ASA actuators

Compact Servo Actuators

Only 24 VDC supply

Very fast response

Reliable design

No moving cables

Patent Pending

Simplus

Direct Drive Actuators

Simplus in Latin means "Simple".

We focus on making direct drive[1] actuators that are **simple** to use, **plus** the additional benefits of:

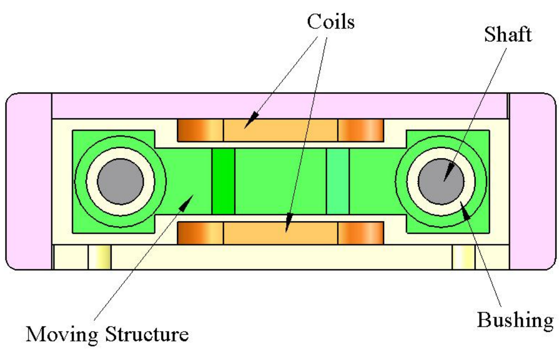
- small form factor
- higher performance
- better reliability

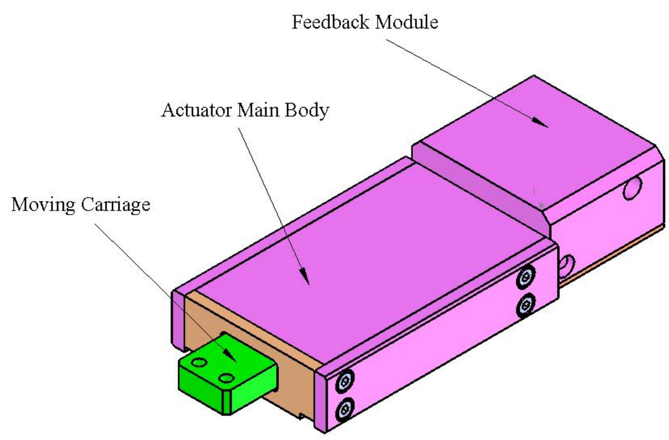
[1] direct drive means driving the load directly without any transmission mechanism, such as pulleys, timing belts, ball screws and gears.

Patent Pending

Introduction to ASA Actuators

The ASA is a compact, direct drive servo actuator. The figures below show the design of an ASA actuator, which is patent pending.





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.

A feedback module houses a high resolution linear encoder, with encoder resolution of 0.5 um, or options of up to 5 nm. Servo control is enabled with this encoder feedback to a servo amplifier/controller.

Advantages

The ASA actuator has the following advantages:

Direct drive

The moving mass is low, thus allowing very high accelerations to be achieved. The linear encoder measures the actual position directly, without any backlash.

Smooth motion

There is no detent force in an ASA actuator motor. Hence, there is no cogging force, like in most brushless motors. Hence, very smooth motion can be achieved.

Reliability

Since there is no contact between the coil and the moving magnet structure, there is no wear and tear. Moreover, since the coils and cable are fixed, the ASA actuator is very reliable.

Force control

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

Selection of an ASA actuator for an application

The selection process involves:

Determining the stroke required

Each ASA size comes with at least 2 stroke options. Select the ASA actuator whose stroke meets the maximum travel required for the application.

Calculating the force required

To select the right ASA actuator for an application, the peak force and RMS force (Root Mean Square force) of the application must be calculated. We can select an actuator with a peak force and continuous force that are larger than the calculated application peak force and RMS force respectively.

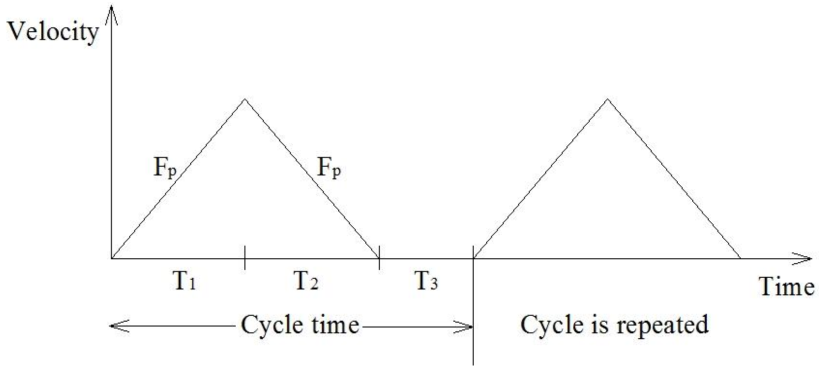
An example of how this is done is described below. Alternatively, a motor selection software program is available from Akribis for automatically calculating and selecting the right motor.

Peak force

In an application, it is important to determine the peak force and RMS force required, in order to select the right ASA actuator. 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 20g, and an acceleration of 40 m/s^2, the peak force required during acceleration will be 0.8 N.

RMS force



The RMS force is calculated with the equation:

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

where
F_{RMS} is the root mean square force
F_p is the peak force$_p$
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 0.8 N. If the dwell time is 0.05 s, then

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

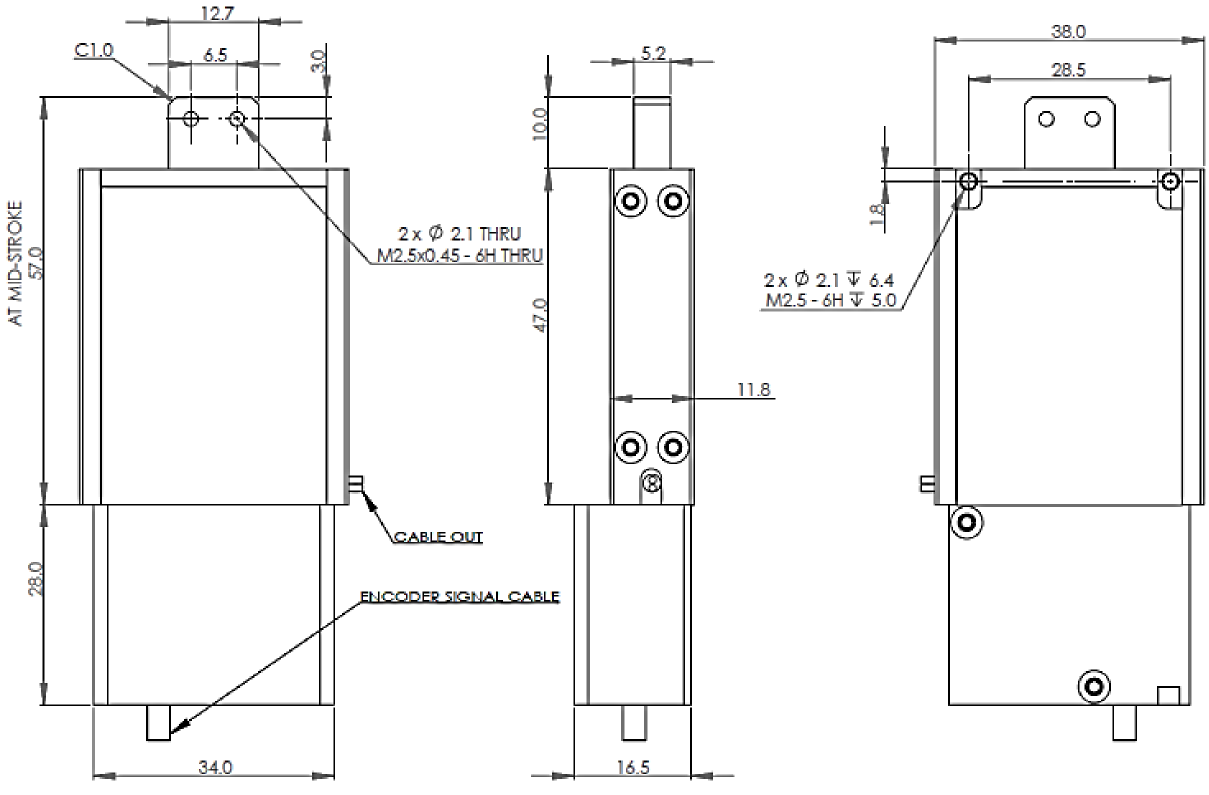
$= \sqrt{}(0.8^2 * 0.01 + 0.8^2 * 0.01)/(0.01+0.01+0.05)$

$= 0.43$ N

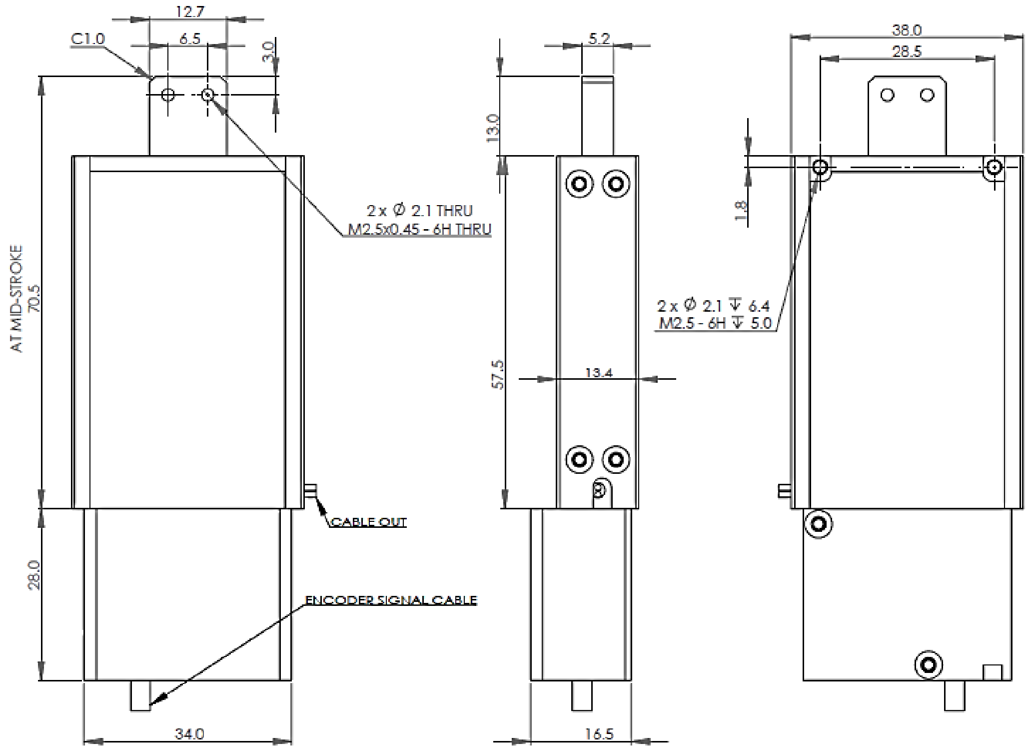
Hence, we can select an ASA actuator with a peak force that exceeds 0.8N, and with a continuous force that exceeds 0.43 N.

Model	Units	ASA-MS3-6	ASA-MS3-12	ASA-MS3-25
Stroke	mm	6	12	25
Force sensitivity (at mid stroke)	N/A	0.92	0.98	0.83
Back EMF constant	V/m/s	0.92	0.98	0.83
Continuous force	N	1.84	1.96	1.66
Peak force	N	7.36	7.84	6.64
Resistance	ohms	1.39	1.77	2.58
Continuous current	A	2.0	2.0	2.0
Peak current	A	8.0	8.0	8.0
Voltage at peak force	V	11.1	14.2	20.6
Actuator constant	N/SqRt(W)	0.78	0.74	0.52
Continuous power	W	5.6	7.1	10.3
Max coil temperature	Deg C	130	130	130
Moving mass	g	19.2	26.8	48.1

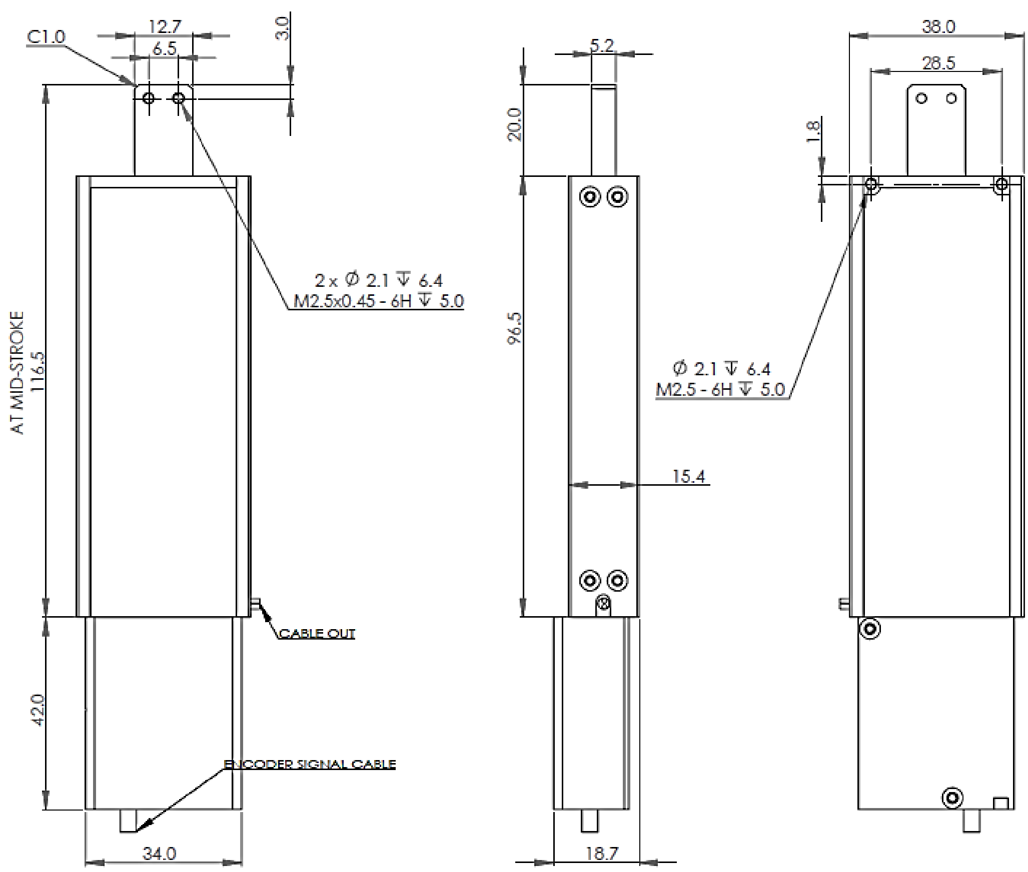
ASA-MS3-6



ASA-MS3-12

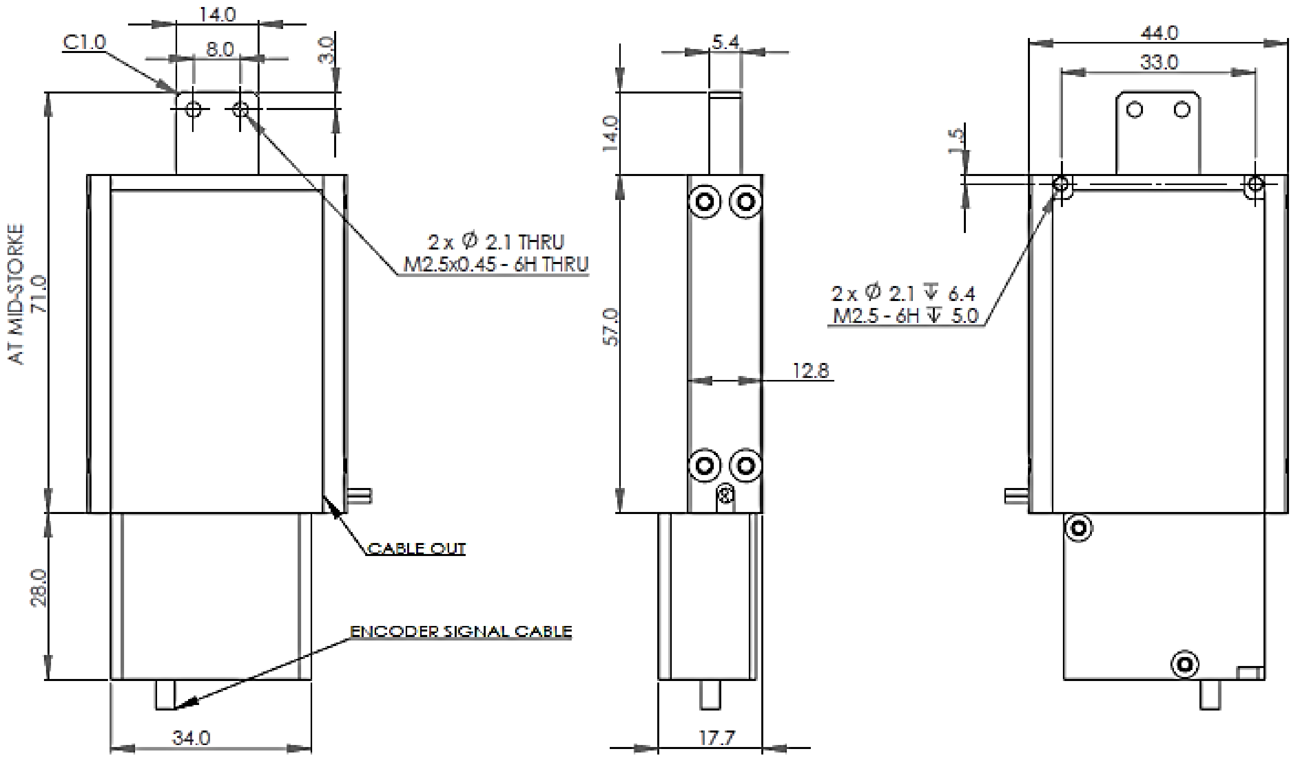


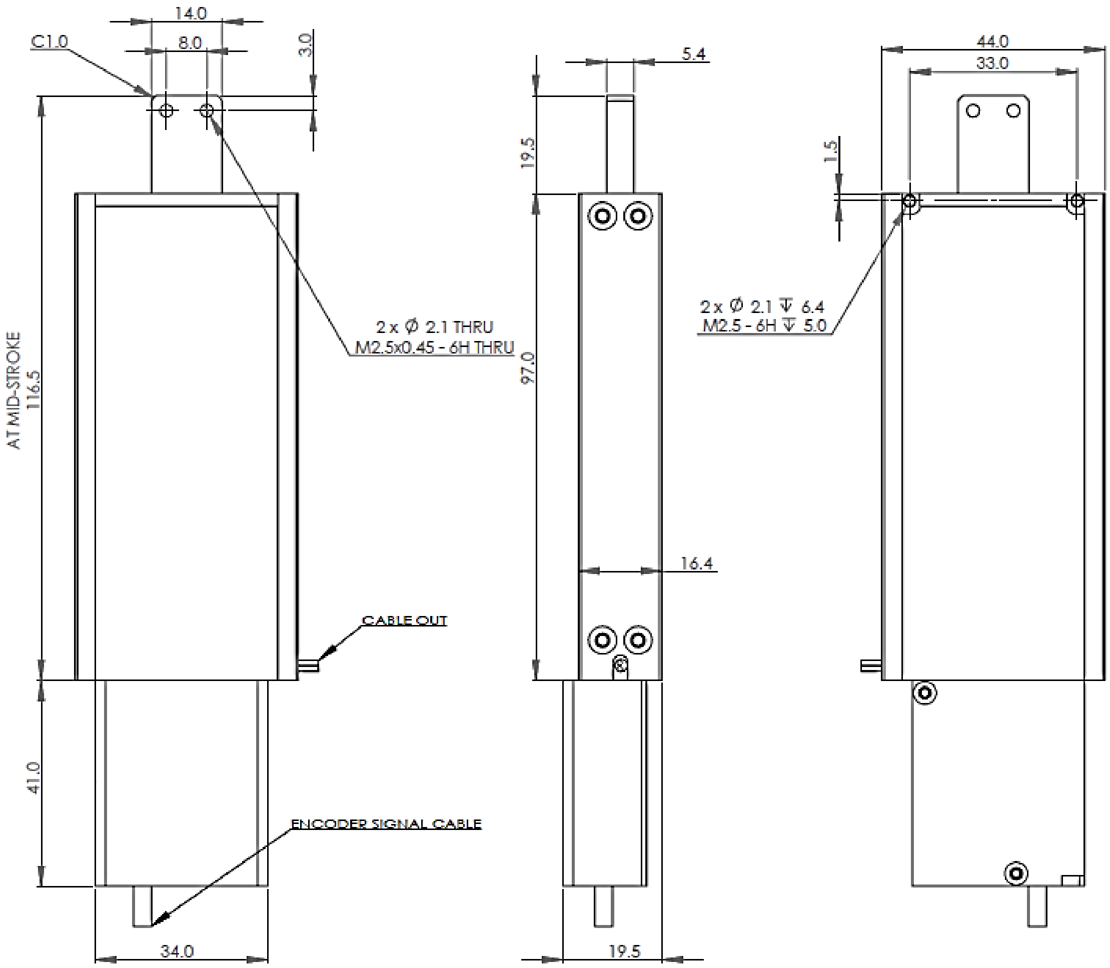
ASA-MS3-25



Model	Units	**ASA-MS4-12**	**ASA-MS4-25**
Stroke	mm	12	25
Force sensitivity (at mid stroke)	N/A	0.54	1.47
Back EMF constant	V/m/s	0.54	1.47
Continuous force	N	1.08	2.94
Peak force	N	4.32	11.76
Resistance	ohms	1.97	2.82
Continuous current	A	2.00	2.00
Peak current	A	8	8
Voltage at peak force	V	15.8	22.6
Actuator constant	N/SqRt(W)	0.38	0.88
Electrical time constant	ms	TBD	TBD
Continuous power	W	7.9	11.3
Max coil temperature	Deg C	130	130
Moving mass	g	29.8	55.7

ASA-MS4-12




14.0
8.0
C1.0
3.0
5.4
19.5
44.0
33.0
1.5
2 x Ø 2.1 THRU
M2.5x0.45 - 6H THRU
2 x Ø 2.1 ↧ 6.4
M2.5 - 6H ↧ 5.0
AT MID-STROKE
116.5
97.0
16.4
CABLE OUT
41.0
ENCODER SIGNAL CABLE
34.0
19.5