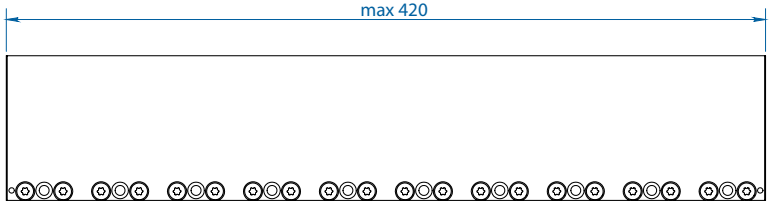




Magnet yokes

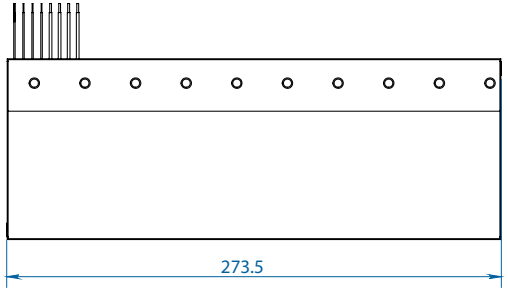


MAGNET YOKE ULV 126mm G2



MAGNET YOKE ULV 420mm G2

Coil unit

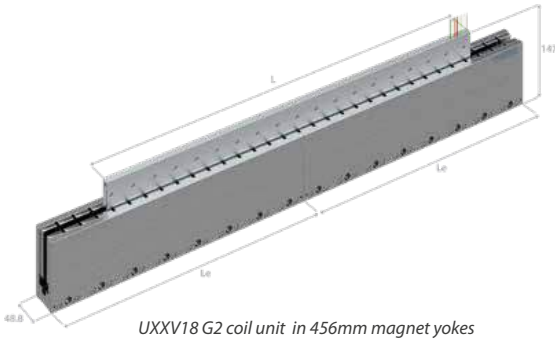


COIL UNIT ULV9 G2

*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*

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	U_{max}	$V_{ac\,rms}$ (V_{dc})	230 (325)			
Peak force @ 20 K/s increase	magnets @ 25°C	F_p	N	1340	2010	2012	4020
Continuous force passive cooled[1]	coils @ T_{max}	F_c	N	64	94	94	184
Continuous force active cooled[2]	coils @ T_{max}	F_c	N	233	349	350	698
Maximum speed[3]	@ U_{max} @ F_c	v_{max}	m/s	2.8	2.8	7.7	2.8
Motor force constant	$I \leq I_c$	K_f	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	magnets @ 25°C	I_p	A_{rms}	11.4	17.1	42.2	34.2
Continuous current passive cooled[1]	coils @ T_{max}	I_c	A_{rms}	0.55	0.80	1.98	1.56
Continuous current active cooled[2]	coils @ T_{max}	I_c	A_{rms}	1.98	2.97	7.34	5.94
Back EMF ph-ph$_{peak}$		K_e	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_{ph}	mH	14.2	9.5	1.6	4.7
Electrical time constant		τ_e	ms	1.7			
Thermal							
Continuous power loss[2]	coils @ T_{max}	P_c	W	118	176		353
Maximum coil temperature		T_{max}	°C	80			
Thermal resistance	coils to mount. sfc.	R_{th}	K/W	0.51	0.34		0.17
Thermal time constant		τ_{th}	s	153			
Temperature sensor				3xPTC + 1xNTC			
Mechanical							
Coil unit mass	ex. cables	m	kg	1.74	2.54		4.95
Coil unit length	ex. cables	L	mm	251.5	365.5		707.5
Motor attraction force	rms @ 0 A	F_a	N	0			
Magnet pitch NN		τ	mm	57			
Lead wire mass	all wires		g	55			
Lead wire type (power, 4x)	length 1 m	d	mm (AWG)	1.75 (18)			
Lead wire type (sensor, 4x)	length 1 m	d	mm (AWG)	0.8 (26)			

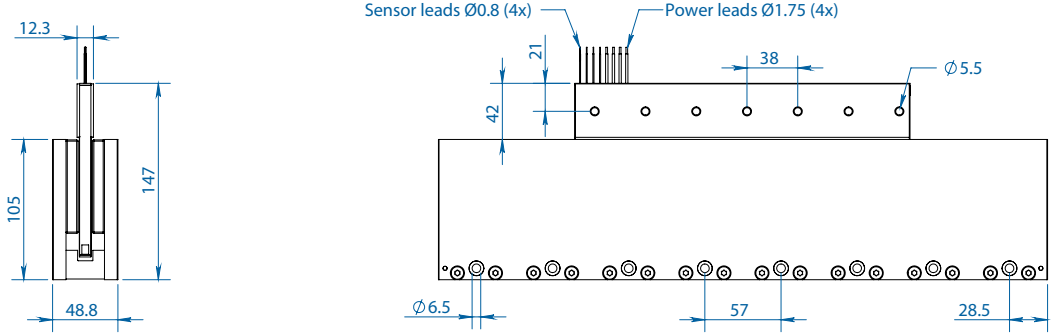
All specifications ±10%

UXXV Magnet yoke dimensions		
Le (mm)	114	456
M6 bolts	2	8
Mass (kg/m)	26	
Magnet yokes can be butted together.		

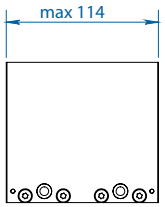
Approvals

1 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.
2 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 continuous current.
3 Actual values depend on bus voltage.

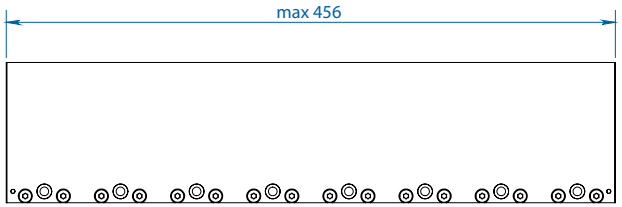
Motor



Magnet yokes

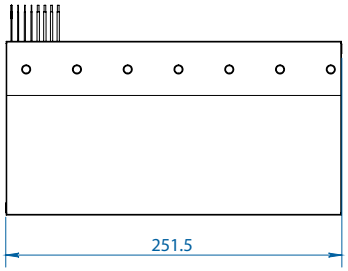


MAGNET YOKE UXXV 114mm G2

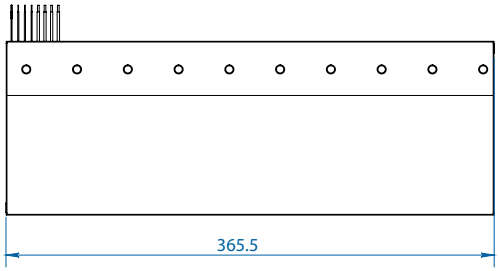


MAGNET YOKE UXXV 456mm G2

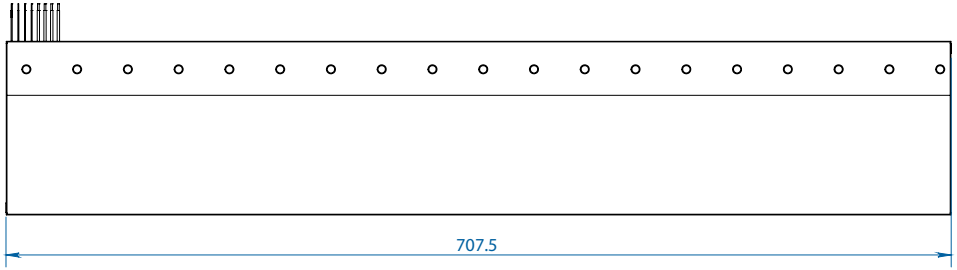
Coil units



COIL UNIT UXV6 G2



COIL UNIT UXV9 G2

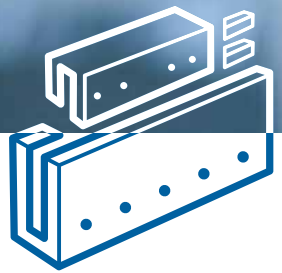


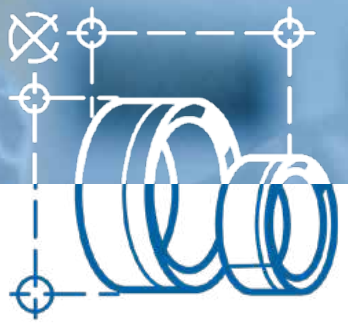
COIL UNIT UXV18 G2

*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*

We direct drive your motion technology





Ironless linear motors

F_p 2.7-4200 N F_c 1.4-846 N

Superior precision with accurate force constant and speed

In contrast to iron core motors, these motors feature an ironless coil unit, therefore no attraction force or cogging between the coil unit and the magnet track. This gives ironless motors their light weight, superior precision, a linear force constant, and extremely dynamic velocity, acceleration, and deceleration.

Perfect for many industries, such as semiconductor, display, inspection, medical, automation, and optics.

www.tecnotion.com/ironless

QTR & QTL torque motors

T_u 0.64-2202 Nm T_c 0.28-907 Nm

Increased accuracy and dynamic performance of your application

Tecnotion torque motor series features superior torque density, low thermal resistance, low cogging and housed design. Motors can be very slim in height but large in diameter (for large axles and turntables) or have a 'height' close to their diameter, resulting in a compact but high-torque motor. 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

TECNOTION® direct drive in motion

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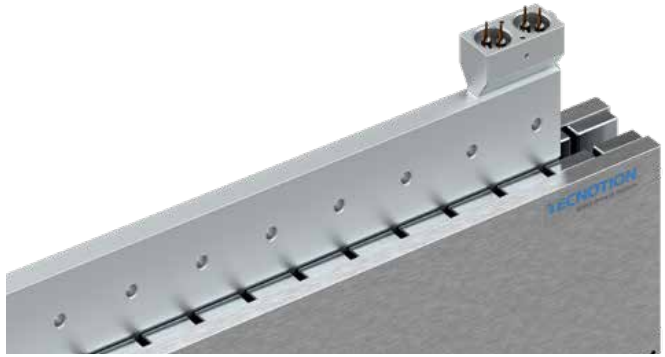

Custom ironless vacuum motor series

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 UXV6N G2	117292
VACUUM Generation 2	Coil unit UXV9N G2	117293
VACUUM Generation 2	Coil unit UXV9S G2	117294
VACUUM Generation 2	Coil unit UXV18N G2	114389
VACUUM Generation 2	Magnet yoke UXXV 114mm G2	117298
VACUUM Generation 2	Magnet yoke UXXV 456mm G2	114411

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