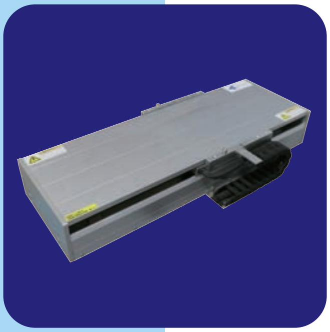
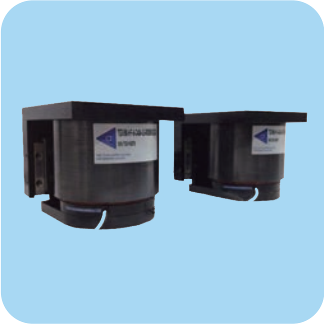
Direct Drive Stages

Linear Motor Stages / Voice Coil Stages





where precision matters

EN-20.8.1

Akribis
where precision matters

Akribis is a Latinized Greek word that means “Precision”. On the Akribis logo, the letter “a” is formed by a line and a circle, representing linear and rotary motions. These are supported by a tetrahedron structure, the same structure as the diamond crystal which has many exceptional physical properties.

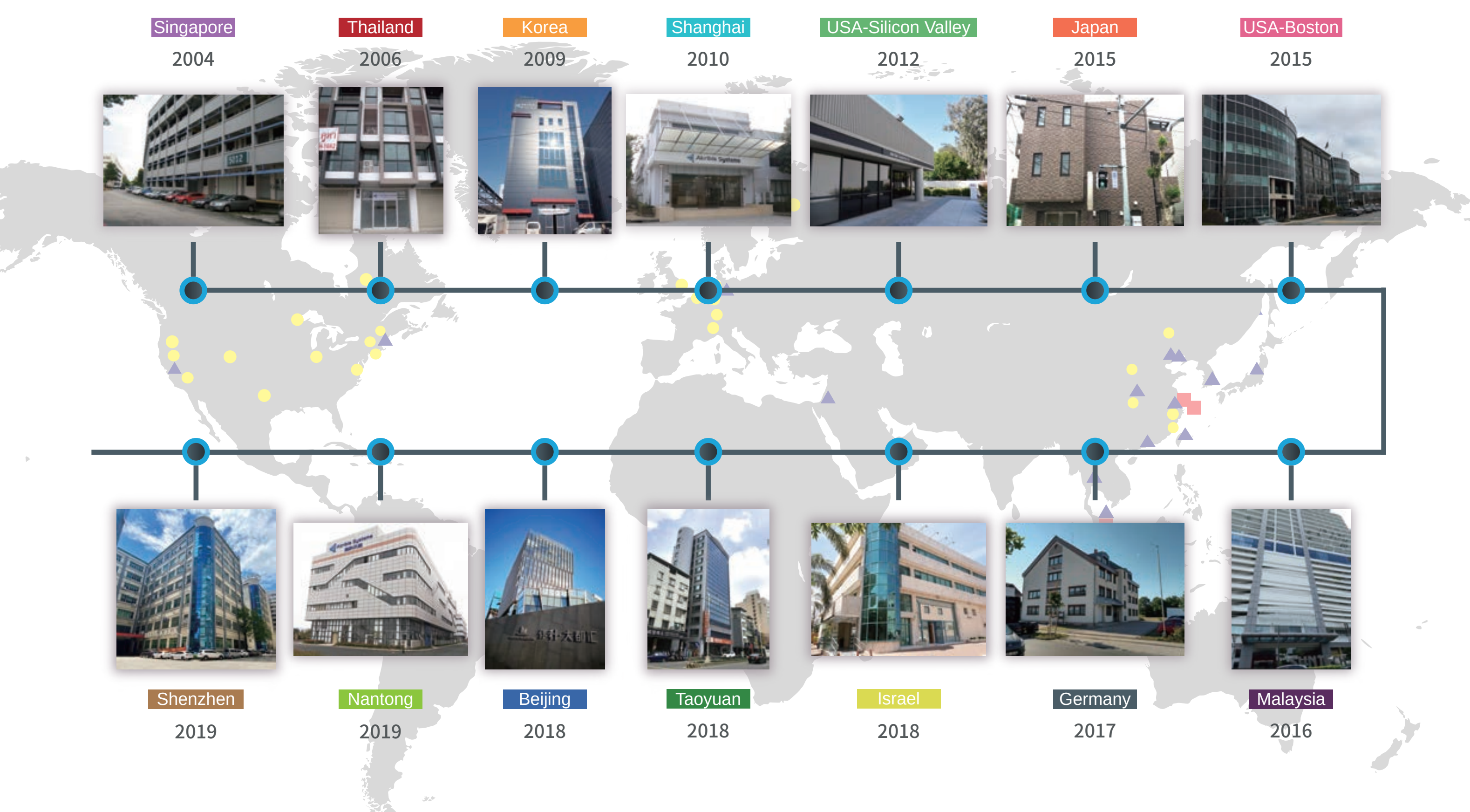
The logo signifies that Akribis Systems’ sound engineering expertise is the basis of the company’ s foundation, and this enables us to provide customers with precise, direct drive motion control solutions.

Akribis Systems Pte Ltd was founded in Aug 2004. We design and manufacture direct drive motors, stages and precision systems that are used in equipment for manufacturing, inspection and testing. Akribis Systems supports a wide range of industries including semiconductor, solar, flat panel, hard disk, LED, printed circuit board, printing, photonics and biomedical manufacturing.

From the beginning, the company has been focusing on innovation and development of new technologies and solutions in motion control, with more than 44 patents applied. Backed by a very strong and committed engineering team, the company continues to develop custom motors and systems for the most demanding applications.

The corporate headquarters of Akribis Systems is situated in Singapore. We have manufacturing facilities in Singapore and in Shanghai & Nantong, China.

Our sales network includes our sales offices in USA, South Korea, Japan, Thailand, Malaysia and Taiwan, and is reinforced by our comprehensive distribution channels in Asia, Europe and North America.



CONTENTS

Please refer to ***Direct Drive Motors*** for Akribis direct drive motors.

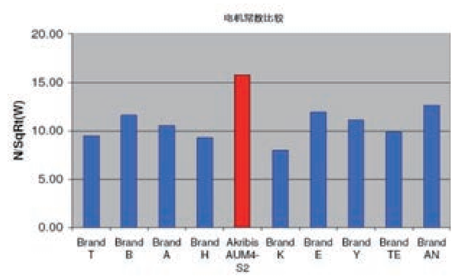
Introduction

Most complete range of linear motors

Akribis linear motors can be categorized into iron core and ironless series. Consisting of motor coils and magnet tracks, Akribis linear motors provide unparalleled advantages and features to improve system performance and efficiency: high speed, high acceleration, low velocity ripple, low operation noise, superior stability, wear & tear free, maintenance free, and long travel stroke. Akribis offers various models under each category, including: AUM, AWM, AHM, ALM and ACR series ironless linear motors; AJM, AQM, AKM series iron core linear motors for automation industry. AKMF series iron core motor with water/oil cooling options for CNC industry.

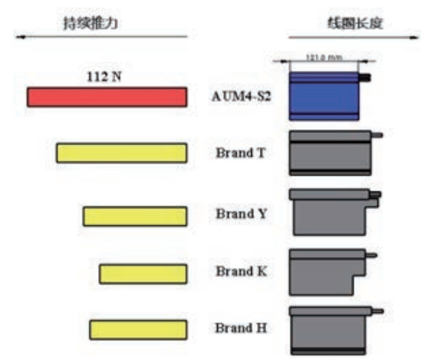
1. Highest motor constant

Using our patented design, our AUM motors produce the highest force with the smallest form factor. The motor constants for AUM series motors are the highest in its class. Motor constant is a measure of efficiency of a motor and it also determines the continuous force a motor can produce.



2. Shortest coil lengths

Even with the shortest coil lengths, our AUM motors produce the highest force.

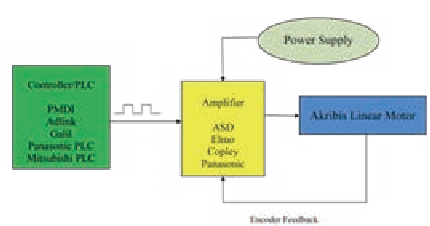


3. Custom design is possible

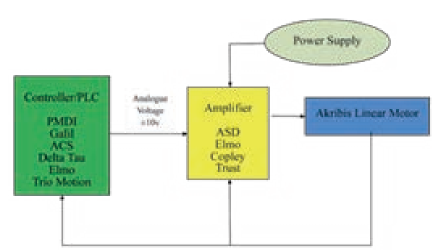
For applications where none of our standard linear motors fit your requirements, Akribis can offer customized designs. We design custom motors for disk drive, semiconductor front and back end, PCB and other industries. From concept design, prototyping and production, Akribis engineers have vast experience in helping our customers achieve the performance they need at affordable costs.

4. Flexible Control Modes

Akribis linear motors are compatible with all well-known motion controllers and drivers.



1. **Pulse and Direction operating mode**
2. **Analog Current / Velocity operating mode**
3. **Distributed Control (EtherCAT, CANopen, RS232, PROFINET)**



Voice Coil Motors

Voice coil motors are short stroke actuators that use permanent magnets and coil windings to generate thrust force.
It is a direct drive motor, which means that the motor drives the load directly without the need of a transmission mechanism.
Akribis offers various types of voice coil motors, including AVM series cylindrical motors， AVA series and ATA series planar motors.

1.Types of motion possible for voice coil motors

1.1 Two position control

A voice coil motor can be used as a simple two position actuator. Mounted with linear guidance bearings, the coil is typically moved while the core is kept stationary, although the reverse can also be done. A positive current cause the voice coil to move in one direction, while a negative current causes it to move in the opposite direction. At both ends, hard stops can be used to stop motion, very much like a pneumatic actuator, except that a voice coil motor is completely powered by electricity without the need for compressed air.

A two position electronic drive, EOD from Akribis can be used to drive the voice coil motor in the manner described above. The peak current, peak current duration and holding current can be adjusted to control the start of motion and the holding force of the voice coil at stationary position.

1.2 Servo control

A voice coil motor can also be used as a servo motor. Other than linear bearings, a feedback device such as a linear encoder can be used for closed loop control. In this way, the acceleration, velocity and stopping position of the voice coil can be controlled precisely.

The MGV, for example is a complete, servo controlled voice coil module, with a AVM voice coil, linear bearings and a linear encoder.

2. Advantages of using voice coil actuators

Low moving mass

oving coil is typically low in mass, thus allowing very high accelerations to be achieved. Short settling times o achievable due to the direct method of driving the load.

Low inductance

uctance of a voice coil motor is typically very low. Hence, the electrical time constant is very low, enabling ce coil motor to have very fast response.

Smooth motion

s no detent force in a voice coil motor. Hence, there is no cogging force, like in most brushless motors. very smooth motion can be achieved, even at low speed.

Reliability

here is no contact between the coil and the core of a voice coil motor, there is no wear and tear, making the oil motor very reliable.

Force control

ce produced by a voice coil motor is linearly proportional to the current applied. This allows it to be ed for force control application.

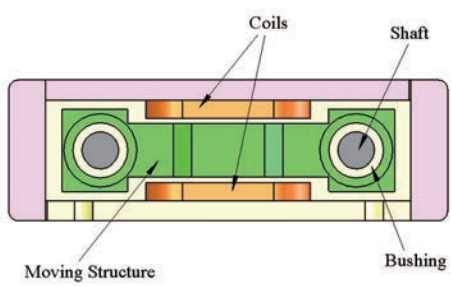
Introduction to ATA actuator

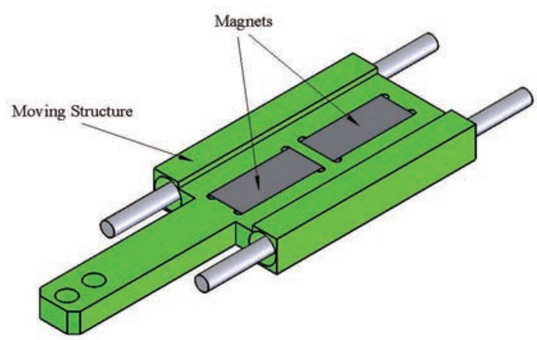
The ATA is a two position, direct drive actuator that is designed for applications that only need control of 2 positions, like pneumatic actuators. However, unlike pneumatic actuators, the ATA does not need compressed air, solenoid valves, air tubing and other components associated with pneumatic systems. Only 24 VDC is required to work with the amplifier, EOD, which drives all our ATA actuators. This makes the ATA actuators suitable even for portable devices/instruments, where compressed air is not readily available.

Design of ATA actuator

The following is the design diagram of ATA. The patent has been applied.

Patent technology



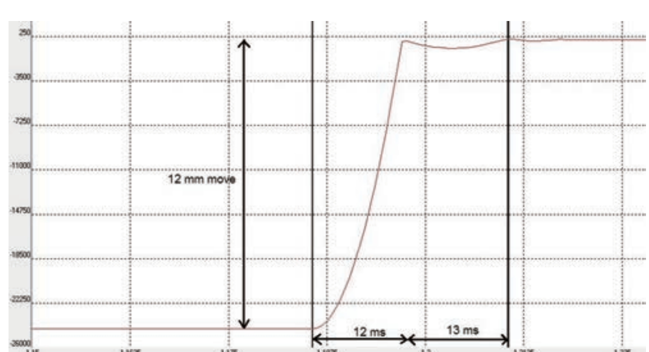


The coils are fixed to the casing, while the magnets are attached to the moving structure. The novel design does not require any magnet back iron. The magnets are held in the pockets of the moving structure, which is made from non-magnetic, low density material. This enables the actuator to have a low moving mass.

The cable that supplies current to the actuator is also fixed. Without any moving cable, the reliability of the actuator is much better than other actuators with moving cables, and high frequency cycling is possible.

Fast response

The response time for the ATA is significantly faster than traditional pneumatic actuators or other types of actuators. A 12 mm move can take only 12 ms. By controlling the peak current and peak current duration, the acceleration and motion time can be adjusted.



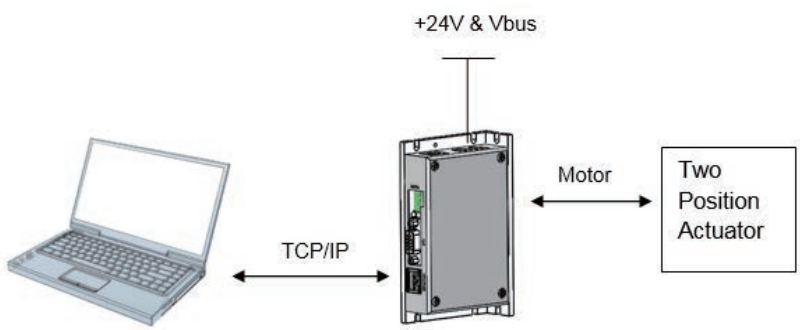
Comparison with pneumatic actuators

The table below compares ATA actuators with traditional pneumatic actuators:

Feature comparison	Pneumatic actuators	ATA actuators
Supply required	Compressed air for driving piston and 24 VDC for solenoid valve	24VDC
Components involved	Air cylinder, tubing, solenoid valve, pressure regulator etc.	ATA anf EOD
Response	Sluggish response	Fast response
Control of holding force	Passive, determined by air pressure and piston size (area of piston)	Can be adjusted on the EOD amplifier

Control Algorithm

EOD series drivers are designed to control ATA actuators for two position control.



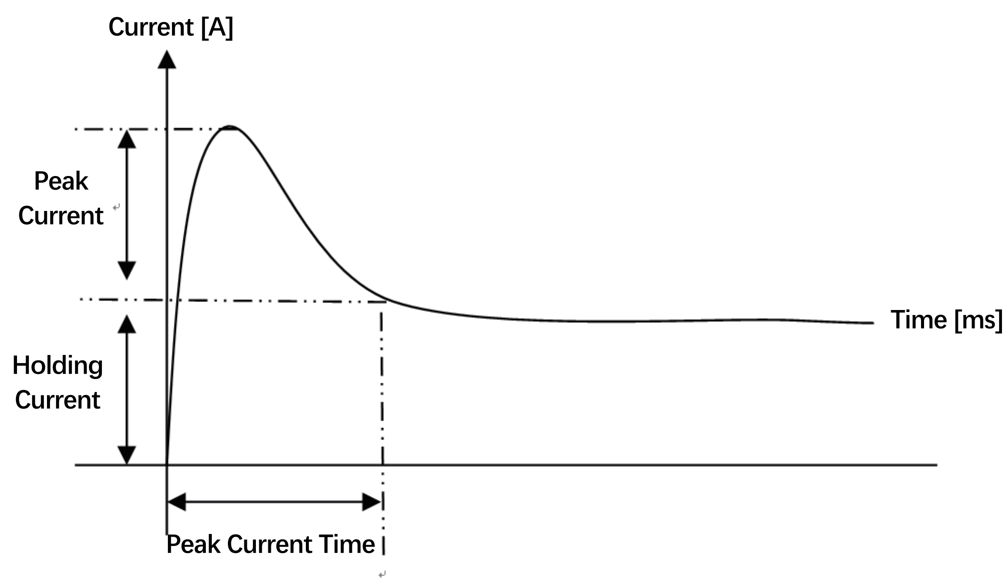
System integration setup is depicted in Figure 1.
Communication between PC and EOD can be established via TCP/IP or RS232.There are two control modes, namely Mode A, direction and move and Mode B, forward and backward. Mode selection is done by software through a GUI. In each mode, control is achieved by two I/O bit with the following truth table.

Mode A (direction and move)		
DIN 1 (Trigger bit 1)	DIN 2 (Trigger bit 2)	Function
0	0	No control
0	1	Retract
1	0	No control
1	1	Forward

Mode B (forward and retract)		
DIN 1(Trigger bit 1)	DIN 2(Trigger bit 2)	Function
0	0	No control
0	1	Forward
1	0	Retract
1	1	Retract

One unique function of EOD is user-defined current profile.

All settings, namely “Peak Current”, “Holding Current”, “Peak Current Time” “Motor Resistance”, need to be filled by user, whose relationship are described in Figure 2 and equations below,

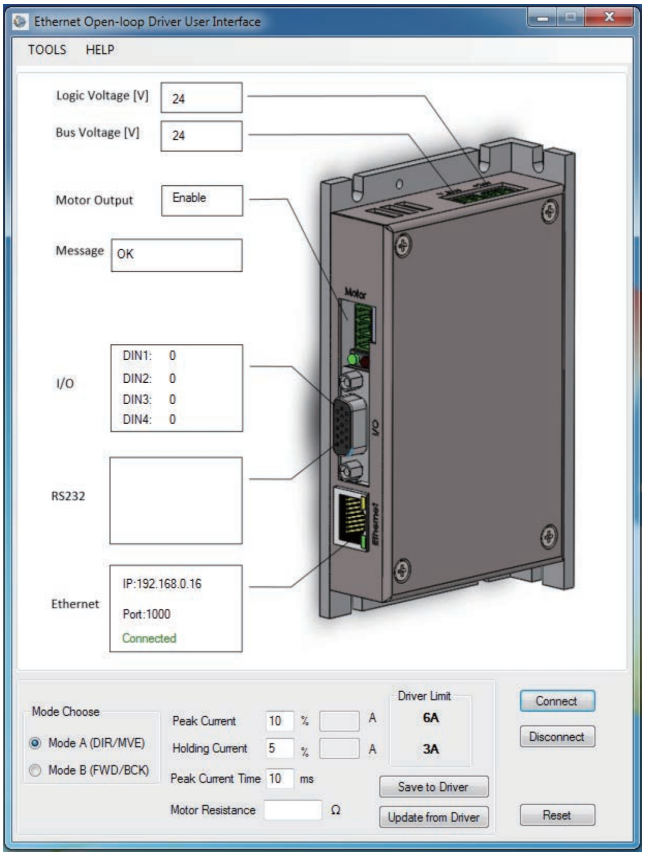


Formula for Peak Current and Holding Current:

Peak Current [A] = Bus voltage [V] / Motor Resistance [ohm] * Peak Current Percentage

Holding Current [A] = Bus voltage [V] / Motor Resistance [ohm] * Holding Current Percentage

All these parameters can be changed through the GUI.



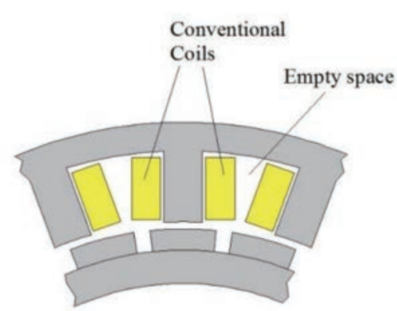
Please refer to Hardware Manual and Software & Operation Manual of EOD for details.

Direct Drive Rotary Motors

Direct drive rotary motors (DDR) are motors that are designed to drive loads directly without the need of any transmission mechanism, such as gears or belts. These motors are also called torque motors. They use high energy permanent magnets to generate high torque.

Akribis offers various types of DDRs, including ADR-A series, ADR-P series and ACD series. We also design many customized direct drive motors according to specific applications.

The ADR-A series motors are iron core type of brushless motors. Through our unique winding design, our ADR-A series motors produce very high torque, compared to other motors in the industry. The form factor of our ADR-A series motors is also smaller than competitor products. With low rotor inertia, these motors give better response and settling time. The maximum speed for our motors is also relatively higher than other motors.

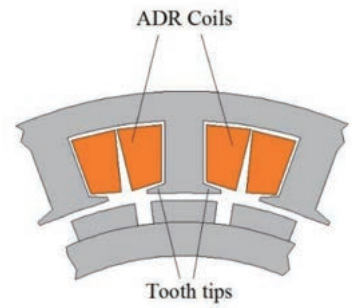


Conventional DDR

The figures below show the windings of a conventional DDR and our ADR-A Series.

Introduction

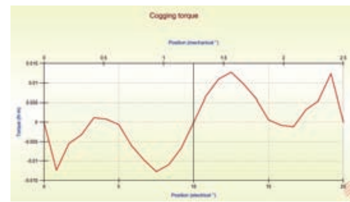
For a conventional DDR, the coils are wound and inserted into the slots, between the teeth of the stator. The coils have rectangular shapes when viewed from the top. There is inherently a large empty space in the slot, between two sets of coils. This space is a wasted, since the available magnetic flux is not used to produce any torque in this region.



ADR-A Series

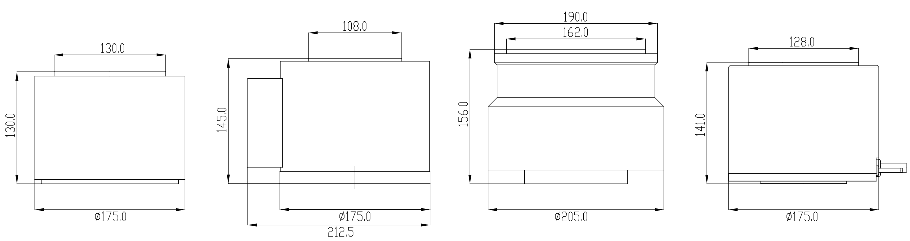
For the ADR-A Series, the coils are wound with a special technique, and up to 35% more coils can be wound, fully utilizing the space in the slots. This results in much higher torque from the motor with the same form factor.

The ADR-A Series also has tooth tips on the stator teeth. This design minimizes cogging torque significantly, without compromise on the motor performance. Akribis design engineers put in a lot of effort to optimize the performance of our motors, including reducing cogging torque to a minimum.



Below is an example that shows the cogging torque of a motor at different positions.

The illustration below shows a comparison of our ADR175-A-138, with other motors of similar diameter.



Brand/Models	Unit	Brand YA	Brand KM	Brand YG	Akribis ADR175-A-138	Our advantages
Outer Diameter	mm	175.0	175.2	190.0 (205.0)	175.0	Low height
Motor Height	mm	130.0	145.0	156.0	141.0	Low height
Peak Torque	Nm	42.0	32.8	30.0	98.6	Highest peak torque
Continuous Torque	Nm	14.0	9.8	Not published	32.9	Highest continuous torque
Max Speed (230VAC)	rpm	300	498	120	501	Highest speed
Rotor Inertia	Kgm2	0.022	0.0071	0.072	0.0076	Low rotor inertia

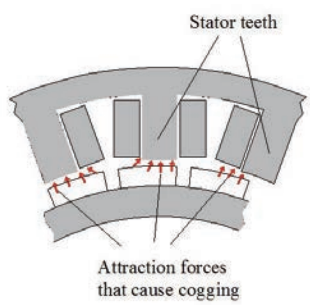
The ADR-A series motors are designed with low cogging toque. They are fully integrated with bearing and different options of encoder, optical encoder with digital output, and optical encoder with SINCOS. The motors also come with low and high speed windings (S or P).

ADR-P and ADR-F Series

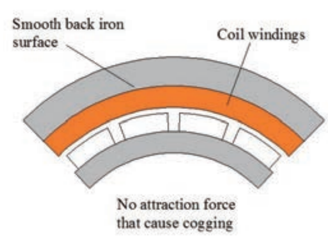
Akribis frameless torque motor ADR-P and ADR-F series consist of only rotors and stators, allowing them to be easily integrated into complex systems. ADR-P series motors are equipped with hall sensors, which easily interface with all types of servo amplifiers and controllers. ADR-F series motors are specifically designed for robot joint applications with low voltage and high speed requirements. The unique coil winding design yields one of the highest torque density in the market.

3. ACD Series

The ACD series motors are coreless type of brushless motors. These motors do not produce any cogging torque, which allows smooth motion to be achieved, with low velocity ripple. The unique winding design also gives high torque density, although the output torque is lower than the ADR-A series motors.



Conventional iron core DDR



ACD Series

These motors are also integrated with high precision bearings, which give good radial and axial runout. High resolution optical encoders with digital output and SINCOS are available as options. The motors also come with low and high speed winding connections (D or Y).

4. ACW Series

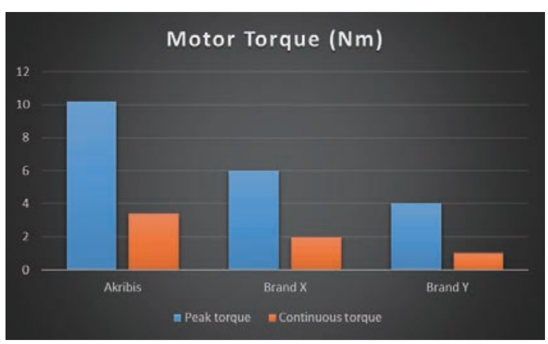
The ACW series are using coreless technology. They are designed with very low profile, and the motors do not produce any cogging torque, which allows smooth motion to be achieved with low velocity ripple.

5. AXD Series

The AXD series are ironcore brushless DC motor. Being similar to ACW series, AXD series adopt flat design, featuring with large mesopore, small volume, high torque density, low moment of inertia and quality, and combine with high resolution optical encoder with high precision.

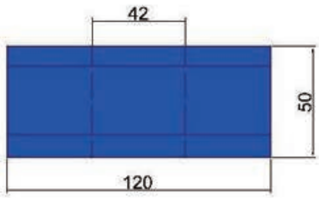
Compact size with high torque density

The AXD Series Direct Drive Torque motor has very high torque density. The peak torque and continuous torque are high, even though the motor form factor is relatively small. Below is a graph that shows a comparison with 2 competitor motors with similar size.

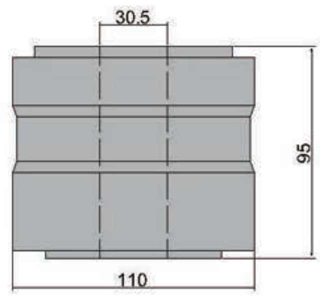


The table below shows a comparison of the key specifications of AXD with 2 competitor motors with similar size. AXD outperforms the competition in every aspect.

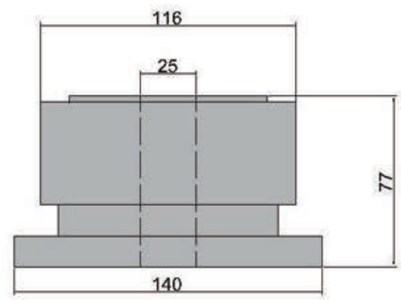
Introduction



Akribis AXD



Brand X



Brand Y

Brand/Models	Akribis AXD 120	Brand X AX200XX	Brand Y DM1C-XXX	AXD vs Competitor
Motor height	50 mm	95 mm	77 mm	AXD is 54%~90% better
Peak torque	10.0Nm	6 Nm	4 Nm	AXD is 70%~155% better
Continuous torque	3.4 Nm	2 Nm	1 Nm	AXD is 70%~240% better
Centre hole size	42 mm	30.5 mm	25 mm	AXD is 38%~68% better
Max speed	1700 rpm	300 rpm	150 rpm	AXD is 400%~900% better
Rotor inertia	0.00102 $kg\cdot m^2$	0.00575 $kg\cdot m^2$	0.0025 $kg\cdot m^2$	AXD is 145%~464% better
Motor mass	2.35 Kg	4.7 kg	3 Kg	AXD is 28%~100% better
Repeatability	± 3 arc sec	± 5 arc sec	±3 arc sec	AXD is 50%~150% better

Low rotor inertia

In the torque equation T = Jα (where T is torque, J is moment of inertia, α is angular acceleration), much higher acceleration can be achieved if the moment of inertia is smaller. The moment of inertia used in the computation actually comprises 2 parts: the moment of inertia of the motor, and the moment of inertia of the load.

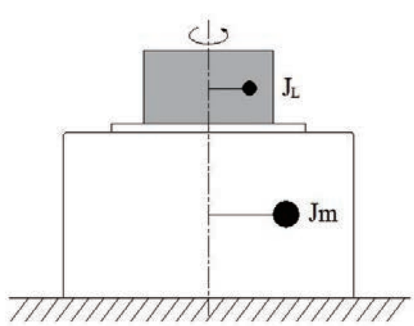


Illustration of motor inertia and load inertia

J = Jm + JL

where

Jm :Motor rotor inertia

JL :Load inertia

In many cases, the moment of inertia of the motor actually contributes a large percentage of the total moment of inertia. This means that the motor torque is used mainly to rotate itself. Little torque is left for the load moment of inertia.

The rotor inertia of AXD is small. This means that more torque can be used to rotate the load, resulting in more dynamic performance. Higher accelerations and shorter settling time can be achieved.

Low overall mass

The overall mass of an AXD motor is also smaller, compared to competitor motors with similar size. Newton's second law (F = ma) tells us that for higher acceleration, either the force has to be larger or the mass has to be smaller.

The trend for the automotive industry is to make cars with lower body mass. Instead of using only steel, aluminum and carbon fiber are used to reinforce the car structure, to reduce mass. This results in better performance and higher fuel efficiency.

Torque motor on a linear motor stage

Similarly, for motors used in motion control, lower motor mass is an advantage, especially when you need to mount the torque motor on a XY table. The dynamics of the XY table is affected by how much load it has to carry. Lower applied force and higher accelerations can be achieved with lower moving mass.

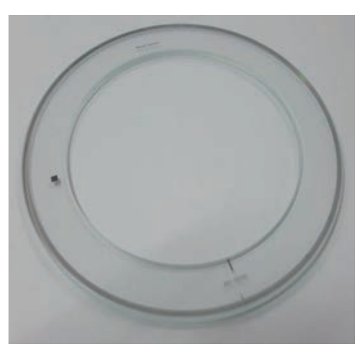
High resolution optical encoder

The AXD torque motor uses a high resolution optical encoder for feedback. Optical encoders provide much better accuracy, repeatability and higher resolution, compared to resolvers.

The working principle of resolvers is based on rotating transformers. Other than the signal processing errors by converters, the inconsistencies in the construction of the windings affect the accuracy of the resolver.

For optical encoders, the divisions on the disk are etched with photographic and semiconductor techniques. The gratings can be made with fine pitch, such as 4, 20, 40 or 80 microns. This results in much higher accuracy.

Resolver construction



Encoder grafting

Large center hole

AXD torque motors are designed with a large center hole. The center hole is sometimes needed for optics design, wiring or pneumatic/vacuum tubing.

Higher speed

AXD torque motors are designed for higher speeds. This means that even for indexing motions, the AXD can perform a motion in a shorter time, compared to a motor with limited maximum speed.

Stages & Systems

The Akribis precision linear motor driven stage features the patented AUM series ironless linear motor in a neat, ready to use package. Being directly driven, the linear motor stage eliminates intermediate transmission mechanism which translates directly into many benefits, including

Fast response in the form of faster accelerations (up to 25G) and settling times, which increase throughput.
High speed up to 5m/s yield lower cycle time.
High stiffness as no mechanical transmission such as gears, belt, ball-screw, etc., are required. The driving force is simply directly coupled to the load.
High Precision by using direct measurement systems. No unnecessary conversion is necessary.
Zero Backlash as a result of direct coupling of the driving force to the load.

The structural frame of the linear motor stage is extruded aluminum, offering good structural strength and cost benefits. These stages can be constructed in single piece up to 3 metres without the need for joining.

The geometrical accuracy of the stage is achieved with the use of a preloaded dual-rails-quad-runner blocks or single-rail-dual-runner blocks re-circulating linear motion ball bearing system. The runner blocks are preloaded for stiffness, and only the ball cage types are selected to deliver a smooth and low noise motion.

The displacement accuracy is achieved with the use of a direct measurement system, consisting of a linear scale (with scale linearity to +/- 3 micron/metre) and a linear encoder. The electrical resolution can be down the sub-micron region.

The wide variety of sizes, force range and travel stroke available, the linear motor modules series finds many application in,

Pick and place
Laser marking; machining; spot welding
Dispensing
Inspection
Printing

Sizing Guide

Linear Motor Sizing Guide

1. Sizing of a linear motor includes calculating the peak force and Root-Mean-Square (RMS) force requirement.

2. Peak force is determined by the moving mass and maximum acceleration required.

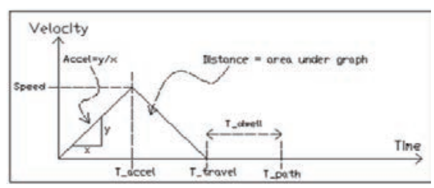
Force = mass*Acceleration+ Friction Force + External Opposing Force

For example, if moving mass is 2.5 kg (including coil assembly), and required acceleration is 30m/s^2, the motor will have to exert a force of 75N. This is assuming Friction and Opposing Forces are negligible.

3. Very often, we do not know the actual required acceleration, but we have the motion time requirement. We can calculate the required acceleration if we know the travel distance and the travel time. Usually for short travel distances, a Triangle-Shape Velocity Profile is used whereas for long travel distances, it is more efficient to use Trapezoidal-Shape Velocity Profile. In a Triangle profile, the motor does not cruise at any velocity.

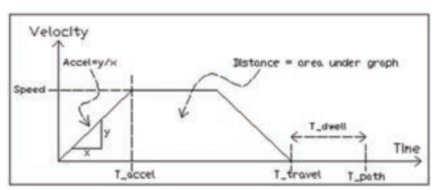
4.For Triangle Profile：

Acceleration = 4 * Distance / Travel_Time^2



5. For Trapezoidal Profile, a desired cruising speed will help to determine the required acceleration.

Acceleration = Cruise Speed / (Travel Time – Distance / Cruise Speed)



6. Similarly, compute the deceleration force required. Most likely, this is the same as acceleration force unless there is an unbalanced force (e.g. gravitational force) acting on the motor.

7. Force required by the motor during cruising (against friction and opposing forces) and dwelling (against opposing force) may also be calculated.

8 . Compute the RMS force using the formula below.

$$RMSForce=\sqrt{\frac{Fa^2*Ta+Fc^2*Tc+Fd^2*Td+Fw^2*Tw}{Ta+Tc+Td+Tw}}$$

where,

Fa = Acceleration Force   Ta = Acceleration Time
Fc = Cruise Force   Tc = Cruise Time
Fd = Deceleration Force   Td = Deceleration Time
Fw = Dwell Force   Tw = Dwell Time

9 . Select a motor according to the computed peak force and RMS force requirement. User should factor in a safety factor of at least 20-30% especially if friction and external opposing forces are assumed to be zero.

10. For example, an application requires the motor to move a 4kg load for 0.3m in 0.2s using Triangle Profile. The motor will dwell 0.15s before moving the same cycle again. Assume friction is negligible and no presence of any unbalanced force.

Acceleration = Deceleration = $4 * 0.3 / (0.2)^2 = 30m/s^2$

Peak Force = Fa = Fd = mass * acceleration = 4 * 30 = 120N

$$RMSForce=\sqrt{\frac{(120)^2*(0.1)+(120)^2*(0.1)}{0.1+0.1+0.15}}=90.7N$$

Giving an additional 30% safety factor, a suitable motor will be AUM3-S4.

11 . Motor selection software is available to automate the calculation process.
Please contact cust-service@akribis-sys.com for a copy of the software.

Voice Coil Motors

1. Peak force

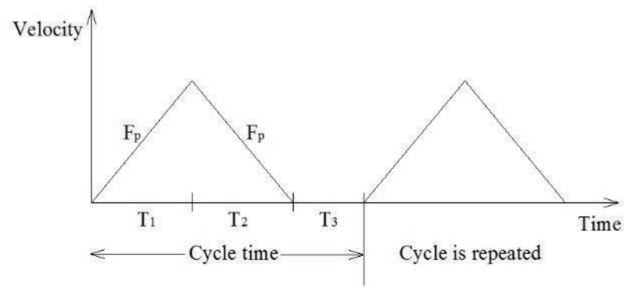
In an application, it is important to determine the peak force and RMS force required, in order to select the right voice coil motor. The peak force is calculated by Newton's second law, F = ma. With a known moving mass, and the acceleration required for the motion profile, we can calculate the peak force required.

For example, with a moving mass of 100g, and an acceleration of 40 m/s^2, the peak force required during acceleration will be 4 N.

2. RMS force

The RMS force is calculated with the equation:

$$F_{RMS} = \sqrt{(F_p^2 \times T_1 + F_p^2 \times T_2) / (T_1+T_2+T_3)}$$



where

F_{RMS} is the root mean square force

F_p is the peak force

T_1 is the acceleration time

T_2 is the deceleration time

T_3 is the dwell time

Using the example described above, if the stroke is 4 mm, and if the time to complete motion is 0.02 s, then the velocity will be 400 mm/s, with an acceleration of 40 m/s^2. The peak force will be 4 N. If the dwell time is 0.05 s, then

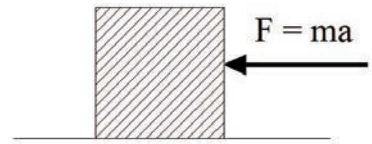
$$F_{RMS} = \sqrt{(F_p^2 \times T_1 + F_p^2 \times T_2) / (T_1+T_2+T_3)}$$
$$= \sqrt{(4^2 \times 0.01 + 4^2 \times 0.01) / (0.01+0.01+0.05)}$$
$$= 2.14 \text{ N}$$

Hence, we can select a voice coil with a peak force that exceeds 4N, and with a continuous force that exceeds 2.14 N.

Direct Drive Rotary Motors

1. Peak torque and continuous torque

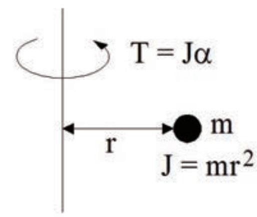
The torque ratings of a DDR motor must meet the torque requirements of the application. In other words, the peak torque and continuous torque of the motor must be higher than the peak torque and RMS (root mean square) torque of the application. Otherwise, the motor will not be able to accelerate as fast as needed, or the motor will over heat after some time.



Linear motion

For linear motion, by Newton's second law, F = ma, where F is the force needed to move an object in N, m is the moving mass in Kg, a is the acceleration in m/s^2,

Similarly, for rotary motion, T = Jα, where T is the torque needed to rotate an object in Nm, J is the moment of inertia in Kgm^2, and α is the angular acceleration, in radians/ s .



Rotary motion

For an application, we can compute the peak torque and RMS torque required:

Peak torque during acceleration/deceleration, T = Jα

$$\text{RMS Torque} = \sqrt{\frac{Ta^2 * ta + Tc^2 * tc + Td^2 * td + Tw^2 * tw}{ta + tc + td + tw}}$$

Ta = Acceleration torque	ta = Acceleration Time
Tc = Cruise torque	tc = Cruise Time
Td = Deceleration torque	td = Deceleration Time
Tw = Dwell torque	tw = Dwell Time

A motor should be selected based on the computed peak torque and RMS torque required. A safety factor of 20-30% may be used, especially if friction and external opposing torque are assumed to be zero in the calculation.

Akribis provides motor selection software, where the peak torque and RMS torque are computed automatically, and a motor is recommended, after you key in the application parameters.

Akribis DDR motors are designed with very high torque density, providing higher peak torque and continuous torque compared to conventional designs.

2. Motor inertia - the smaller the better

In the torque equation, , T = Jα, much higher acceleration can be achieved if the moment of inertia is smaller. The moment of inertia used in the computation actually comprises 2 parts: the moment of inertia of the motor, and the moment of inertia of the load.

In many cases, the moment of inertia of the motor actually contributes a large percentage of the total moment of inertia. This means that the motor torque is used mainly to rotate itself. Little torque is left for the load moment of inertia.

This often creates a dilemma for design engineers. The objective is to achieve a higher target performance, with higher acceleration, to reduce cycle time. Hence, higher torque is needed. In order to get higher torque, the engineer selects a bigger motor with larger torque ratings. However, the bigger motor also comes with a larger motor inertia, and this result in having higher torque requirements. The bigger motor may not meet the objective of achieving higher target performance after all.

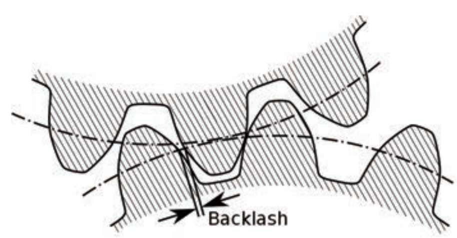
Therefore, a DDR motor with a smaller moment of inertia is an advantage. It should be noted that DDR motors using an outer rotor design will naturally have much higher motor inertia.

Akribis ADR-A series motors are designed with optimal moment of inertia. The torque density to motor inertia ratio is excellent.

3. Must the motor moment of inertia be matched to the load inertia?

When using conventional servo motors with mechanical transmission systems, it is a common practice to match the motor inertia to the load inertia. Ratios of 1:5, or up to 1:10 are used. For DDR motors, it is not necessary to match the motor inertia to the load inertia.

In conventional servo motor applications, mechanical transmissions such as belts, pulleys, rack and pinion etc introduce backlash. Hence, during very small rapid motions when reversing direction of motion, the load may be decoupled from the motor for a short period of time. This creates instability in the control system. Inertia matching is used to solve this problem, so that the controller can operate in a stable manner.

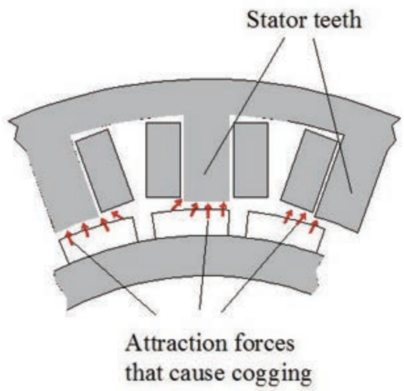


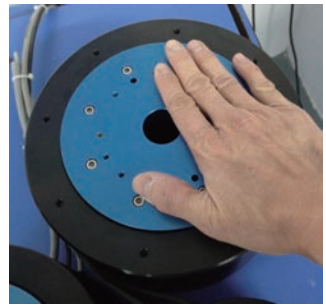
In a DDR application, the load is directly coupled to the motor without any transmission device, so there is no backlash. Consequently, there is no need for inertia matching.

4. Cogging or detent torque

DDR motors with teeth on the iron core laminations will have a cogging effect. The figure below illustrates cogging torque caused by the attraction force between the stator teeth and the magnets.

Cogging torque can be felt when you try to rotate a motor with your hand. You will feel some opposing force at certain positions.





Rotate motor by hand to feel cogging effect

The disadvantage of cogging torque is that it causes torque ripple during motion, which causes velocity ripple as well. Motion controllers can compensate the effect to a certain extent, but for slow speed applications where constant velocity is required, the effect of cogging will be detrimental.

Another disadvantage of cogging is that it affects motion settling performance, and jittering at target position.

Akribis ADR motor is designed with minimal cogging torque, due to the optimized slot/pole configuration, and the introduction of tooth tips in the stator laminations. The maximum cogging torque, peak to peak is published in our data specifications.

The ACD and ACW series motors are using coreless design, which means that they do not have any cogging torque.

5. Maximum speed

In fast indexing applications, very high peak speeds may be reached during motion. It is therefore important to consider the type of windings required for the application, and ensure that the bus voltage from the amplifier is sufficient to overcome the back EMF voltage.

To put it simply, the bus voltage should be greater than the sum of the voltage generated by the back EMF, and the peak current multiplied by the terminal resistance of the motor:

$V > (Kv * Speed + Ip * R)$

where

V is the bus voltage, the unit is VDc

Kv is the back EMF constant of the motor

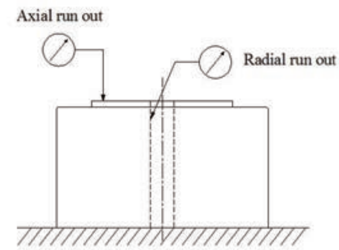
Ip is the peak current, the unit is Apk

R is the terminal resistance of the motor

Akribis DDR motors typically provide 2 types of windings to cater for different speed and voltage requirements. Series winding is suitable for lower current, higher voltage type of drive electronics, while parallel winding is suitable for higher current, lower voltage type of drive electronics. Users should select the type of winding that allows the maximum speed of the application to be achieved, with matching drive electronics based on the current and voltage supply.

6. Axial and radial run out

The axial and radial run out of a DDR motor is determined by the precision of the bearing used, precision of the machined components and the assembly of the components. The axial and radial run out need to be considered for applications that require higher accuracy.



The method of measuring run out is illustrated in the diagram above.

The axial and radial run out of Akribis DDR motors are shown in the specifications sheet. For standard motors, the normal axial and radial run out is shown, with higher grade options available for selection.

7. Feedback

Akribis DDR motors typically use optical incremental encoders for feedback. However, other options are available, such as resolvers, absolute encoders and inductive encoders.

All Akribis direct drive rotary motors are equipped with optical encoders. With higher encoder resolution after interpolation, Akribis rotary motors can satisfy your need of precision in any type of demanding applications.

For example, Akribis ADR135 motors are equipped with circular optical encoder scale. With 400X interpolation digital output, the motor can achieve 1202000 counts per revolution. With SINCOS (analog) output and 4096X interpolation rate from servo drive, the motor can achieve 12308480 counts per revolution.

Stages & Systems

1. Accuracy, Repeatability and Resolution

There are many ways to define the three confusing terms for accuracy, repeatability and resolution. Professor Slocum of Massachusetts Institute of Technology in his book “Precision Machine Design” [1], defines them in a very interesting manner namely,
“Accuracy is the ability to tell the truth”
“Repeatability is the ability to tell the same story over and over again”
“Resolution is how detailed your story is”
[1] A.H. Slocum. Precision Machine Design. Prentice Hall, Englewood Cliffs, New Jersey, 1992.

Typically, a servo positioning system usually consists of the mechanics which includes the structural elements and the bearing guidance; the prime mover such as the motor and its electronics; a feedback device and the controller.
In a nut-shell
Accuracy has a dual meaning for a positioning system, namely

accuracy of the motion is contributed mainly by the bearings and it is the lateral deviation from the ideal motion path or the straight-line accuracy or running parallelism.

ability to be served to a desired position, which is the largest error between any two points in a positioning system's coverage.

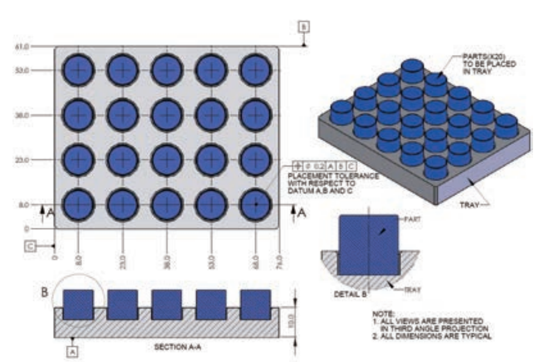
Like accuracy, repeatability has a dual meaning for a positioning system, namely

repeatability of the motion is the ability of the bearing to repeat its motion. For linear motion bearings, this is often referred to as the straight-line repeatability or running parallelism repeatability.

ability to be servoed to the same position, which is the error between a number of successive attempts to move a workpiece or tool to the same position within the positioning system's coverage.

Resolution in a position system currently is determined by the ability of the bearing to allow for a small increment of motion. It is the smallest mechanical step that the positioning system is capable of making during point to point motion. In other words, it will be meaningless to put an encoder with nanometer encoder resolution on a positioning system with contact type bearing and hoping to achieve nanometer level mechanical resolution. For contact type of bearings, 0.1 micron is by far the best achievable results.

The three terms are best illustrated with a pick and place example below. The objective is to place the cylinder into a tray as shown in figure 1 below.
The specifications indicate that we have to place the cylinder such that the centre of the cylinder is accurate to within a diameter of 0.2 millimetre, with respect to the three datums marked A, B and C.



In order to satisfy the specification, it is important that we select a position system with adequate resolution to achieve the require repeatability. The Table below shows a typical example on deciding the positioning resolution.

Description	Value
Tolerance (+/- 3 sigma)	= 0.2 mm
Required repeatability	= 0.2 mm/6 = 0.033 mm
Required resolution	= 0.033 mm/10 = 0.003 mm

Therefore, we should use an encoder with at least 3 microns resolution.

Now, if we successive move the cylinder to the same position, we can note down the actual position of the cylinder's centre via an independent measurement system. The centre of the cylinder can be plotted as in figure 2 below.

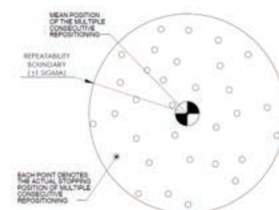


Figure 2: Actual stopping position of cylinder centre

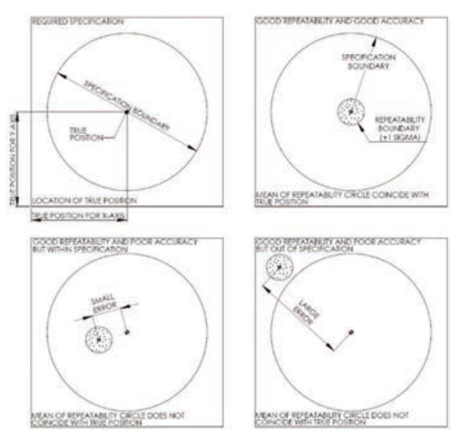


Figure 3: Specifications, Accuracy and Repeatability

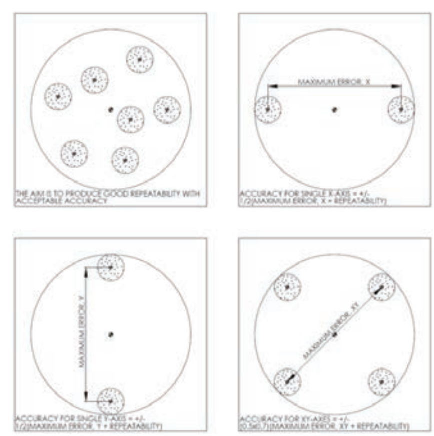


Figure 4: The aim is to produce good repeatability with acceptable accuracy

The mean position of the consecutive repositioning is marked by the centre of a circle which enclose all the points. The boundary of the big circle is the repeatability of the positioning system. Now if we superimpose the repeatability circle onto the given specifications as shown in figure 3.0, in positioning system, it is much easier to achieve good repeatability than good accuracy. In many cases, the positioning need not have to be very accurate, but only reasonably accurate, as reasonably accurate but repeatable positioning systems are capable to positioning within the required specifications given the proper positioning resolution as shown in Figure 4. It is economical to build a system which is repeatable and correct the accuracy using calibration and error compensation in the controller.

2. The relationship between force and speed.

To relate the terms force and speed, let's take a look at the 7 common terms in physics when dealing with position systems, namely

Description	Units	Symbol
Force	N	F
Load or mass	kg	m
Time	s	t
Acceleration	m/s^2	a
Velocity	m/s	v
Displacement	m	s
work	Nm	W
Power	Nm/s, Watt	P

This equation is known as the equation of motion and it gives the instantaneous value of the acceleration corresponding to the instantaneous values of the forces that are acting.

If an object starts moving from rest, that is, its initial velocity is zero, then, the relationship between velocity and acceleration is given by the equation, $v = at$

Likewise, the relationship between displacement, velocity and acceleration is given by equation, ︰ $s = ½at^2$

When a force is applied to an object or load and displaced (moved) it over a distance, the work done by the force during the displacement is related by the equation, $W = Fs$

When time comes into the equation, we have power which is the rate of doing work and it is related to velocity by the equation, ︰ $P = Fv$

Now, let's relate all these terms back to positioning systems. The objective of a positioning system is to position a tool (which is the load) with respect to a workpiece. We are always concerned over how fast (which is related to time) we can perform this task of moving (which is displacement) the tool to the workpiece (which is the work to be done). To do this work, we may use a motor which is available in many sizes.

The capacity of a motor is measured by the rate in which it can do work or deliver energy. The total work done or energy output is not a measure of this capacity. A motor no matter how big or small can deliver a large amount of energy if given sufficient time. On the other hand, a large and powerful motor can deliver a large amount of energy in a short period of time. In other words, if we want to travel from one point to another, we can reach that place travelling either in a small car or a big car. The only different is how long to reach the place when the same route is used. In the same light, a sport car can reach a speed of 100km/h in 5 seconds and within a very short distance. A family car can also reach 100km/h, but maybe in 12 seconds and need a longer distance. The different is in the capacity of the engine which can produce more power to accelerate the mass of the car in a very short time, thus over a very short distance.

Given the same load and travel distance, a bigger motor will be able to accelerate its load in a shorter time and at a higher velocity when compared to a smaller motor.

Motor Driver and Controller Product Recommendation

Akribis ASD100/240		AC/DC power supply Pulse, analog velocity and analog current mode
Mitsubishi MR-J4/MR-J5		AC power supply Pulse or SSCNET III /H network mode Power rating up to 22 KW
Panasonic A5L / A6L		AC/DC power supply pulse&direction, analog velocity/current mode, EtherCAT
Copley Xenus/Plus/Accelnet		AC/DC power supply Pulse, analog velocity and analog current mode
Trust Automation TA115 / TA310 / TA330		Linear amplifier Analog velocity and analog current mode Low current ripple
ACS CMhp/ba		AC power supply Driver and multi-axis controller integrated Abundant configuration options Excellent servo performance
ACS SPiiPlusEC		Programmable motion controller EtherCAT network control Maximum support 64 axes Special motion trajectory planning function
ACS UDMmc		Support 4 axes at most, 20A current PWM output 12V-80VDC input Support voice coil motors, brushless motors, and stepper motors Collaborate with ACS network controller
Akribis Centra-i		Ci servo motion controller, up to 8 axes of remote amplifiers and 4 I/O modules. 16kHz servo sampling rate, less than 8ns synchronization jitter.
Akribis AGD301		High performance 3-axis centralized motion servo drive , up to 90Vdc, 5.6Arms continuous current per axis. 16kHz servo sampling rate, ideal for highly coordinated applications.

Please contact Akribis Sales engineers for more details （cust-service@akribis-sys.com）.

Linear Encoder Product Recommendation

Akribis ABA50/ABI51/ABI52 Series		ABA50/ABI51/ABI52 series, compact design Resolution from 0.1μm to 0.5μm Increased tolerance for easy installation
Renishaw RGH/ATOM/Quantic Series		Mental / glass / stainless steel encoder scales Resolution from 10μm to 1nm
SIKO LEC/MSK Series		Magnetic scale Resolution up to 0.2 μm Optional digital or analog

Please contact Akribis Sales engineers for more details （cust-service@akribis-sys.com）.

Frequently Asked Questions

1. What is the maximum payload that the motor can drive?

From Newton's law F=ma, the force applied is proportional to mass and acceleration. Hence, as long as the force can overcome friction force, a heavy mass can be moved with relatively small force except that the acceleration of this mass will be small. For example, a AUM2-S2 motor with peak force of 88N can move a 10 Kg load with maximum acceleration of 8.8 m/s2 when moving horizontally.

2. How about the maximum payload in vertical orientation?

In vertical movements, the motor has to overcome gravity in addition to providing force for upward vertical motion (F = mg + ma). In this case, the maximum load is determined by the maximum force divided by 9.81 m/s2. If the vertical force has to be sustained continuously, the maximum load will be the continuous force of the motor. For example, the maximum vertical load for AUM2-S2 motor will be 2.2 Kg, since the continuous force for this motor is 22N. If the load is supported by a counterbalance (such as a spring), then the AUM2-S2 motor can move a heavier load in a vertical position.

3. What is the maximum speed of a motor or module?

There is no theoretical limit for the speed of a linear motor because there is no contact. However, the speed is typically limited by the mechanical bearings. For example, for linear guidance system using rails and runner blocks, the maximum speed is typically limited to 5 m/s. This is why in most applications, the speed for linear motors is limited to 5 m/s. An option of using ceramic ball bearings allow speeds of up to 10 m/s. Using air bearings also enable higher speeds to be possible.

4. How about the maximum acceleration?

For acceleration, as explained by Newton's law (F=ma), it is dependent on the maximum force (peak force) of the motor as well as the mass to be moved.

5. What is the maximum length of a linear motor?

There is no limit on the length for linear motors AUM and ACM. This is because the motor tracks can be joined together in sections. The linear rails can also be joined together as well. The linear scale used for encoder feedback can also come in long lengths. Hence linear motor applications can be more than 20 meters or more.

6. What happens to a linear motor when power is cut off suddenly?

When power is suddenly cut off, a linear motor may continue to move under its own inertia until it hits the end stopper or comes to a stop by friction force. This is usually not an issue but it may present a problem in some applications.

It is possible to install a brake with the linear motor which can be activated when power is cut off. In this way, the motor can stop immediately. Such a brake is typically installed on the rails of the linear bearing system.

7. Is linear motor suitable for clean room applications?

Yes, linear motors can be used in clean room environments. In fact, many front-end semiconductor applications have been using linear motors. For example, in wafer fabrication plants, high precision lithography machines use linear motors for very high precision XY position stage, with nanometer resolutions and sub-micron accuracy, in clean room class 10 facilities.

With linear motor gaining popularity in more applications, linear motors are now also used in other applications, such as semiconductor back end packaging, testing, pick and place, hard disk assembly and testing etc. Many such applications are also being applied in a clean room environment.

The advantages of linear motor over traditional ball screw drives in clean room environment are:
- No contact in the drive actuator. Hence there is no wear and tear which causes particle generation
- No lubricant needed on the linear motor. Lubricants are a source of contamination

8. What is the effect of magnetic field from linear motors?

In some applications, there is a concern of damaging sensitive components by the magnetic field from linear motors. Generally, in such applications, it is recommended to use ironless linear motors (AUM) as the magnet flux circuit is closed and there is negligible magnetic field outside the magnet track. For iron core type of linear motor (like ACM), there is some magnetic field within 50-60 mm from the magnet track. The field decays as this distance increases. This field is constant and does not generate any RFI.

9.Ferrite bead

Ferrite beads (FB) are connected to the terminals of electric motors to filter the voltage spikes from the motor driver. Voltage spikes will cause insulation failure of electric motors. When the output voltage of the driver is not stable, the ferrite bead can protect the motor from being damaged by the voltage spikes.
In addition to ferrite beads, Akribis provides high quality cables with shielding layer and motor driver with high SNR (signal-noise ratio) to guarantee the high-performance functioning of the motors.

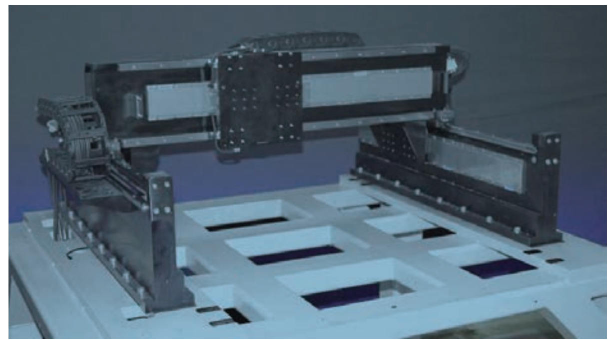
10.Hall sensor

Hall sensors use the Hall Effect to output voltage signal indicating the position information of the motor mover. The motor driver can implement commutation of the motor based on this information. The combination of Hall sensor and high-resolution encoder can improve the accuracy of commutation. Akribis provides professional solutions of encoder commutation.

Motion Control of Gantry Stages

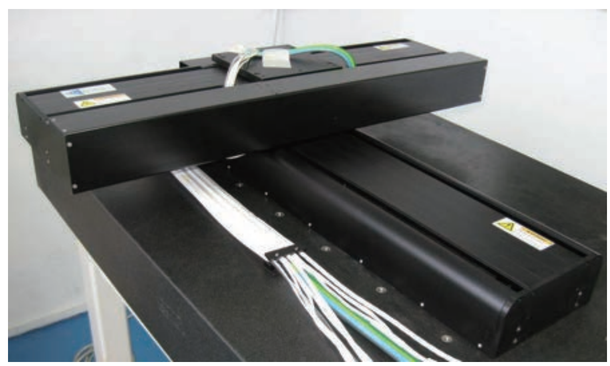
A gantry stage is basically an XY table where the top axis is supported at the 2 ends by the bottom axis. The top axis and its payload is supported by 2 parallel linear bearings at the 2 sides of the stage.

See picture below. This configuration allows the top axis to carry an end effector (like pick and place mechanism, camera, etc.) to access the work piece at any XY positions from the top.



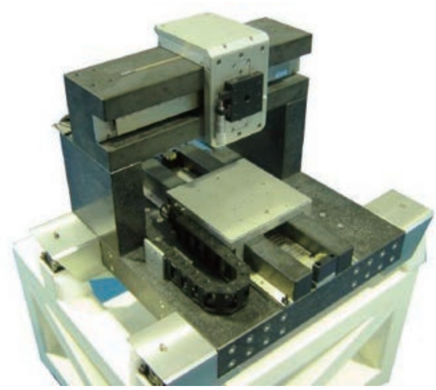
A standard stacked XY table will usually have to move the work piece while the end effector is fixed on top. This is usually not recommended if the work piece is very big and heavy, or if the top axis stroke is very long.

Since the top axis is only supported at the middle, it would deflect downwards at the 2 ends (more significant as the top axis length increases), resulting in poor flatness specifications.



A nice hybrid configuration is to separate the X and Y where the top axis is mounted on a stationary bridge.

In this case, the bottom axis carries the work piece in one direction and the top axis carries the end effector to move in the orthogonal direction.



In motion control, we are more concerned on the bottom axis of the first type of configuration (moving bridge). The load is supported at the 2 sides, it can easily create yaw error if the driving force is not in line with the CG (center of gravity) of the moving load.

In motion control, we call the bottom axis of such configuration as gantry axis.

1.Types of gantry axis configuration.

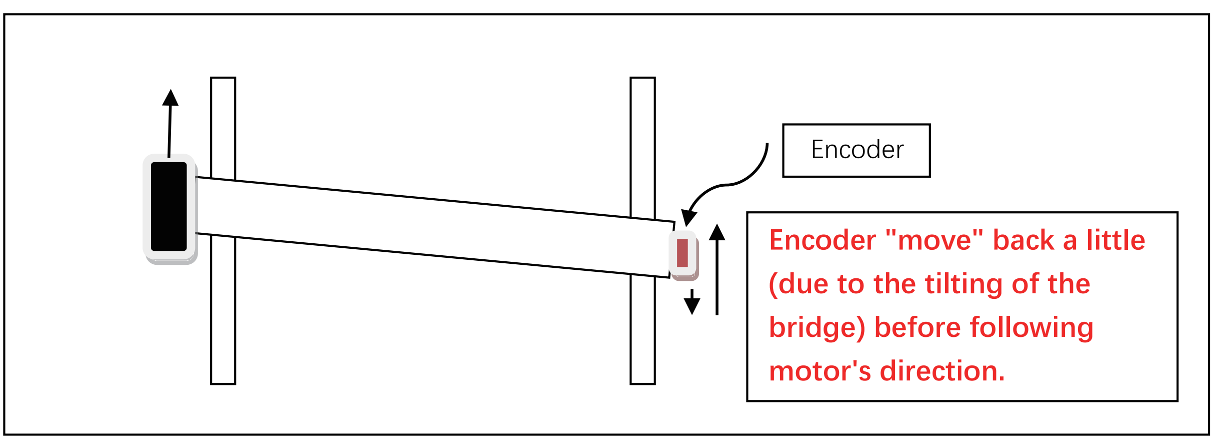
T-drive

T-drive means the bottom axis is driven by one motor at the side, the other side is supported and guided by a linear bearing. This configuration requires only one driver and one encoder. It is the most cost effective gantry configuration. Ideally, the encoder should be mounted at the center of the gantry but this is usually impossible. Most designs will have the encoder mounted at one side.

The main disadvantage of this configuration is the unbalanced driving force. It is almost impossible to drive in line with the CG of load. This will result in high yaw error. The side without motor is always being dragged behind by the motor at the other side. When the motor changes direction, there will be big yaw error which result in high reversal error. In other words, the side without motor will remain stationary until the motor side has moved enough to drag it along.

To improve repeatability of this configuration, it is recommended to approach the critical position always in same direction. This could mean over travelling in one direction then move back in the required direction. This would produce similar yaw error every time so that this yaw error doesn't contribute to the repeatability error of the gantry axis.

One important consideration in a T-drive configuration is the location of encoder with respect to the motor driving force. If it is opposite to the motor driving force, the encoder may register an opposite direction motion before it starts to follow the motor direction (see illustration below). This is, in a way, like a positive feedback situation that could affect servo performance. So, it is recommended to have the encoder at the same side of the motor.



H-drive

H-drive means the gantry is driven by 2 motors, one at each side of the gantry. This would provide a more balanced driving force and minimize the problems experienced in T-drive configuration.

2.Encoder configurations.

For H-drive configuration, there are options to use 1 or 2 encoders.

Single encoder

In single encoder configuration (again, usually mounted at one side of the gantry), both motors would receive the same feedback signal and have the same position error all the time. Essentially, both motors will output the same force all the time. However, this doesn't guarantee that there will be no yaw error because the load inertia and friction experienced at the 2 sides will not be the same. But generally, having motors driving at both sides would reduce the reversal error significantly as compared to T-drive configuration.

In this configuration, it is possible to use only one driver if the driver's current rating can drive the 2 motors connected in parallel. However, there will be only one hall sensors port in the driver, so the 2 motors must be aligned exactly to their respective magnetic tracks to ensure accurate commutation.

Dual encoders - one on each side of gantry

Having encoders at both sides of the gantry would provide actual position difference between the 2 motors. However, this would require 2 separate position loops to control the 2 motors, it would require 2 drivers.

With 2 encoders, the stopping position can be controlled to the accuracy and repeatability of the encoders.

3.Rigid vs Flexible link between the bridge and the gantry axis

In single encoder system, either T-drive or H-drive configuration, the bridge should be rigidly mounted on the gantry axis to minimize yaw error.

However, there are important factors for consideration in rigid link design.

Bridge length is fixed and fully constrained when rigidly mounted at the 2 ends

If the environment temperature changes, the top axis bridge will expand or contract. More importantly, the moving axis mounted on the bridge will generate heat and dissipate through the bridge. As the bridge length changes (it will be more significant if the bridge is long), the stress on the 2 linear bearings will increase, resulting in higher friction on the gantry axis. The bridge itself may also bend and twist which will affect the top axis as well.

Mechanical alignment of the 2 linear bearings

If the 2 bearings are not parallel or their straightness and/or flatness are not controlled, it would result in uneven friction across the full stroke of the gantry axis. Some part of the stroke will have higher friction than other part. This could affect servo performance and require higher driving force from the motors than the calculated force requirement.

It can be very costly to machine the base support of the gantry stage to the required accuracy if the gantry is big (sometimes may not be possible at all).

On the other hand, most rigidly mounted bearings will still have some small degree of compliance to allow some displacement in the orthogonal directions. So the performance (or if it is functional at all) depends on the machining accuracy, bearings clearance, gantry size, etc.

Rigid link with dual encoders

With 2 encoders, it will provide the Yaw error (position difference between the 2 motors) to the controller. However, the assembly error of the 2 encoder scales and the scales' error itself could result in similar effect as misaligned bearings. In this case, the controller will try to servo the 2 motors to the commanded position. So if there is encoder scale error and bridge length is fully constrained, the controller will output very high current to the motors trying to stretch, bend or twist the bridge in order minimize their respective position errors. The 2 motors will be fighting each other and result in instability and higher continuous force.

One way to handle the difference in encoder scale error (including assembly alignment tolerance) is to map the differential error in one of the driver to match the encoder reading of the other. In this case, the bridge will be at their naturally "relax" orientation (no fighting between the gantry motors). But this doesn't mean that the yaw error is zero. In fact, it is impossible to achieve zero yaw error all the time in rigid gantry unless the mechanical setup (parallelism, straightness, flatness, etc.) is perfect.

Flexible link

Flexible link means allowing some freedom in yaw direction at one side (usually called the gantry master), and on the other side, allow translational freedom in the top axis direction and yaw rotation (to allow expansion/contraction of bridge and rotation due to straightness error in gantry bearings and encoder scale error).

It requires 2 encoders and 2 controller axes (2 drivers) in order to control the yaw direction.
This is more costly in terms of the number of control components, but allows higher tolerance in the mechanical parts fabrication and assembly.

4.Controller configuration

In single driver configuration, the controller will see the gantry as one motor and everything behave like a conventional axis. It is more important to size the driver and power supply based on the combined motor current and back EMF.

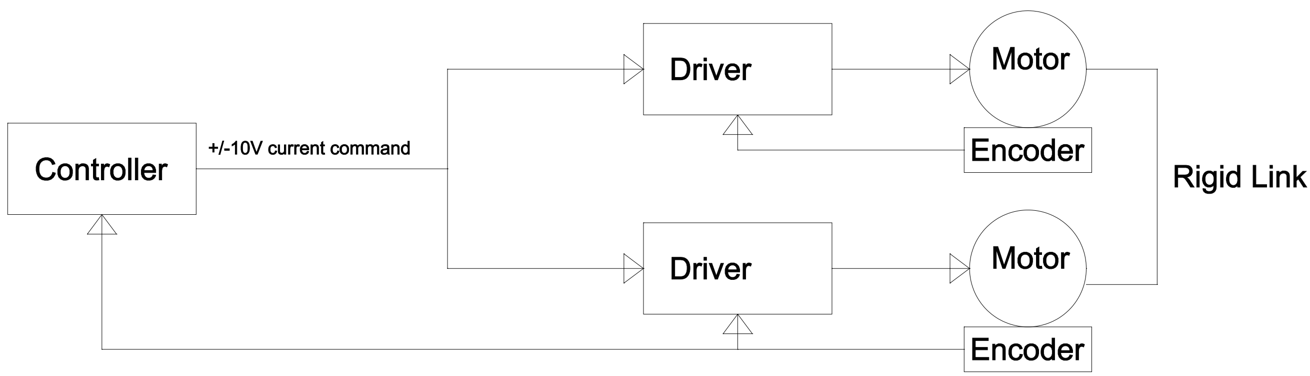
In dual-driver configuration, there are a few options.

Shared current command

This is similar to connecting the 2 gantry motors in parallel to a single driver with 1 encoder feedback. In the case when the driver's current or voltage rating could not support the 2 motors in parallel connection, it will be necessary to drive the motor separately with 2 drivers.

The controller treats the gantry as a single motor with only 1 position loop. The encoder feedback is used to compute current command and converted to a +/-10V analog signal, which is connected in parallel to the 2 drivers. Both motors should output the same force if their commutation alignment is the same.

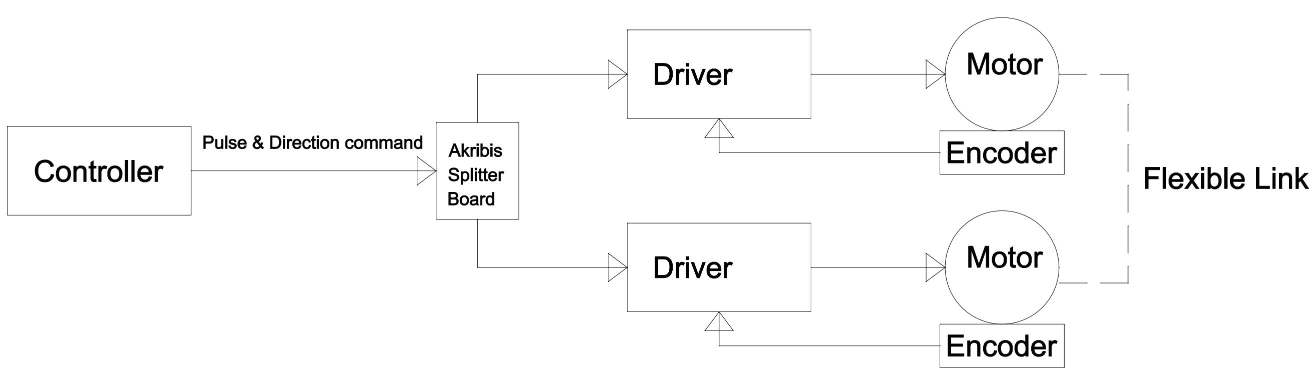
In the case when it is not easy to ensure good commutation alignment by mechanical design, it is possible to use separate encoders connected to their respective drivers for commutation purpose. Only one of the encoders will be connected to the controller since there is only 1 position loop.



Shared position command

Similar to shared current command, in this case, the 2 drivers are operating in position mode. The position command can be sent in pulse & direction or other equivalent formats. To ensure strong pulse signals are received at the 2 drivers, it is recommended to use a splitter circuit board from Akribis to split the signals.

Again, the controller treats this as a single motor and generate one motion path profile. Position control is done in the drivers, so it is possible to apply encoder error compensation separately in each driver to avoid fighting between the 2 motors.

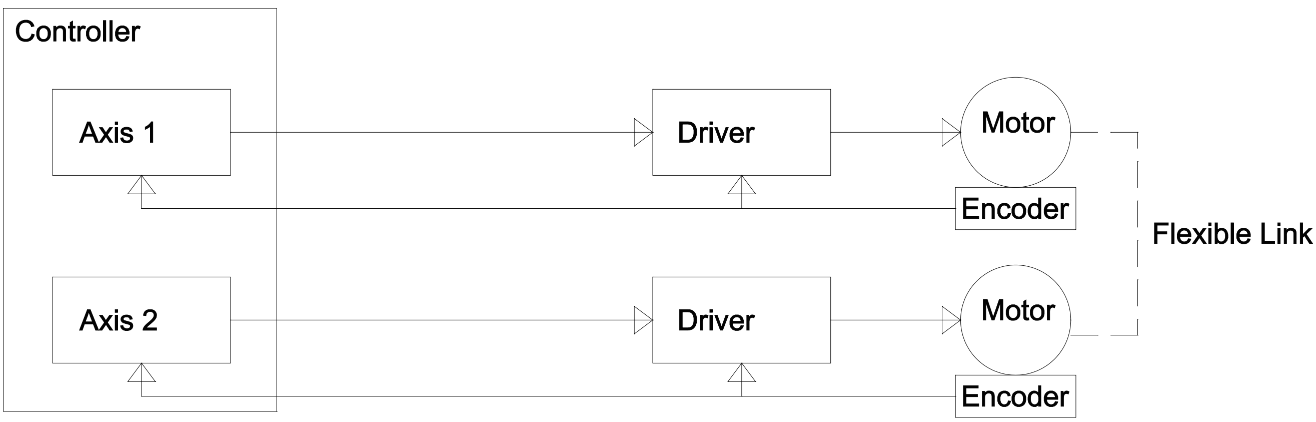


Vector mode or Gear mode with 1:1 ratio

When the 2 drivers are connected to separate axes in the controller (this will take up 2 controller axes), it is possible to control the 2 motors separately. This may be necessary if the application requires some movement in the yaw axis (not always orthogonal to the main gantry axis). Of course, this would require a flexible link gantry design.

When moving in the main gantry direction, it is advisable to group the 2 axes in vector mode or gear mode because most controller has special error handling in such mode to decelerate and stop both motors together even if only one of the motors encountered an error condition.

If there isn't such protection in place, when one motor encountered error and stopped, the other may continue to move and could cause damage to the gantry mechanism.

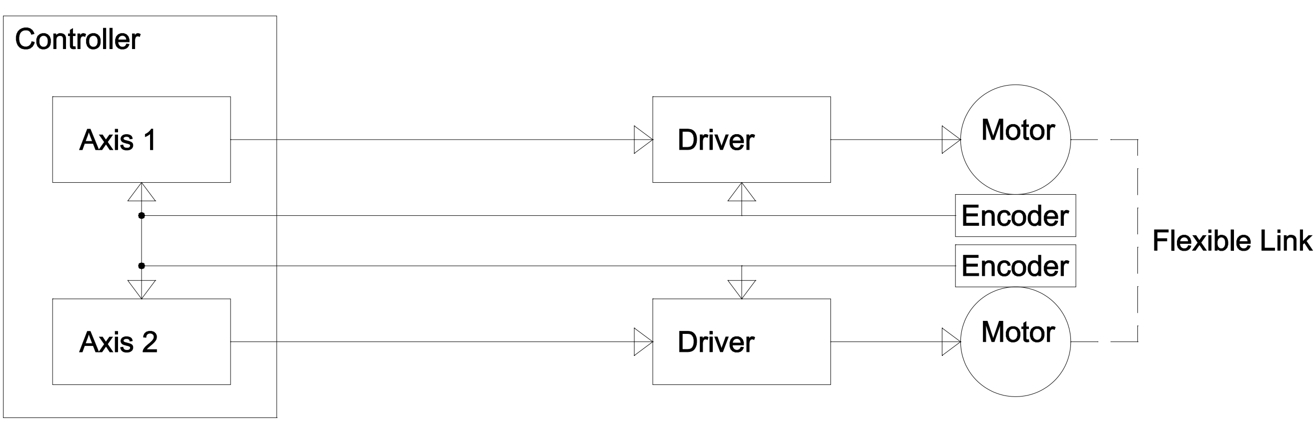


Active yaw control

With 2 complete set of motor, encoder, driver and controller axis, it would be better to share both encoder signals among the 2 position loops so that each motor is aware of the actual position of the other motor.

For example, when one motor is slowed down by high friction, the other motor can also slow down to reduce the yaw error. The controller is actively trying to correct the yaw error at all time, hence the name "active yaw control".

Most advanced controllers like Elmo, ACS and Polaris support active yaw control, refer to next section for more description.

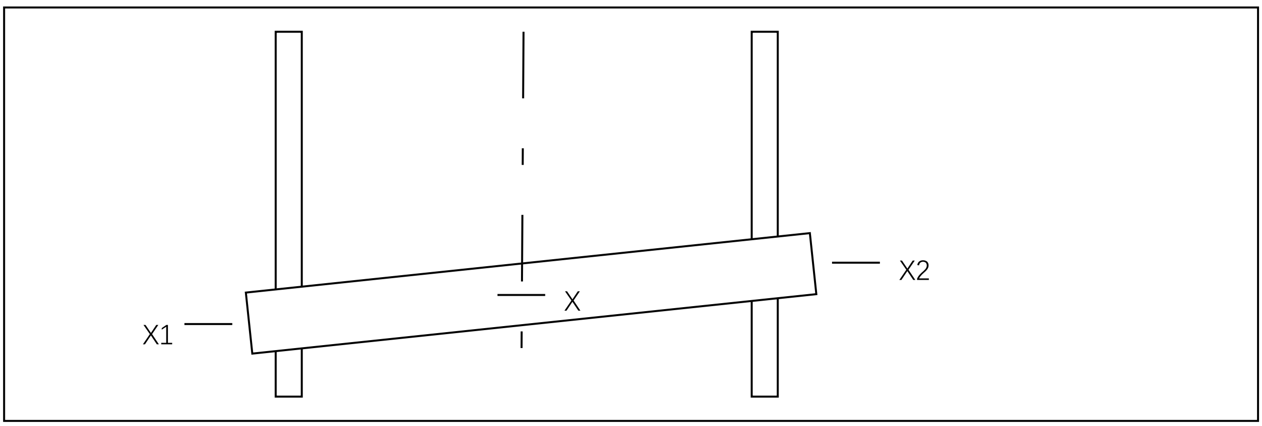


5.Active yaw control

Active yaw control requires 2 set of motor, encoder, driver and controller axis.

The controller transforms the 2 physical gantry axes (X1 and X2) into gantry main axis (X-axis) and a Yaw-axis based on the following equations.

X = (X1 + X2) / 2
Yaw = X1 - X2



The controller generates motion profile to X axis (which is effectively the desired position at the mid-point of the bridge) while the yaw command should always be zero (that means the bridge is orthogonal to X-axis).

After transforming the X1 and X2 encoder values into X and Yaw's feedback values, the position and velocity control loops (PID, PIP or any other control structure) are processed to output the required current command to X and Yaw axis. These current commands will be transformed back to X1 and X2 axis and send to the current loop of their respective driver.

In this way, X1 and X2 motor will output different force to correct any yaw error while moving the gantry according to the required X-axis profile.

In case of rigid gantry (or less flexible gantry link), it is recommended to set a weak yaw controller by reducing the control gains for Yaw-axis or limit the current command to Yaw-axis. It will be useless (or even harmful) to output strong yaw control to a rigid gantry as the motors will not be able to correct the yaw error due to the rigidity of the gantry.

LINEAR MODULE

LINEAR MODULE

DGL SERIES

- Linear motor positioning system
- Excellent force / size ratio
- Precise homing
- Standard design

DGL Module with Brushless Linear Motors

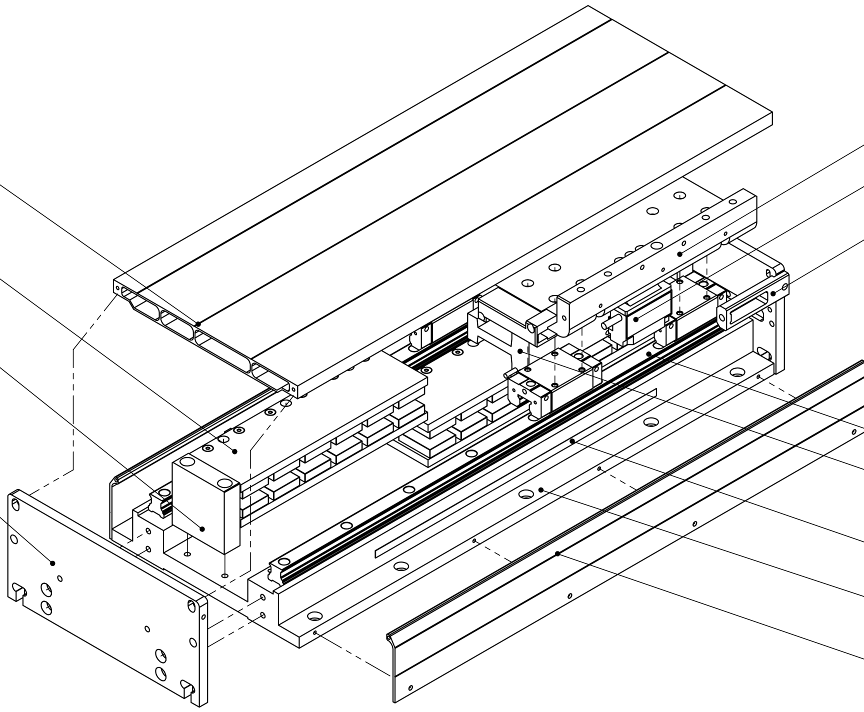
Akribis DGL series utilize direct drive linear motor positioning system. It consists of dual linear guides, linear motor, encoder feedback and aluminum cover to form a compact footprint, high performance module.

The linear motor in the DGL can be Akribis patented AUM series ironless linear motor or AJM, AKM series iron core linear motor. The AUM linear motor is cogging free, allowing for velocity control, scanning application. While the AJM, AKM linear motor is iron core, suitable for point-to-point motion and more cost-effective.

	Linear Motors	Series	Continuous Force (Fcn) (Unit: N)	Peak Force (Fpk) (Unit: N)	Stroke❶ (mm)	Page
DGL150	AJM Series	DGL150-AJM30-B2	68.1	214.7	100 ~ 1200	041
		DGL150-AJM30-B4	136.2	429.4		042
	AUM Series	DGL150-AUM2-S4	35.2	176		043
DGL180	AJM Series	DGL180-AJM50-B2	117	369	100 ~ 1200	046
		DGL180-AJM50-B4	234	738.1		047
	AUM Series	DGL180-AUM3-S2	57	289		048
		DGL180-AUM3-S4	113	578		049
DGL200	AJM Series	DGL200-AJM80-B2	174.5	550.2	100 ~ 1200	052
		DGL200-AJM80-B4	348.9	1100.4		053
	AKM Series	DGL200-AKM50-B2	361.3	805.3		054
		DGL200-AKM50-B4	722.6	1159.3		055
	AUM Series	DGL200-AUM4-S2	110	624		056
		DGL200-AUM4-S4	211	1248		057
DGL260	AJM Series	DGL260-AJM100-B2	223.4	704.5	100 ~ 1200	060
		DGL260-AJM100-B4	446.8	1409.1		061
	AKM Series	DGL260-AKM100-B2	722.6	1159.3		062
		DGL260-AKM100-B4	1445.3	3221.1		063
	AUM Series	DGL260-AUM5-S2	197	1415		064
		DGL260-AUM5-S4	472	2830		065

❶ Larger stroke on request.

Exploded View



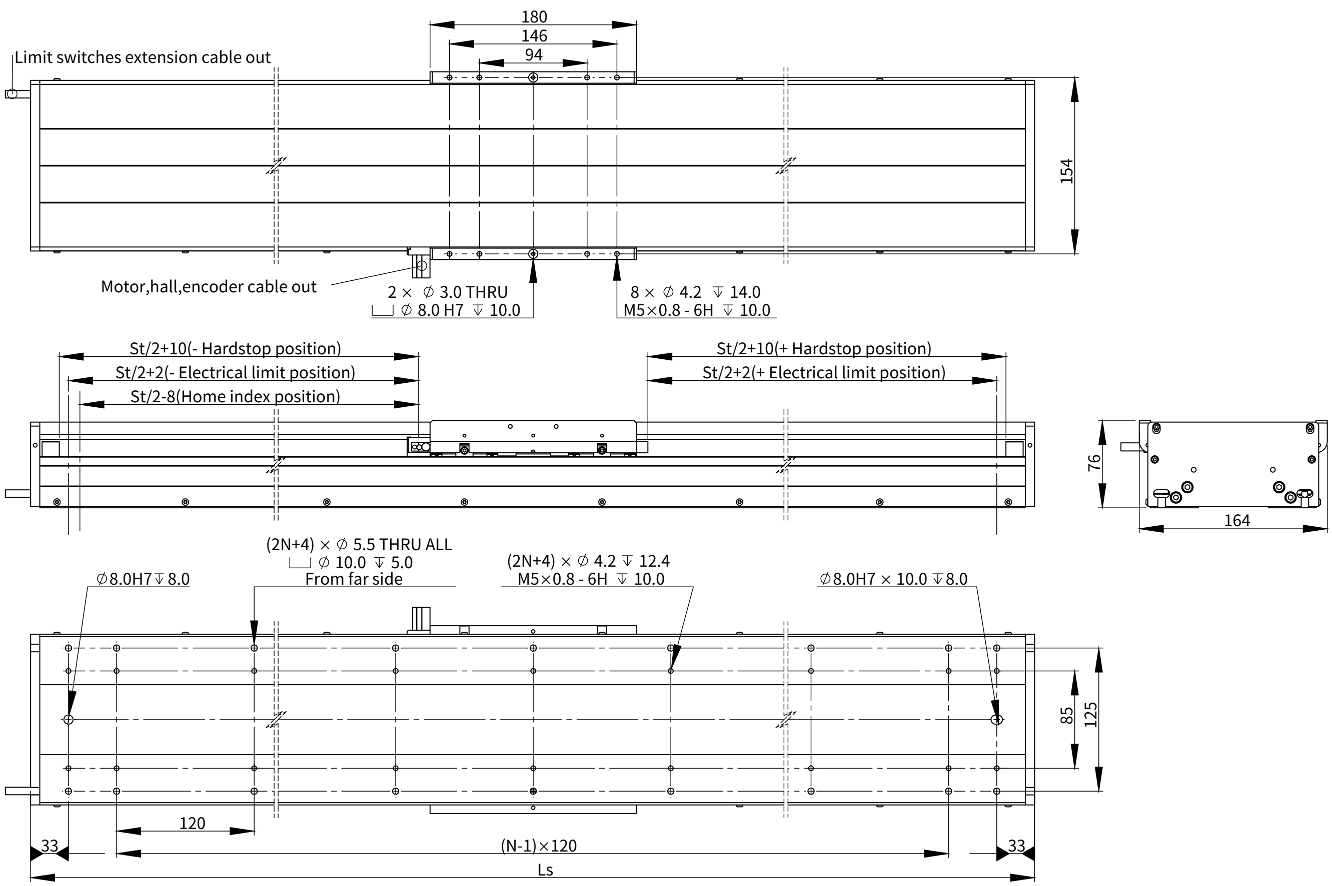
DGL150 Ironcore & Ironless Series

Motor	Unit	DGL150 Ironcore Series		DGL150 Ironless Series
		AJM30-B2	AJM30-B4	AUM2-S4
Continuous Force	N	68.1	136.2	35.2
Peak Force	N	214.7	429.4	176.0
Effective Stroke	mm	100-1200	100-1200	100-1200
Resolution	μm	0.05/0.1/0.5/SINCOS		
Repeatability	μm	TTL 0.5 Encoder/SINCOS: ±3		
		Absolute 0.05 Encoder: ±1; TTL 0.1 Encoder: ±1		
Horizontal Straightness	μm/mm	10/500	10/500	10/500
Vertical Straightness	μm/mm	20/500	20/500	20/500
No-load Moving Mass	kg	2.4	3.5	1.1
Rated Payload	kg	10	20	20
Max. Allowable Roll Moment Load	Nm	102	102	41
Max. Allowable Pitch Moment Load	Nm	145	218	36
Max. Allowable Yaw Moment Load	Nm	145	218	36

Note:
- All values are measured based on module fully mounted on a 5μm granite table.
- Values are measured according to Akribis measuring standard.
- All specifications above are standard, contact Akribis for special request.

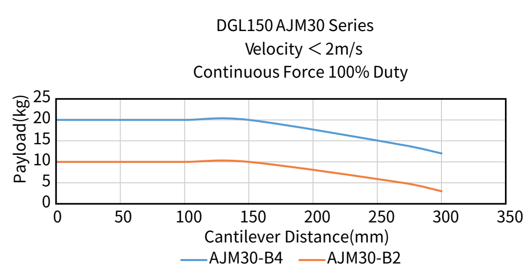
DGL150 Ironcore Series

DGL150-AJM30-B2 Dimension Drawing

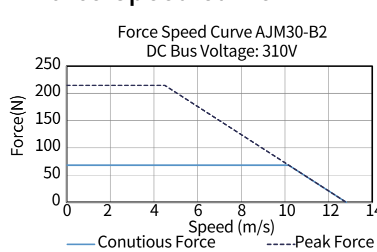


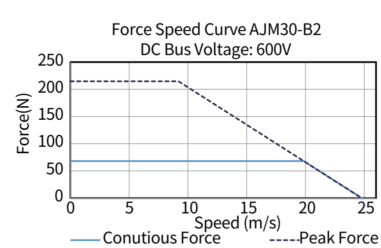
Effective Stroke(mm)	N	Module Length Ls (mm)	Module Mass (kg)
100	3	370	8.3
200	3	470	9.7
300	5	570	11.0
400	5	670	12.4
500	5	770	13.7
600	7	870	15.1
700	7	970	16.4
800	9	1070	17.9
900	9	1170	19.2
1000	9	1270	20.6
1100	11	1370	21.9
1200	11	1470	23.3

Cantilever-Payload Curve

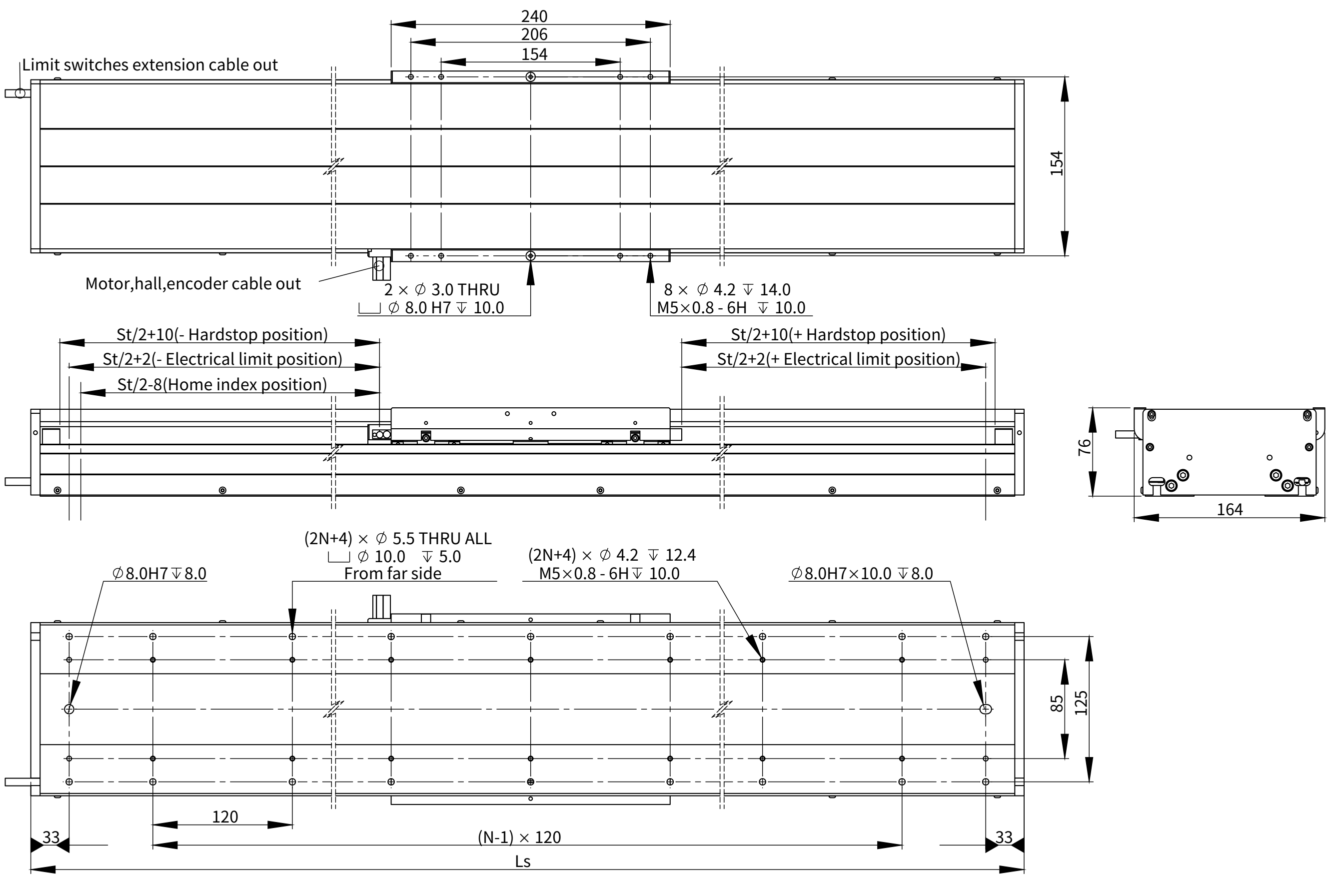


Force-Speed Curve



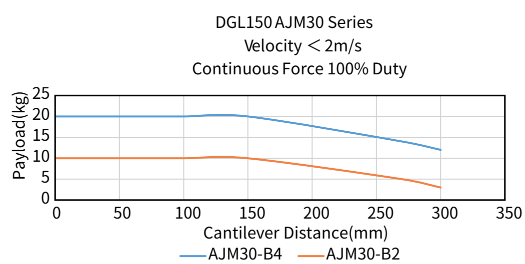


DGL150-AJM30-B4 Dimension Drawing

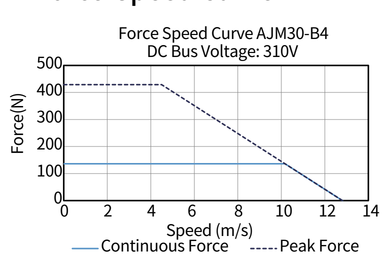


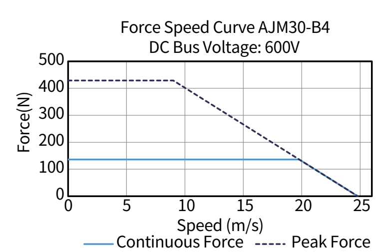
Effective Stroke(mm)	N	Module Length Ls (mm)	Module Mass (kg)
100	3	430	9.8
200	3	530	11.2
300	5	630	12.6
400	5	730	14.1
500	7	830	15.5
600	7	930	16.7
700	7	1030	18.2
800	9	1130	19.5
900	9	1230	21.0
1000	11	1330	22.3
1100	11	1430	23.7
1200	13	1530	25.1

Cantilever-Payload Curve



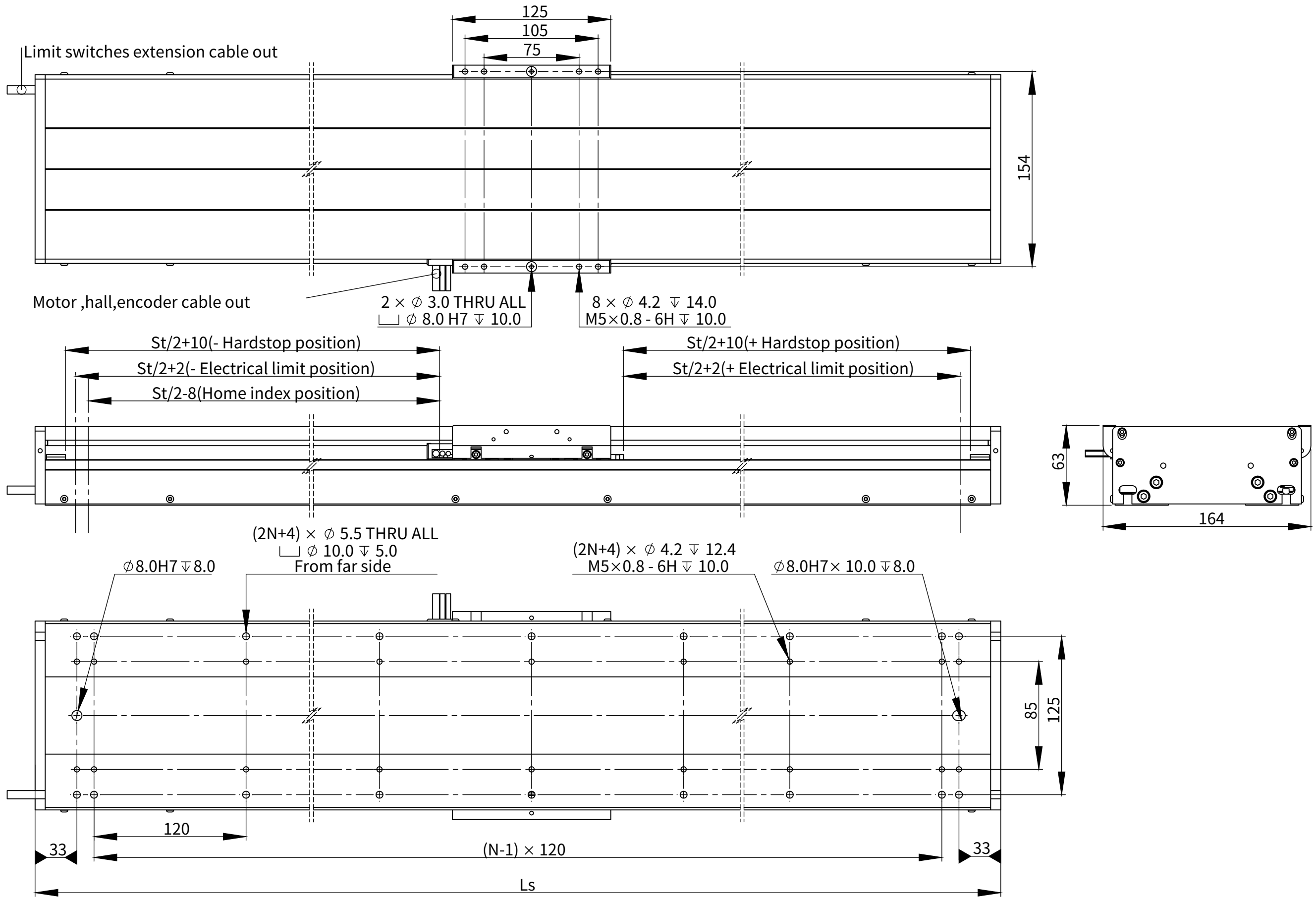
Force-Speed Curve





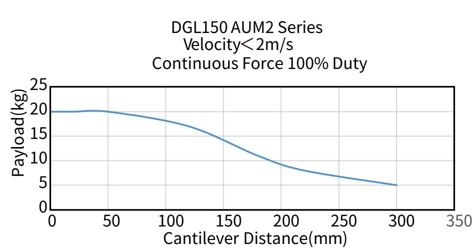
DGL150 Ironless Series

DGL150-AUM2-S4 Dimension Drawing

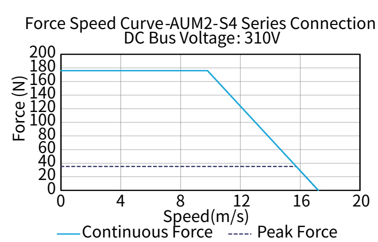


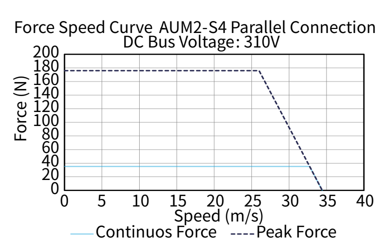
Effective Stroke(mm)	N	Module Length Ls (mm)	Module Mass (kg)
100	1	313	5.5
200	3	413	6.9
300	3	513	8.0
400	5	613	9.4
500	5	713	10.8
600	7	813	11.9
700	7	913	13.3
800	7	1013	14.7
900	9	1113	15.7
1000	9	1213	17.0
1100	11	1313	18.3
1200	11	1413	19.4

Cantilever-Payload Curve



Force-Speed Curve





Ordering Part Number (OPN)

DGL150 (Ironcore)

DL1 S 01 J01 E73 1 A 1

Model:
- DL1: DGL150

Cover Type:
- S: Standard (Clear Anodized)
- T: Standard (Black Anodized)

Effective Stroke:[1]
- 01: 100mm
- 02: 200mm
- 03: 300mm
- 04: 400mm
- 05: 500mm
- 06: 600mm
- 07: 700mm
- 08: 800mm
- 09: 900mm
- 10: 1000mm
- 11: 1100mm
- 12: 1200mm

Motor Type:
- J01: AJM30-B2-J (Peak Force: 214.7N)
- J02: AJM30-B2-K (Peak Force: 214.7N)
- J03: AJM30-B4-J (Peak Force: 429.4N)
- J04: AJM30-B4-K (Peak Force: 429.4N)

Encoder Type:
- E73: ABA50E EnDat2.2 (0.05μm)
- E71: ABA50M Mitsubish (0.05μm)
- EBF: Quantic (0.5μm)
- EBH: Quantic (0.1μm)
- E9F: ABI51D (0.5μm)
- E9H: ABI51D (0.1μm)
- EA0: ABI52 (SINCOS)

Scale Type:
- 1: Steel tape, 11ppm/K

Cable Length:
- A: 0.5m
- B: 3.0m

Termination:
- 1: Flying Leads
- 2: DSUB

DGL150 (Ironless)

DL1 S 01 U06 E73 1 A 1

Model:
- DL1: DGL150

Cover Type:
- S: Standard (Clear Anodized)
- T: Standard (Black Anodized)
- C: Conventional (Clear Anodized)
- D: Conventional (Black Anodized)

Effective Stroke:[1]
- 01: 100mm
- 02: 200mm
- 03: 300mm
- 04: 400mm
- 05: 500mm
- 06: 600mm
- 07: 700mm
- 08: 800mm
- 09: 900mm
- 10: 1000mm
- 11: 1100mm
- 12: 1200mm

Motor Type:
- U06: AUM2-S-S4-K (Peak Force: 176.0N)
- U07: AUM2-P-S4-K (Peak Force: 176.0N)

Encoder Type:
- E73: ABA50E EnDat2.2 (0.05μm)
- E71: ABA50M Mitsubish (0.05μm)
- EBF: Quantic (0.5μm)
- EBH: Quantic (0.1μm)
- E9F: ABI51D (0.5μm)
- E9H: ABI51D (0.1μm)
- EA0: ABI52 (SINCOS)

Scale Type:
- 1: Steel tape, 11ppm/K

Cable Length:
- A: 0.5m
- B: 3.0m

Termination:
- 1: Flying Leads
- 2: DSUB

Note:
[1] Standard stroke in intervals of 100mm only, for more options, please contact Akribis sales engineers.

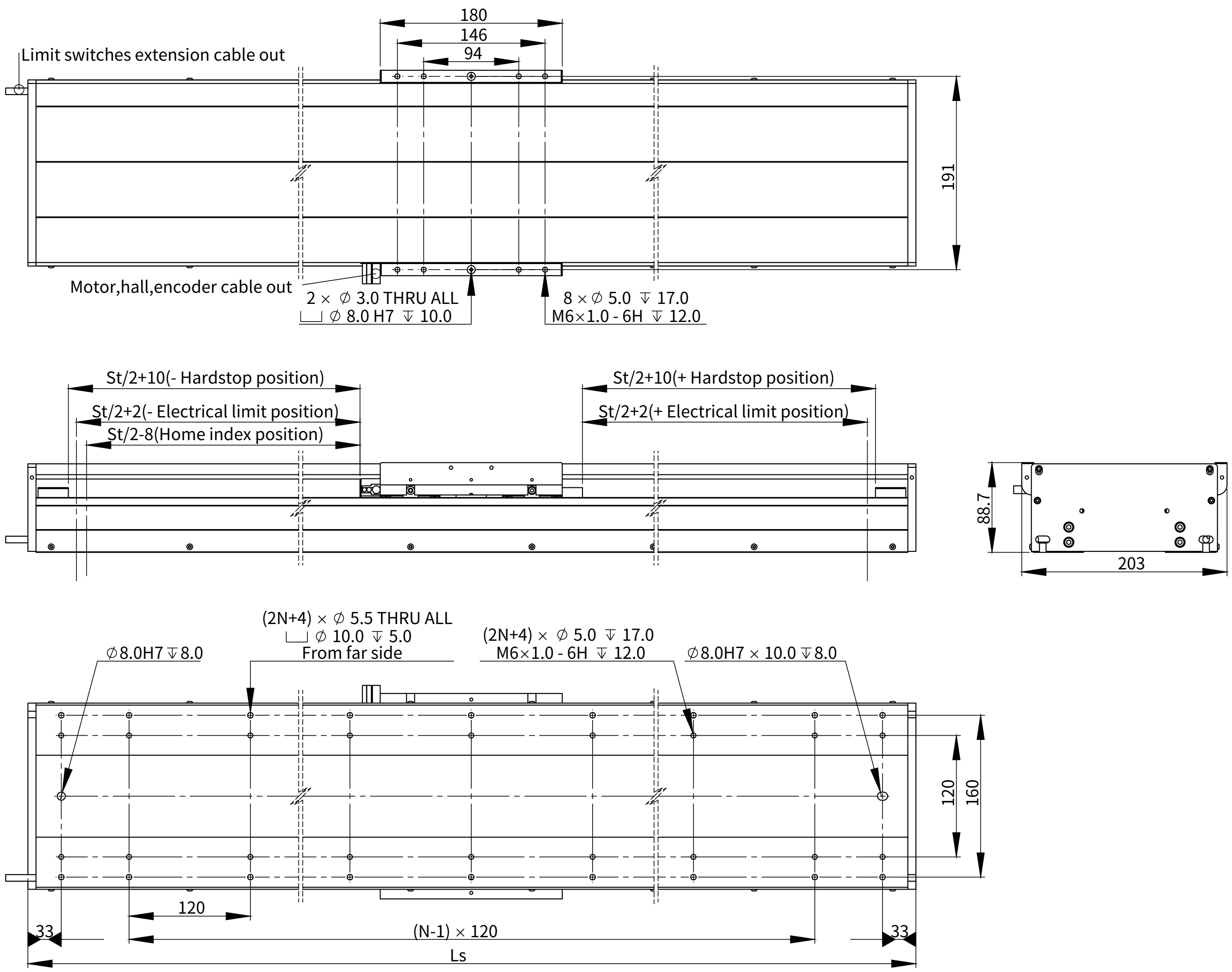
DGL180 Ironcore & Ironless Series

Motor	Unit	DGL180 Ironcore Series		DGL180 Ironless Series	
		AJM50-B2	AJM50-B4	AUM3-S2	AUM3-S4
Continuous Force	N	117.0	234.0	57.0	113.0
Peak Force	N	369.0	738.1	289.0	578.0
Effective Stroke	mm	100-1200	100-1200	100-1200	100-1200
Resolution	µm	0.05/0.1/0.5/SINCOS			
Repeatability	µm	TTL 0.5 Encoder/SINCOS: ±3			
		Absolute 0.05 Encoder: ±1; TTL 0.1 Encoder: ±1			
Horizontal Straightness	µm/mm	10/500	10/500	10/500	10/500
Vertical Straightness	µm/mm	20/500	20/500	20/500	20/500
No-load Moving Mass	kg	3.5	4.9	2.9	3.9
Rated Payload	kg	20	30	40	50
Max. Allowable Roll Moment Load	Nm	140	140	140	140
Max. Allowable Pitch Moment Load	Nm	145	218	145	218
Max. Allowable Yaw Moment Load	Nm	145	218	145	218

Note:
- All values are measured based on module fully mounted on a 5µm granite table.
- Values are measured according to Akribis measuring standard.
- All specifications above are standard, contact Akribis for special request.

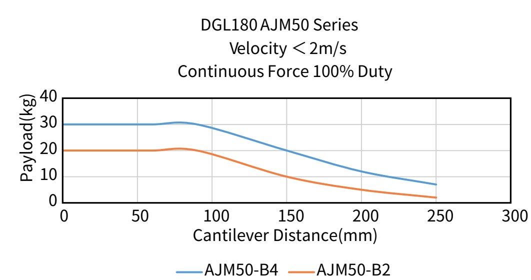
DGL180 Ironcore Series

DGL180-AJM50-B2 Dimension Drawing

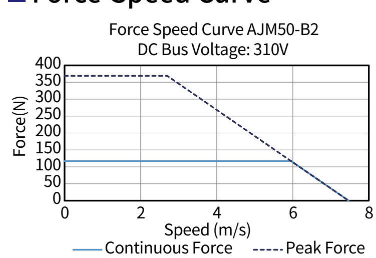


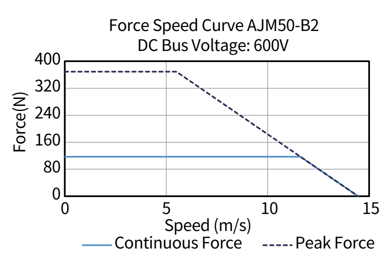
Effective Stroke(mm)	N	Module Length Ls (mm)	Module Mass (kg)
100	3	420	12.7
200	3	520	14.5
300	5	620	16.6
400	5	720	18.4
500	7	820	20.4
600	7	920	22.3
700	7	1020	24.3
800	9	1120	26.2
900	9	1220	28.3
1000	11	1320	30.1
1100	11	1420	32.3
1200	11	1520	33.9

Cantilever-Payload Curve

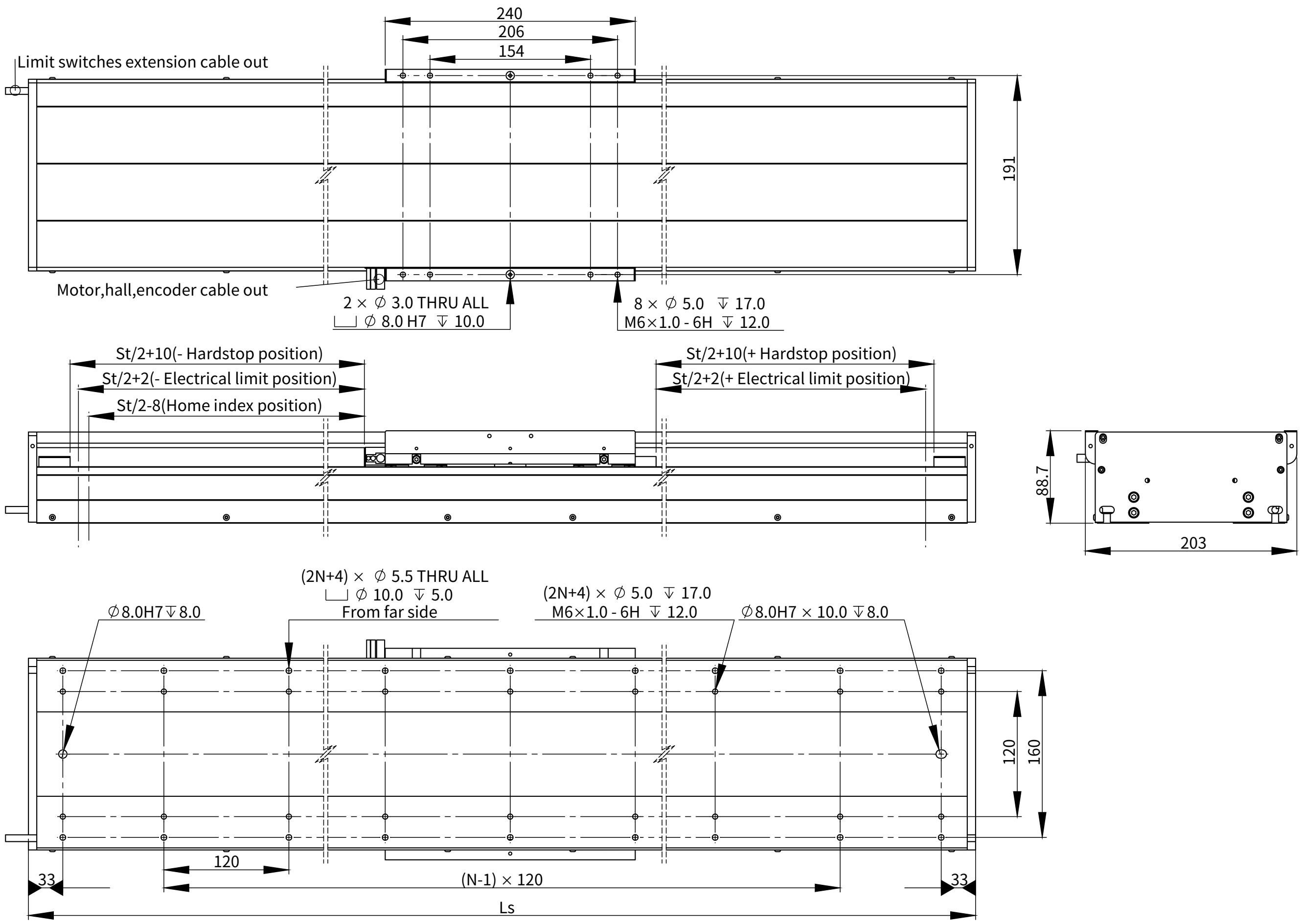


Force-Speed Curve



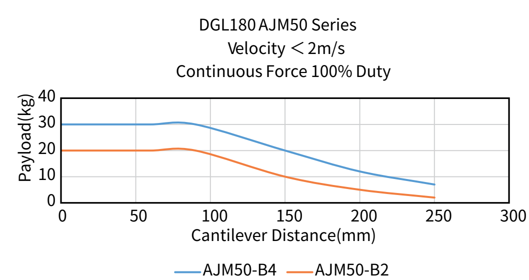


DGL180-AJM50-B4 Dimension Drawing

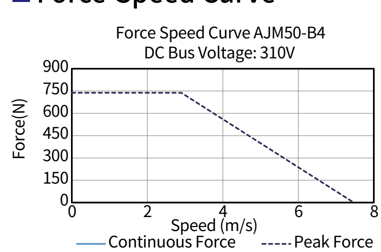


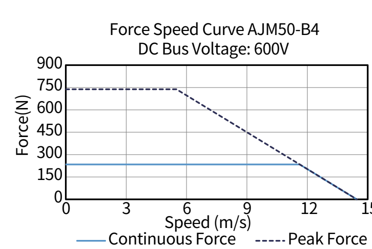
Effective Stroke(mm)	N	Module Length Ls (mm)	Module Mass (kg)
100	3	480	15.1
200	5	580	17.2
300	5	680	19.0
400	5	780	21.1
500	7	880	23.0
600	7	980	25.1
700	9	1080	26.7
800	9	1180	28.9
900	9	1280	30.8
1000	11	1380	32.7
1100	11	1480	34.6
1200	13	1580	36.7

Cantilever-Payload Curve



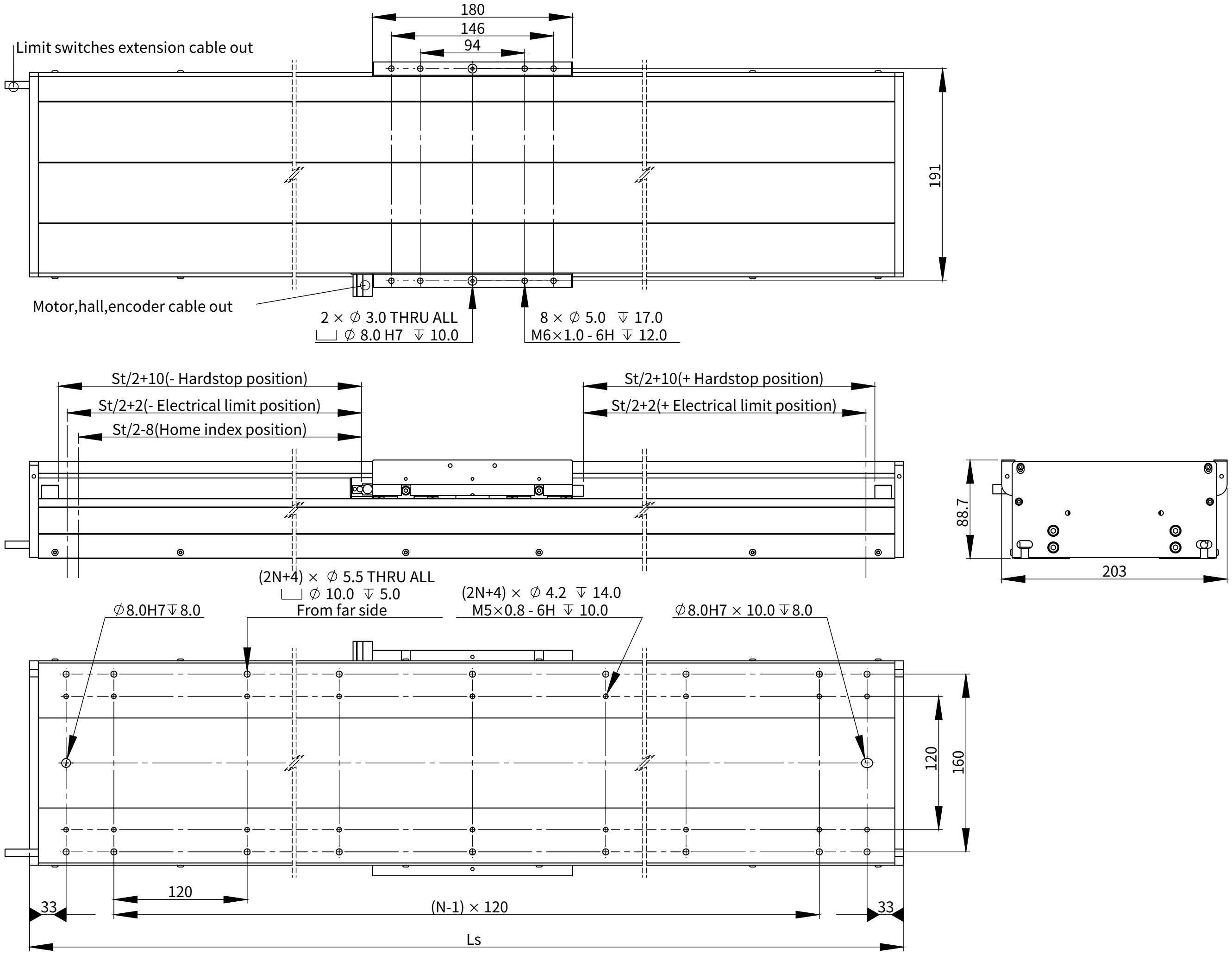
Force-Speed Curve





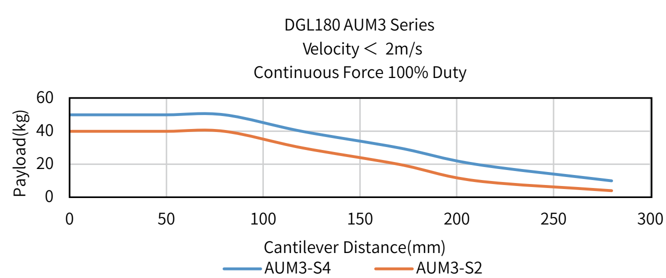
DGL180 Ironless Series

DGL180-AUM3-S2 Dimension Drawing

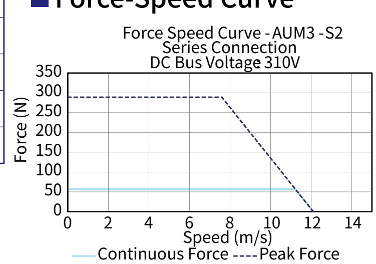


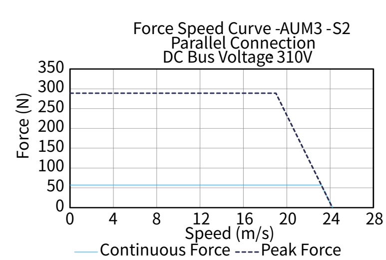
Effective Stroke(mm)	N	Module Length Ls (mm)	Module Mass (kg)
100	3	372	11.7
200	3	472	14.1
300	5	572	16.0
400	5	672	18.4
500	5	772	20.9
600	7	872	22.8
700	7	972	25.3
800	9	1072	27.8
900	9	1172	29.7
1000	9	1272	32.1
1100	11	1372	34.5
1200	11	1472	36.5

Cantilever-Payload Curve

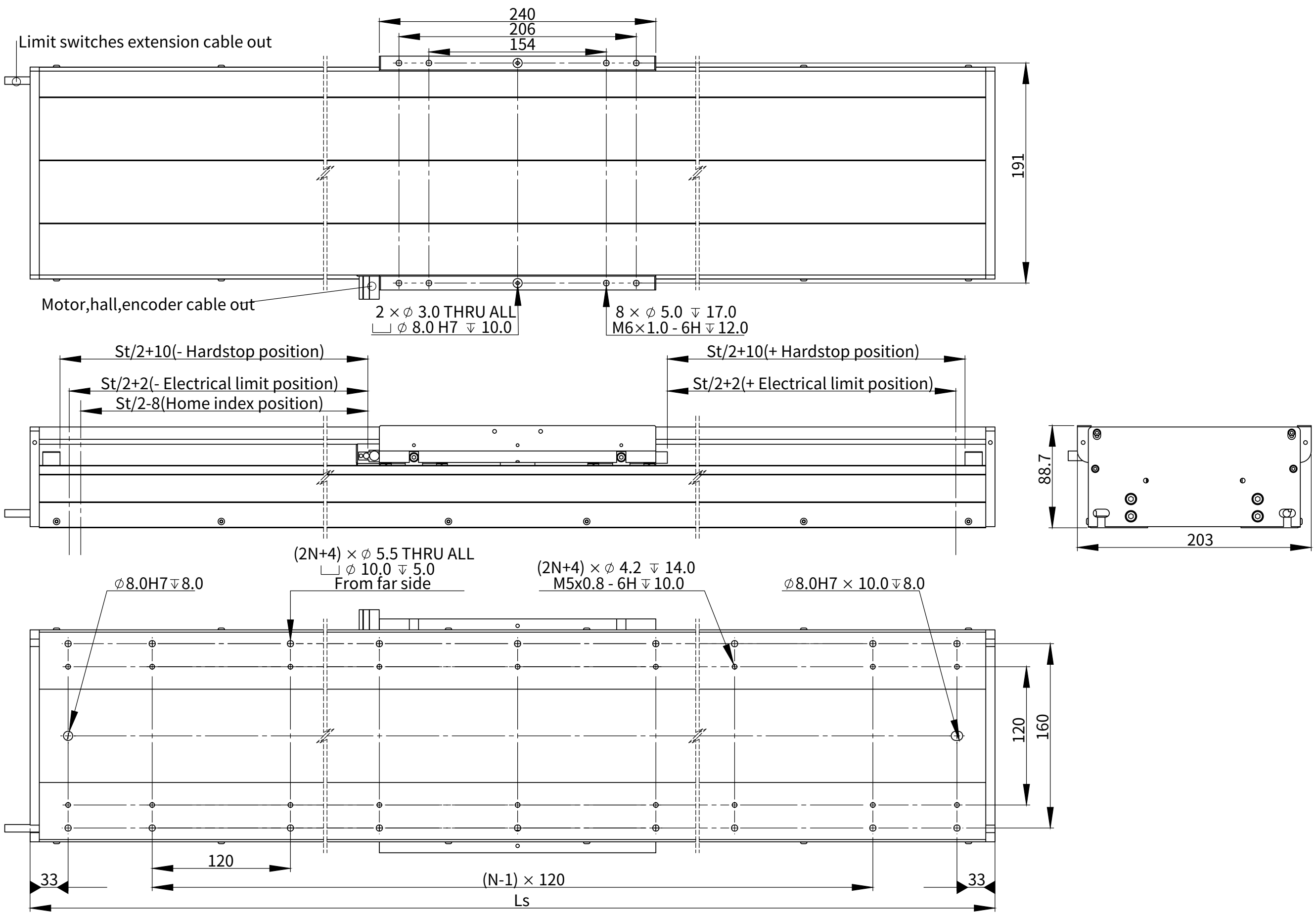


Force-Speed Curve



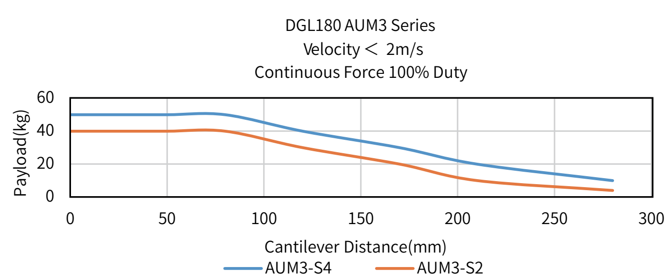


DGL180-AUM3-S4 Dimension Drawing

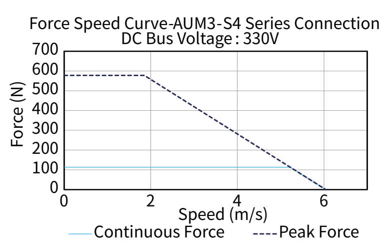


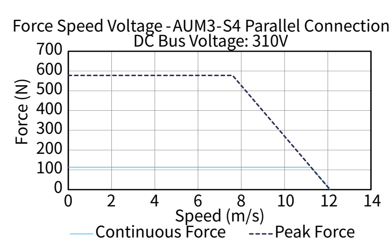
Effective Stroke(mm)	N	Module Length Ls (mm)	Module Mass (kg)
100	3	432	13.9
200	3	532	16.5
300	5	632	18.4
400	5	732	20.8
500	7	832	23.2
600	7	932	25.2
700	7	1032	27.6
800	9	1132	30.0
900	9	1232	32.1
1000	11	1332	34.5
1100	11	1432	36.9
1200	13	1532	38.9

Cantilever-Payload Curve



Force-Speed Curve





Introduction | Sizing Guide | Frequently Asked Questions | Motion Control of Gantry Stages | Linear Module | Voice Coil Module | Miniature Stages | Stacked Stages | Gantry Stages

Ordering Part Number (OPN)

DGL180 (Ironcore)

DL2 S 01 J15 E73 1 A 1

Model:
- DL2: DGL180

Cover Type:
- S: Standard (Clear Anodized)
- T: Standard (Black Anodized)
- C: Conventional (Clear Anodized)
- D: Conventional (Black Anodized)
- B: Bellow

Effective Stroke:[1]
- 01: 100mm
- 02: 200mm
- 03: 300mm
- 04: 400mm
- 05: 500mm
- 06: 600mm
- 07: 700mm
- 08: 800mm
- 09: 900mm
- 10: 1000mm
- 11: 1100mm
- 12: 1200mm

Motor Type:
- J15: AJM50-B2-J (Peak Force: 369.0N)
- J16: AJM50-B2-K (Peak Force: 369.0N)
- J17: AJM50-B4-J (Peak Force: 738.1N)
- J18: AJM50-B4-K (Peak Force: 738.1N)

Encoder Type:
- E73: ABA50E EnDat2.2 (0.05μm)
- E71: ABA50M Mitsubish (0.05μm)
- EBF: Quantic (0.5μm)
- EBH: Quantic (0.1μm)
- E9F: ABI51D (0.5μm)
- E9H: ABI51D (0.1μm)
- EA0: ABI52 (SINCOS)

Scale Type:
- 1: Steel tape, 11ppm/K

Cable Length:
- A: 0.5m
- B: 3.0m

Termination:
- 1: Flying Leads
- 2: DSUB

DGL180 (Ironless)

DL2 S 01 U17 E73 1 A 1

Model:
- DL2: DGL180

Cover Type:
- S: Standard (Clear Anodized)
- T: Standard (Black Anodized)
- C: Conventional (Clear Anodized)
- D: Conventional (Black Anodized)
- B: Bellow

Effective Stroke:[1]
- 01: 100mm
- 02: 200mm
- 03: 300mm
- 04: 400mm
- 05: 500mm
- 06: 600mm
- 07: 700mm
- 08: 800mm
- 09: 900mm
- 10: 1000mm
- 11: 1100mm
- 12: 1200mm

Motor Type:
- U17: AUM3-S-S2-J (Peak Force: 289.0N)
- U18: AUM3-S-S2-K (Peak Force: 289.0N)
- U19: AUM3-P-S2-J (Peak Force: 289.0N)
- U20: AUM3-P-S2-K (Peak Force: 289.0N)
- U25: AUM3-S-S4-J (Peak Force: 578.0N)
- U26: AUM3-S-S4-K (Peak Force: 578.0N)
- U27: AUM3-P-S4-J (Peak Force: 578.0N)
- U28: AUM3-P-S4-K (Peak Force: 578.0N)

Encoder Type:
- E73: ABA50E EnDat2.2 (0.05μm)
- E71: ABA50M Mitsubish (0.05μm)
- EBF: Quantic (0.5μm)
- EBH: Quantic (0.1μm)
- E9F: ABI51D (0.5μm)
- E9H: ABI51D (0.1μm)
- EA0: ABI52 (SINCOS)

Scale Type:
- 1: Steel tape, 11ppm/K

Cable Length:
- A: 0.5m
- B: 3.0m

Termination:
- 1: Flying Leads
- 2: DSUB

Note:
[1] Standard stroke in intervals of 100mm only, for more options, please contact Akribis sales engineers.

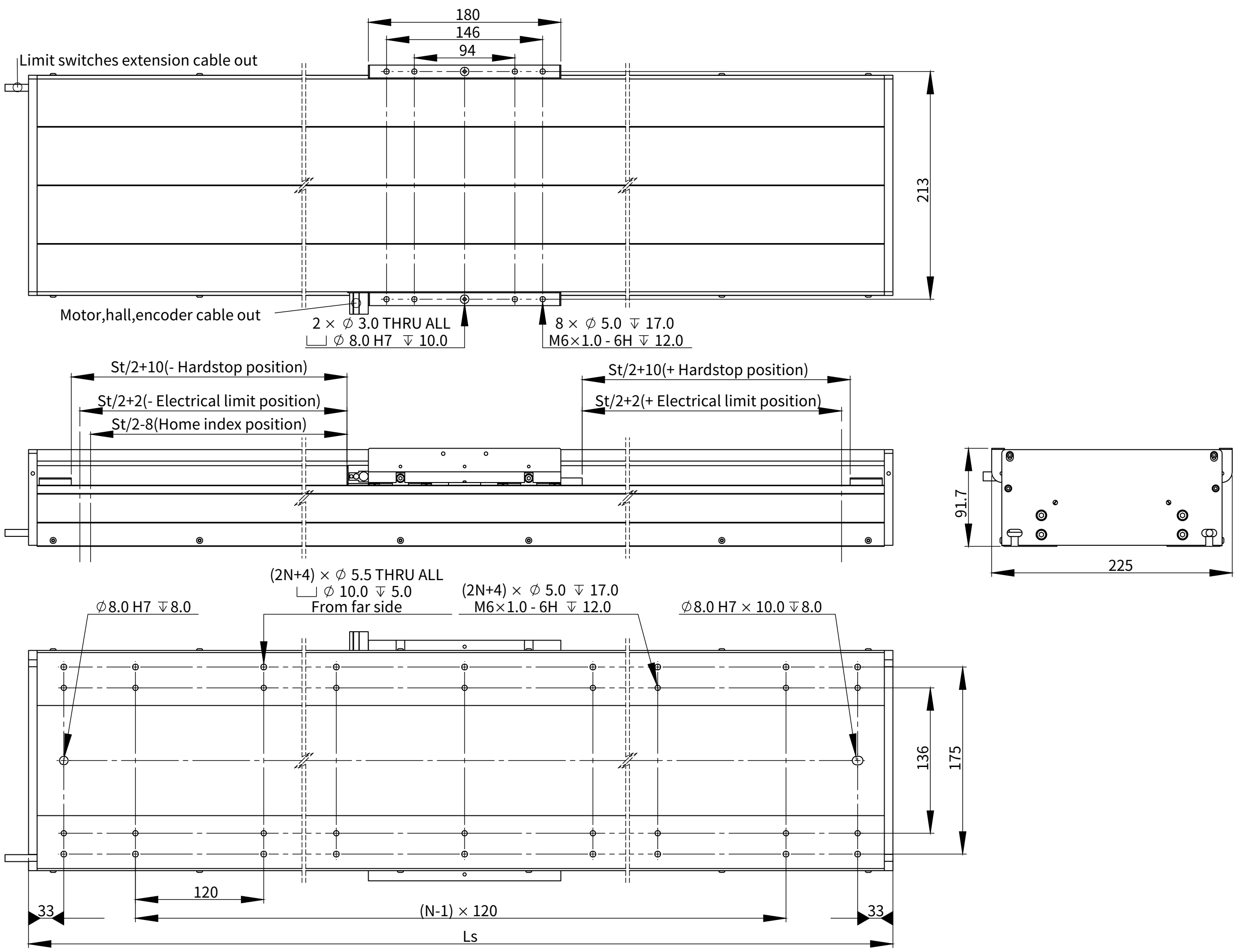
DGL200 Ironcore & Ironless Series

Motor	Unit	DGL200 Ironcore Series				DGL200 Ironless Series	
		AJM80-B2	AJM80-B4	AKM50-B2	AKM50-B4	AUM4-S2	AUM4-S4
Continuous Force	N	174.5	348.9	361.3	722.6	110.0	221.0
Peak Force	N	550.2	1100.4	805.3	1610.5	624.0	1248.0
Effective Stroke	mm	100-1200	100-1200	100-1200	100-1200	100-1200	100-1200
Resolution	µm	0.05/0.1/0.5/SINCOS					
Repeatability	µm	TTL 0.5 Encoder/SINCOS: ±3					
		Absolute 0.05 Encoder: ±1; TTL 0.1 Encoder: ±1					
Horizontal Straightness	µm/mm	10/500	10/500	10/500	10/500	10/500	10/500
Vertical Straightness	µm/mm	20/500	20/500	20/500	20/500	20/500	20/500
No-load Moving Mass	kg	4.2	6.1	8.6	14.2	3.2	4.4
Rated Payload	kg	20	30	35	50	60	70
Max. Allowable Roll Moment Load	Nm	249	249	249	249	166	166
Max. Allowable Pitch Moment Load	Nm	145	218	218	546	145	218
Max. Allowable Yaw Moment Load	Nm	145	218	218	546	145	218

Note:
- All values are measured based on module fully mounted on a 5µm granite table.
- Values are measured according to Akribis measuring standard.
- All specifications above are standard, contact Akribis for special request.

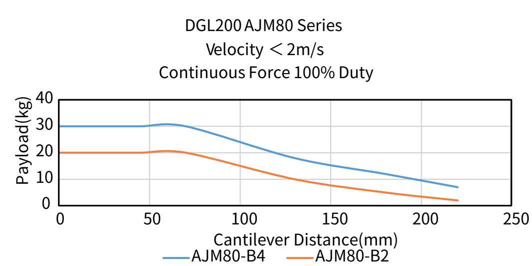
DGL200 Ironcore Series

DGL200-AJM80-B2 Dimension Drawing

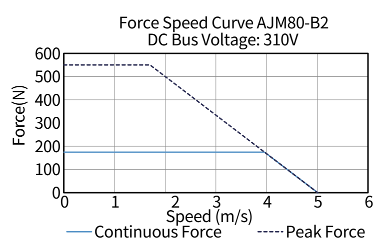


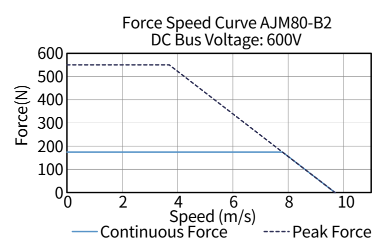
Effective Stroke(mm)	N	Module Length Ls (mm)	Module Mass (kg)
100	3	420	14.7
200	3	520	16.9
300	5	620	19.3
400	5	720	21.5
500	7	820	23.9
600	7	920	26.1
700	7	1020	28.5
800	9	1120	30.5
900	9	1220	33.1
1000	11	1320	35.2
1100	11	1420	37.6
1200	11	1520	39.8

Cantilever-Payload Curve

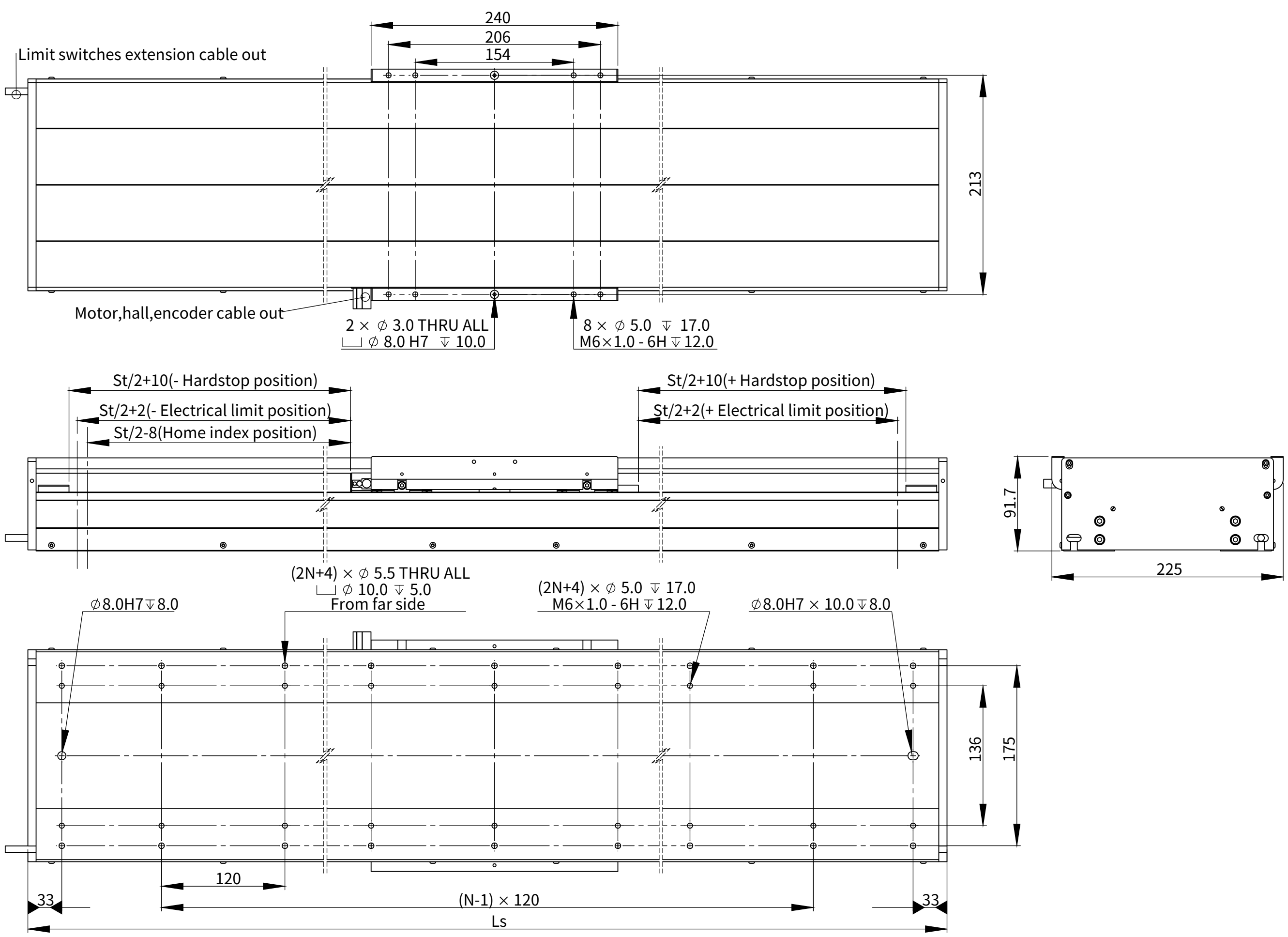


Force-Speed Curve



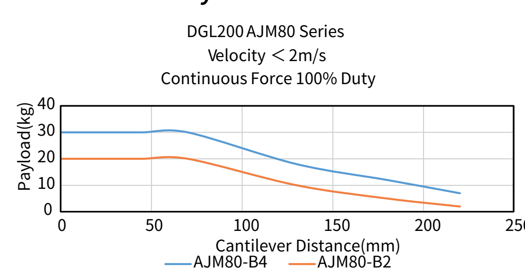


DGL200-AJM80-B4 Dimension Drawing

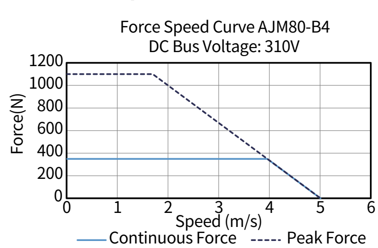


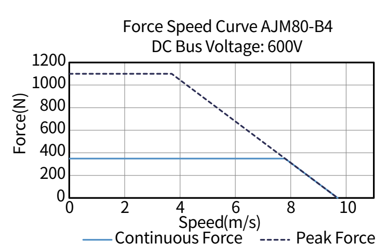
Effective Stroke(mm)	N	Module Length Ls (mm)	Module Mass (kg)
100	3	480	17.8
200	5	580	20.1
300	5	680	22.4
400	5	780	24.8
500	7	880	26.8
600	7	980	29.4
700	9	1080	31.5
800	9	1180	33.8
900	9	1280	36.1
1000	11	1380	38.5
1100	11	1480	40.7
1200	13	1580	43.1

Cantilever-Payload Curve

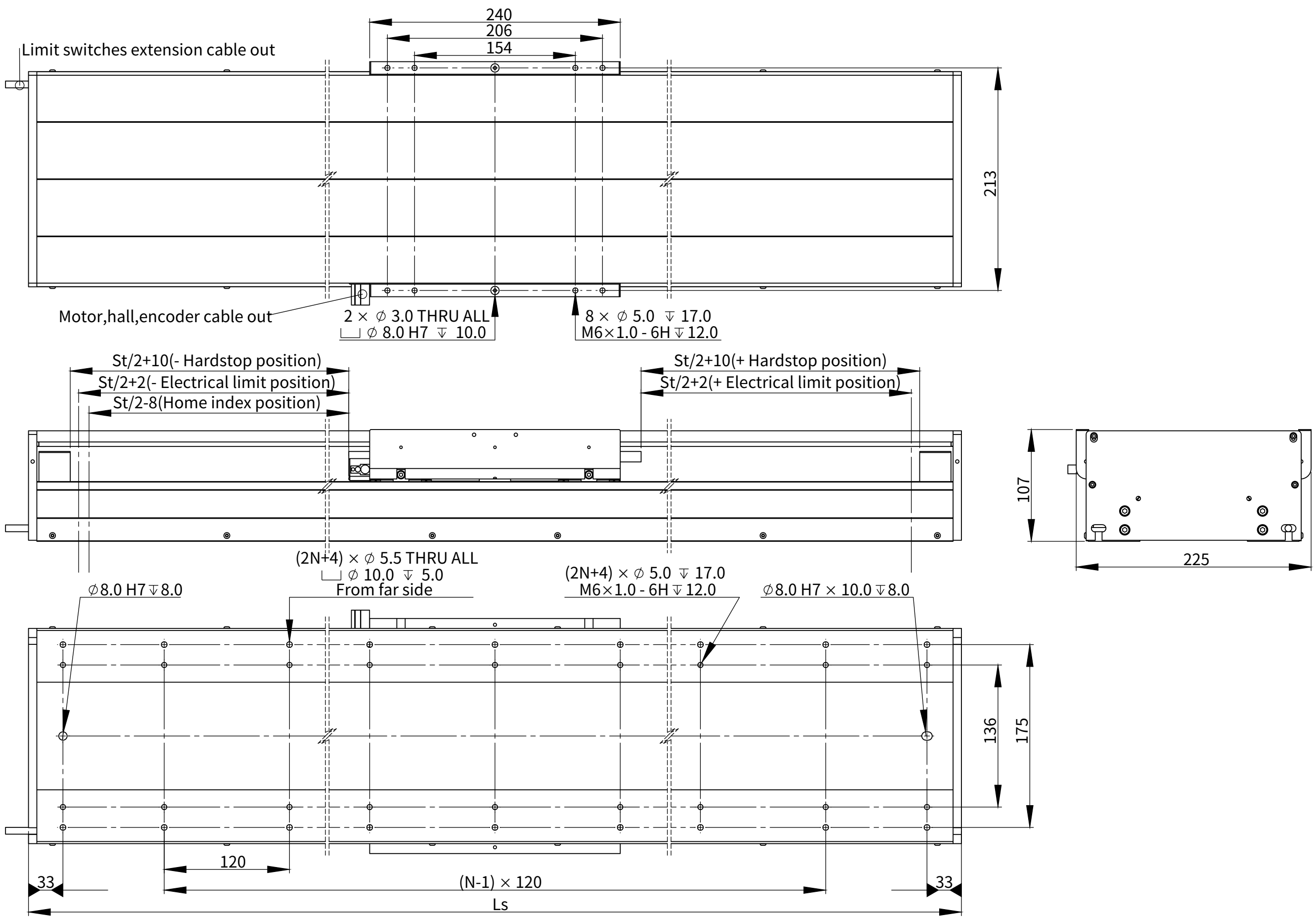


Force-Speed Curve



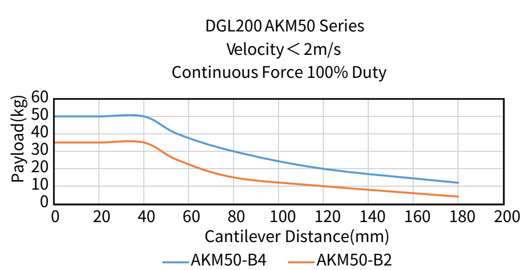


DGL200-AKM50-B2 Dimension Drawing

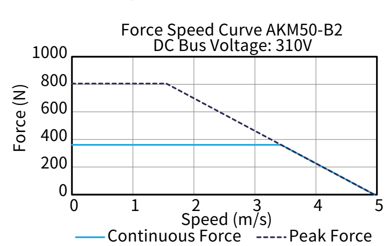


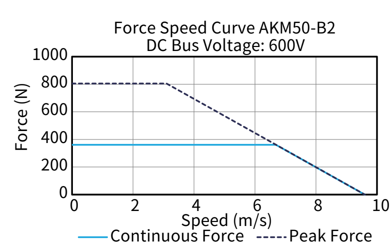
Effective Stroke(mm)	N	Module Length Ls (mm)	Module Mass (kg)
100	3	480	19.8
200	5	580	21.8
300	5	680	24.2
400	5	780	26.2
500	7	880	28.3
600	7	980	30.2
700	9	1080	32.1
800	9	1180	34.6
900	9	1280	36.7
1000	11	1380	38.4
1100	11	1480	40.5
1200	13	1580	42.9

Cantilever-Payload Curve

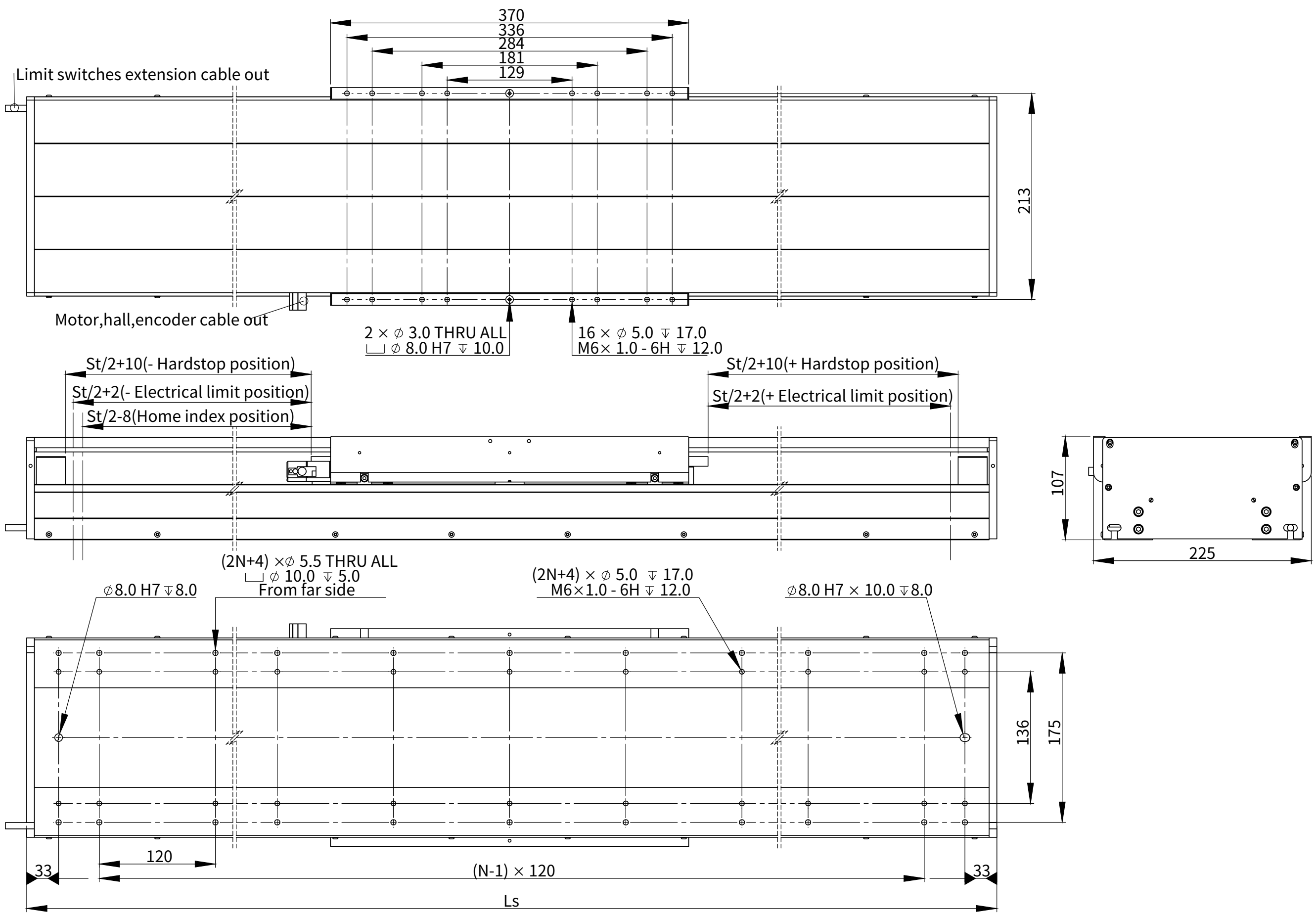


Force-Speed Curve



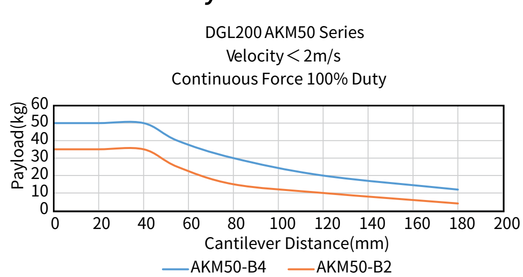


DGL200-AKM50-B4 Dimension Drawing

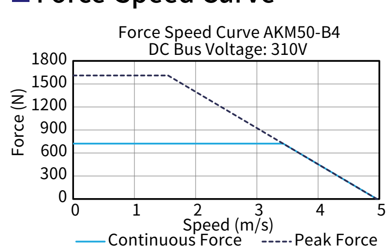


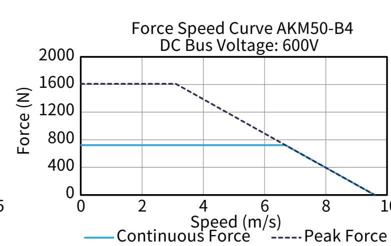
Effective Stroke(mm)	N	Module Length Ls (mm)	Module Mass (kg)
100	5	610	28.4
200	5	710	30.4
300	7	810	32.3
400	7	910	34.4
500	7	1010	36.8
600	9	1110	38.7
700	9	1210	40.6
800	11	1310	42.6
900	11	1410	44.8
1000	11	1510	47.1
1100	13	1610	49.0
1200	13	1710	51.0

Cantilever-Payload Curve



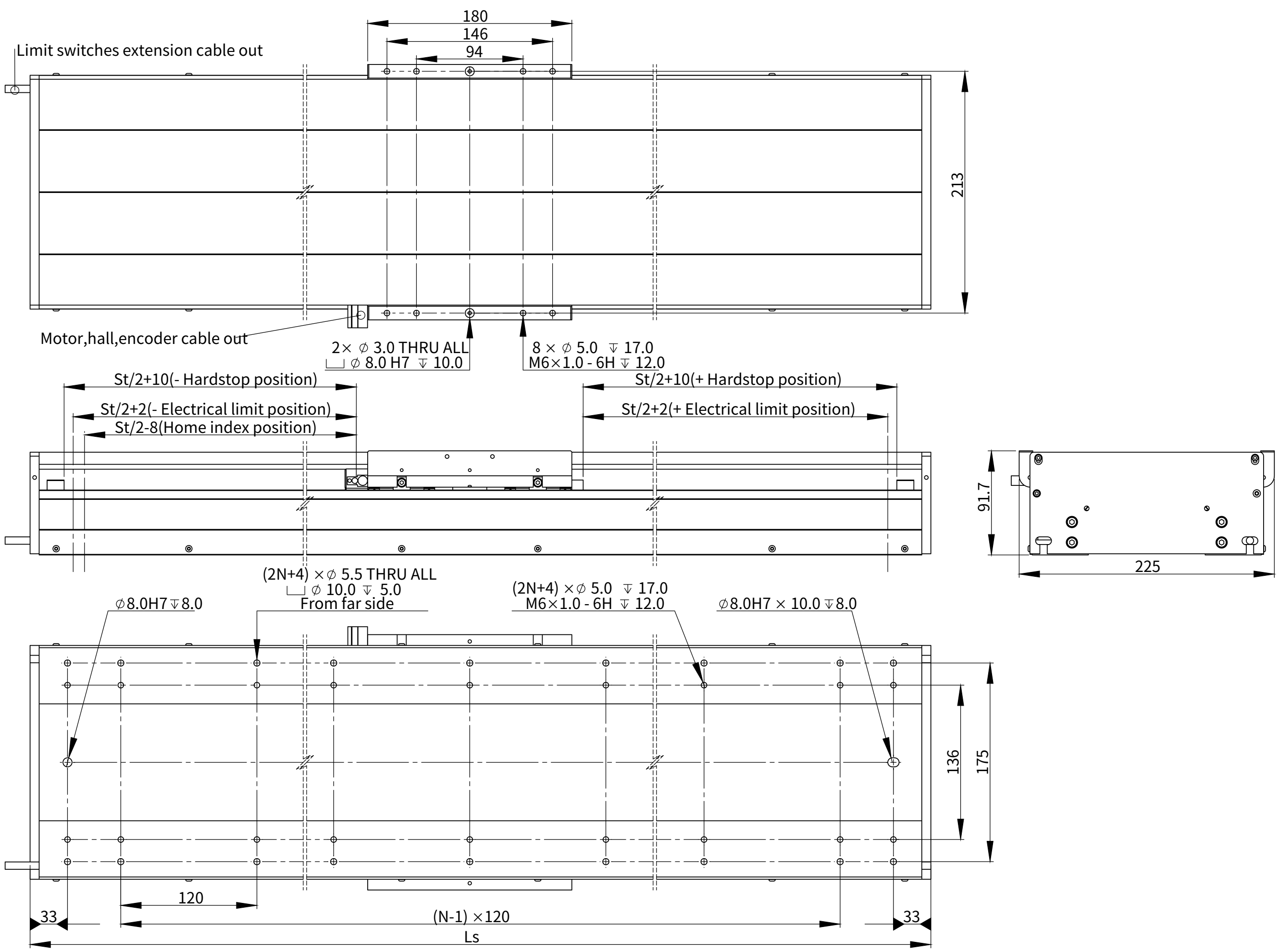
Force-Speed Curve





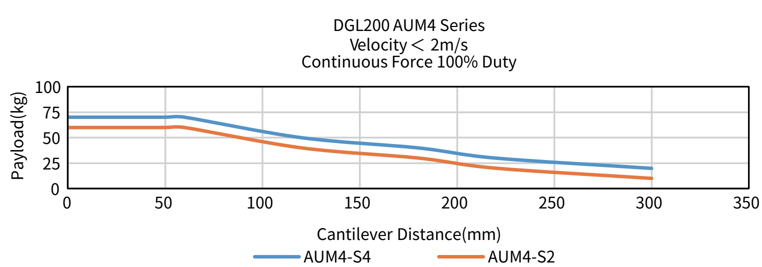
DGL200 Ironless Series

DGL200-AUM4-S2 Dimension Drawing

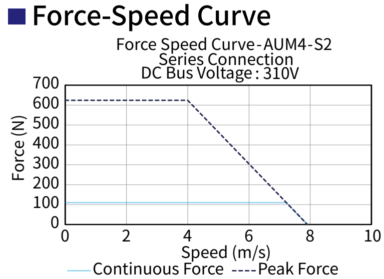


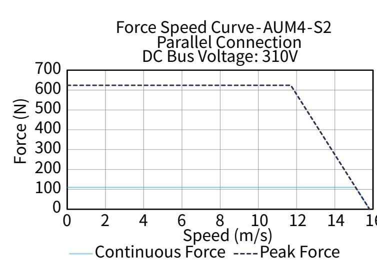
Effective Stroke(mm)	N	Module Length Ls (mm)	Module Mass (kg)
100	3	380	14.6
200	3	480	18.0
300	5	580	20.4
400	5	680	23.8
500	5	780	27.2
600	7	880	29.6
700	7	980	33.0
800	9	1080	36.4
900	9	1180	38.9
1000	9	1280	42.2
1100	11	1380	45.6
1200	11	1480	48.1

Cantilever-Payload Curve

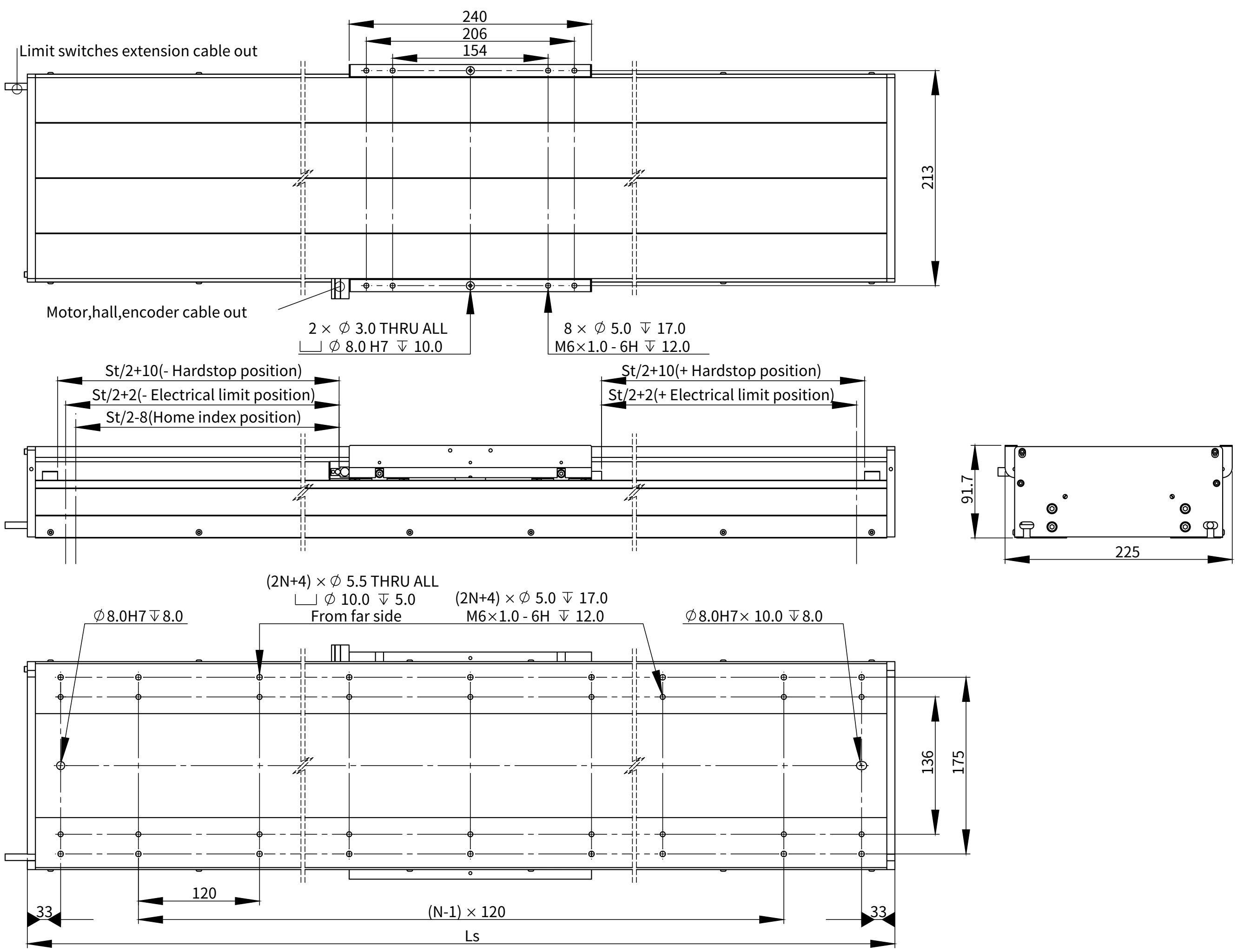


Force-Speed Curve



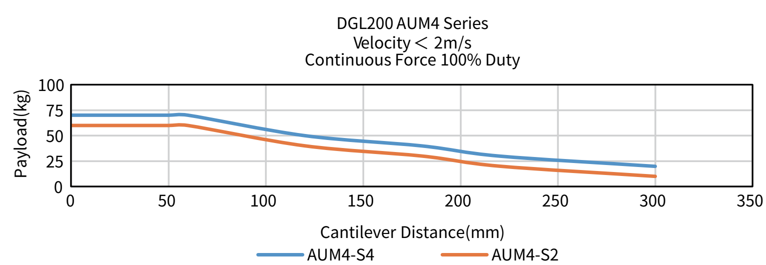


DGL200-AUM4-S4 Dimension Drawing

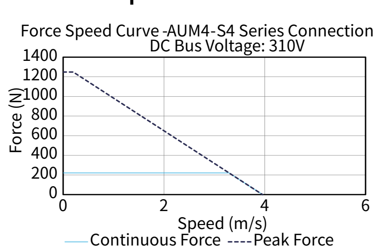


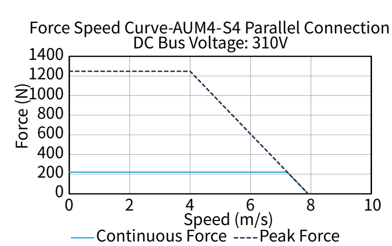
Effective Stroke(mm)	N	Module Length Ls (mm)	Module Mass (kg)
100	3	440	17.6
200	3	540	21.0
300	5	640	23.5
400	5	740	26.9
500	7	840	30.2
600	7	940	32.7
700	7	1040	36.1
800	9	1140	39.4
900	9	1240	41.9
1000	11	1340	45.2
1100	11	1440	48.6
1200	13	1540	51.1

Cantilever-Payload Curve



Force-Speed Curve





Ordering Part Number (OPN)

DGL200 (Ironcore)

DL3 S 01 J30 E73 1 A 1

Model:
- DL3: DGL200

Cover Type:[1]
- S: Standard (Clear Anodized)
- T: Standard (Black Anodized)
- C: Conventional (Clear Anodized)
- D: Conventional (Black Anodized)
- B: Bellow

Effective Stroke:[2]
- 01: 100mm
- 02: 200mm
- 03: 300mm
- 04: 400mm
- 05: 500mm
- 06: 600mm
- 07: 700mm
- 08: 800mm
- 09: 900mm
- 10: 1000mm
- 11: 1100mm
- 12: 1200mm

Motor Type:
- J30: AJM80-B2-J (Peak Force: 550.2N)
- J31: AJM80-B2-K (Peak Force: 550.2N)
- J32: AJM80-B4-J (Peak Force: 1100.4N)
- J33: AJM80-B4-K (Peak Force: 1100.4N)
- K22: AKM50-B2-J (Peak Force: 805.3N)
- K23: AKM50-B2-K (Peak Force: 805.3N)
- K24: AKM50-B4-J (Peak Force: 1610.5N)
- K25: AKM50-B4-K (Peak Force: 1610.5N)

Encoder Type:
- E73: ABA50E EnDat2.2 (0.05µm)
- E71: ABA50M Mitsubish (0.05µm)
- EBF: Quantic (0.5µm)
- EBH: Quantic (0.1µm)
- E9F: ABI51D (0.5µm)
- E9H: ABI51D (0.1µm)
- EA0: ABI52 (SINCOS)

Scale Type:
- 1: Steel tape, 11ppm/K

Cable Length:
- A: 0.5m
- B: 3.0m

Termination:
- 1: Flying Leads
- 2: DSUB

DGL200 (Ironless)

DL3 S 01 U42 E73 1 A 1

Model:
- DL3: DGL200

Cover Type:
- S: Standard (Clear Anodized)
- T: Standard (Black Anodized)
- C: Conventional (Clear Anodized)
- D: Conventional (Black Anodized)
- B: Bellow

Effective Stroke:[2]
- 01: 100mm
- 02: 200mm
- 03: 300mm
- 04: 400mm
- 05: 500mm
- 06: 600mm
- 07: 700mm
- 08: 800mm
- 09: 900mm
- 10: 1000mm
- 11: 1100mm
- 12: 1200mm

Motor Type:
- U42: AUM4-S-S2-J (Peak Force: 624.0N)
- U43: AUM4-S-S2-K (Peak Force: 624.0N)
- U44: AUM4-P-S2-J (Peak Force: 624.0N)
- U45: AUM4-P-S2-K (Peak Force: 624.0N)
- U50: AUM4-S-S4-J (Peak Force: 1248.0N)
- U51: AUM4-S-S4-K (Peak Force: 1248.0N)
- U52: AUM4-P-S4-J (Peak Force: 1248.0N)
- U53: AUM4-P-S4-K (Peak Force: 1248.0N)

Encoder Type:
- E73: ABA50E EnDat2.2 (0.05µm)
- E71: ABA50M Mitsubish (0.05µm)
- EBF: Quantic (0.5µm)
- EBH: Quantic (0.1µm)
- E9F: ABI51D (0.5µm)
- E9H: ABI51D (0.1µm)
- EA0: ABI52 (SINCOS)

Scale Type:
- 1: Steel tape, 11ppm/K

Cable Length:
- A: 0.5m
- B: 3.0m

Termination:
- 1: Flying Leads
- 2: DSUB

Note:
1. No C cover and Bellow cover for AKM50 Series.
2. Standard stroke in intervals of 100mm only, for more options, please contact Akribis sales engineers.

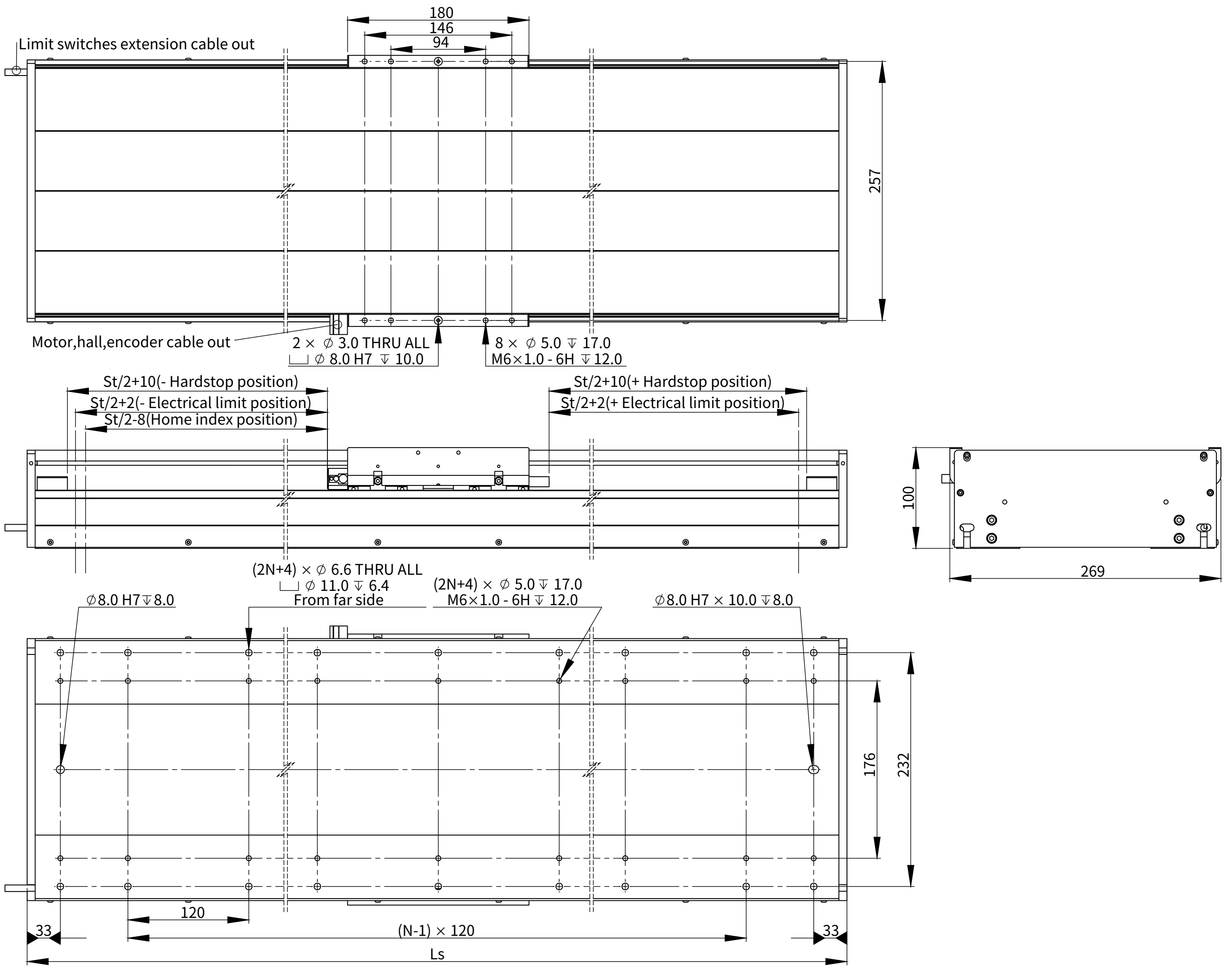
DGL260 Ironcore & Ironless Series

Motor	Unit	DGL260 Ironcore Series				DGL260 Ironless Series	
		AJM100-B2	AJM100-B4	AKM100-B2	AKM100-B4	AUM5-S2	AUM5-S4
Continuous Force	N	223.4	446.8	722.6	1445.3	197.0	393.0
Peak Force	N	704.5	1409.1	1610.5	3221.1	1415.0	2830.0
Effective Stroke	mm	100-1200	100-1200	100-1200	100-1200	100-1200	100-1200
Resolution	µm	0.05/0.1/0.5/SINCOS					
Repeatability	µm	TTL 0.5 Encoder/SINCOS: ±3					
		Absolute 0.05 Encoder: ±1; TTL 0.1 Encoder: ±1					
Horizontal Straightness	µm/mm	10/500	10/500	10/500	10/500	10/500	10/500
Vertical Straightness	µm/mm	20/500	20/500	20/500	20/500	20/500	20/500
No-load Moving Mass	kg	6.1	8.6	12.6	22	6.6	9.9
Rated Payload	kg	50	70	50	70	120	140
Max. Allowable Roll Moment Load	Nm	350	350	350	350	350	350
Max. Allowable Pitch Moment Load	Nm	145	218	350	584	310	545
Max. Allowable Yaw Moment Load	Nm	145	218	350	584	310	545

Note:
- All values are measured based on module fully mounted on a 5µm granite table.
- Values are measured according to Akribis measuring standard.
- All specifications above are standard, contact Akribis for special request.

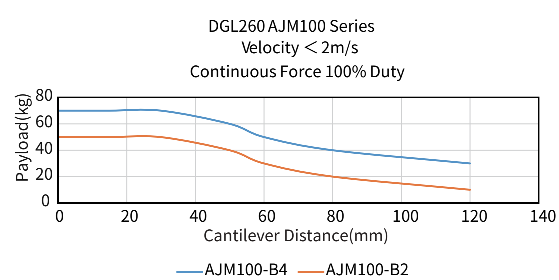
DGL260 Ironcore Series

DGL260-AJM100-B2 Dimension Drawing

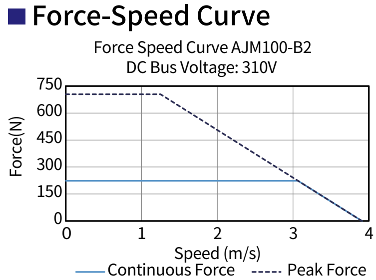


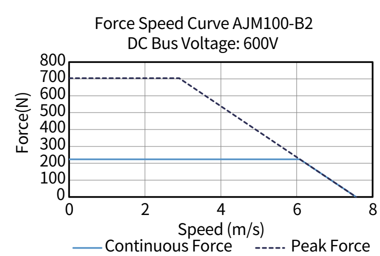
Effective Stroke(m	N	Module Length Ls (mm)	Module Mass (kg)
100	3	420	19.7
200	3	520	22.8
300	5	620	26.1
400	5	720	29.2
500	7	820	32.5
600	7	920	35.7
700	7	1020	39.1
800	9	1120	42.0
900	9	1220	45.5
1000	11	1320	48.5
1100	11	1420	51.9
1200	11	1520	55.0

Cantilever-Payload Curve

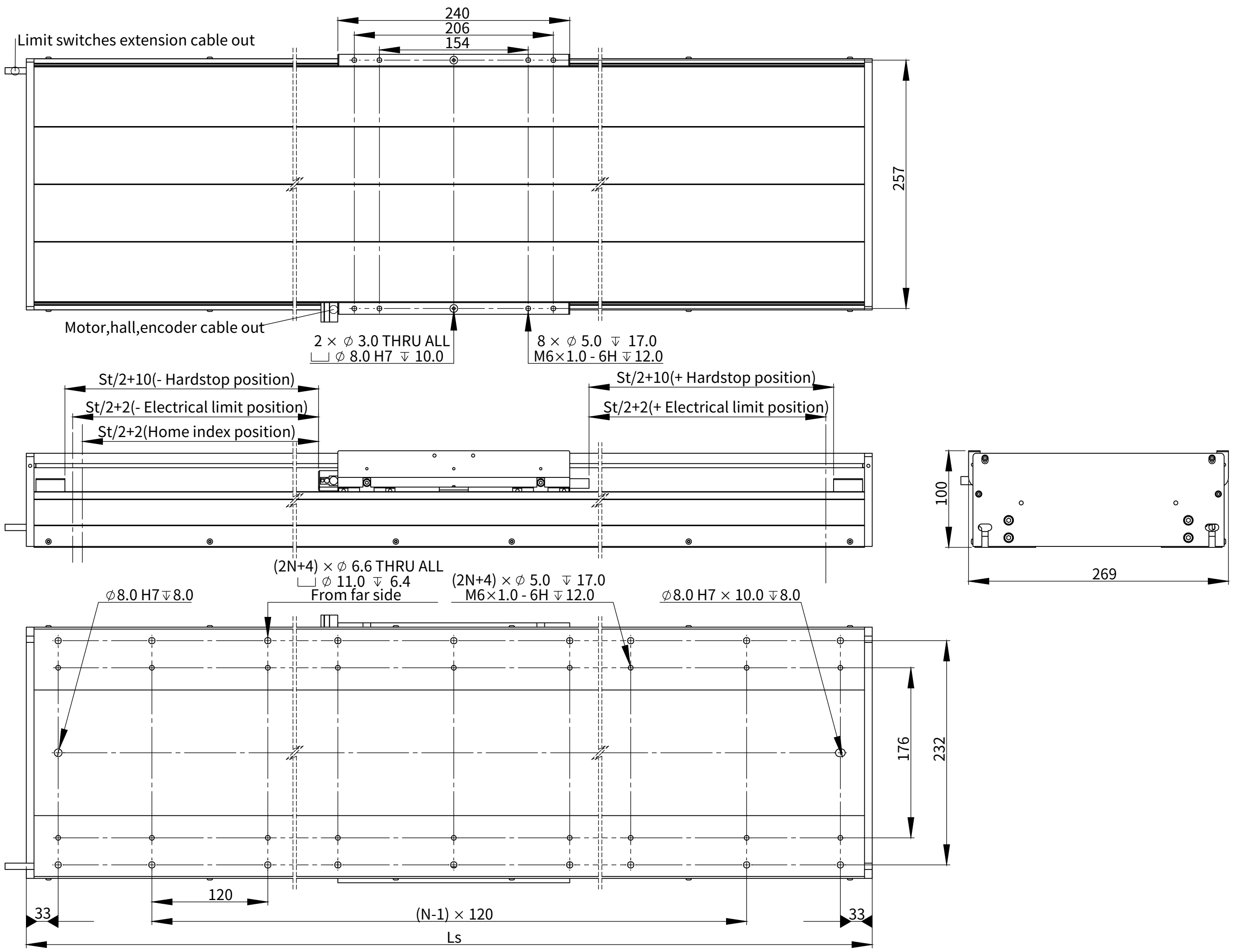


Force-Speed Curve



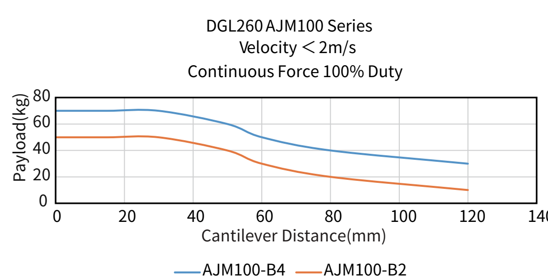


DGL260-AJM100-B4 Dimension Drawing

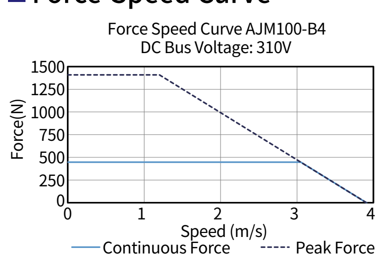


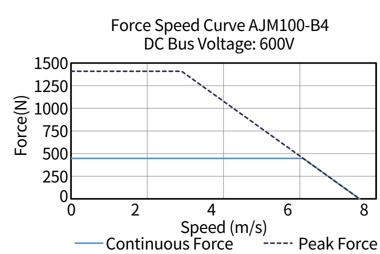
Effective Stroke(mm)	N	Module Length Ls (mm)	Module Mass (kg)
100	3	480	23.8
200	5	580	27.3
300	5	680	30.2
400	5	780	33.6
500	7	880	36.7
600	7	980	40.1
700	9	1080	43.2
800	9	1180	46.5
900	9	1280	49.6
1000	11	1380	53.0
1100	11	1480	56.1
1200	13	1580	59.4

Cantilever-Payload Curve

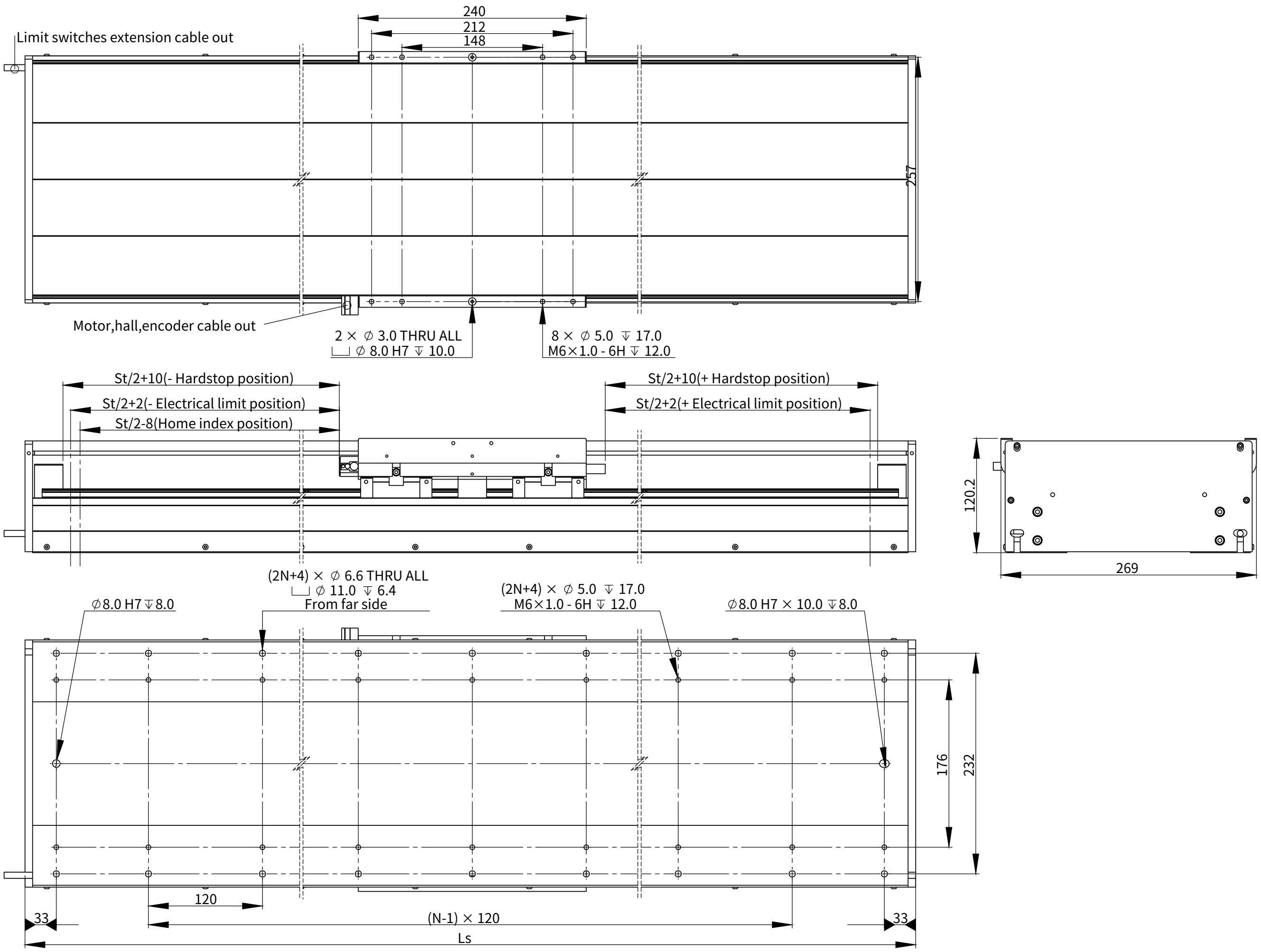


Force-Speed Curve



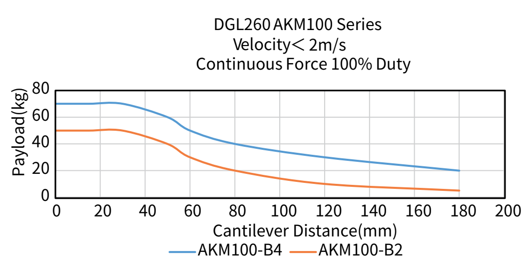


DGL260-AKM100-B2 Dimension Drawing

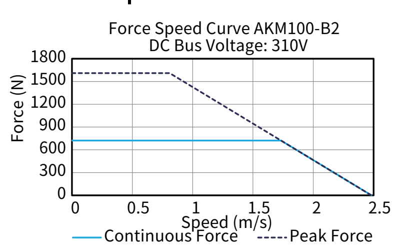


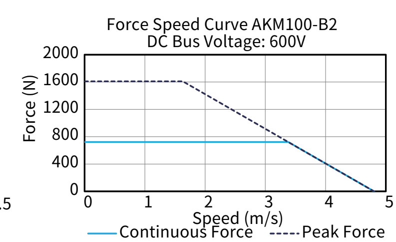
Effective Stroke(mm)	N	Module Length Ls (mm)	Module Mass (kg)
100	3	480	30.8
200	5	580	34.2
300	5	680	38.3
400	5	780	41.9
500	7	880	45.2
600	7	980	48.6
700	9	1080	52.1
800	9	1180	56.2
900	9	1280	59.6
1000	11	1380	63.2
1100	11	1480	66.5
1200	13	1580	70.0

Cantilever-Payload Curve

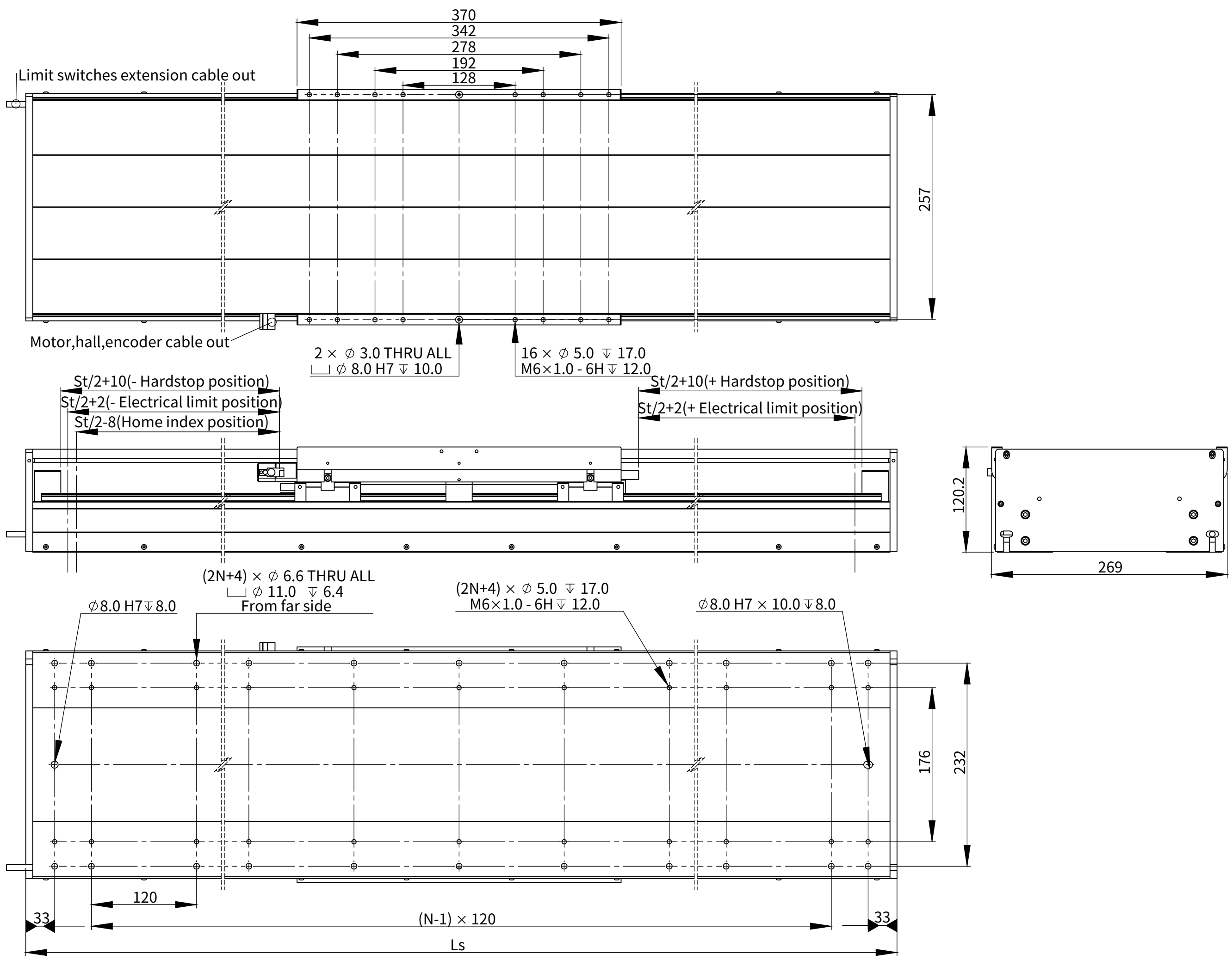


Force-Speed Curve



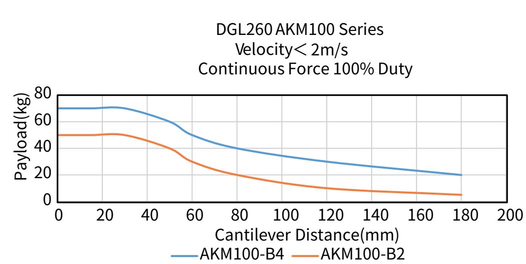


DGL260-AKM100-B4 Dimension Drawing

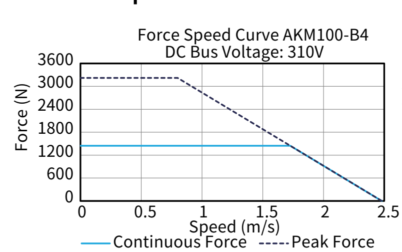


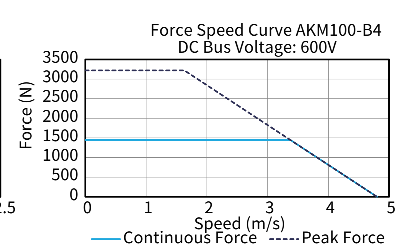
Effective Stroke(mm)	N	Module Length Ls (mm)	Module Mass (kg)
100	5	610	44.5
200	5	710	47.9
300	5	810	51.3
400	7	910	54.7
500	7	1010	58.9
600	9	1110	62.3
700	9	1210	65.7
800	11	1310	69.1
900	11	1410	72.6
1000	11	1510	76.7
1100	13	1610	80.1
1200	13	1710	83.6

Cantilever-Payload Curve



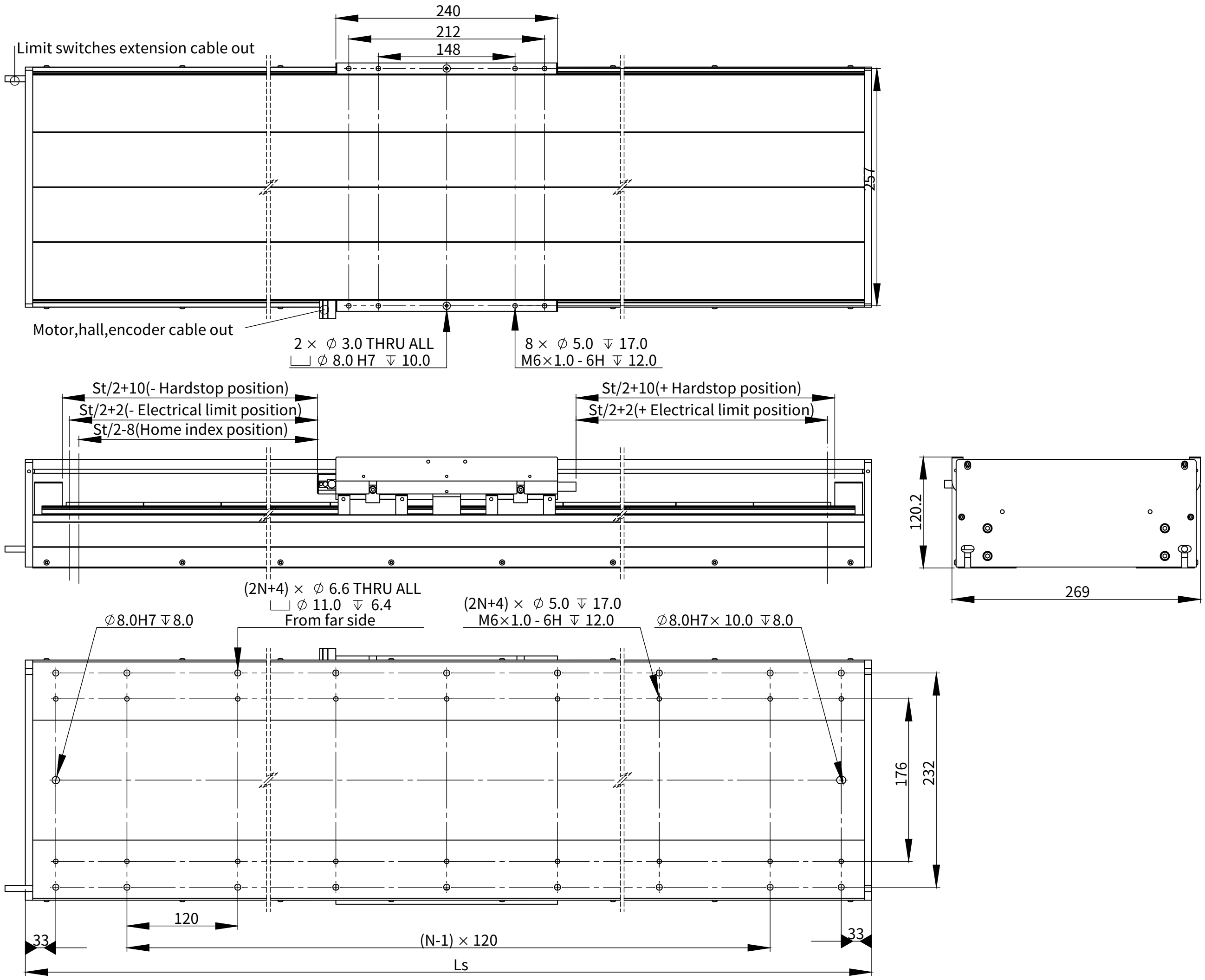
Force-Speed Curve





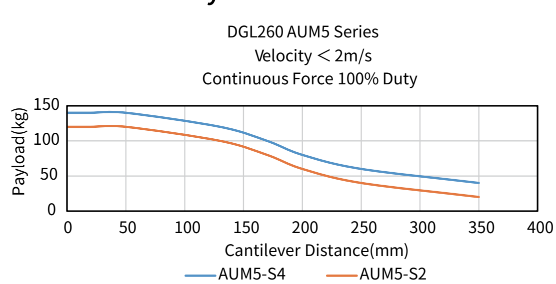
DGL260 Ironless Series

DGL260-AUM5-S2 Dimension Drawing

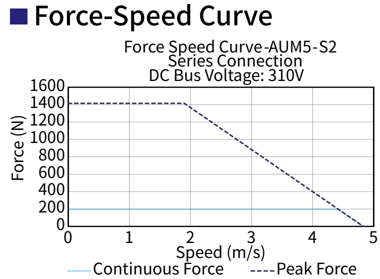


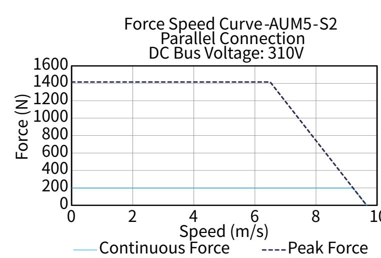
Effective Stroke(mm)	N	Module Length Ls (mm)	Module Mass (kg)
100	3	480	30.4
200	5	580	35.3
300	5	680	42.3
400	5	780	47.2
500	7	880	52.0
600	7	980	56.8
700	9	1080	61.7
800	9	1180	68.8
900	9	1280	73.6
1000	11	1380	78.5
1100	11	1480	83.3
1200	13	1580	88.2

Cantilever-Payload Curve

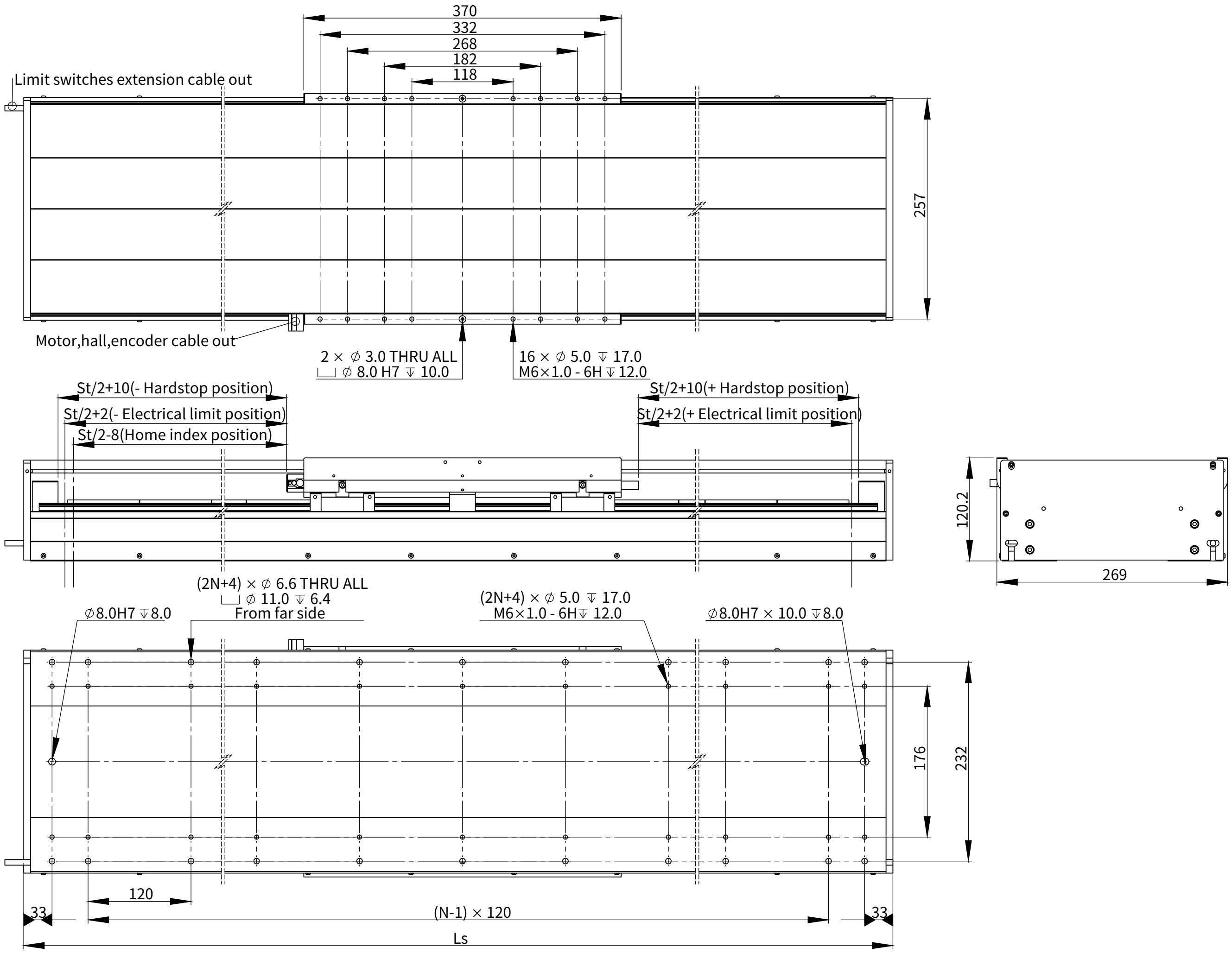


Force-Speed Curve



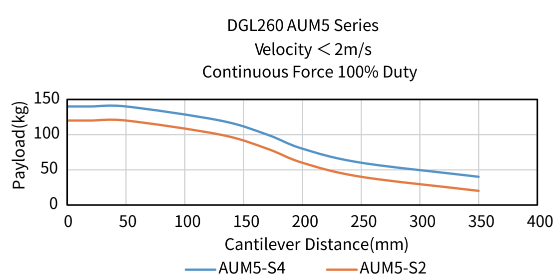


DGL260-AUM5-S4 Dimension Drawing

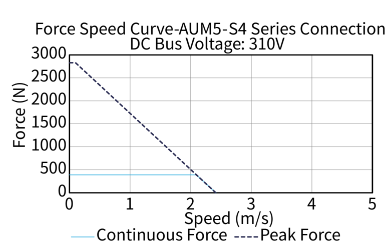


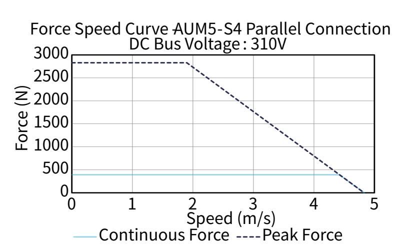
Effective Stroke(mm)	N	Module Length Ls (mm)	Module Mass (kg)
100	5	610	41.5
200	5	710	46.3
300	5	810	51.3
400	7	910	56.1
500	7	1010	63.2
600	9	1110	68.0
700	9	1210	72.9
800	11	1310	77.8
900	11	1410	84.7
1000	11	1510	89.6
1100	13	1610	94.4
1200	13	1710	99.3

Cantilever-Payload Curve



Force-Speed Curve





Ordering Part Number (OPN)

DGL260 (Ironcore)

DL4 S 01 J45 E73 1 A 1

Model:
- DL4: DGL260

Cover Type:[1]
- S: Standard (Clear Anodized)
- T: Standard (Black Anodized)
- B: Bellow

Effective Stroke:[2]
- 01: 100mm
- 02: 200mm
- 03: 300mm
- 04: 400mm
- 05: 500mm
- 06: 600mm
- 07: 700mm
- 08: 800mm
- 09: 900mm
- 10: 1000mm
- 11: 1100mm
- 12: 1200mm

Motor Type:
- J45: AJM100-B2-J (Peak Force: 704.5N)
- J46: AJM100-B2-K (Peak Force: 704.5N)
- J47: AJM100-B4-J (Peak Force: 1409.1N)
- J48: AJM100-B4-K (Peak Force: 1409.1N)
- K42: AKM100-B2-J (Peak Force: 1610.5N)
- K43: AKM100-B2-K (Peak Force: 1610.5N)
- K44: AKM100-B4-J (Peak Force: 3221.1N)
- K45: AKM100-B4-K (Peak Force: 3221.1N)

Encoder Type:
- E73: ABA50E EnDat2.2 (0.05µm)
- E71: ABA50M Mitsubish (0.05µm)
- EBF: Quantic (0.5µm)
- EBH: Quantic (0.1µm)
- E9F: ABI51D (0.5µm)
- E9H: ABI51D (0.1µm)
- EA0: ABI52 (SINCOS)

Scale Type:
- 1: Steel tape, 11ppm/K

Cable Length:
- A: 0.5m
- B: 3.0m

Termination:
- 1: Flying Leads
- 2: DSUB

DGL260 (Ironless)

DL4 S 01 U72 E73 1 A 1

Model:
- DL4: DGL260

Cover Type:
- S: Standard (Clear Anodized)
- T: Standard (Black Anodized)
- B: Bellow

Effective Stroke:[2]
- 01: 100mm
- 02: 200mm
- 03: 300mm
- 04: 400mm
- 05: 500mm
- 06: 600mm
- 07: 700mm
- 08: 800mm
- 09: 900mm
- 10: 1000mm
- 11: 1100mm
- 12: 1200mm

Motor Type:
- U72: AUM5-S-S2-J (Peak Force: 1415.0N)
- U73: AUM5-S-S2-K (Peak Force: 1415.0N)
- U74: AUM5-P-S2-J (Peak Force: 1415.0N)
- U75: AUM5-P-S2-K (Peak Force: 1415.0N)
- U80: AUM5-S-S4-J (Peak Force: 2830.0N)
- U81: AUM5-S-S4-K (Peak Force: 2830.0N)
- U82: AUM5-P-S4-J (Peak Force: 2830.0N)
- U83: AUM5-P-S4-K (Peak Force: 2830.0N)

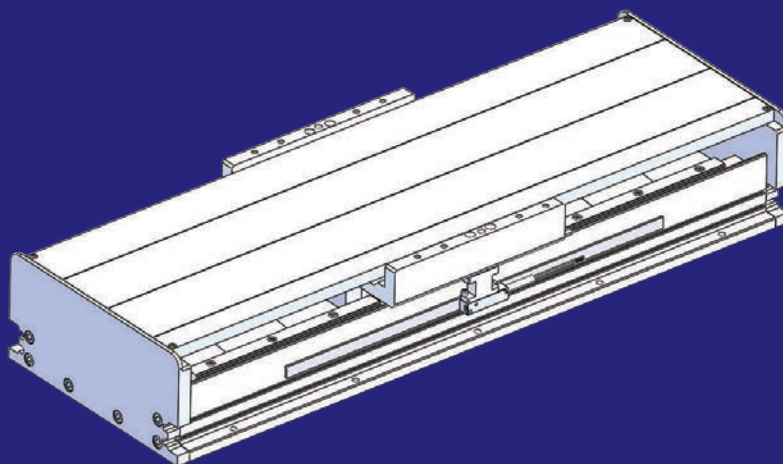
Encoder Type:
- E73: ABA50E EnDat2.2 (0.05µm)
- E71: ABA50M Mitsubish (0.05µm)
- EBF: Quantic (0.5µm)
- EBH: Quantic (0.1µm)
- E9F: ABI51D (0.5µm)
- E9H: ABI51D (0.1µm)
- EA0: ABI52 (SINCOS)

Scale Type:
- 1: Steel tape, 11ppm/K

Cable Length:
- A: 0.5m
- B: 3.0m

Termination:
- 1: Flying Leads
- 2: DSUB

Note:
1. No Bellow cover for AJM100 Series.
2. Standard stroke in intervals of 100mm only, for more options, please contact Akribis sales engineers.



DGC SERIES

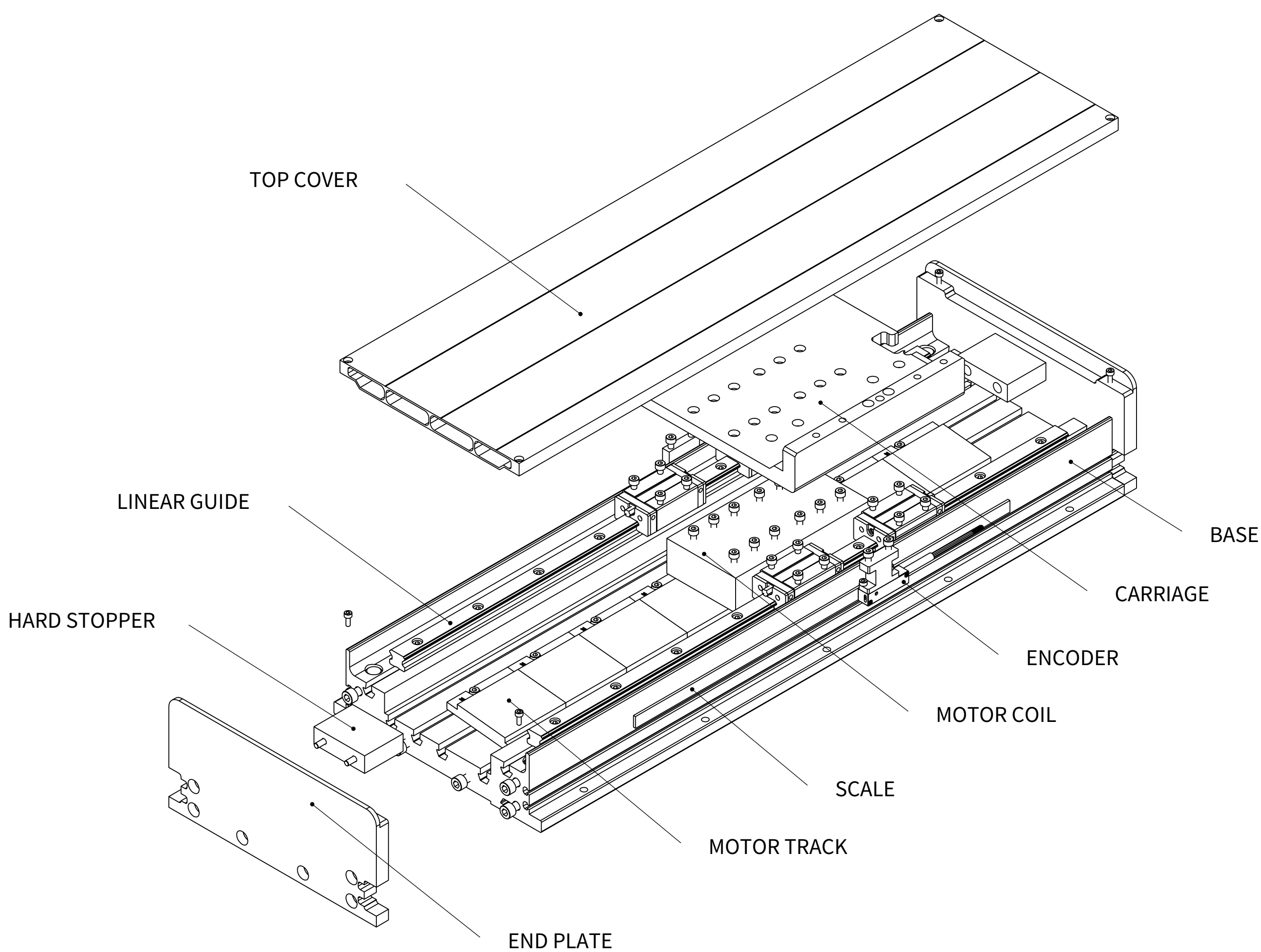
- Linear motor positioning system
- Short lead time
- High price-performance ratio
- Easy installation

DGC205 Series

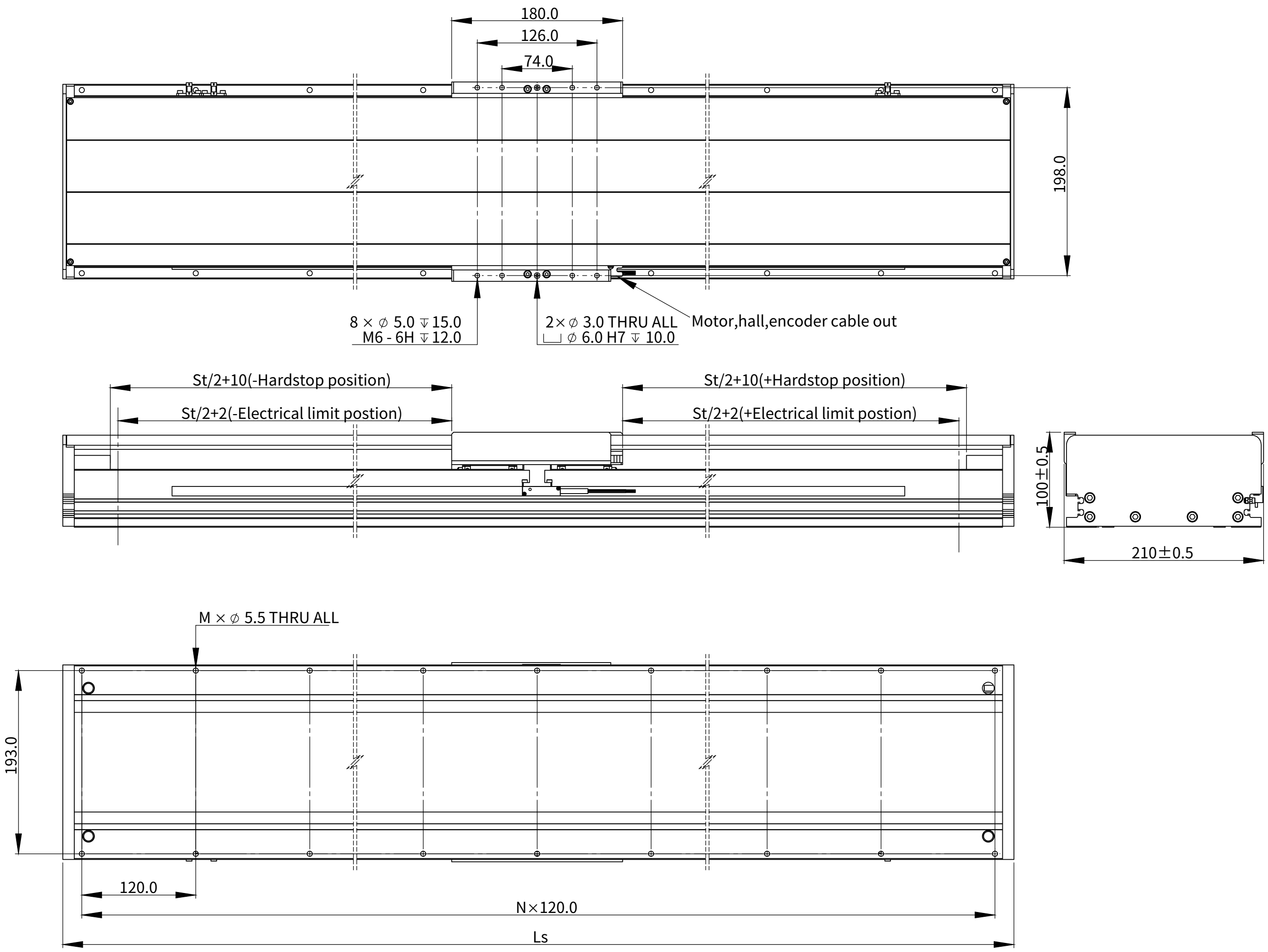
Module Model	Unit	DGC205-AQM50-B1	DGC205-AQM50-B2	DGC205-AQM80-B1	DGC205-AQM80-B2
Continuous Force	N	126.6	253.1	202.5	405.0
Peak Force	N	318.9	637.9	510.3	1020.6
Effective Stroke	mm	100~1100	100~1100	100~1100	100~1100
Encoder Resolution[1]	μm	0.5, 1.0	0.5, 1.0	0.5, 1.0	0.5, 1.0
Repeatability	μm	0.5 Resolution: ±5; 1.0 Resolution: ±10			
Straightness	μm/mm	±10/300	±10/300	±10/300	±10/300
Max Speed	m/s	2	2	2	2
No-load Moving Mass	kg	3.3	5.6	3.9	6.8

[1] 0.5 μm resolution: TTL digital optical scale, 1.0 μm resolution: TTL digital magnetic scale.

Exploded View

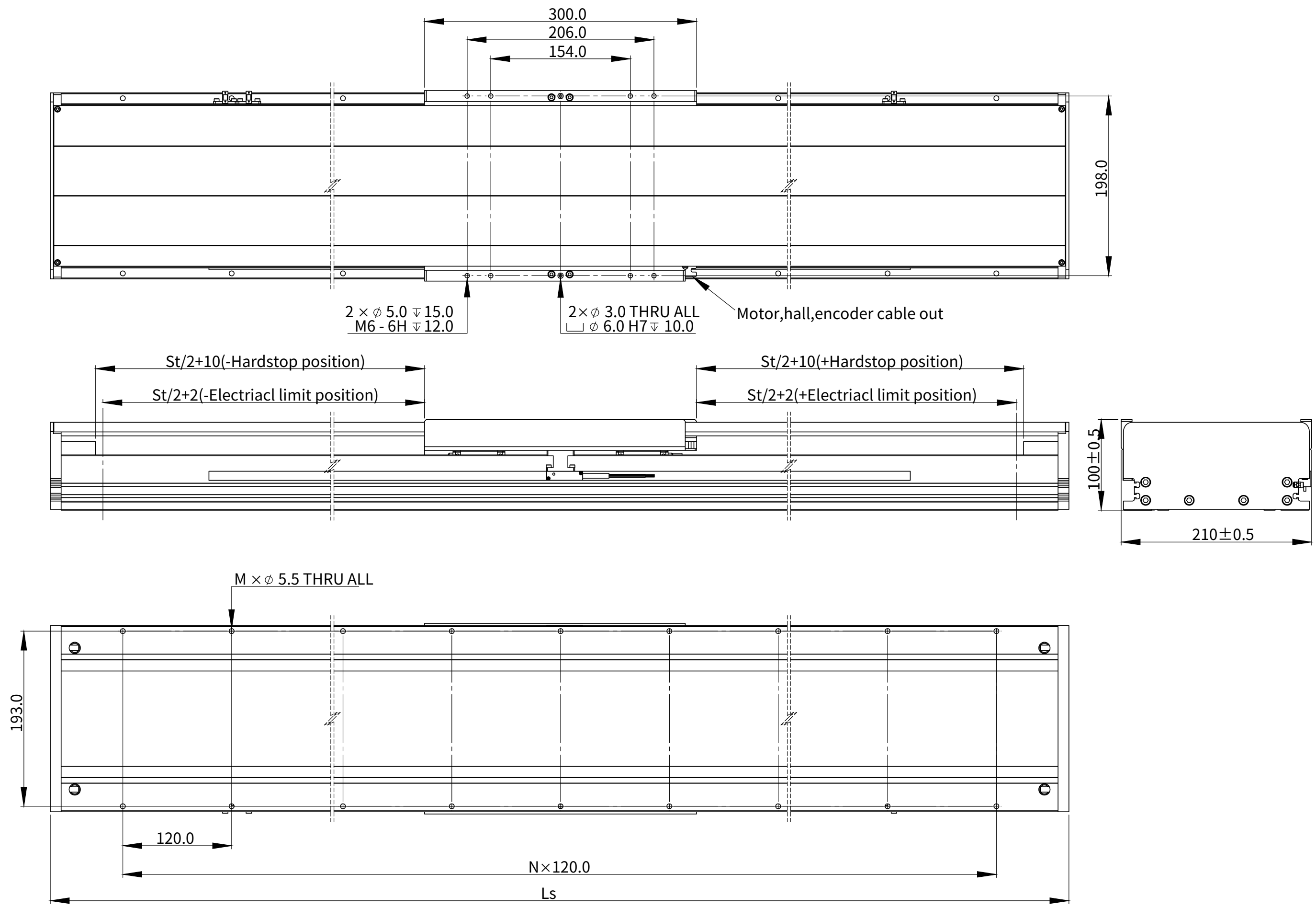


DGC205-B1 Dimension Drawing



Effective Stroke(mm)	Module Length Ls (mm)	N	M	Module Mass (kg)	
				DGC205-AQM50-B1	DGC205-AQM80-B1
100	400	2	6	14	15
200	500	2	6	16	17
300	600	4	10	18	19
400	700	4	10	20	22
500	800	6	14	23	25
600	900	6	14	25	27
700	1000	8	18	28	30
800	1100	8	18	30	32
900	1200	8	18	32	34
1000	1300	10	22	34	37
1100	1400	10	22	37	40

DGC205-B2 Dimension Drawing



Effective Stroke(mm)	Module Length Ls (mm)	N	M	Module Mass (kg)	
				DGC205-AQM50-B2	DGC205-AQM80-B2
100	520	4	10	18	20
200	620	4	10	21	23
300	720	4	10	23	25
400	820	6	14	25	28
500	920	6	14	28	30
600	1020	8	18	30	33
700	1120	8	18	32	35
800	1220	8	18	35	38
900	1320	10	22	37	40
1000	1420	10	22	40	43
1100	1520	12	26	42	45

Ordering Part Number (OPN)

DC1 S 01 Q30 E0F 1 A 1

Model:
- DC1: DGC205

Cover Type:
- S: Standard (Clear Anodized)

Effective Stroke:[1]
- 01: 100mm
- 02: 200mm
- 03: 300mm
- 04: 400mm
- 05: 500mm
- 06: 600mm
- 07: 700mm
- 08: 800mm
- 09: 900mm
- 10: 1000mm
- 11: 1100mm

Motor Type:
- Q30: AQM50-B1-J (Peak Force: 318.9N)
- Q31: AQM50-B1-K (Peak Force: 318.9N)
- Q32: AQM50-B2-J (Peak Force: 637.9N)
- Q33: AQM50-B2-K (Peak Force: 637.9N)
- Q40: AQM80-B1-J (Peak Force: 510.3N)
- Q41: AQM80-B1-K (Peak Force: 510.3N)
- Q42: AQM80-B2-J (Peak Force: 1020.6N)
- Q43: AQM80-B2-K (Peak Force: 1020.6N)

Encoder Type:
- E0F: ABI-21 (0.5µm)
- EDE: LEC200 (1.0µm)

Scale Type:
- 1: Steel tape, 11ppm/K
- 7: Magnetic Tape, 17ppm/K

Cable Length:
- A: 0.5m

Termination:
- 1: Flying Leads
- 2: DSUB

Note:
[1] Standard stroke in intervals of 100mm only, for more options, please contact Akribis sales engineers.

XRL SERIES

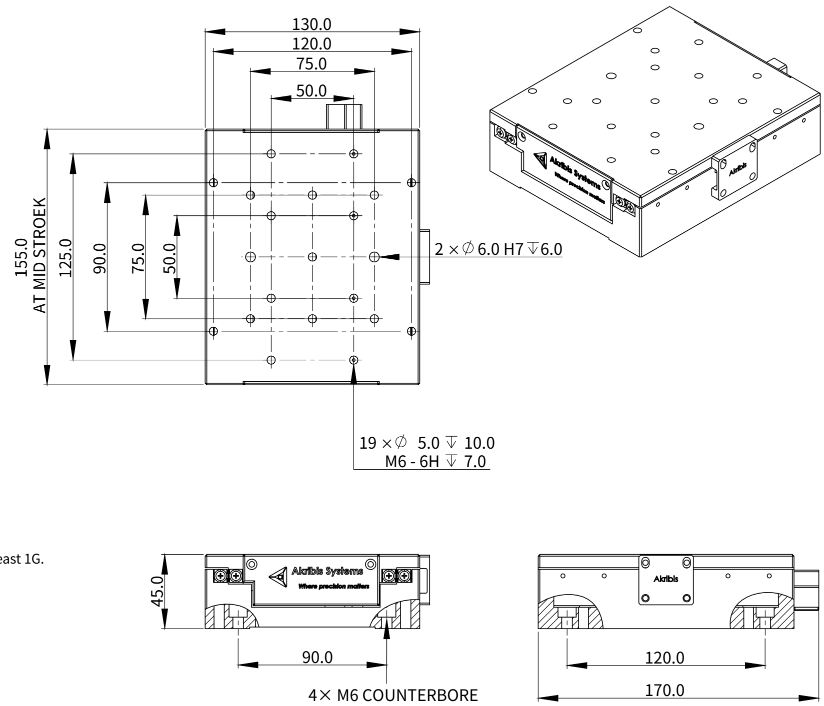
- Suitable for smooth movement
- Quick response, Short settling time
- Low friction
- High precision

XRL130-35

Specifications	Unit	Value
Effective Stroke	mm	35
Continuous Force	N	26.4
Peak Force	N	132.0
Resolution	µm	QT: 0.1
		TN: SINCOS
Bidirectional Repeatability	µm	QT: ±0.3
		TONIC: ±0.1 (4096X Interpolation)
Straightness	µm	±2.0
Flatness	µm	±2.5
Rated Payload[1]	kg	3.5
No-load Moving Mass	kg	1.2
No-load Total Mass	kg	2.3
Max. Allowable Horizonal Mounting Load	kg	12
Max. Allowable Side Mounting Load	kg	10
Max. Allowable Roll Moment Load	Nm	29.0
Max. Allowable Pitch Moment Load	Nm	29.9
Max. Allowable Yaw Moment Load	Nm	36.3

[1] The rated load is based on the load in which the acceleration of the mass is at least 1G.

Dimension Drawing

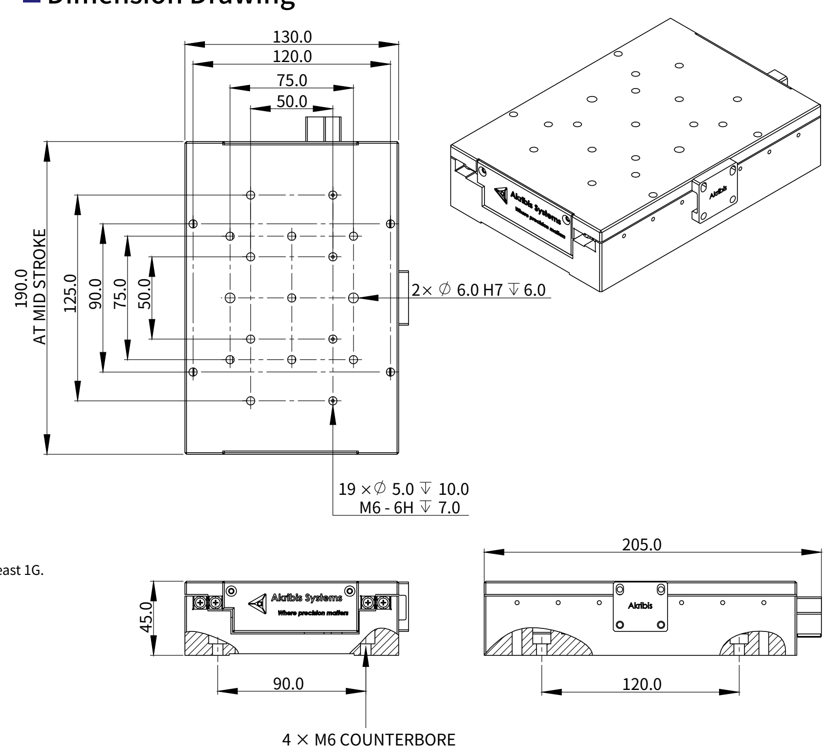


XRL130-60

Specifications	Unit	Value
Effective Stroke	mm	60
Continuous Force	N	26.4
Peak Force	N	132.0
Resolution	µm	QT: 0.1
		TN: SINCOS
Bidirectional Repeatability	µm	QT: ±0.3
		TONIC: ±0.1 (4096X Interpolation)
Straightness	µm	±2.0
Flatness	µm	±2.5
Rated Payload[1]	kg	4
No-load Moving Mass	kg	1.4
No-load Total Mass	kg	2.6
Max. Allowable Horizonal Mounting Load	kg	12
Max. Allowable Side Mounting Load	kg	10
Max. Allowable Roll Moment Load	Nm	35.3
Max. Allowable Pitch Moment Load	Nm	42.7
Max. Allowable Yaw Moment Load	Nm	51.9

[1] The rated load is based on the load in which the acceleration of the mass is at least 1G.

Dimension Drawing

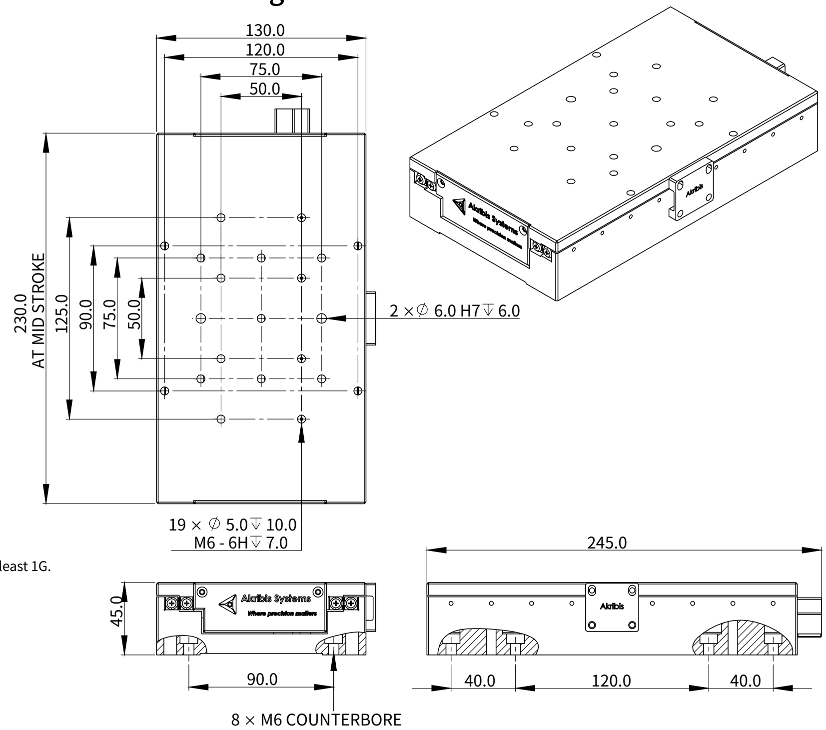


XRL130-110

Specifications	Unit	Value
Effective Stroke	mm	110
Continuous Force	N	26.4
Peak Force	N	132.0
Resolution	µm	QT: 0.1
		TN: SINCOS
Bidirectional Repeatability	µm	QT: ±0.3
		TONIC: ±0.1 (4096X Interpolation)
Straightness	µm	±2.0
Flatness	µm	±2.5
Rated Payload[1]	kg	5
No-load Moving Mass	kg	1.9
No-load Total Mass	kg	3.5
Max. Allowable Horizonal Mounting Load	kg	12
Max. Allowable Side Mounting Load	kg	10
Max. Allowable Roll Moment Load	Nm	41.4
Max. Allowable Pitch Moment Load	Nm	60.9
Max. Allowable Yaw Moment Load	Nm	73.9

[1] The rated load is based on the load in which the acceleration of the mass is at least 1G.

■ Dimension Drawing

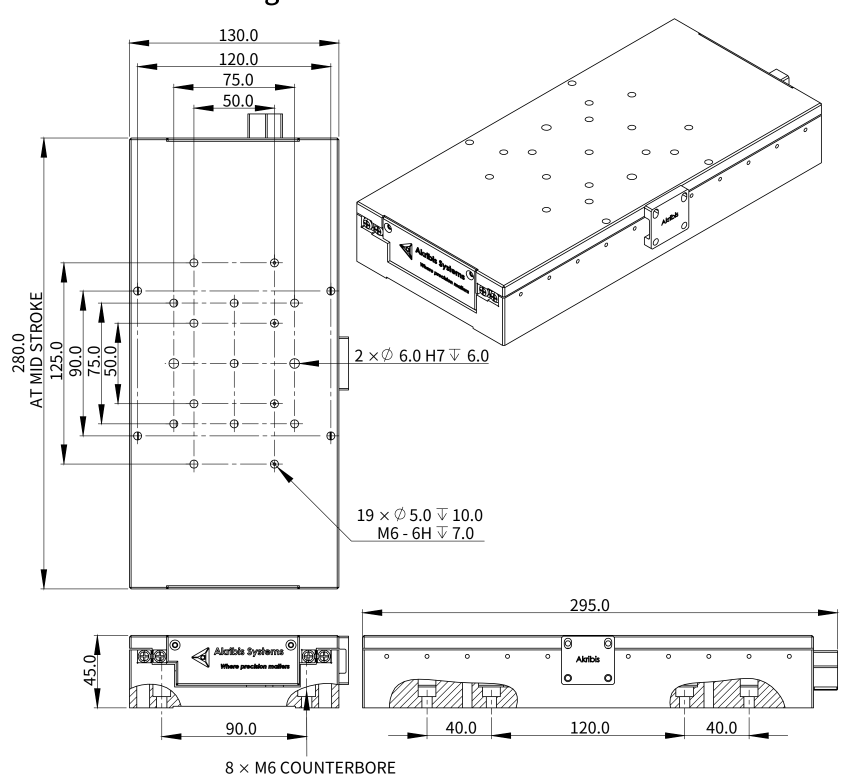


XRL130-160

Specifications	Unit	Value
Effective Stroke	mm	160
Continuous Force	N	26.4
Peak Force	N	132.0
Resolution	µm	QT: 0.1
		TN: SINCOS
Bidirectional Repeatability	µm	QT: ±0.3
		TONIC: ±0.1 (4096X Interpolation)
Straightness	µm	±2.0
Flatness	µm	±2.5
Rated Payload[1]	kg	5
No-load Moving Mass	kg	2.3
No-load Total Mass	kg	3.9
Max. Allowable Horizonal Mounting Load	kg	12
Max. Allowable Side Mounting Load	kg	10
Max. Allowable Roll Moment Load	Nm	64.2
Max. Allowable Pitch Moment Load	Nm	88.4
Max. Allowable Yaw Moment Load	Nm	107.3

[1] The rated load is based on the load in which the acceleration of the mass is at least 1G.

■ Dimension Drawing

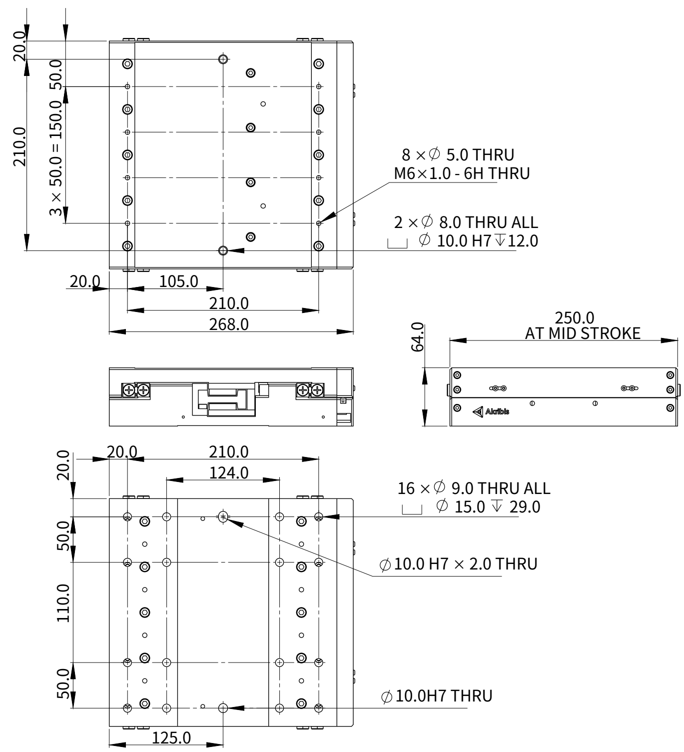


XRL250-100-S2 / XRL250-50-S3

XRL250			
Specifications	Unit	S2	S3
Effective Stroke	mm	100	50
Motor	-	AUM3-S2	AUM3-S3
Continuous Force	N	57.0	85.0
Peak Force	N	289.0	433.0
Resolution	µm	ABI21: 0.5/0.2	
		AT2: 0.2/0.05	
Bidirectional Repeatability	µm	ABI21-0.5: ±2	
		ABI21-0.2: ±1	
		AT2-0.2: ±1	
		AT2-0.05: ±0.5	
Straightness	µm	±3.0	±3.0
Flatness	µm	±3.5	±3.5
Rated Payload[1]	kg	8.0	9.0
No-load Moving Mass	kg	6.0	6.0
No-load Total Mass	kg	12.5	13.0
Max. Allowable Horizonal Mounting Load	kg	30	30
Max. Allowable Side Mounting Load	kg	26	26
Max. Allowable Roll Moment Load	Nm	233.3	233.3
Max. Allowable Pitch Moment Load	Nm	208.8	208.8
Max. Allowable Yaw Moment Load	Nm	253.6	253.6

[1] The rated load is based on the load in which the acceleration of the mass is at least 1G.

Dimension Drawing

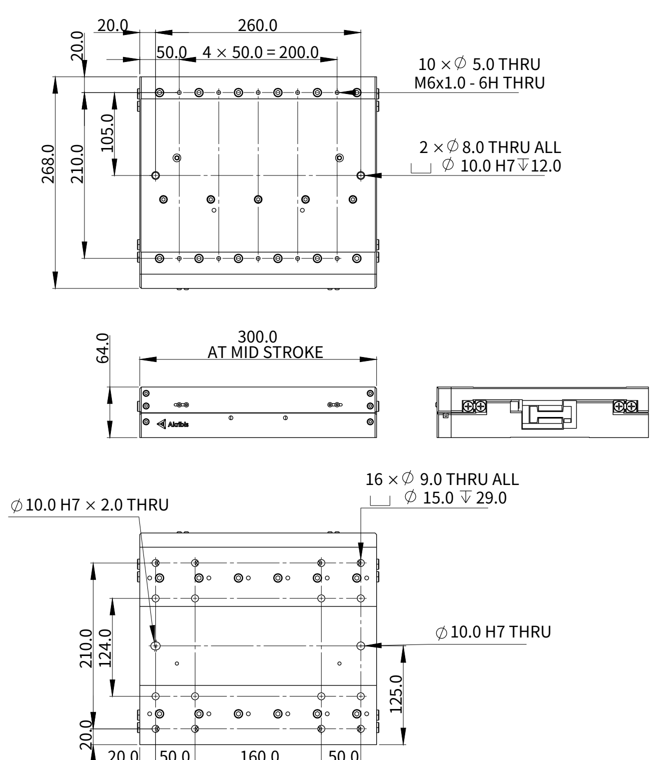


XRL250-150-S2 / XRL250-100-S3

XRL250			
Specifications	Unit	S2	S3
Effective Stroke	mm	150	100
Motor	-	AUM3-S2	AUM3-S3
Continuous Force	N	57.0	85.0
Peak Force	N	289.0	433.0
Resolution	µm	ABI21: 0.5/0.2	
		AT2: 0.2/0.05	
Bidirectional Repeatability	µm	ABI21-0.5: ±2	
		ABI21-0.2: ±1	
		AT2-0.2: ±1	
		AT2-0.05: ±0.5	
Straightness	µm	±3.0	±3.0
Flatness	µm	±3.5	±3.5
Rated Payload[1]	kg	9.0	10.0
No-load Moving Mass	kg	7.20	7.2.0
No-load Total Mass	kg	15.0	15.5
Max. Allowable Horizonal Mounting Load	kg	30	30
Max. Allowable Side Mounting Load	kg	26	26
Max. Allowable Roll Moment Load	Nm	292.1	292.1
Max. Allowable Pitch Moment Load	Nm	321.1	321.1
Max. Allowable Yaw Moment Load	Nm	390.0	390.0

[1] The rated load is based on the load in which the acceleration of the mass is at least 1G.

Dimension Drawing

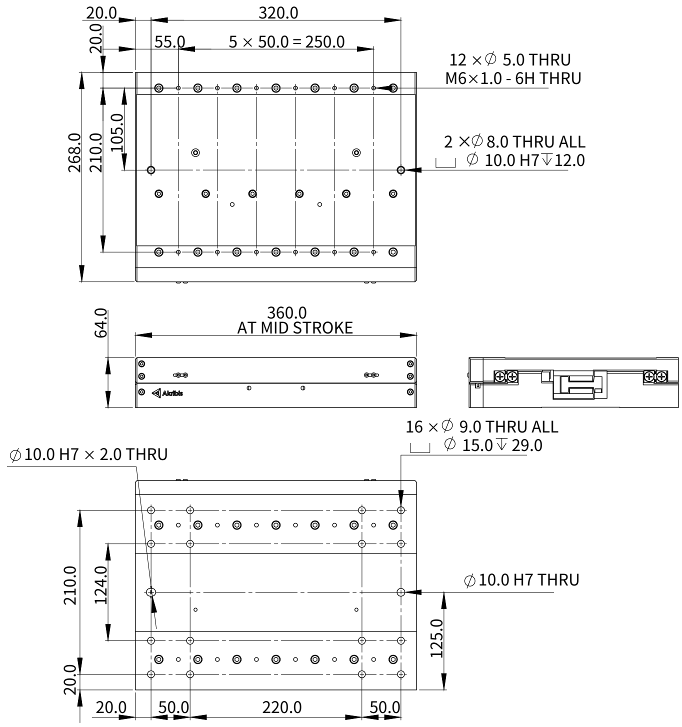


XRL250-200-S2 / XRL250-150-S3

XRL250			
Specifications	Unit	S2	S3
Effective Stroke	mm	200	150
Motor	-	AUM3-S2	AUM3-S3
Continuous Force	N	57.0	85.0
Peak Force	N	289.0	433.0
Resolution	µm	ABI21: 0.5/0.2	
		AT2: 0.2/0.05	
Bidirectional Repeatability	µm	ABI21-0.5: ±2	
		ABI21-0.2: ±1	
		AT2-0.2: ±1	
		AT2-0.05: ±0.5	
Straightness	µm	±3.0	±3.0
Flatness	µm	±3.5	±3.5
Rated Payload [1]	kg	9.0	11.0
No-load Moving Mass	kg	8.7	8.7
No-load Total Mass	kg	17.9	18.4
Max. Allowable Horizonal Mounting Load	kg	30	30
Max. Allowable Side Mounting Load	kg	26	26
Max. Allowable Roll Moment Load	Nm	320.2	320.2
Max. Allowable Pitch Moment Load	Nm	393.9	393.9
Max. Allowable Yaw Moment Load	Nm	478.4	478.4

[1] The rated load is based on the load in which the acceleration of the mass is at least 1G.

Dimension Drawing



Ordering Part Number (OPN)

XL1 T 03 U04 EBH 1 A 1

Model:
- XL1: XRL130

Cover Type:
- T: Standard (Black Anodized)

Effective Stroke:
- 03: 35mm
- 06: 60mm
- 11: 110mm
- 16: 160mm

Motor Type:
- U04: AUM2-S-S3-K (Peak Force: 132.0N)
- U05: AUM2-P-S3-K (Peak Force: 132.0N)

Encoder Type:
- EBH: Quantic (0.1µm)
- EEA: Tonic (SINCOS)

Scale Type:
- 1: Steel tape, 11ppm/K

Cable Length:
- A: 0.5m

Termination:
- 1: Flying Leads
- 2: DSUB
- 3: M23

XL2 T 05 U17 E0F 1 A 1

Model:
- XL2: XRL250

Cover Type:
- T: Standard (Black Anodized)

Effective Stroke:
- 05: 50mm
- 10: 100mm
- 15: 150mm
- 20: 200mm

Motor Type:
- U17: AUM3-S-S2-J (Peak Force: 289.0N)
- U18: AUM3-S-S2-K (Peak Force: 289.0N)
- U19: AUM3-P-S2-J (Peak Force: 289.0N)
- U20: AUM3-P-S2-K (Peak Force: 289.0N)
- U21: AUM3-S-S3-J (Peak Force: 433.0N)
- U22: AUM3-S-S3-K (Peak Force: 433.0N)
- U23: AUM3-P-S3-J (Peak Force: 433.0N)
- U24: AUM3-P-S3-K (Peak Force: 433.0N)

Encoder Type:
- E0F: ABI-21 (0.5µm)
- E0G: ABI-21 (0.2µm)
- ECG: ATOM2 (0.2µm)
- ECJ: ATOM2 (0.05µm)

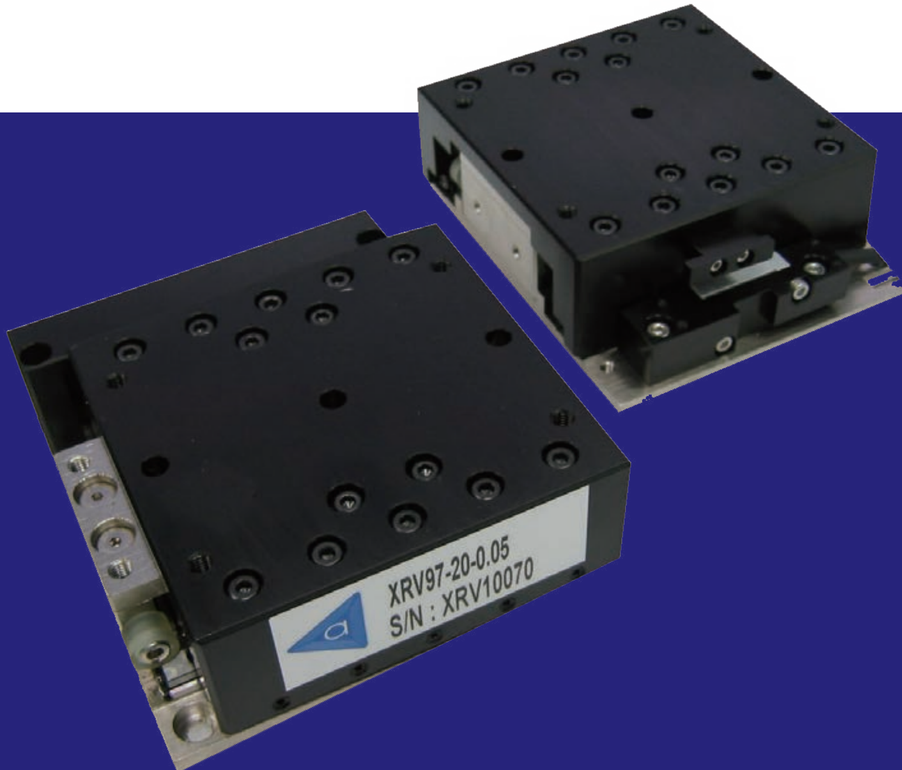
Scale Type:
- 1: Steel tape, 11ppm/K

Cable Length:
- A: 0.5m
- B: 3.0m

Termination:
- 1: Flying Lead
- 2: DSUB
- 3: M23

VOICE COIL MODULE

VOICE COIL MODULE



XRV SERIES

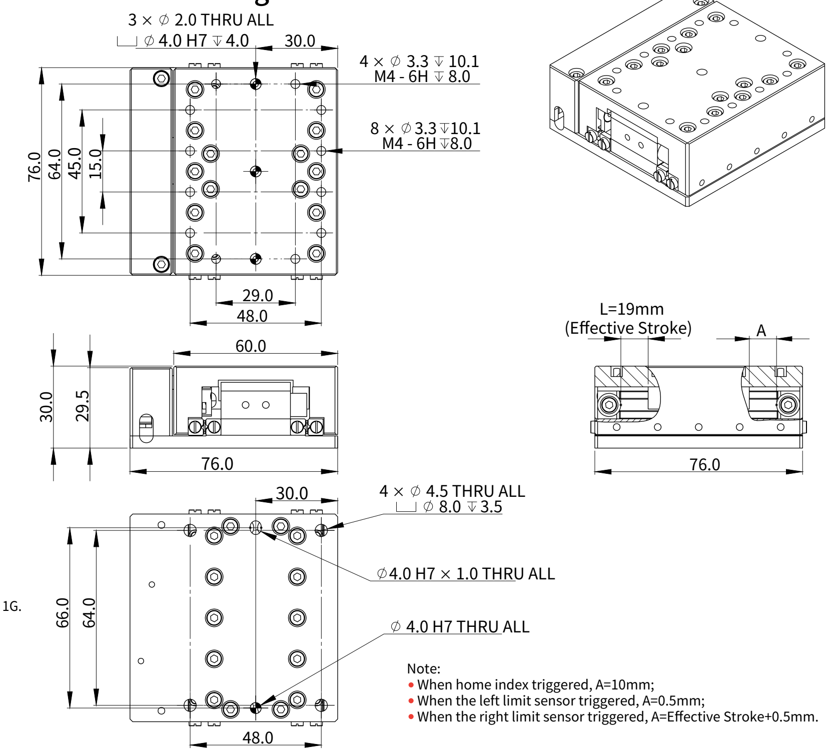
- Suitable for micro motion and smooth motion
- Fast response and short settling time
- Low friction
- No commutation needed
- High precision

XRV76

Specifications	Unit	Value
Stroke[1]	mm	20
Motor	-	AVA1-20
Continuous Force	N	2.74
Peak Force	N	8.20
Resolution	μm	ABI21: 0.5/0.2
		AT2: 0.2/0.05
Bidirectional Repeatability	μm	ABI21 0.5/0.2: ±1
		AT2 0.2/0.05: ±0.5
Straightness	μm	±2.5
Flatness	μm	±2.5
Rated Payload[2]	Kg	0.1
No-load Moving Mass	Kg	0.17
No-load Total Mass	Kg	0.48
Max. Allowable Payload	Kg	1.0
Max. Allowable Roll Moment Load	Nm	0.4
Max. Allowable Pitch Moment Load	Nm	0.5
Max. Allowable Yaw Moment Load	Nm	0.4

1. Stroke refers to hardstop-to-hardstop mechanical stroke. The limit sensor are positioned 0.5mm from the hardstops.
2. The rated load is based on the load in which the acceleration of the mass is at least 1G.

Dimension Drawing



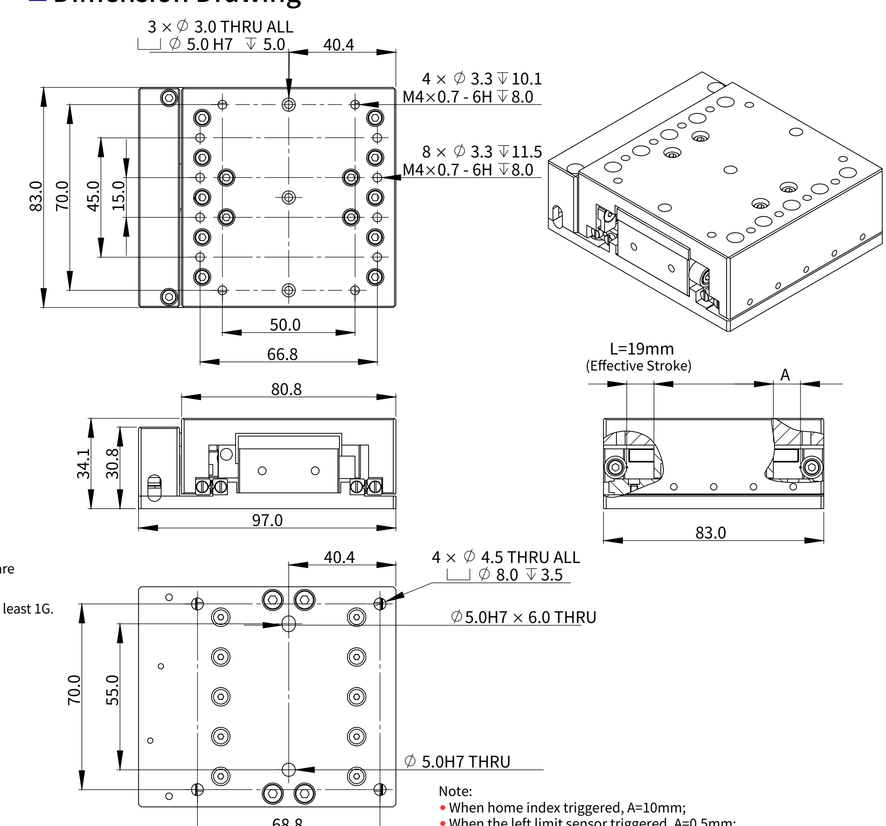
Note:
- When home index triggered, A=10mm;
- When the left limit sensor triggered, A=0.5mm;
- When the right limit sensor triggered, A=Effective Stroke+0.5mm.

XRV97

Specifications	Unit	Value
Stroke[1]	mm	20
Motor	-	AVA2-20
Continuous Force	N	10.08
Peak Force	N	30.20
Resolution	μm	ABI21: 0.5/0.2
		AT2: 0.2/0.05
Bidirectional Repeatability	μm	ABI21 0.5/0.2: ±1
		AT2 0.2/0.05: ±0.5
Straightness	μm	±2.5
Flatness	μm	±2.5
Rated Payload[2]	Kg	0.7
No-load Moving Mass	Kg	0.27
No-load Total Mass	Kg	1.16
Max. Allowable Payload	Kg	2.4
Max. Allowable Roll Moment Load	Nm	0.6
Max. Allowable Pitch Moment Load	Nm	0.5
Max. Allowable Yaw Moment Load	Nm	0.4

1. Stroke refers to hardstop-to-hardstop mechanical stroke. The limit sensor are positioned 0.5mm from the hardstops.
2. The rated load is based on the load in which the acceleration of the mass is at least 1G.

Dimension Drawing



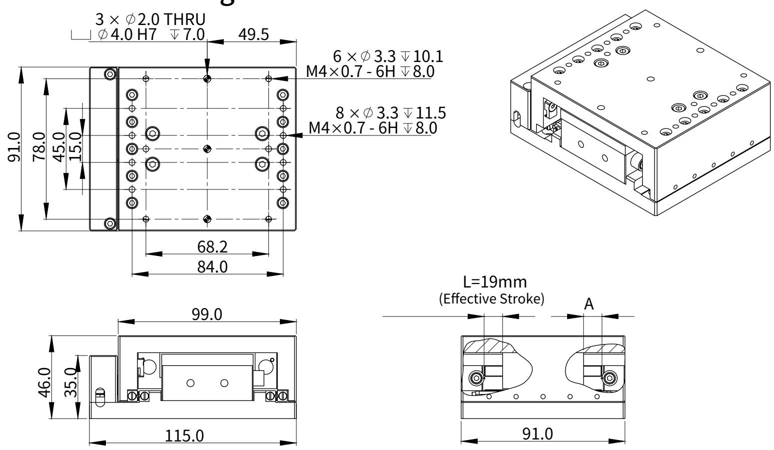
Note:
- When home index triggered, A=10mm;
- When the left limit sensor triggered, A=0.5mm;
- When the right limit sensor triggered, A=Effective Stroke+0.5mm.

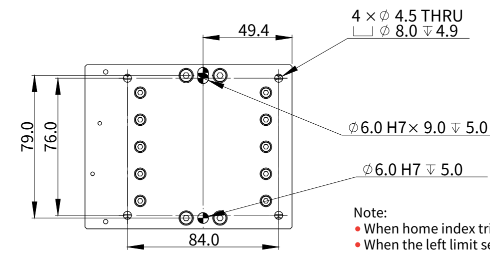
XRV115

Specifications	Unit	Value
Stroke❶	mm	20
Motor	-	AVA3-20
Continuous Force	N	17.92
Peak Force	N	53.8
Resolution	µm	ABI21: 0.5/0.2
		AT2: 0.2/0.05
Bidirectional Repeatability	µm	ABI21 0.5/0.2: ±1
		AT2 0.2/0.05: ±0.5
Straightness	µm	±2.5
Flatness	µm	±2.5
Rated Payload❷	Kg	1.4
No-load Moving Mass	Kg	0.43
No-load Total Mass	Kg	2.21
Max. Allowable Payload	Kg	5.2
Max. Allowable Roll Moment Load	Nm	0.8
Max. Allowable Pitch Moment Load	Nm	0.5
Max. Allowable Yaw Moment Load	Nm	0.4

❶ Stroke refers to hardstop-to-hardstop mechanical stroke. The limit sensor are positioned 0.5mm from the hardstops.
❷ The rated load is based on the load in which the acceleration of the mass is at least 1G.

Dimension Drawing





Note:
- When home index triggered, A=10mm;
- When the left limit sensor triggered, A=0.5mm;
- When the right limit sensor triggered, A=Effective Stroke+0.5mm.

Ordering Part Number (OPN)

XRV1 T E0F 1 A 1

Model - Coil Type:
- XRV1: XRV76-AVA1-20-0.5A
- XRV2: XRV97-AVA2-20-0.5A
- XRV3: XRV115-AVA3-20-0.5A

Cover Type:
- T: Standard (Black Anodized)

Encoder Type:
- E0F: ABI-21 (0.5µm)
- E0G: ABI-21 (0.2µm)
- ECF: ATOM2 (0.2µm)
- ECJ: ATOM2 (0.2µm)

Termination:
- 1: Flying Leads

Cable Length:
- A: 0.5m

Scale Type:
- 1: Steel tape, 11ppm/K❶
- 2: Glass G8 Soda Lime, 8ppm/K❷

Note:
❶ ABI-21 uses steel tape scale only.
❷ ATOM2 uses glass scale only.

XMGV SERIES

- Direct drive
- Zero Cogging, Zero backlash ironless linear motor actuator
- Stroke from 15mm to 30mm
- Suitable for high speed and high acceleration application
- Smooth motion even at low speed (minimum velocity ripple)
- Use cross roller guide for high stiffness

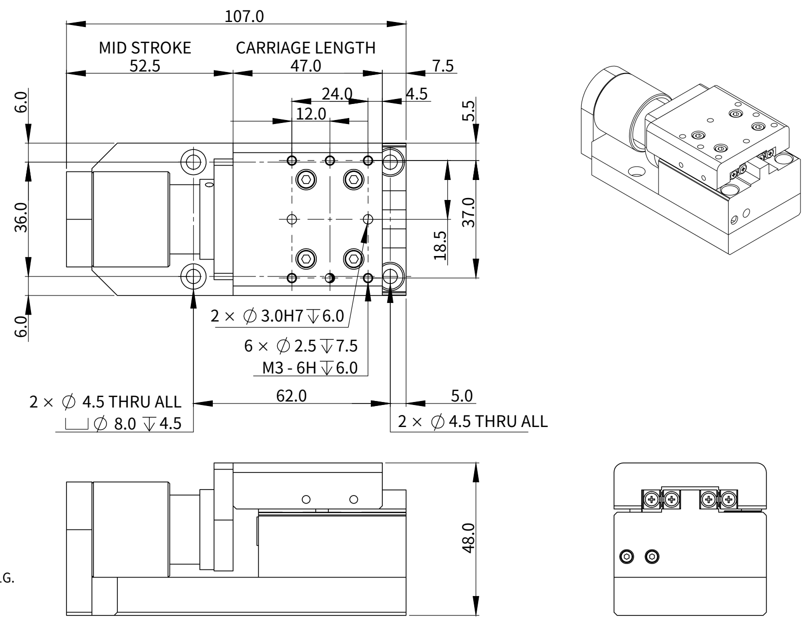
XMGV30

Specifications	Unit	Value
Stroke[1]	mm	15
Motor	-	AVM30-15
Continuous Force	N	4.63
Peak Force	N	29.40
Resolution	μm	ABI21: 0.5/0.2
		AT2: 0.2/0.05
Bidirectional Repeatability	μm	ABI21 0.5/0.2: ±1
		AT2 0.2/0.05: ±0.5
Straightness	μm	±2.5
Flatness	μm	±2.5
Rated Payload[2]	Kg	0.6
No-load Moving Mass	Kg	0.14
No-load Total Mass	Kg	0.51
Max. Allowable Payload	Kg	1.4
Max. Allowable Roll Moment Load	Nm	0.8
Max. Allowable Pitch Moment Load	Nm	1.0
Max. Allowable Yaw Moment Load	Nm	1.2

[1] Stroke refers to hardstop-to-hardstop mechanical stroke. The limit sensor are positioned 0.5mm from the hardstops.

[2] The rated load is based on the load in which the acceleration of the mass is at least 1G.

Dimension Drawing



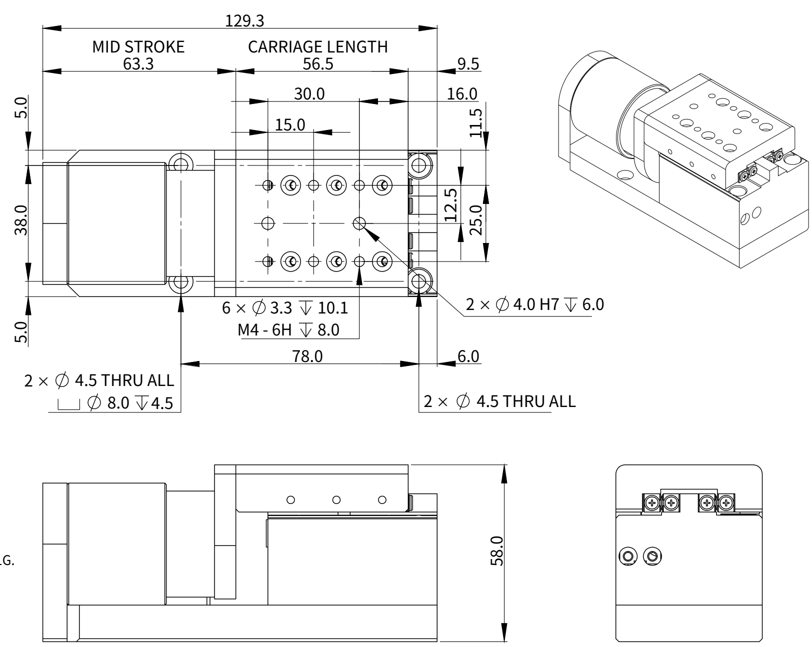
XMGV40

Specifications	Unit	Value
Stroke[1]	mm	20
Motor	-	AVM40-20
Continuous Force	N	9.93
Peak Force	N	58.05
Resolution	μm	ABI21: 0.5/0.2
		AT2: 0.2/0.05
Bidirectional Repeatability	μm	ABI21 0.5/0.2: ±1
		AT2 0.2/0.05: ±0.5
Straightness	μm	±2.5
Flatness	μm	±2.5
Rated Payload[2]	Kg	1.5
No-load Moving Mass	Kg	0.20
No-load Total Mass	Kg	0.80
Max. Allowable Payload	Kg	2.8
Max. Allowable Roll Moment Load	Nm	1.4
Max. Allowable Pitch Moment Load	Nm	2.6
Max. Allowable Yaw Moment Load	Nm	3.2

[1] Stroke refers to hardstop-to-hardstop mechanical stroke. The limit sensor are positioned 0.5mm from the hardstops.

[2] The rated load is based on the load in which the acceleration of the mass is at least 1G.

Dimension Drawing



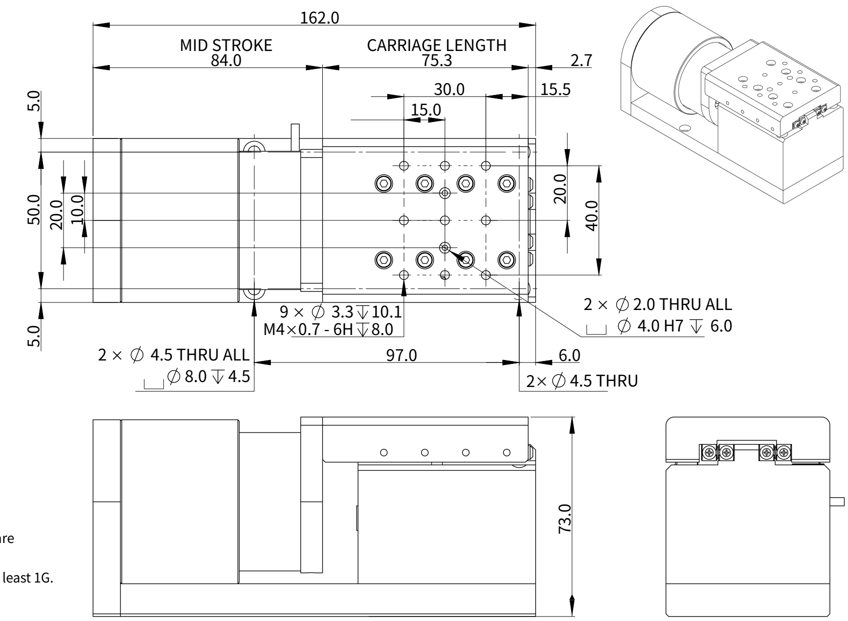
XMGV60

Specifications	Unit	Value
Stroke❶	mm	25
Motor	-	AVM60-25
Continuous Force	N	26.35
Peak Force	N	119.00
Resolution	µm	ABI21: 0.5/0.2
		AT2: 0.2/0.05
Bidirectional Repeatability	µm	ABI21 0.5/0.2: ±1
		AT2 0.2/0.05: ±0.5
Straightness	µm	±2.5
Flatness	µm	±2.5
Rated Payload❷	Kg	4.0
No-load Moving Mass	Kg	0.45
No-load Total Mass	Kg	1.90
Max. Allowable Payload	Kg	7.1
Max. Allowable Roll Moment Load	Nm	3.4
Max. Allowable Pitch Moment Load	Nm	9.0
Max. Allowable Yaw Moment Load	Nm	11.0

❶ Stroke refers to hardstop-to-hardstop mechanical stroke. The limit sensor are positioned 0.5mm from the hardstops.

❷ The rated load is based on the load in which the acceleration of the mass is at least 1G.

Dimension Drawing



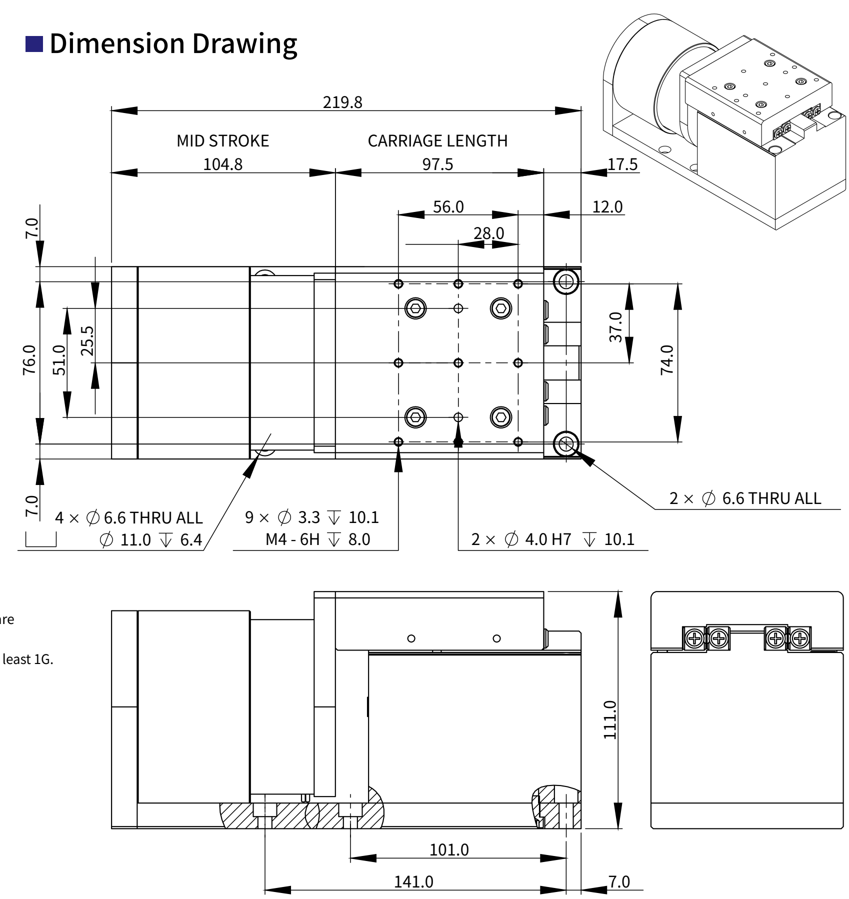
XMGV90

Specifications	Unit	Value
Stroke❶	mm	30
Motor	-	AVM90-30
Continuous Force	N	89.10
Peak Force	N	315.00
Resolution	µm	ABI21: 0.5/0.2
		AT2: 0.2/0.05
Bidirectional Repeatability	µm	ABI21 0.5/0.2: ±1
		AT2 0.2/0.05: ±0.5
Straightness	µm	±2.5
Flatness	µm	±2.5
Rated Payload❷	Kg	14.0
No-load Moving Mass	Kg	1.63
No-load Total Mass	Kg	5.31
Max. Allowable Payload	Kg	18.3
Max. Allowable Roll Moment Load	Nm	16.0
Max. Allowable Pitch Moment Load	Nm	21.0
Max. Allowable Yaw Moment Load	Nm	25.6

❶ Stroke refers to hardstop-to-hardstop mechanical stroke. The limit sensor are positioned 0.5mm from the hardstops.

❷ The rated load is based on the load in which the acceleration of the mass is at least 1G.

Dimension Drawing



Ordering Part Number (OPN)

XMV1 T V16 E0F 1 A 1

Model:
XMV1: XMGV30
XMV2: XMGV40
XMV3: XMGV60
XMV4: XMGV90

Cover Type:
T: Standard (Black Anodized)

Coil Type:❶
V16: AVM30-15-0.5A (Peak Force: 29.40N)
V26: AVM40-20-0.5A (Peak Force: 58.05N)
V37: AVM60-25-0.5A (Peak Force: 119.00N)
V48: AVM90-30-0.5A (Peak Force: 315.00N)

Termination:
1: Flying Leads

Cable Length:
A: 0.5m

Scale Type:
1: Steel tape, 11ppm/K❷
2: Glass G8 Soda Lime, 8ppm/K❸

Encoder Type:
E0F: ABI-21 (0.5μm)
E0G: ABI-21 (0.2μm)
ECF: ATOM2 (0.2μm)
ECJ: ATOM2 (0.2μm)

Note:

❶ For Coil Type, only allow the following combinations:
XMGV30 : AVM30-15-0.5A
XMGV40 : AVM40-20-0.5A
XMGV60 : AVM60-25-0.5A
XMGV90 : AVM90-30-0.5A

❷ ABI-21 uses steel tape scale only.

❸ ATOM2 uses glass scale only.

TGV SERIES

- Thru hole voice coil feature
- Low friction
- High precision

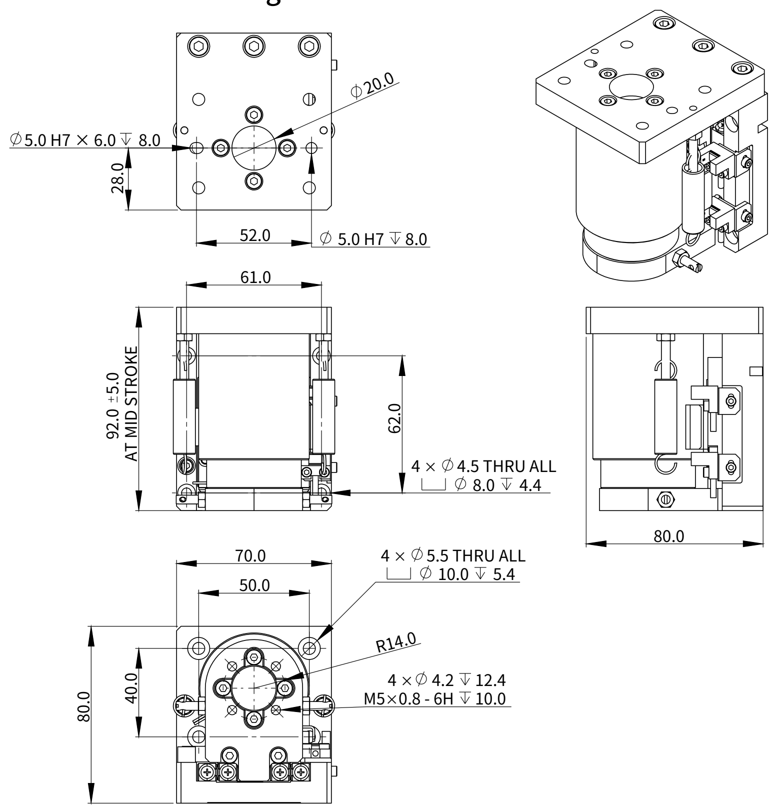
TGV50

Specifications	Unit	Value
Stroke[1]	mm	10
Motor	-	AVM50-HF-10-C15
Continuous Force	N	25.20
Peak Force	N	105.00
Resolution	µm	ABI21: 0.5/0.2
		AT2: 0.2/0.05
Bidirectional Repeatability	µm	ABI21 0.5/0.2: ±1
		AT2 0.2/0.05: ±0.5
Straightness	µm	±2.5
Flatness	µm	±2.5
Rated Payload[2]	Kg	3.0
No-load Moving Mass	Kg	0.26
No-load Total Mass	Kg	1.21
Max. Allowable Payload	Kg	7.5
Max. Allowable Roll Moment Load	Nm	6.8
Max. Allowable Pitch Moment Load	Nm	8.0
Max. Allowable Yaw Moment Load	Nm	9.8

[1] Stroke refers to hardstop-to-hardstop mechanical stroke. The limit sensor are positioned 0.5mm from the hardstops.

[2] The rated load is based on the load in which the acceleration of the mass is at least 1G.

■ Dimension Drawing



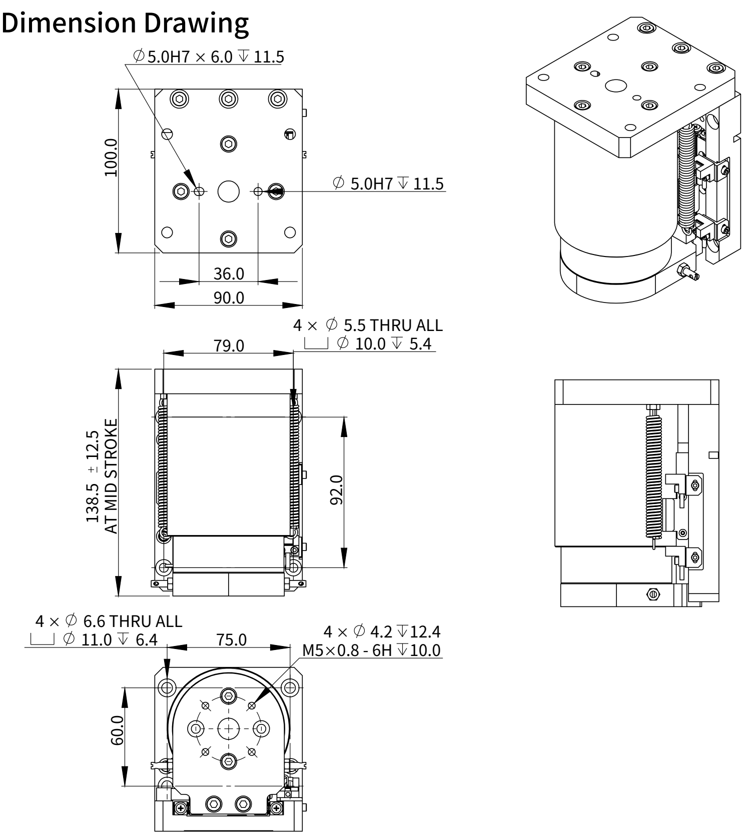
TGV75

Specifications	Unit	Value
Stroke[1]	mm	25
Motor	-	AVM75-HF-25-C12
Continuous Force	N	124.69
Peak Force	N	572.90
Resolution	µm	ABI21: 0.5/0.2
		AT2: 0.2/0.05
Bidirectional Repeatability	µm	ABI21 0.5/0.2: ±1
		AT2 0.2/0.05: ±0.5
Straightness	µm	±2.5
Flatness	µm	±2.5
Rated Payload[2]	Kg	8.0
No-load Moving Mass	Kg	1.11
No-load Total Mass	Kg	3.85
Max. Allowable Payload	Kg	11.2
Max. Allowable Roll Moment Load	Nm	14.4
Max. Allowable Pitch Moment Load	Nm	15.0
Max. Allowable Yaw Moment Load	Nm	18.2

[1] Stroke refers to hardstop-to-hardstop mechanical stroke. The limit sensor are positioned 0.5mm from the hardstops.

[2] The rated load is based on the load in which the acceleration of the mass is at least 1G.

■ Dimension Drawing



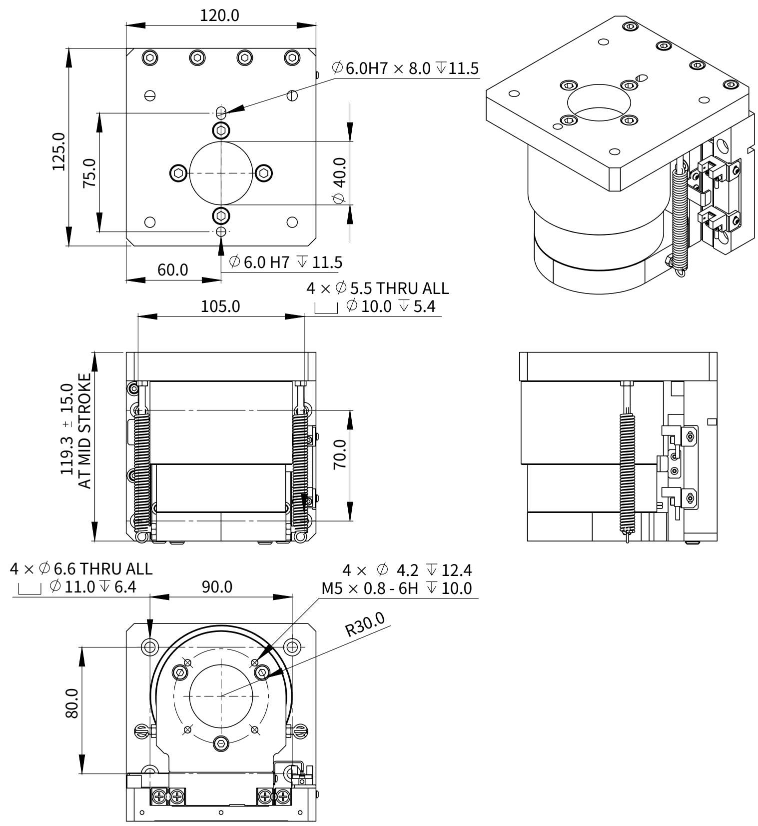
TGV90

Specifications	Unit	Value
Stroke[1]	mm	30
Motor	-	AVM90-30-C77
Continuous Force	N	57.30
Peak Force	N	202.60
Resolution	μm	ABI21: 0.5/0.2
		AT2: 0.2/0.05
Bidirectional Repeatability	μm	ABI21 0.5/0.2: ±1
		AT2 0.2/0.05: ±0.5
Straightness	μm	±2.5
Flatness	μm	±2.5
Rated Payload[2]	Kg	6.0
No-load Moving Mass	Kg	1.41
No-load Total Mass	Kg	3.76
Max. Allowable Payload	Kg	14.7
Max. Allowable Roll Moment Load	Nm	28.3
Max. Allowable Pitch Moment Load	Nm	21.1
Max. Allowable Yaw Moment Load	Nm	25.7

[1] Stroke refers to hardstop-to-hardstop mechanical stroke. The limit sensor are positioned 0.5mm from the hardstops.

[2] The rated load is based on the load in which the acceleration of the mass is at least 1G.

Dimension Drawing



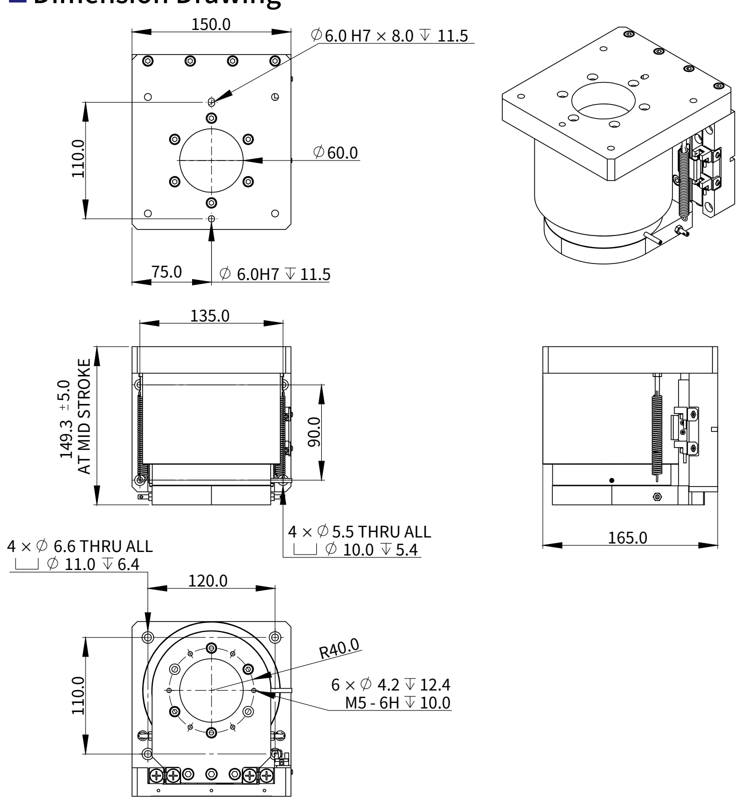
TGV130

Specifications	Unit	Value
Stroke[1]	mm	10
Motor	-	AVM130-HF-10-C29
Continuous Force	N	162.40
Peak Force	N	487.20
Resolution	μm	ABI21: 0.5/0.2
		AT2: 0.2/0.05
Bidirectional Repeatability	μm	ABI21 0.5/0.2: ±1
		AT2 0.2/0.05: ±0.5
Straightness	μm	±2.5
Flatness	μm	±2.5
Rated Payload[2]	Kg	15.0
No-load Moving Mass	Kg	2.35
No-load Total Mass	Kg	10.1
Max. Allowable Payload	Kg	25.0
Max. Allowable Roll Moment Load	Nm	91.1
Max. Allowable Pitch Moment Load	Nm	70.9
Max. Allowable Yaw Moment Load	Nm	86.1

[1] Stroke refers to hardstop-to-hardstop mechanical stroke. The limit sensor are positioned 0.5mm from the hardstops.

[2] The rated load is based on the load in which the acceleration of the mass is at least 1G.

Dimension Drawing



Ordering Part Number (OPN)

TGV1 T V33 E0F 1 A 1 L1

Model:
TGV1: TGV50-10
TGV2: TGV75-25
TGV3: TGV90-30
TGV4: TGV130-10

Cover Type:
T: Standard (Black Anodized)

Coil Type:[1]
V33: AVM50-HF-10-0.5A-C15 (Peak Force: 105.0N)
V41: AVM75-HF-25-0.5A-C12 (Peak Force: 572.9N)
V51: AVM90-30-0.5A-C77 (Peak Force: 202.6N)
V58: AVM130-HF-10-0.5A-C29 (Peak Force: 487.2N)

Encoder Type:
E0F: ABI-21 (0.5μm)
E0G: ABI-21 (0.2μm)
ECF: ATOM2 (0.2μm)
ECJ: ATOM2 (0.2μm)

Scale Type:
1: Steel tape, 11ppm/K[2]
2: Glass G8 Soda Lime, 8ppm/K[3]

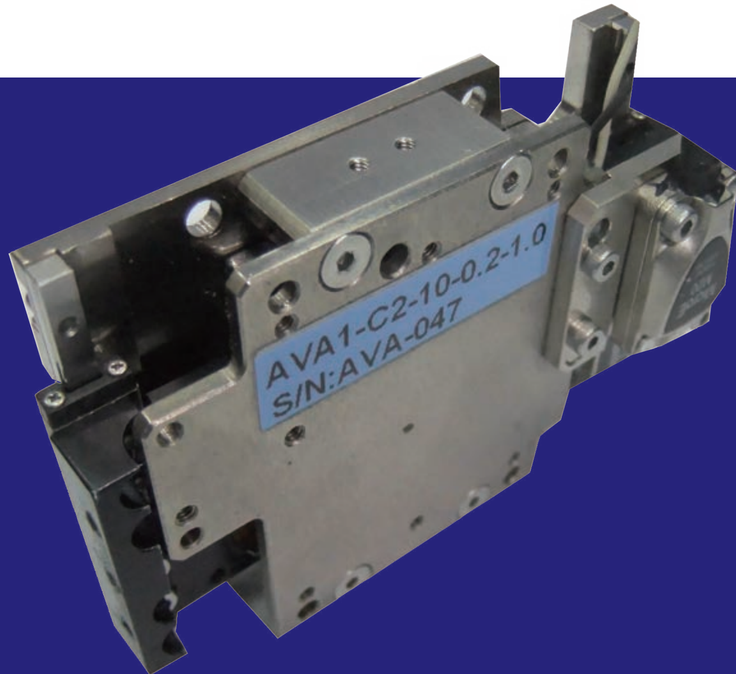
Cable Length:
A: 0.5m

Termination:
1: Flying Leads

Counter Balance:
L1
L2
L3
L4

Payload[4]					
Model	Unit	L1	L2	L3	L4
TGV50-10	g	500	1000	2000	3000
TGV75-25	g	2000	4000	6000	8000
TGV90-30	g	2000	3000	4000	6000
TGV130-10	g	5000	8000	10000	15000

Note:
1. For Coil Type, only allow the following combinations:
   TGV50-10 : AVM50-HF-10-0.5A-C15
   TGV75-25 : AVM75-HF-25-0.5A-C12
   TGV90-30 : AVM90-30-0.5A-C77
   TGV130-10 : AVM130-HF-10-0.5A-C29
2. ABI-21 uses steel tape scale only.
3. ATOM2 uses glass scale only.
4. Counter-balance position is at mid- stroke.



DGV SERIES

- Direct drive linear mechanism by planar voice coil motor
- Zero cogging effect, zero backlash
- Suitable for short stroke, high speed, and high frequency linear application

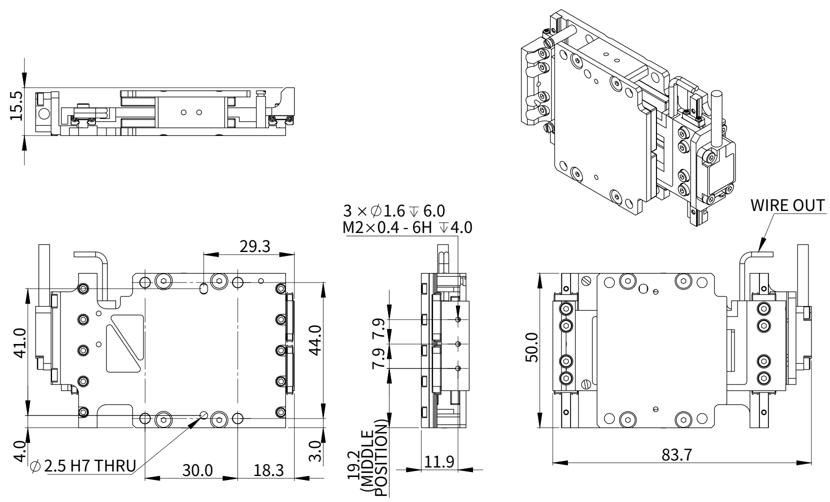
DGV16

Specifications	Unit	Value
Stroke[1]	mm	10
Motor	-	AVA1-C2-10
Continuous Force	N	4.00
Peak Force	N	12.0
Resolution	μm	ABI21: 1.0/0.5/0.2
		AT2: 0.2/0.05
Bidirectional Repeatability	μm	ABI21: 1.0/0.5/0.2: ±1
		AT2: 0.2/0.05: ±0.5
Straightness	μm	±3
Flatness	μm	±3
Rated Payload[2]	Kg	0.17
No-load Moving Mass	Kg	0.028
No-load Total Mass	Kg	0.220
Max. Allowable Payload	Kg	0.4
Max. Allowable Roll Moment Load	Nm	1.3
Max. Allowable Pitch Moment Load	Nm	0.3
Max. Allowable Yaw Moment Load	Nm	1.3

[1] Stroke refers to hardstop-to-hardstop mechanical stroke. Effective stroke equals to mechanical stroke for this short-stroke stage.

[2] The rated load is based on the load in which the acceleration of the mass is at least 1G.

Dimension Drawing



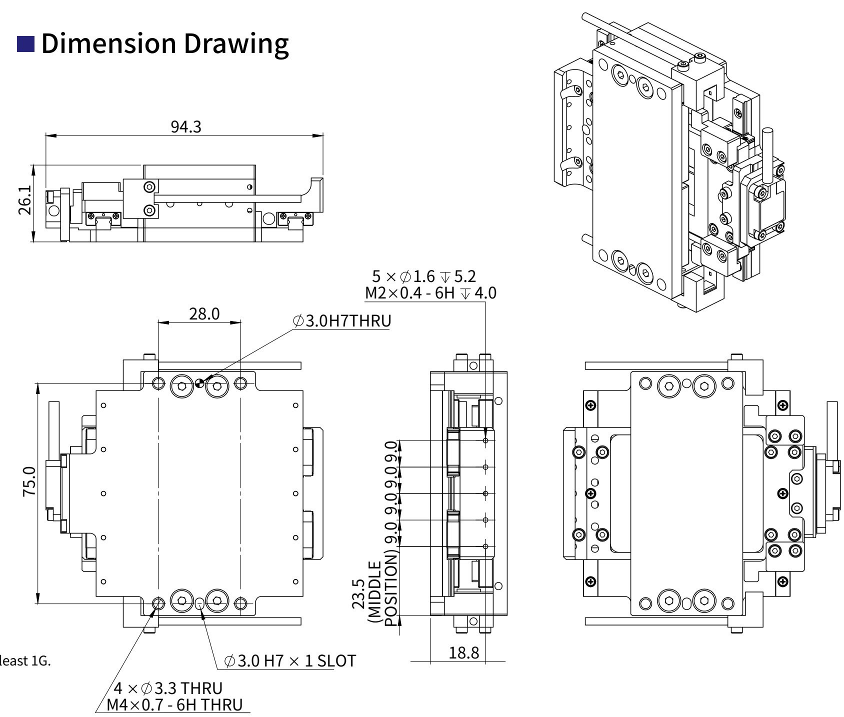
DGV26

Specifications	Unit	Value
Stroke[1]	mm	20
Motor	-	AVA2-20
Continuous Force	N	10.08
Peak Force	N	30.2
Resolution	μm	ABI21: 1.0/0.5/0.2
		AT2: 0.2/0.05
Bidirectional Repeatability	μm	ABI21: 1.0/0.5/0.2: ±1
		AT2: 0.2/0.05: ±0.5
Straightness	μm	±3
Flatness	μm	±3
Rated Payload[2]	Kg	0.40
No-load Moving Mass	Kg	0.110
No-load Total Mass	Kg	0.750
Max. Allowable Payload	Kg	0.5
Max. Allowable Roll Moment Load	Nm	1.4
Max. Allowable Pitch Moment Load	Nm	0.6
Max. Allowable Yaw Moment Load	Nm	1.4

[1] Stroke refers to hardstop-to-hardstop mechanical stroke. Effective stroke equals to mechanical stroke for this short-stroke stage.

[2] The rated load is based on the load in which the acceleration of the mass is at least 1G.

Dimension Drawing



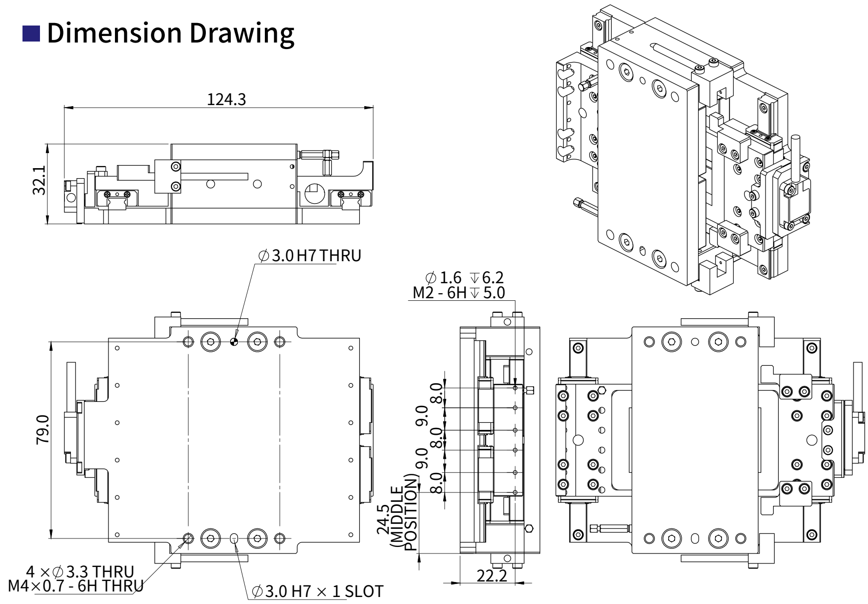
DGV32

Specifications	Unit	Value
Stroke[1]	mm	20
Motor	-	AVA3-20
Continuous Force	N	17.92
Peak Force	N	53.8
Resolution	µm	ABI21: 1.0/0.5/0.2 AT2: 0.2/0.05
Bidirectional Repeatability	µm	ABI21: 1.0/0.5/0.2: ±1 AT2: 0.2/0.05: ±0.5
Straightness	µm	±3
Flatness	µm	±3
Rated Payload[2]	Kg	0.74
No-load Moving Mass	Kg	0.160
No-load Total Mass	Kg	1.100
Max. Allowable Payload	Kg	1.1
Max. Allowable Roll Moment Load	Nm	5.5
Max. AllowablePitch Moment Load	Nm	1.6
Max. Allowable Yaw Moment Load	Nm	5.5

❶ Stroke refers to hardstop-to-hardstop mechanical stroke. Effective stroke equals to mechanical stroke for this short-stroke stage.

❷ The rated load is based on the load in which the acceleration of the mass is at least 1G.

Dimension Drawing



Ordering Part Number (OPN)

DGV1 E E0E 1 A 1

Model - Coil Type:
- DGV1: DGV16-AVA1-C2-10-0.5A
- DGV2: DGV26-AVA2-20-0.5A
- DGV3: DGV32-AVA3-20-0.5A

Cover Type:
- E: EN

Encoder Type:
- E0E: ABI-21 (1.0µm)
- E0F: ABI-21 (0.5µm)
- E0G: ABI-21 (0.2µm)
- ECF: ATOM2 (0.2µm)
- ECJ: ATOM2 (0.05µm)

Termination:
- 1: Flying Leads

Cable Length:
- A: 0.5m

Scale Type:
- 1: Steel tape, 11ppm/K ❶
- 2: Glass G8 Soda Lime, 8ppm/K ❷

Note:

❶ ABI-21 uses steel tape scale only.

❷ ATOM2 uses glass scale only.

MBV SERIES

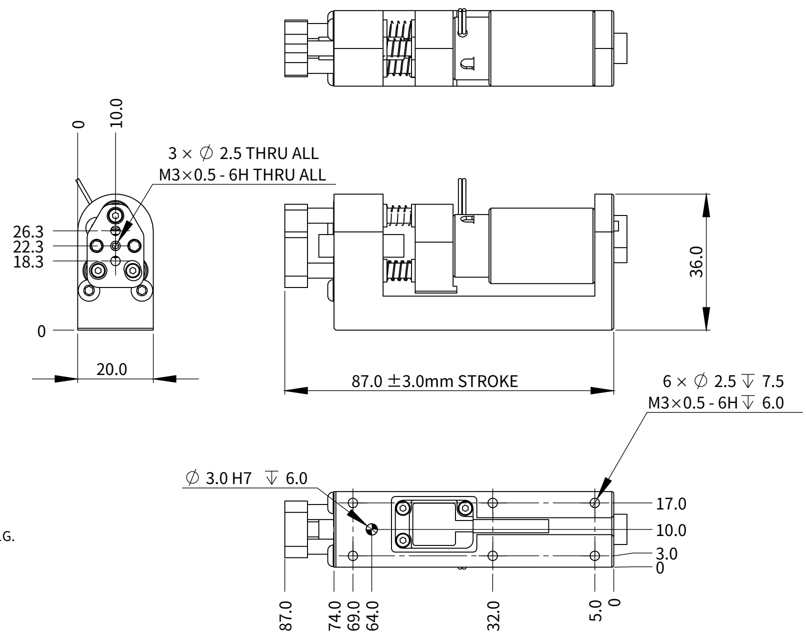
- Direct drive linear mechanism by voice coil motor
- Zero cogging effect, zero backlash
- Suitable for short stroke, high speed, and high acceleration application

MBV20

Specifications	Unit	Value
Stroke[1]	mm	6.0
Motor	-	AVM20-HF-6-C28-3.0A
Continuous Force	N	5.69
Peak Force	N	17.06
Resolution	μm	ABI21: 1.0/0.5/0.2
		AT2: 0.2/0.1
Bidirectional Repeatability	μm	±2.5
Straightness	μm	±5.0
Flatness	μm	±5.0
Rated Payload[2]	Kg	0.3
No-load Moving Mass	Kg	0.035
No-load Total Mass	Kg	0.14
Max. Allowable Payload	Kg	0.4
Max. Allowable Roll Moment Load	Nm	*[3]
Max. Allowable Pitch Moment Load	Nm	*[3]
Max. Allowable Yaw Moment Load	Nm	*[3]

1. Stroke refers to hardstop-to-hardstop mechanical stroke. Effective stroke equals to mechanical stroke for this short-stroke stage.
2. The rated load is based on the load in which the acceleration of the mass is at least 1G.
3. This stage is not suitable for moment load, please contact us for more details.

Dimension Drawing

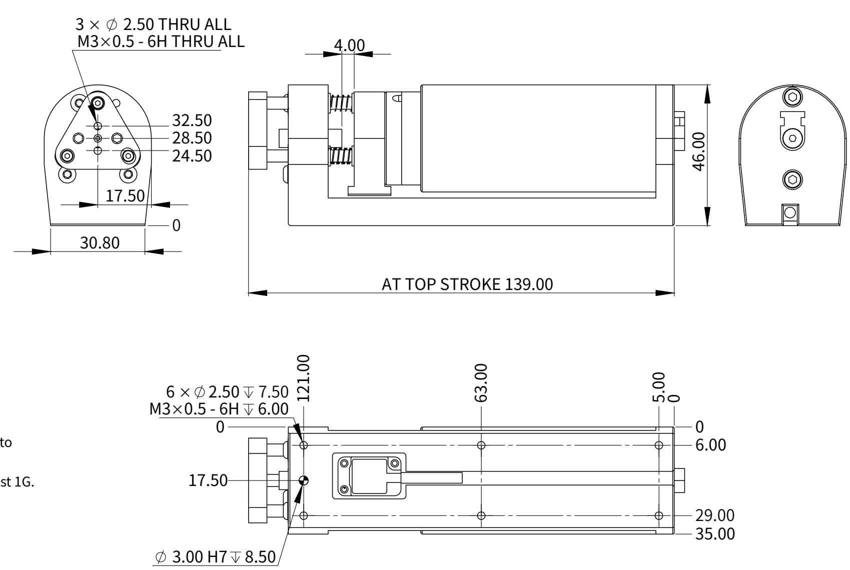


MBV35

Specifications	Unit	Value
Stroke[1]	mm	8.0
Motor	-	AVM35-HF-8-C35-3.0A
Continuous Force	N	27.43
Peak Force	N	137.16
Resolution	μm	ABI21: 1.0/0.5/0.2
		AT2: 0.2/0.1
Bidirectional Repeatability	μm	±2.5
Straightness	μm	±5.0
Flatness	μm	±5.0
Rated Payload[2]	Kg	2.0
No-load Moving Mass	Kg	0.14
No-load Total Mass	Kg	0.65
Max. Allowable Payload	Kg	3.0
Max. Allowable Roll Moment Load	Nm	*[3]
Max. Allowable Pitch Moment Load	Nm	*[3]
Max. Allowable Yaw Moment Load	Nm	*[3]

1. Stroke refers to hardstop-to-hardstop mechanical stroke. Effective stroke equals to mechanical stroke for this short-stroke stage.
2. The rated load is based on the load in which the acceleration of the mass is at least 1G.
3. This stage is not suitable for moment load, please contact us for more details.

Dimension Drawing



Ordering Part Number (OPN)

MBV1 E V08 E0E 1 A 1

Model:
- MBV1: MBV20
- MBV2: MBV35

Cover Type:
- E: EN

Coil Type:
- V08: AVM20-HF-6-0.5A-C28 (Peak Force: 17.06N)
- V23: AVM35-HF-8-0.5A-C35 (Peak Force: 137.16N)

Encoder Type:
- E0E: ABI-21 (1.0µm)
- E0F: ABI-21 (0.5µm)
- E0G: ABI-21 (0.2µm)

Scale Type:
- 1: Steel tape, 11ppm/K

Cable Length:
- A: 0.5m

Termination:
- 1: Flying Leads

XCV SERIES

- Direct drive linear mechanism by voice coil motor
- Zero cogging effect, zero backlash
- High repeatability and accuracy
- Suitable for short stroke, high speed, and high acceleration application
- Cross roller stage providing high stiffness
- Maximized dynamic performance

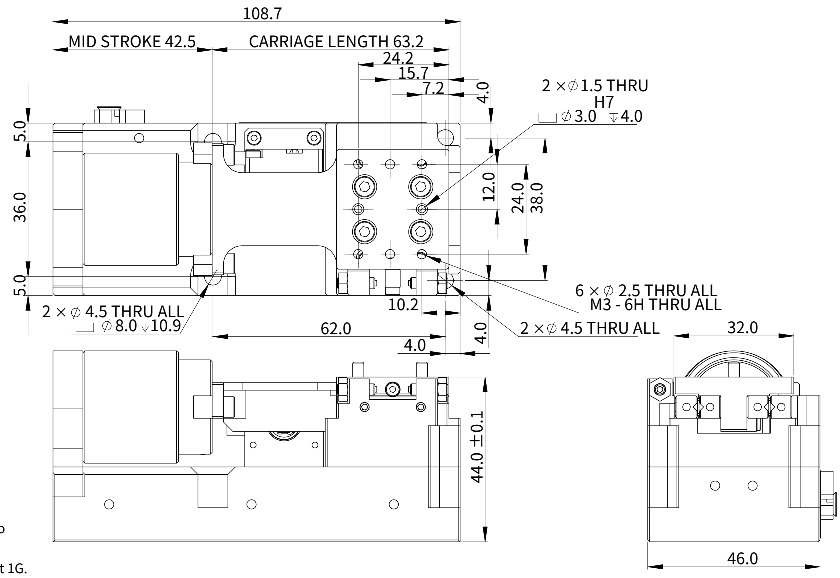
XCV30

Specifications	Unit	Value
Stroke❶	mm	4
Motor	-	AVM30-HF-4-C116-0.5
Continuous Force	N	7.27
Peak Force	N	46.17
Resolution	μm	ABI21: 1.0/0.5/0.2
		AT2: 0.2/0.05
Bidirectional Repeatability	μm	ABI21: 1.0/0.5/0.2: ±1
		AT2: 0.2/0.05: ±0.5
Straightness	μm	±3.0
Flatness	μm	±3.0
Rated Payload❷	Kg	1.0
No-load Moving Mass	Kg	0.072
No-load Total Mass	Kg	0.48
Max. Allowable Payload	Kg	4.0
Max. Allowable Roll Moment Load	Nm	5.0
Max. Allowable Pitch Moment Load	Nm	7.3
Max. Allowable Yaw Moment Load	Nm	7.1

❶ Stroke refers to hardstop-to-hardstop mechanical stroke. Effective stroke equals to mechanical stroke for this short-stroke stage.

❷ The rated load is based on the load in which the acceleration of the mass is at least 1G.

■ Dimension Drawing



Ordering Part Number (OPN)

XCV1 T V18 E0E 1 A 1

Model:
XCV1: XCV30

Cover Type:
T: Standard (Black Anodized)

Coil Type:
V18: AVM30-HF-4-0.5A-C116 (Peak Force: 46.17N)

Termination:
1: Flying Leads

Cable Length:
A: 0.5m

Scale Type:
1: Steel tape, 11ppm/K❶
2: Glass G8 Soda Lime, 8ppm/K❷

Encoder Type:
E0E: ABI-21 (1.0μm)
E0F: ABI-21 (0.5μm)
E0G: ABI-21 (0.2μm)
ECG: ATOM2 (0.2μm)
ECJ: ATOM2 (0.05μm)

Note:
❶ ABI-21 uses steel tape scale only.
❷ ATOM2 uses glass scale only.

MINIATURE STAGES

MINIATURE STAGES

AM SERIES

- Small volume
- Good repeatability
- Direct drive
- Standard design
- Flexible in stacking up XY, XT or XYT stage

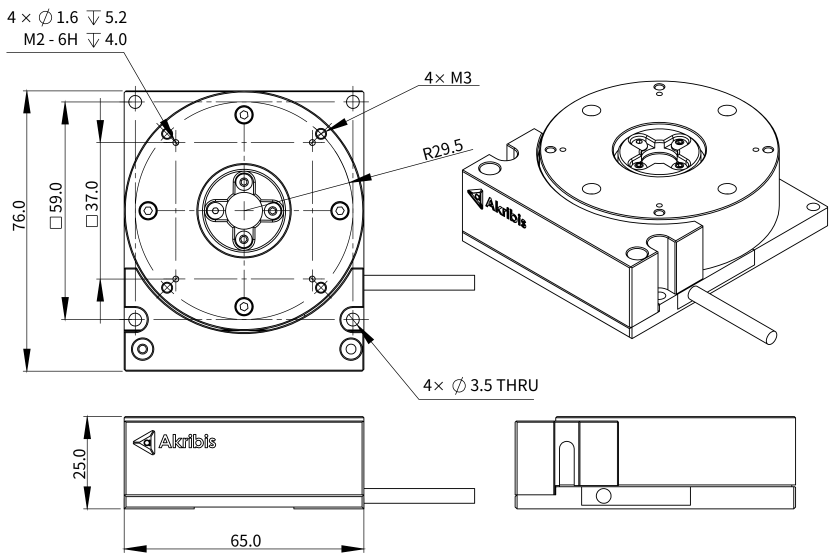
AMR Series

Mini rotary position module

Specifications	Unit	Value
Stroke[1]	Degree	50
Continuous Torque	Nm	0.13
Peak Torque	Nm	0.51
Resolution	lines/rev	ABI22 (SINCOS): 2568
		AT2 (SINCOS): 10272
Bidirectional Repeatability	arc sec	ABI22 SINCOS: ±0.5 (4096X)
		AT2 SINCOS: ±0.5 (4096X)
Max. Speed	Degree/s	720
Axial Runout	µm	5
Radial Runout	µm	10
Rotor Inertia	Kg.m²	0.00014
No-load Total Mass	Kg	0.52
Max. Allowable Axial Load	N	18
Max. Allowable Moment Load	Nm	0.84

[1] Effective stroke is 1 degree from hardstop, hardstop to hardstop = 52 degrees.

Dimension Drawing



AMS Series

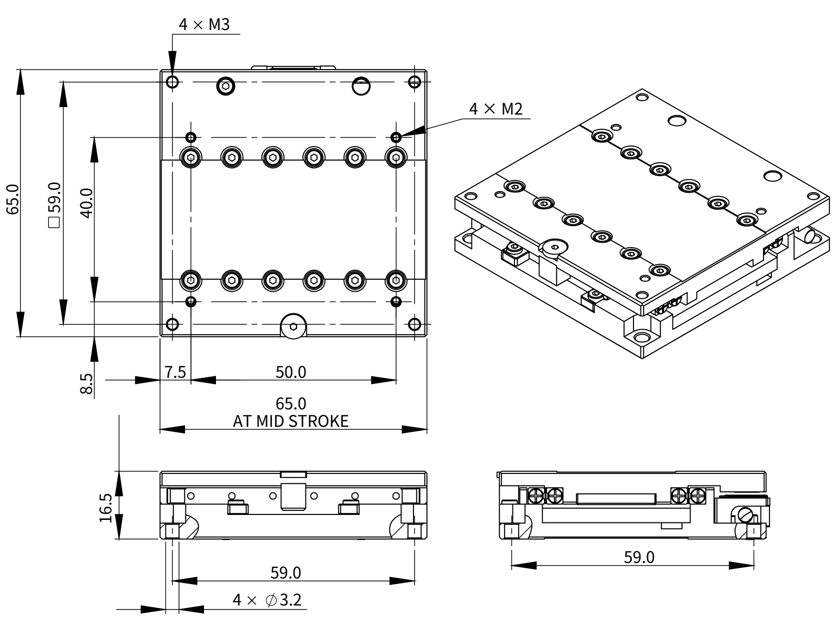
Ultra-thin mini linear position module

Specifications	Unit	Value
Stroke[1]	mm	15
Continuous Force	Nm	4.6
Peak Force	Nm	8.4
Resolution	µm	ABI22: SINCOS
		ABI21: 0.5/0.2
		AT2: SINCOS
		AT2: 0.2/0.05
Bidirectional Repeatability	µm	ABI22 SINCOS: ±0.4 (4096X)
		ABI21 0.5/0.2: ±1
		AT2 0.2/0.05: ±0.5
		AT2 SINCOS: ±0.3 (4096X)
Straightness	µm	±1.5
Flatness	µm	±1.5
Rated Payload[2]	Kg	0.3
No-load Moving Mass	Kg	0.18
No-load Total Mass	Kg	0.42
Max. Allowable Payload	Kg	3.0
Max. Allowable Roll Moment Load	Nm	1.6
Max. Allowable Pitch Moment Load	Nm	2.0
Max. Allowable Yaw Moment Load	Nm	2.4

[1] Effective stroke is 0.5mm from hardstop, hardstop to hardstop = 16mm.

[2] The rated load is based on the load in which the acceleration of the mass is at least 1G.

Dimension Drawing



Ordering Part Number (OPN)

AMR1 T E0A 1 A 1

Model:
AMR1: AMR65D-50

Cover Type:
T: Standard (Black Anodized)

Encoder Type:
E0A: ABI-22 (SINCOS)
E0F: ABI-21 (0.5µm)
E0G: ABI-21 (0.2µm)
ECA: ATOM2 (SINCOS)
ECG: ATOM2 (0.2µm)
ECJ: ATOM2 (0.05µm)

Scale Type:
1: Steel tape, 11ppm/K ❶
4: Nickel, 14ppm/K ❷

Cable Length:
A: 0.5m
B: 3.0m

Termination:
1: Flying Leads

AMS1 E E0A 1 A 1 A

Model:
AMS1: AMS65X-15

Cover Type:
E: EN

Encoder Type:
E0A: ABI-22 (SINCOS)
E0F: ABI-21 (0.5µm)
E0G: ABI-21 (0.2µm)
ECA: ATOM2 (SINCOS)
ECG: ATOM2 (0.2µm)
ECJ: ATOM2 (0.05µm)

Scale Type:
1: Steel tape, 11ppm/K ❸
2: Glass G8 Soda Lime, 8ppm/K ❹

Cable Length:
A: 0.5m
B: 3.0m

Termination:
1: Flying Leads

Guide Option:
A: Anti-creep cross roller
B: Non anti-creep cross roller

Note:
❶ ATOM2 uses steel tape scale only.
❷ ABI-21 & ABI-22 uses Nickel scale only.
❸ ABI-21 uses steel tape scale only.
❹ ATOM2 uses glass scale only.

STACKED STAGES

STACKED STAGES

DGL-XY SERIES

- High speed, high acceleration
- High precision, high rigidity
- Standard design
- Short lead time

DGL-XY

Basic Model		Unit	DGL-XY-S-L100-U100	DGL-XY-S-L200-U200	DGL-XY-S-L300-U300	DGL-XY-S-L400-U300
Effective Stroke		mm	100×100	200×200	300×300	400×300
Maximum Travel Speed		m/s	2	2	2	2
Maximum Linear Acceleration		g	3	3	3	3
Motor	Lower Axis	-	AUM3-S4	AUM3-S4	AUM3-S4	AUM3-S4
	Upper Axis	-	AUM3-S2	AUM3-S2	AUM3-S2	AUM3-S2
Continuous Force / Peak Force	Lower Axis	N	113 / 578	113 / 578	113 / 578	113 / 578
	Upper Axis	N	57 / 289	57 / 289	57 / 289	57 / 289
Repeatability		μm	±1	±1	±1	±1
Orthogonality		arc-sec	10	10	10	10
Nominal System Weight		kg	29	34	39	42
No-load Moving Mass	Lower Axis	kg	19.0	21.0	24.0	24.0
	Upper Axis	kg	2.9	2.9	2.9	2.9
Material		-	Aluminum	Aluminum	Aluminum	Aluminum

Note:
- Values of velocity, acceleration and no-load moving mass are approximations only and may vary based on customer applications and requirements.

Ordering Part Number (OPN)

SL S 01 01 U25 U17 E73 1 A 1

Model:
SL: DGL-XY

Cover Type:
S: Standard (Clear Anodized)
T: Standard (Black Anodized)
C: Conventional (Clear Anodized)
D: Conventional (Black Anodized)
B: Bellow

Lower Axis Stroke:[1]
01: 100mm
02: 200mm
03: 300mm
04: 400mm

Upper Axis Stroke:[1]
01: 100mm
02: 200mm
03: 300mm

Lower Axis Motor:
U25: AUM3-S-S4-J (Peak Force: 578.0N)
U26: AUM3-S-S4-K (Peak Force: 578.0N)
U27: AUM3-P-S4-J (Peak Force: 578.0N)
U28: AUM3-P-S4-K (Peak Force: 578.0N)

Upper Axis Motor:
U17: AUM3-S-S2-J (Peak Force: 289.0N)
U18: AUM3-S-S2-K (Peak Force: 289.0N)
U19: AUM3-P-S2-J (Peak Force: 289.0N)
U20: AUM3-P-S2-K (Peak Force: 289.0N)

Encoder Type:
E73: ABA50E EnDat2.2 (0.05μm)
E71: ABA50M Mitsubishi (0.05μm)
EBF: Quantic (0.5μm)
EBH: Quantic (0.1μm)
E9F: ABI51D (0.5μm)
E9H: ABI51D (0.1μm)
EA0: ABI52 (SINCOS)

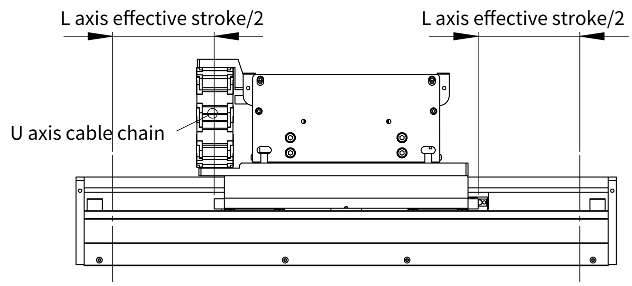
Scale Type:
1: Steel tape, 11ppm/K

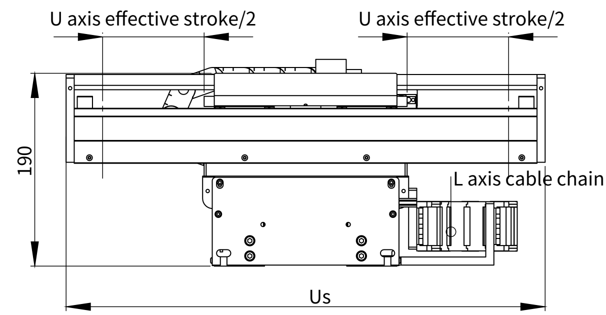
Cable Length:
A: 0.5m
B: 3.0m

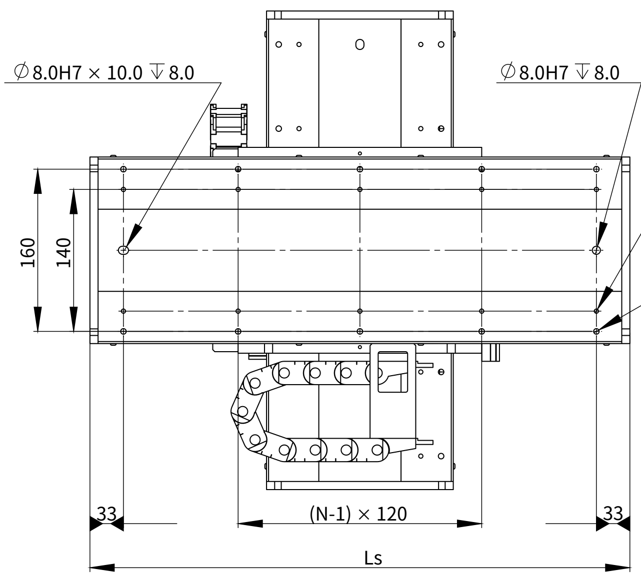
Termination:
1: Flying Leads
2: DSUB

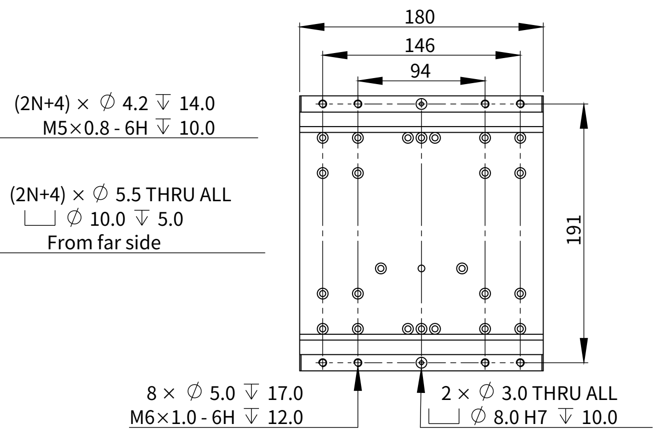
Note:
1 Standard stroke in intervals of 100mm only, for more options, please contact Akribis sales engineers.

Dimension Drawing





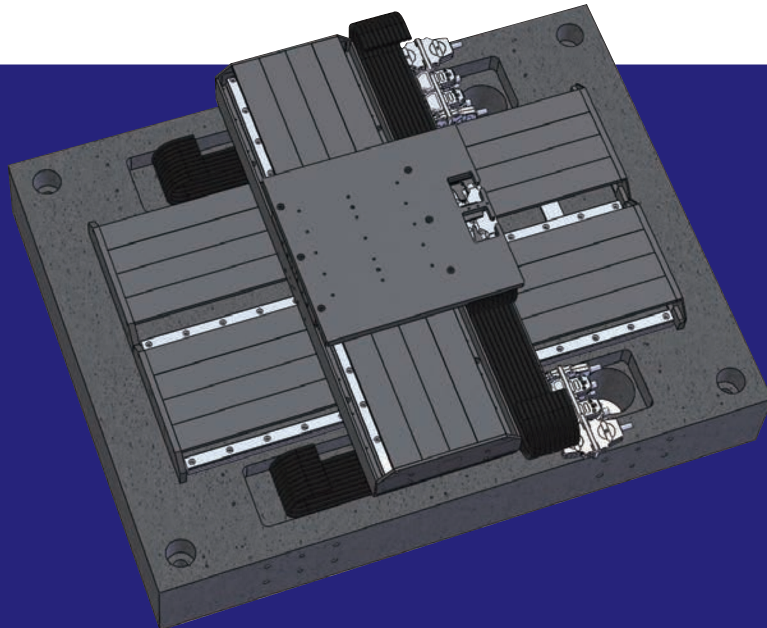




Customer payload mounting interface

LOWER-AXIS EFFECTIVE STROKE	UPPER-AXIS EFFECTIVE STROKE	"Ls" LOWER AXIS LENGTH	"Us" LOWER AXIS LENGTH	N
100	100	432	372	3
200	200	532	472	3
300	300	632	572	5
400	300	732	572	5

Note:
- Other nominal travel lengths and nominal travel combinations are available.
- Electrical and mechanical limits included in gantry system.
- Dimensions in millimeters.



TDS-XY SERIES

- Three rail guides support longer upper axis in the bottom
- Compact size with customized flat cables with built-in tubes

TDS-XY

	Unit	L	U
Effective Stroke	mm	500	500
Rated Payload	kg	20	
No-load Moving Mass	kg	40	7
Max Acceleration	m/s²	10	10
Max Velocity	m/s	1	1
Motor Model	-	AUM5-S3	AUM4-S3
Continuous Force	N	295	166
Peak Force	N	2122	936
Encoder Resolution	μm	0.05/0.5/SINCOS	0.05/0.5/SINCOS
Minimal Step Size	μm	0.5	0.5
Bidirectional Repeatability	μm	±1.0	±1.0
Accuracy	μm	±10.0	±10.0
Straightness	μm	±10.0	±10.0
Flatness	μm	±10.0	±10.0
Yaw	arc-sec	±10.0	±10.0
Pitch	arc-sec	±10.0	±10.0
Orthogonality	arc-sec	10.0	
No-load Stage Weight	kg	350	

Note:
- The table above presents the highest capability of this stage layout.
- Contact us for more options and details.

Ordering Part Number (OPN)

TD S 05 05 U76 U46 E73 1 A 1

Model:
TD: TDS-XY

Cover Type:
S: Standard (Clear Anodized)
T: Standard (Black Anodized)
N: No Cover

Lower Axis Stroke:[1]
05: 500mm

Upper Axis Stroke:[1]
05: 500mm

Lower Axis Motor:
U76: AUM5-S-S3-J (Peak Force: 2122.0N)
U77: AUM5-S-S3-K (Peak Force: 2122.0N)
U78: AUM5-P-S3-J (Peak Force: 2122.0N)
U79: AUM5-P-S3-K (Peak Force: 2122.0N)

Upper Axis Motor:
U46: AUM4-S-S3-J (Peak Force: 936.0N)
U47: AUM4-S-S3-K (Peak Force: 936.0N)
U48: AUM4-P-S3-J (Peak Force: 936.0N)
U49: AUM4-P-S3-K (Peak Force: 936.0N)

Encoder Type:
E73: ABA50E EnDat2.2 (0.05μm)

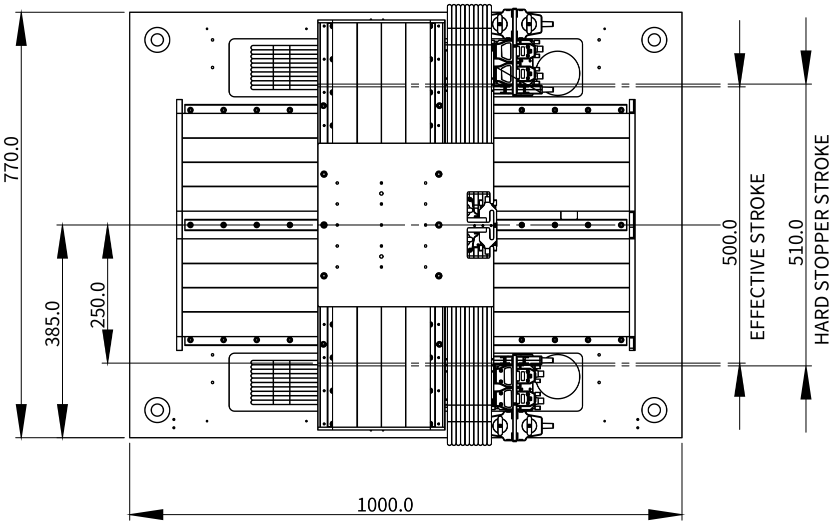
Scale Type:
1: Steel tape, 11ppm/K

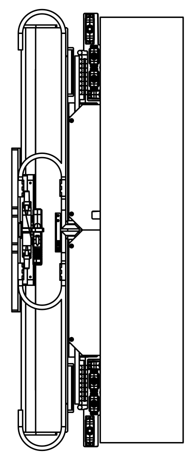
Cable Length:
A: 0.5m
B: 3.0m

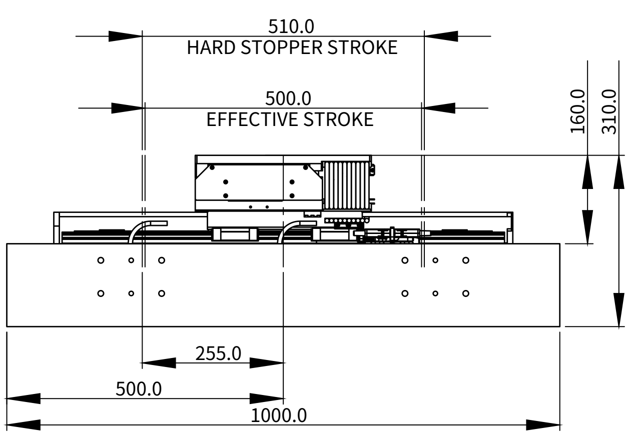
Termination:
1: Flying Leads
2: DSUB

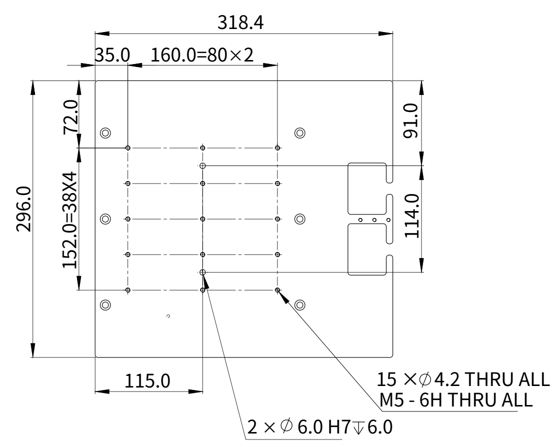
Note:
[1] Standard stroke in intervals of 100mm only, for more options, please contact Akribis sales engineers.

Dimension Drawing



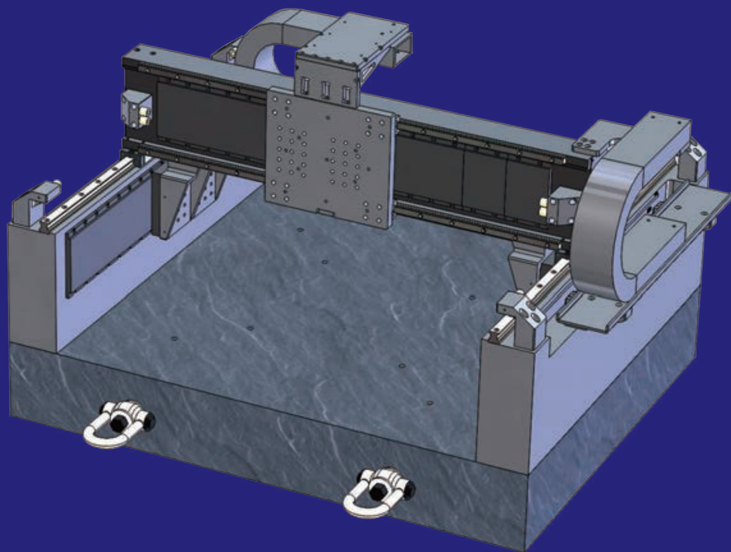






GANTRY STAGES

GANTRY STAGES



VRG-I SERIES

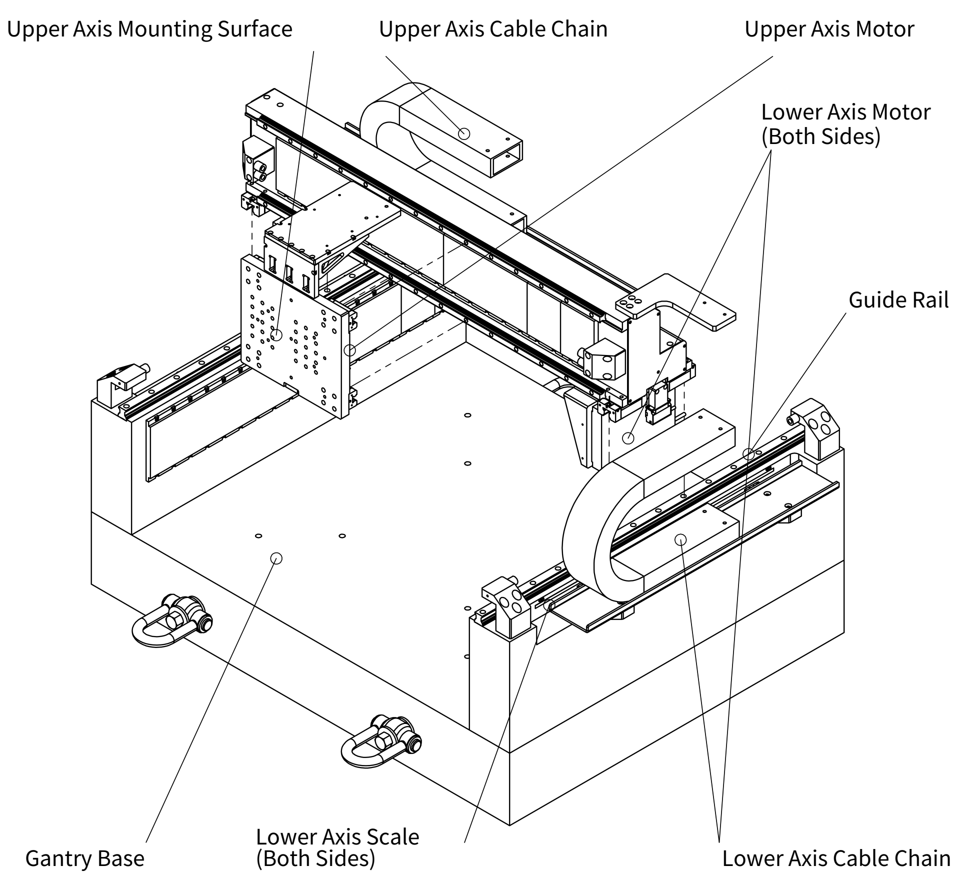
- Direct drive, zero backlash linear motor
- Three configurations H (dual motor dual encoder), J (dual motor single encoder), T (single motor single encoder)
- High peak and continuous force
- High efficiency

VRG-I

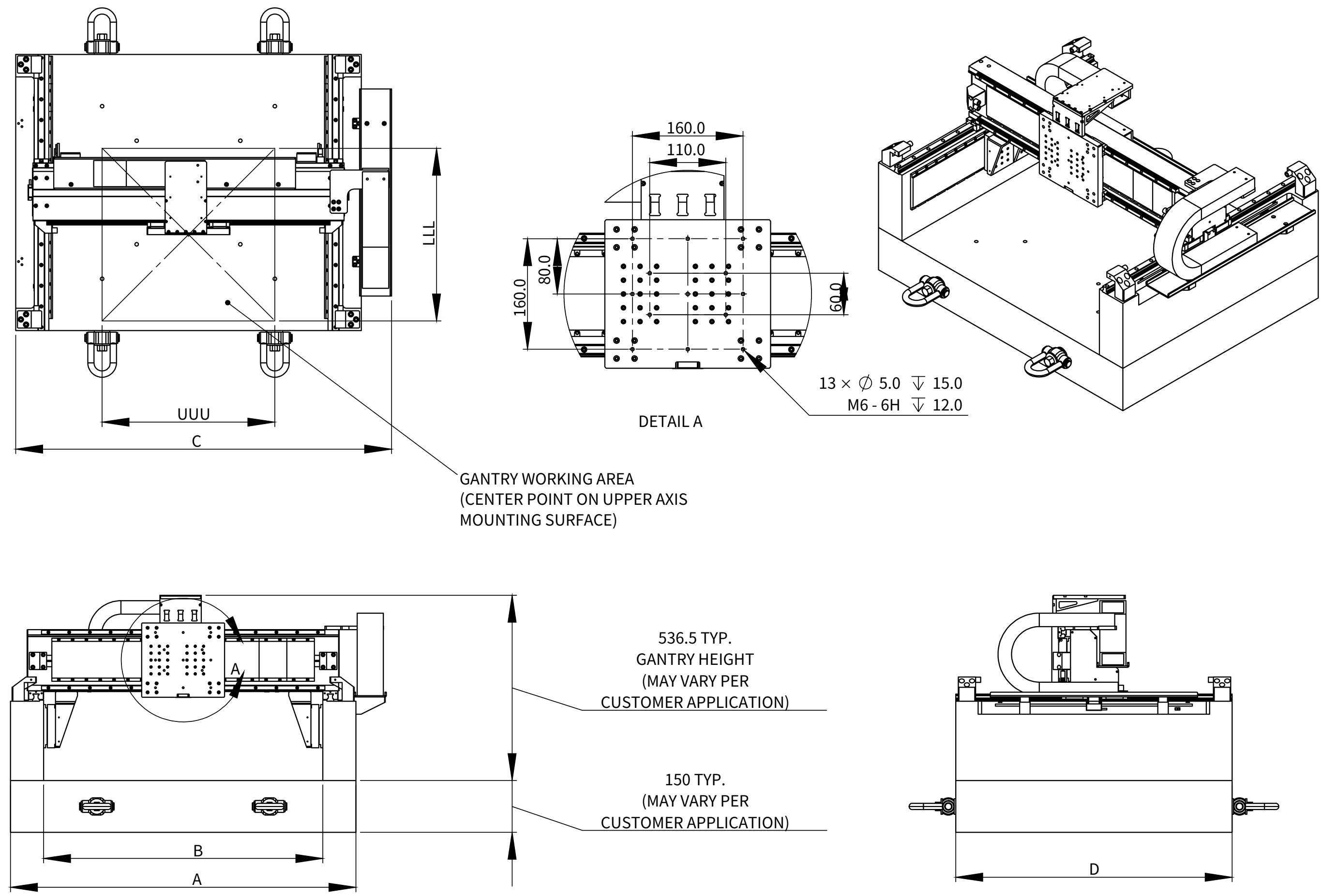
Basic Model		Unit	VRG1-H-L300N-U300N	VRG1-H-L400N-U400N	VRG1-H-L500N-U500N	VRG1-H-L600N-U600N
Effective Stroke		mm	300×300	400×400	500×500	600×600
Maximum Travel Speed		m/s	2	2	2	2
Maximum Linear Acceleration		g	3	3	3	3
Motor	Lower Axis	-	AJM100-B4*2	AJM100-B4*2	AJM100-B4*2	AJM100-B4*2
	Upper Axis	-	AJM100-B4	AJM100-B4	AJM100-B4	AJM100-B4
Continuous Force	Lower Axis	N	893.6	893.6	893.6	893.6
	Upper Axis	N	446.8	446.8	446.8	446.8
Repeatability		μm	±3	±3	±3	±3
Orthogonality		arc-sec	10	10	10	10
Nominal System Weight (Base not included)		kg	103	116	131	148
No-load Moving Mass	Lower Axis	kg	41.0	45	48.0	52.0
	Upper Axis	kg	7.0	7.0	7.0	7.0
Material		-	Aluminum, Granite Optional	Aluminum, Granite Optional	Aluminum, Granite Optional	Aluminum, Granite Optional
Finish		-	Black Anodized	Black Anodized	Black Anodized	Black Anodized

Note:
- Values of velocity , acceleration and no-load moving mass are approximations only and may vary based on customer applications and requirements.
- All specifications listed in the table are based on H-gantry design (dual motor, dual encoder). Other configurations namely I-Gantry (dual motor, single encoder) and T-gantry (single motor, single encoder) will have performance limitation.

Exploded View



Dimension Drawing



"LLL" LOWER-AXIS NOMINAL TRAVEL	"UUU" UPPER-AXIS NOMINAL TRAVEL	"A" GANTRY WIDTH	"B" UPPER-AXIS GANTRY SPACING	"C" SYSTEM WIDTH	"D" SYSTEM DEPTH
300	300	800	608	888	600
400	400	900	708	988	700
500	500	1000	808	1088	800
600	600	1100	908	1188	900

Note:
- Other nominal travel lengths and nominal travel combinations are available.
- "A" , "B" , "C" , "D" dimensions are shown for reference only and may vary per customer application.
- Electrical and mechanical limits included in gantry system.
- Dimensions in millimeters.

Ordering Part Number (OPN)

G1 H 03 03 J01 J01 E73 1 A 1

Model:
G1: VRG-I

Gantry Config: [1]
H: H-Gantry
J: J-Gantry
T: T-Gantry

Lower Axis Stroke: [2]
03: 300mm
04: 400mm
05: 500mm
06: 600mm
07: 700mm

Upper Axis Stroke: [2]
03: 300mm
04: 400mm
05: 500mm
06: 600mm
07: 700mm

Lower Axis Motor:
J01: AJM30-B2-J (Peak Force: 214.7N)
J02: AJM30-B2-K (Peak Force: 214.7N)
J03: AJM30-B4-J (Peak Force: 429.4N)
J04: AJM30-B4-K (Peak Force: 429.4N)
J15: AJM50-B2-J (Peak Force: 369.0N)
J16: AJM50-B2-K (Peak Force: 369.0N)
J17: AJM50-B4-J (Peak Force: 738.1N)
J18: AJM50-B4-K (Peak Force: 738.1N)
J30: AJM80-B2-J (Peak Force: 550.2N)
J31: AJM80-B2-K (Peak Force: 550.2N)
J32: AJM80-B4-J (Peak Force: 1100.4N)
J33: AJM80-B4-K (Peak Force: 1100.4N)
J45: AJM100-B2-J (Peak Force: 704.5N)
J46: AJM100-B2-K (Peak Force: 704.5N)
J47: AJM100-B4-J (Peak Force: 1409.1N)
J48: AJM100-B4-K (Peak Force: 1409.1N)

Termination:
1: Flying Leads
2: DSUB

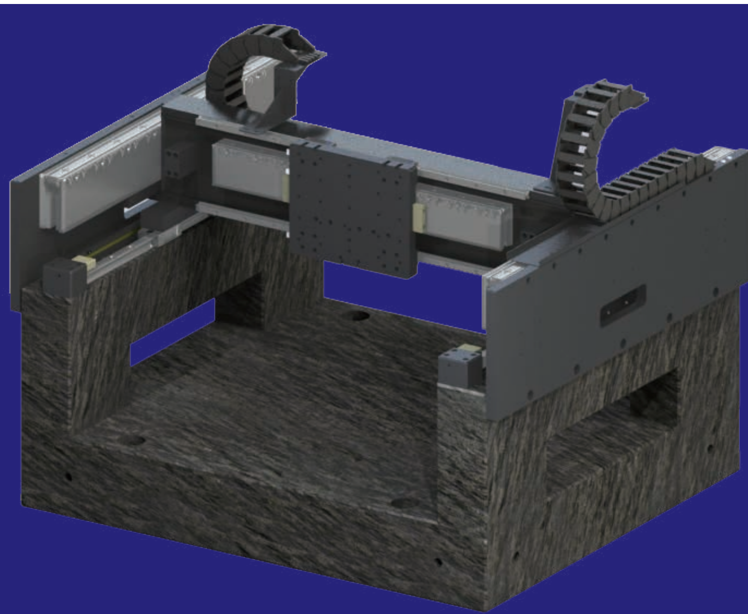
Cable Length:
A: 0.5m
B: 3.0m

Scale Type:
1: Steel tape,11ppm/K

Encoder Type:
E73: ABA50E EnDat2.2 (0.05μm)
E71: ABA50M Mitsubishi (0.05μm)
EBF: Quantic (0.5μm)
EBH: Quantic (0.1μm)
E9F: ABI51D (0.5μm)
E9H: ABI51D (0.1μm)
EA0: ABI52 (SINCOS)

Upper Axis Motor:
J01: AJM30-B2-J (Peak Force: 214.7N)
J02: AJM30-B2-K (Peak Force: 214.7N)
J03: AJM30-B4-J (Peak Force: 429.4N)
J04: AJM30-B4-K (Peak Force: 429.4N)
J15: AJM50-B2-J (Peak Force: 369.0N)
J16: AJM50-B2-K (Peak Force: 369.0N)
J17: AJM50-B4-J (Peak Force: 738.1N)
J18: AJM50-B4-K (Peak Force: 738.1N)
J30: AJM80-B2-J (Peak Force: 550.2N)
J31: AJM80-B2-K (Peak Force: 550.2N)
J32: AJM80-B4-J (Peak Force: 1100.4N)
J33: AJM80-B4-K (Peak Force: 1100.4N)
J45: AJM100-B2-J (Peak Force: 704.5N)
J46: AJM100-B2-K (Peak Force: 704.5N)
J47: AJM100-B4-J (Peak Force: 1409.1N)
J48: AJM100-B4-K (Peak Force: 1409.1N)

Note:
❶ All gantry stages are black anodized. Gantry Configuration: H= Dual motor dual encoder, J= Dual motor single encoder, T= Single motor single encoder.
❷ Standard stroke in intervals of 100mm only, for more options, please contact Akribis sales engineers.



VRG-II SERIES

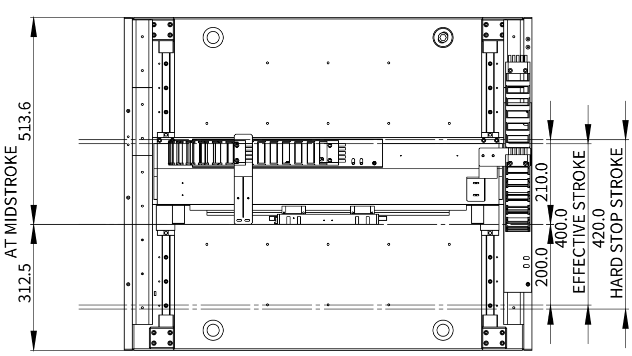
- A versatile gantry stage that generates propulsion in line with the bridge' s COG
- Use ironless AUM motor
- Low velocity ripple

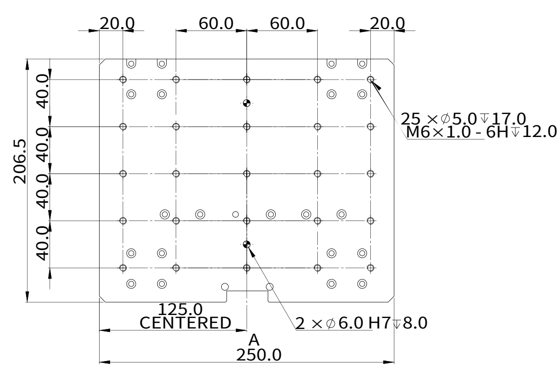
VRG-II

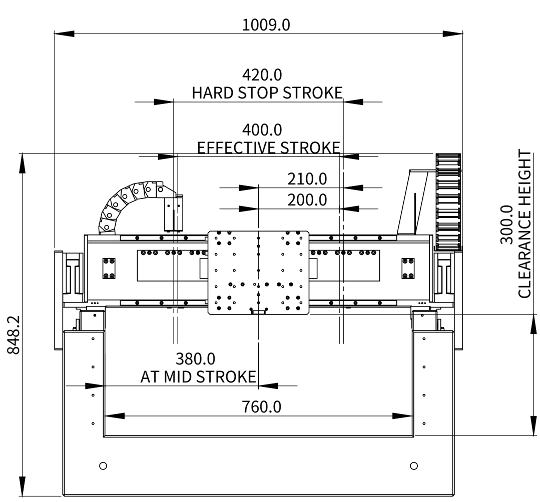
	Unit	L	U
Effective Stroke	mm	400	400
Rated Payload	kg	20	
No-load Moving Mass	kg	40	4
Max Acceleration	m/s²	20	20
Max Velocity	m/s	2	2
Motor Model	-	2 × AUM5-S4	AUM5-S2
Continuous Force	N	2 × 393	197
Peak Force	N	2 × 2830	1415
Encoder Resolution	µm	0.05/0.5/SINCOS	0.05/0.5/SINCOS
Minimal Step Size	µm	0.5	0.5
Bidirectional Repeatability	µm	±1.5	±1.0
Accuracy	µm	±10.0	±10.0
Straightness	µm	±10.0	±10.0
Flatness	µm	±10.0	±10.0
Yaw	arc-sec	±10.0	±10.0
Pitch	arc-sec	±10.0	±10.0
Orthogonality	arc-sec	10.0	
No-load Stage Weight	kg	570	

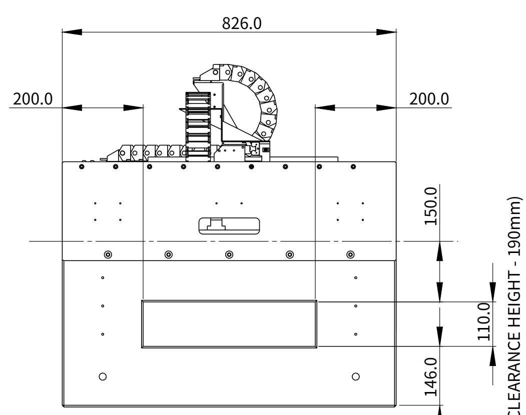
Note:
- The table above presents the highest capability of this stage layout.
- Contact us for more options and details.

Dimension Drawing









Ordering Part Number (OPN)

G2 H 02 02 U46 U17 E73 1 A 2

Model:
- G2: VRG-II

Gantry Config: [1]
- H: H-Gantry
- J: J-Gantry
- T: T-Gantry

Lower Axis Stroke: [2]
- 02: 200mm
- 03: 300mm
- 04: 400mm
- 05: 500mm
- 06: 600mm
- 07: 700mm
- 08: 800mm

Upper Axis Stroke: [2]
- 02: 200mm
- 03: 300mm
- 04: 400mm
- 05: 500mm
- 06: 600mm
- 07: 700mm
- 08: 800mm

Lower Axis Motor:
- U46: AUM4-S-S3-J (Peak Force: 936.0N)
- U47: AUM4-S-S3-K (Peak Force: 936.0N)
- U48: AUM4-P-S3-J (Peak Force: 936.0N)
- U49: AUM4-P-S3-K (Peak Force: 936.0N)
- U50: AUM4-S-S4-J (Peak Force: 1248.0N)
- U51: AUM4-S-S4-K (Peak Force: 1248.0N)
- U52: AUM4-P-S4-J (Peak Force: 1248.0N)
- U53: AUM4-P-S4-K (Peak Force: 1248.0N)
- U76: AUM5-S-S3-J (Peak Force: 2122.0N)
- U77: AUM5-S-S3-K (Peak Force: 2122.0N)
- U78: AUM5-P-S3-J (Peak Force: 2122.0N)
- U79: AUM5-P-S3-K (Peak Force: 2122.0N)
- U80: AUM5-S-S4-J (Peak Force: 2830.0N)
- U81: AUM5-S-S4-K (Peak Force: 2830.0N)
- U82: AUM5-P-S4-J (Peak Force: 2830.0N)
- U83: AUM5-P-S4-K (Peak Force: 2830.0N)

Upper Axis Motor:
- U17: AUM3-S-S2-J (Peak Force: 289.0N)
- U18: AUM3-S-S2-K (Peak Force: 289.0N)
- U19: AUM3-P-S2-J (Peak Force: 289.0N)
- U20: AUM3-P-S2-K (Peak Force: 289.0N)
- U21: AUM3-S-S3-J (Peak Force: 433.0N)
- U22: AUM3-S-S3-K (Peak Force: 433.0N)
- U23: AUM3-P-S3-J (Peak Force: 433.0N)
- U24: AUM3-P-S3-K (Peak Force: 433.0N)
- U25: AUM3-S-S4-J (Peak Force: 578.0N)
- U26: AUM3-S-S4-K (Peak Force: 578.0N)
- U27: AUM3-P-S4-J (Peak Force: 578.0N)
- U28: AUM3-P-S4-K (Peak Force: 578.0N)
- U46: AUM4-S-S3-J (Peak Force: 936.0N)
- U47: AUM4-S-S3-K (Peak Force: 936.0N)
- U48: AUM4-P-S3-J (Peak Force: 936.0N)
- U49: AUM4-P-S3-K (Peak Force: 936.0N)
- U50: AUM4-S-S4-J (Peak Force: 1248.0N)
- U51: AUM4-S-S4-K (Peak Force: 1248.0N)
- U52: AUM4-P-S4-J (Peak Force: 1248.0N)
- U53: AUM4-P-S4-K (Peak Force: 1248.0N)

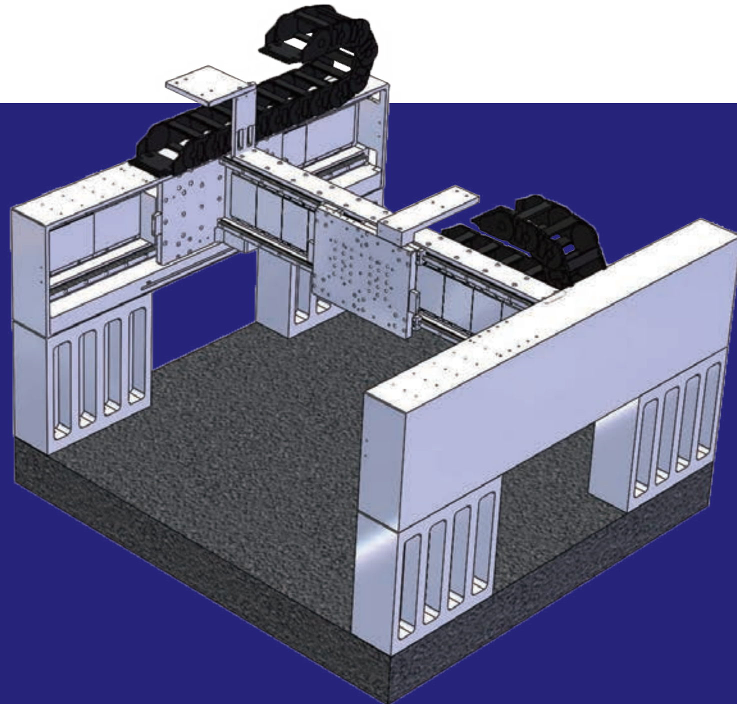
Encoder Type:
- E73: ABA50E EnDat2.2 (0.05µm)
- E71: ABA50M Mitsubishi (0.05µm)
- EBF: Quantic (0.5µm)
- EBH: Quantic (0.1µm)
- E9F: ABI51D (0.5µm)
- E9H: ABI51D (0.1µm)
- EA0: ABI52 (SINCOS)

Scale Type:
- 1: Steel tape,11ppm/K

Cable Length:
- A: 0.5m
- B: 3.0m

Termination:
- 2: DSUB
- 3: M23

Note:
[1] All gantry stages are black anodized. Gantry Configuration: H= Dual motor dual encoder, J= Dual motor single encoder, T= Single motor single encoder.
[2] Standard stroke in intervals of 100mm only, for more options, please contact Akribis sales engineers.



VRG-III SERIES

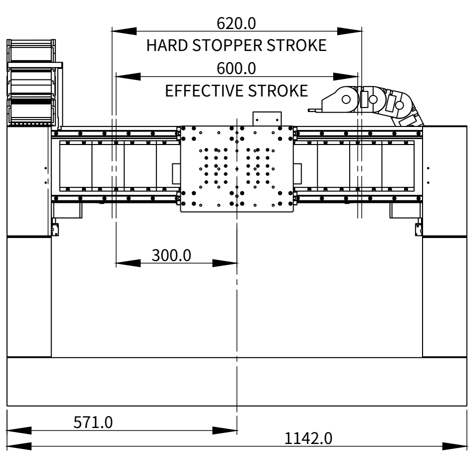
- A versatile gantry stage that generates propulsion in line with the bridge' s COG
- Use ironcore AJM, AKM motor
- High force density

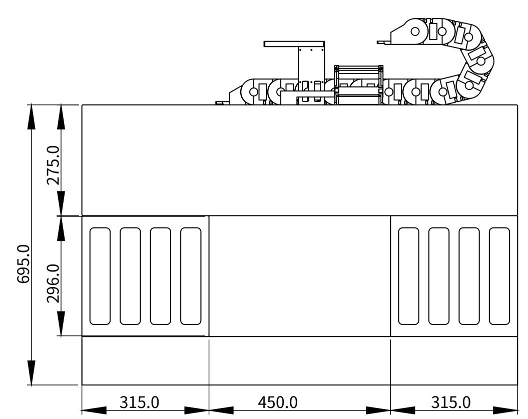
VRG-III

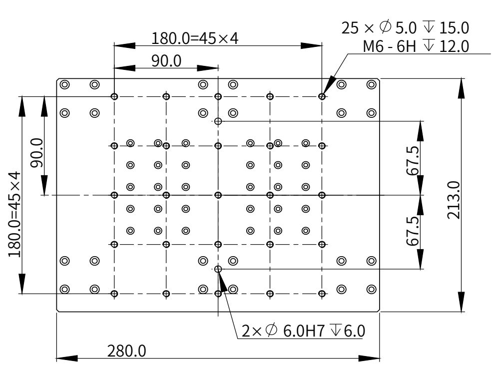
	Unit	L	U
Effective Stroke	mm	600	600
Rated Payload	kg	50	
No-load Moving Mass	kg	80	10
Max Acceleration	m/s²	20	20
Max Velocity	m/s	2	2
Motor Model	-	2 × AKM100-B4	AJM100-B4
Continuous Force	N	2 × 722	446
Peak Force	N	2 × 1610	1409
Encoder Resolution	μm	0.05/0.5/SINCOS	0.05/0.5/SINCOS
Minimal Step Size	μm	0.5	0.5
Bidirectional Repeatability	μm	±2	±1.5
Accuracy	μm	±10.0	±10.0
Straightness	μm	±10.0	±10.0
Flatness	μm	±10.0	±10.0
Yaw	arc-sec	±10.0	±10.0
Pitch	arc-sec	±10.0	±10.0
Orthogonality	arc-sec	10.0	
No-load Stage Weight	kg	635	

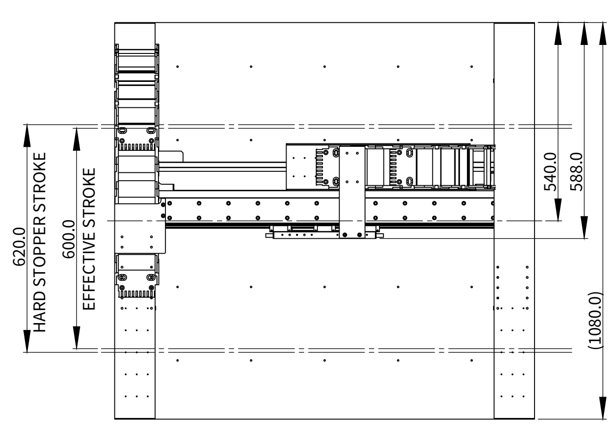
Note:
- The table above presents the highest capability of this stage layout.
- Contact us for more options and details.

Dimension Drawing









Ordering Part Number (OPN)

G3 H 02 02 K03 J03 E73 1 A 2

Model:
- G3: VRG-III

Gantry Config: [1]
- H: H-Gantry
- J: J-Gantry
- T: T-Gantry

Lower Axis Stroke: [2]
- 02: 200mm
- 03: 300mm
- 04: 400mm
- 05: 500mm
- 06: 600mm
- 07: 700mm
- 08: 800mm

Upper Axis Stroke: [2]
- 02: 200mm
- 03: 300mm
- 04: 400mm
- 05: 500mm
- 06: 600mm
- 07: 700mm
- 08: 800mm

Lower Axis Motor:
- K03: AKM30-B2-J (Peak Force: 483.2N)
- K04: AKM30-B2-K (Peak Force: 483.2N)
- K05: AKM30-B4-J (Peak Force: 966.3N)
- K06: AKM30-B4-K (Peak Force: 966.3N)
- K22: AKM50-B2-J (Peak Force: 805.3N)
- K23: AKM50-B2-K (Peak Force: 805.3N)
- K24: AKM50-B4-J (Peak Force: 1610.5N)
- K25: AKM50-B4-K (Peak Force: 1610.5N)
- K42: AKM100-B2-J (Peak Force: 1610.5N)
- K43: AKM100-B2-K (Peak Force: 1610.5N)
- K44: AKM100-B4-J (Peak Force: 3221.1N)
- K45: AKM100-B4-K (Peak Force: 3221.1N)

Upper Axis Motor:
- J03: AJM30-B4-J (Peak Force: 429.4N)
- J04: AJM30-B4-K (Peak Force: 429.4N)
- J30: AJM80-B2-J (Peak Force: 550.2N)
- J31: AJM80-B2-K (Peak Force: 550.2N)
- J45: AJM100-B2-J (Peak Force: 704.5N)
- J46: AJM100-B2-K (Peak Force: 704.5N)
- J47: AJM100-B4-J (Peak Force: 1409.1N)
- J48: AJM100-B4-K (Peak Force: 1409.1N)

Encoder Type:
- E73: ABA50E EnDat2.2 (0.05μm)
- E71: ABA50M Mitsubishi (0.05μm)
- EBF: Quantic (0.5μm)
- EBH: Quantic (0.1μm)
- E9F: ABI51D (0.5μm)
- E9H: ABI51D (0.1μm)
- EA0: ABI52 (SINCOS)

Scale Type:
- 1: Steel tape,11ppm/K

Cable Length:
- A: 0.5m
- B: 3.0m

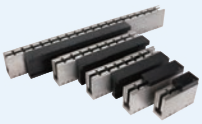
Termination:
- 2: DSUB
- 3: M23

Note:
❶ All gantry stages are black anodized. Gantry Configuration: H= Dual motor dual encoder, J= Dual motor single encoder, T= Single motor single encoder.
❷ Standard stroke in intervals of 100mm only, for more options, please contact Akribis sales engineers.

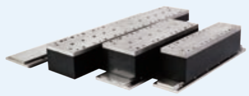
Other Driect Drive Products

Motor Series

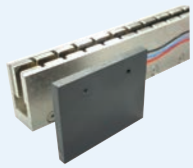
AUM series



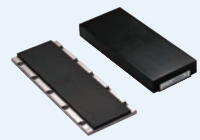
ACM series



AWM series

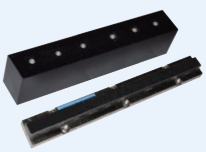


AJM Series

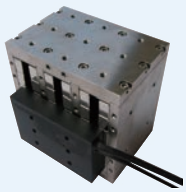


AKM Series

AQM series

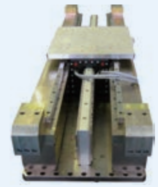


AHM series

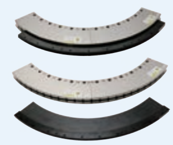


ALM series

ACM-D series

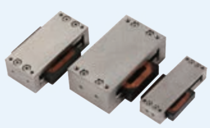


ACR series



AVM series

AVA series



ATA series

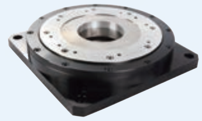
ADR-A series

ADR-B series

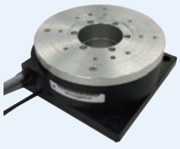
ADR-P/ADR-F series

ACD series

ACW series



AXD series



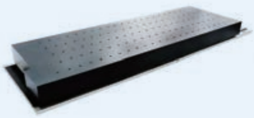
AXM series

ADR-H series

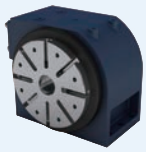
Other Direct Drive Products

Direct Drive Products for CNC

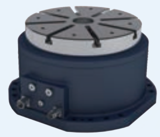
AKMF series linear motor



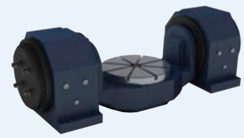
ARH series horizontal CNC turntable



ARV series vertical CNC turntable



ATRT series Dual-axis CNC turntable

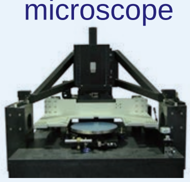


AMH series Dual-axis milling head

Precision Stages for Industries

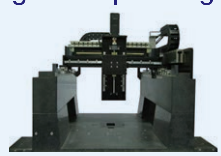
5-axis XYZT for 3D measurement

XYZ stage for wafer microscope



XYZ stage for medical application

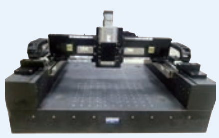
XYZ Stage for glue dispensing



XYZ stage for optical system assembly

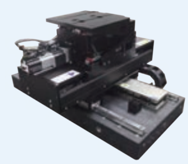
XYZ stage for laser application

H-drive gantry stage



Hollow XY stage for wafer detection

XYZ stage for wafer detection

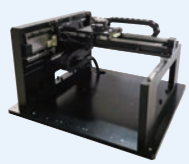


14-axis FPD stage for G6 laser packing

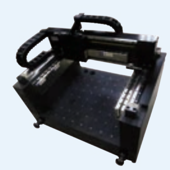
6 DOF mini stage for optical alignment

XYZ stage for fiber optic alignment

XY Stage for glue dispensing

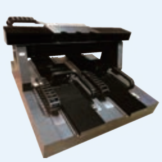


H-drive gantry stage for assembly and testing

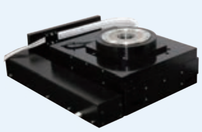


XYT stage for glass laser cutting

XYZ stage for PCB exposure



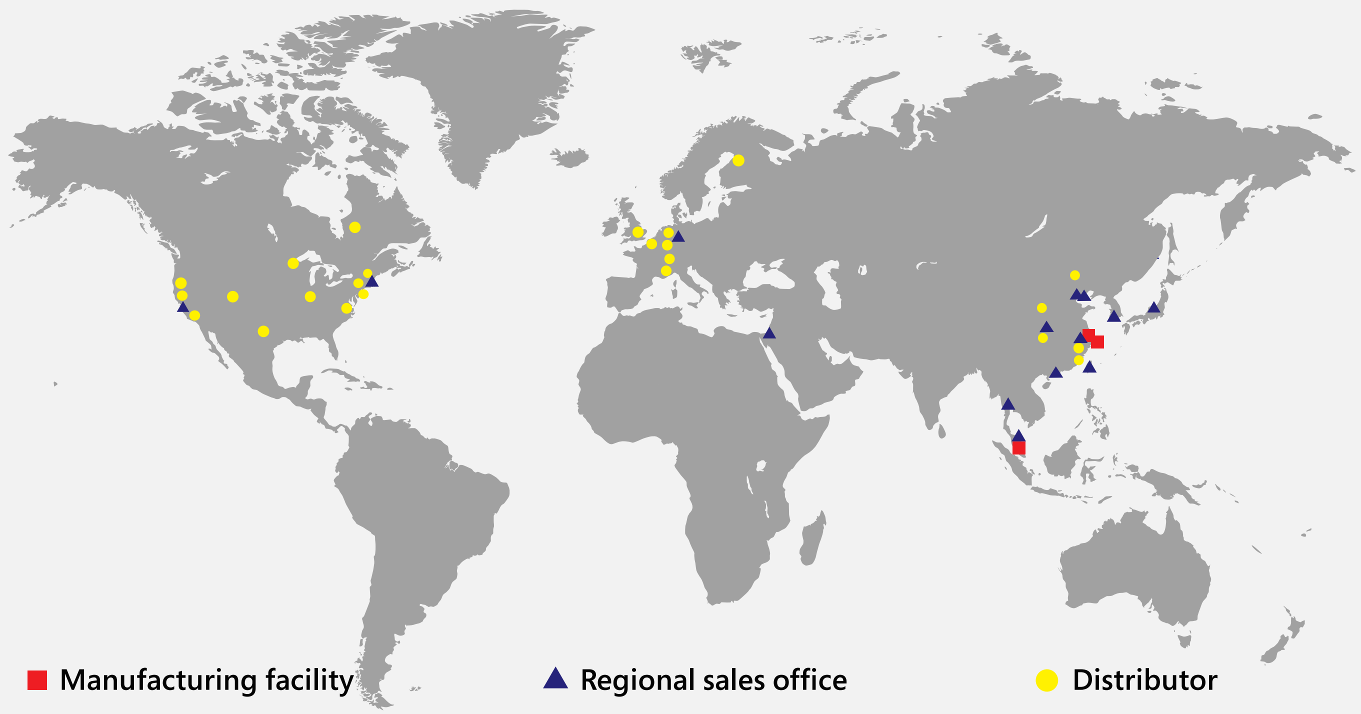
XYZ stage for wafer testing



H-drive gantry stage for testing and laser application

LX1030Z gantry machining center

Akribis Worldwide Offices and Distribution Network



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