SiMB Series
Precision Ball Screw + Stepping Servo Motor

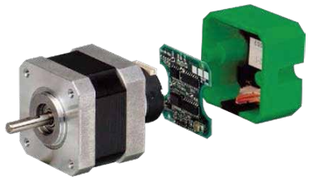
MoBo

Features

- A Stepping Servo Motor, what we call Si-servo Motor, is mounted directly onto the Shaft end of a Precision Ball Screw, which is high resolution and precise positioning unit.
- An Encoder and a Memory chip are installed at the end of Motor, high accurate positioning, ultra smooth drive, torque control drive, and closed loop function have been achieved.
- Ball Screw Shaft is ideally constructed to form the Motor Rotor Shaft.
- Since combining the Motor Shaft and Ball Screw Shaft, Coupling-less, saving total length, and reducing labor cost can be achieved.
- Exclusive Driver, and Cable are provided for Si-servo Motor.

Database compensation control

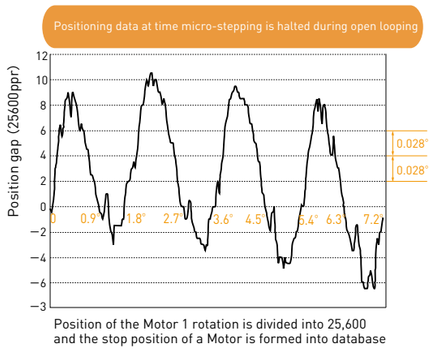
Control mechanism of the Si servo is not simply the micro-step control. Both an Encoder and a Memory chip are installed, and the Encoder position for 400pulse resolution per revolution as well as electrical current feedback are standard. Furthermore, data inherent to the Motor is recorded in the Memory at time of shipping from the factory so that high speed and high precision positioning to designated positions can be realized using a precise database revision control method of compensation and control when the Motor starts.



Sampling motor characteristics

Cogging Torque and Torque ripples originate from Motor processing and assembly precision, big factors that can hinder a low vibration, high accuracy positioning. The Si servo, by accurately measuring and storing individual Motor characteristics data inherit to the Motor, we can create a database of the optimal electrical current wave forms for the highest possible rotary precision.

Sampling of Motor's Positioning Characteristic



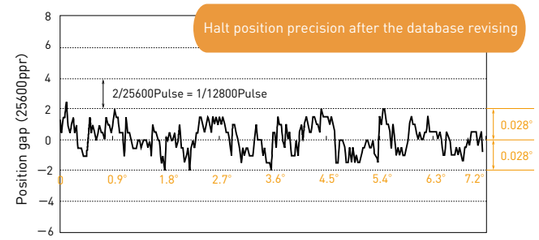
Position of the Motor 1 rotation is divided into 25,600 and the stop position of a Motor is formed into database

Storing data in memory

The data gained from sampling is stored in Memory within the Motor, which can be transferred to a Driver by using an Encoder cable at the time power is supplied. This makes it possible for the Driver and the Motor to work as an optimal combination.

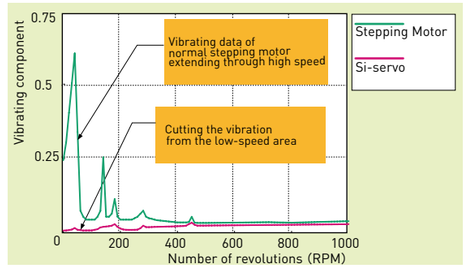
High precision positioning

This is not just a simple command analysis as with Micro-step controls. It raises the actual precision of halting to a proper 10000 pulse encoder.
Furthermore uniform pitch positioning to the pulse, which can not be achieved by Micro-step, has been realized.
(*As one condition, the output Torque of the Motor needs to sufficiently exceed load resistance.)



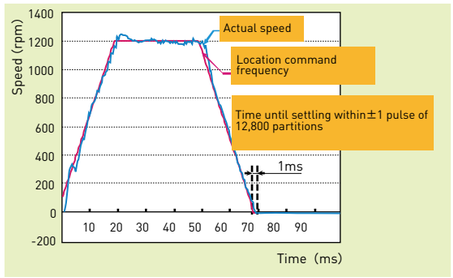
Low vibrations

Vibrating elements in the Motor have been largely removed thanks to the optimal high-speed revision current commands while the Motor is in operation. Also unlike a standard Servo Motor, there is no searching between Encoder counts when the Motor stops.



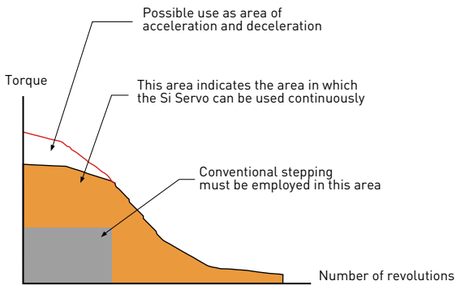
Settling time

The Si Servo makes the most of the stepping motor's advantsges including its ability to closely follow the command pulse train
The amount of time until setting within ±1 pulse of 12,800 partitions is only 1ms. Providing superior performance in high response systems.



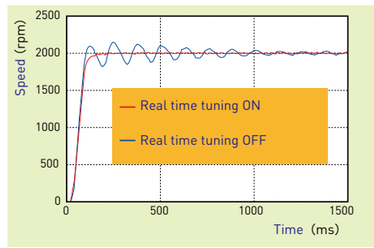
Surplus Torque

Because the Si Servo is never step out, it is possible to operate continuously at 100% capacity. There is no need to consider the Torque margin as with the Stepping Motor.

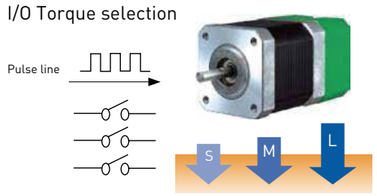


Real-time auto-tuning

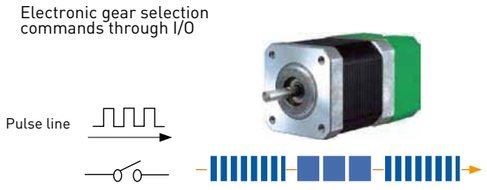
Even machinery that could not operate smoothly with conventional tuning methods will automatically imitate Inertia and Rigidity, always able to realize the optimal responsive and stable tuning.



Torque controls through stepping
Five steps of Torque control are performed during position control. Optional Torque value settings are possible during the point table operations. A high degree of freedom in control is possible thanks to being able to switch back and forth between position control and torque control. Even during Torque control, differential controls are still being performed internally, so positions will not deviate.



External electronic gear transfer
Using external I/O signals and/or communication commands, switching the electronicgear setting in two steps possible. Even controller that cannot output except on command pulses with low frequencies can be highly functional in a wide range from low speed to high speed operations.
*Switching can be performed while the motor is halted.



⚠ Depends on the condition, this product will not be suitable for your specifications.
Please always consult with KSS regarding your requirement.

●Specifications

Model	Shaft Nominal Dia. (mm)	Lead (mm)	Travel (mm)	Travel per pules (μm)	Reference Thrust (N)	Mass (g)
SiMB0401	φ4	1	30	1/25,600	30	114
SiMB0801	φ8	1	100	1/25,600	300	130
SiMB0802	φ8	2	160	2/25,600	150	165
SiMB0805	φ8	5	150	5/25,600	80	200

Repeatability(reference)	max. ±0.001mm
Lost Motion(reference)	max. 0.001mm

※The reference value about Repeatability and Lost Motion represents when the MoBo built into KSS original Stage. Please make a contact to KSS for actual value.

Note1) Detail specifications & dimensions are shown in drawings from page P149.
Note2) Acceleration & Deceleration Rate should be recommended by 0.5ms/kHz or more(Abiliby as a Motor itself) .
Note3) Reference Thrust may vary depending on the operating condition, please ask KSS for more detail.

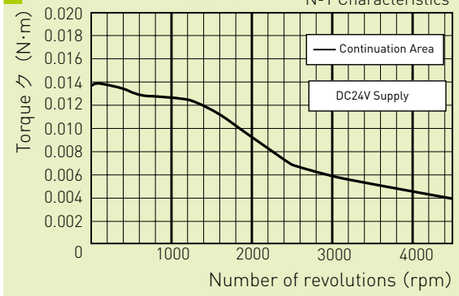
●Motor Specifications

Model		TS3692N61S02(SiMB0401)	TS3617N370S04 (SiMB08xx)
Maximum output torque	N・m	0.017	0.24
Maximum rotating speed	rpm	4500	4500
Rated current	A0-p	0.35	2.0
Rated voltage	V	3.0	2.2
Coil resistance	Ω	8.5±15%	1.1±15%
Rotor inductance	mH	3.4±20%	1.4±20%
Rotor inertia	10^{-7}kg・m^2	1.9	35
Shaft run out	mm T.I.R	0.05	0.05
Load limit in Vertical Position	N	230	300
Thrust play	mm max.	0.01	0.01
Coil Method	—	2-phase hybird stepping motor Bipolar coil	
Insulation class	—	CLASS B	
Insulation resistance	MΩ min.	100 (at DC500V)	
Dielectric strength	V	500 (at AC 1MIN)	
Operating temperature range	℃	−20～+50	
Operating humidity range	%RH	5～95	
Storage temperature range	℃	−40～+70	

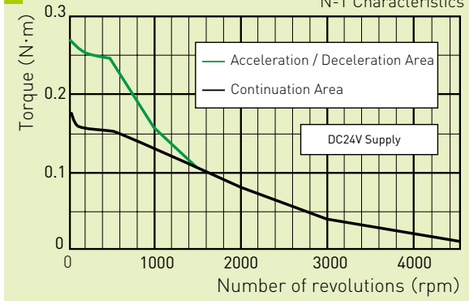
Note) Rotor Inertia includes Ball Screw Shaft.

●Torque Characteristics

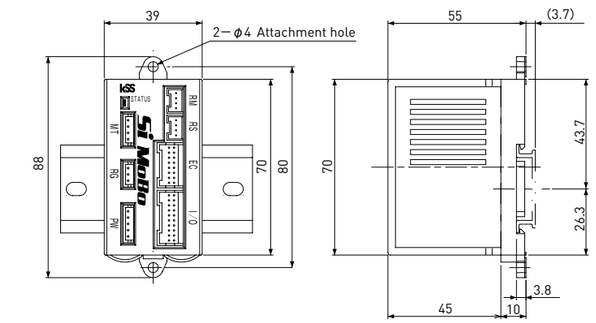
TS3692N61S02(□20) N-T Characteristics



TS3617N370S04(□42) N-T Characteristics



●Driver Outer Dimensions



●ドライバ仕様 / Driver Specifications

Model			Si-02LDE(SiMB0401)	Si-02DE(SiMB08xx)
Applicable Motor Model			TS3692N61S02	TS3617N370S04
Rated Output Current(A0-p)			0.35	2.0
Maximum Output Current(A0-p)			1.0	4.5
Controlling Method			Transistor PWM（Sine Wave Drive）	
Feedback			Incremental Encoder 200 ppr	Increnebtal Encoder 400ppr
Power supply	Voltage (V)	Power supply	DC24V±10% or DC36V±10%	
		Control power supply	DC24V±10%	
	Power Supply Current(A)		2	
Position Command Method			Communication and Control Input through 3 Mode Pules Lines and RS485	
Conditions for Use	Temperature for Use		0～+50℃	
	Storage Temperature		−20～+85℃	
	Humidity for Use or Storage		Under 90%RH(no condensation)	
	Resistance Vibrations		0.5G	
	Impact Resistance		2G	
Standard Functions	Dynamic Braking		None	
	Regenerative Function		Able to connect to external regeneration processing circuit	
	Over Travle Prevention		Hard OT, Soft OT(Select ON or OFF parameters)	
	Internal Speed Setting		Point Table Transfer Speed, Jog Speed, Reset Speed	
	Display		1- LED(Alarm Display, Servo ON Conditions)	
Input / Output	Input	Control Input	5 points(Select function parameters)	
		Command Pulse Input	CW / CCW、PULSE / SIGN、A / B Phase Input(Select parameters) Maximum response waves : 750kpps	
	Output	Control output	3 points(Select parameters), Brake Release Signal	
Protection Functions			EEPROM abnormalities, Encoder abnormalities, System abnormalities, Over Currents, Driver overheating, Excessive location deviation, Motor current abnormalities, Control Current abnormalities	
Zero Return Mode			Zero LS Signal input or using mechanical stopper(Set parameters of 7 methods)	
Multi-axis			Multi-drops of up to 15 axis with RS485	
Settigs			Parameters are set through use of a computer(RS485 converter required)	
Standard, Environmental, and Protection Grades			UL conformance / CE(self-declaration) / Corresponds to RoHS / IP40	

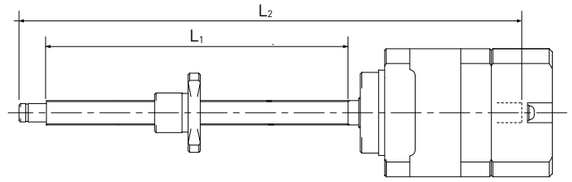
●Model number notation

Model number notation for customized SiMB series is as follows.
In case of standard style, model number is described in catalogue from page P149 to page P150.

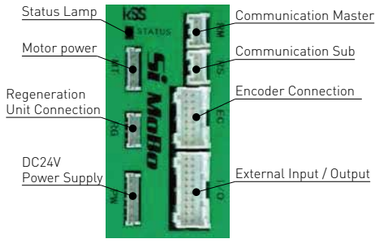
SiMB 08 01 - 50 R 100 C3 - 0
① ② ③ ④ ⑤ ⑥ ⑦ ⑧

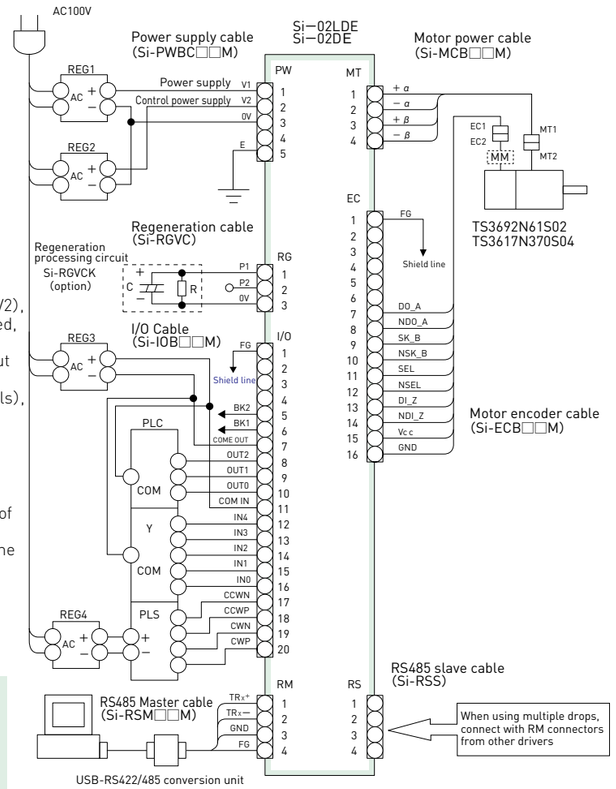
①Series No.
SiMB：Precision Ball Screw+Stepping Servo Motor
②Screw Shaft nominal diameter(mm)
③Lead(mm)
01 means 1mm
④Screw thread length(mm)
L_1：See below
⑤Thread direction（R=Right-hand)
⑥Screw Shaft total length(mm)
L_2：See below
⑦Accuracy grade
⑧Axial play(μm)

【④⑥Definition of Screw length】



●Connections





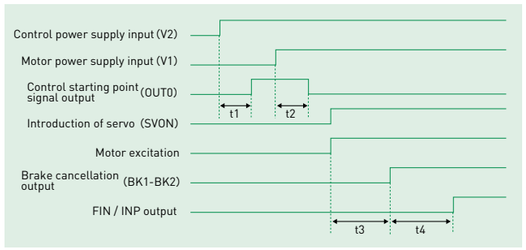
*REG1 uses either DC24V or DC36V for stabilizing power supply to the main circuit power supply. When DC24V is used, REG2 may be shared.
*REG2 uses DC24V for stabilizing power supply to the control circuit.
*REG3 uses DC24V for stabilizing power supply to I/O.
*REG4 uses DC5V(or higher) for stabilizing power supply when the command pulse line outputs an open collector.
*BK1 and 2 have no voltage relay connector output.
*MM refers to motor memory unit, and is packaged only in cables TS3692N61S02 and TS3617N370S04.

■Timing the introduction of activation power supply

If using separate power supplies from activation(V1) and control (V2), introduce the control power supply first. When the control is supplied, the OUT0 signal is turned on as a signal that control has begun. Introduce the activation power supply only after confiming the output from this signal. If using the same power supply for activation and control (connecting the power supply to parallel V1 and V2 terminals), you can introduce them at the same time.

■Initialization action when introducing power supply

Give the command to turn on the servo timed with the introduction of the activation power supply and the OUT0 signal.*3 When the positioning of the motor excitation starting point (every 7.2° from the machine angle) is complate, the FIN/INP signal will be output and initialization actions are complete.*2All pulse line and other commands input before these initialization actions will be ignored. Furthermore, be sure to use non-voltage relay connection output BK1-BK2 on this device, where the brake cancellation signal measures timing with the motor excitation activation.



■Power Supply Introduction Timing

(These value do not take into consideration times for starting control and activation power supplies)

Symbol	Meaning	Time	Unit
t1	Introduce control power supply, after t1 OUT0 signal is output.	1000	ms
t2	Introduce control power supply, after t2 conditions are set for motor excitation*3	50	
t3	After the command to turn on servo, motor excitation begins and positioning of the motor excitation starting point(every 7.2° from the machine angle) is perfomed.*1 The brake cancellation signal is output at the same time.	500	
t4	After the brake cancellation signal is output and t4, the FIN/INP signal is output and initialization actions are complete *2	Value of Parameter 53	

*1) If the motor rotor cannot accurately position the excitation starting point when the FIN/INP signal is output because it is on the edge of the machine or because the machine has a strong resistance to friction, this is a possibillity that vibrations may occur or that the prescribed torque cannot be output. In this case, either set parameter 53, "Time to Hold Excitation at start Time," to an appropriately large value, or set parameter 56, "Machine Edge Detection Sequence," to "1".
*2) If parameter 58, "Machine Edge Detection Sequence", is set to "1", after t4 is completed, machine edge detection activities will begin and the FIN/INP signal will be output upon completion.
*3) If the automatic servo on function is in effect, motor excitation will begin at the same time the control start signal(OUT0)output goes off.

Control Input Selection Table

Selection Function	Code	Contents	Selection Function	Code	Contents
SVON	01	Servo ON	SBK	18	Single block
PJOG	02	CW JOG	EXIN	1C	Input branching
NJOG	03	CCW JOG	EMCE	20	Emergency stop (control movement)
ARST	04	Reset alarm	EMCF	21	Emergen stop (servo-free)
STR	05	Start	EXIN2	23	Input branching 2
ZSTR	06	Zero start	EXIN3	24	Input branching 3
DEC	07	Deceleration	STRP	25	Start (One-shot Input)
HOLD	08	Hold	ZSTRP	26	Zero start (one-shot Input)
P0_IN	09	Point number input	ERST	27	Clear deviation
P1_IN	0A		MFIN	28	M Completion
P2_IN	0B		SENS	29	Sensor positioning
P3_IN	30		STP	2A	Stop
P4_IN	31		RSEL	38	Select resolution function
P5_IN	32		TSEL0	39	Torque selection input
P6_IN	33		TSEL1	3A	
P7_IN	34		TSEL2	3B	
TDIN	0C	Teaching	TSEL3	3C	
POT	12	CW OT	TSEL4	3D	
NOT	13	CCW OT	VDIR	2E	Input selection for revolution direction

Parameters 60 and 61 refer to the above codes.

Parameter 60	IN3	IN2	IN1	IN0
Parameter 61				IN4

Control Output Selection Table

Selection Function	Code	Contents	Selection Function	Code	Contents
RDY	01	Servo ready	P0_OUT	04	Current point output
INP	02	In position	P1_OUT	05	
ALM	03	Alarm	P2_OUT	06	
PRG	11	Program in operation	P3_OUT	20	
FIN	12	Completed	P4_OUT	21	
VCMP	1A	Velocity agreement	P5_OUT	22	
VZR	1B	Zero velocity	P6_OUT	23	
TFIN	1C	Torque completed	P7_OUT	24	
FIN+TFIN	1D	Completed and torque completed	P0_FIN	14	Point completion output
M0	30	M output	P1_FIN	15	
M1	31		P2_FIN	16	
M2	32		P3_FIN	28	
TLMT	38	Torque limit	P4_FIN	29	
SLMT	39	Speed limit	P5_FIN	2A	
POTOUT	3A	Positive drive prohibited	P6_FIN	2B	
NOTOUT	3B	Negative drive prohibited	P7_FIN	2C	
ZFIN	3C	Zero complete	ZPLS	3E	Z phase signal output
ZERO	3D	Zero position output	—	—	—

Parameters 63 refer to the above codes.

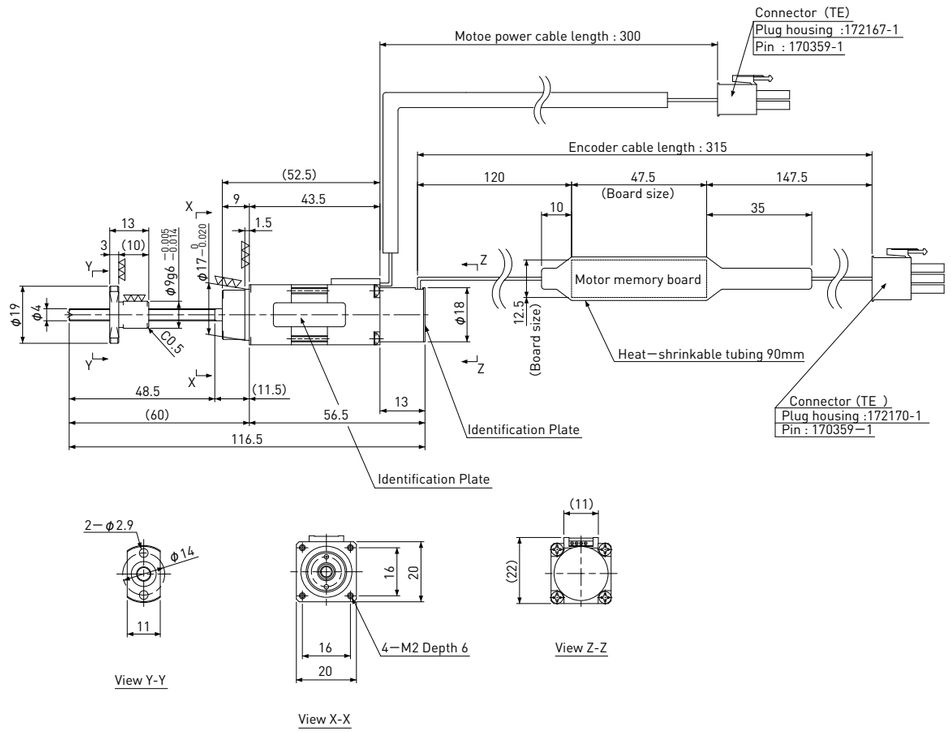
Parameter 63		OUT2	OUT1	OUT0

*Parameter number 60, 61, and 63 are 32-bit hexadecimal data, and are divided into 8 bits each, set through the input and output functions. When functions are set, the corresponding terminals are assigned to the set functions.
*When multiple input terminals are assigned to the same function,the one with input perfoms that function.
*When multiple output terminals are assigned to the same function,the output from that function will be perfomed at all assigend terminals.

Precision Ball Screw + Stepping Servo Motor

SiMB □20 / NEMA 08

Shaft dia.ϕ4



Unit:mm

Model	Lead	Travel	Reference Thrust (N)	Mass (g)
SiMB0401	1	30	30	114

Ball Screw Specifications	
Accuracy grade	JIS C3
Thread direction	Right
Axial play	0
Shaft material	Stainless steel
Nut material	Chrome-molybdenum steel
Surface hardness	Min. HRC55 (Thread area)
Lubricant	KSS original grease MSG No.1

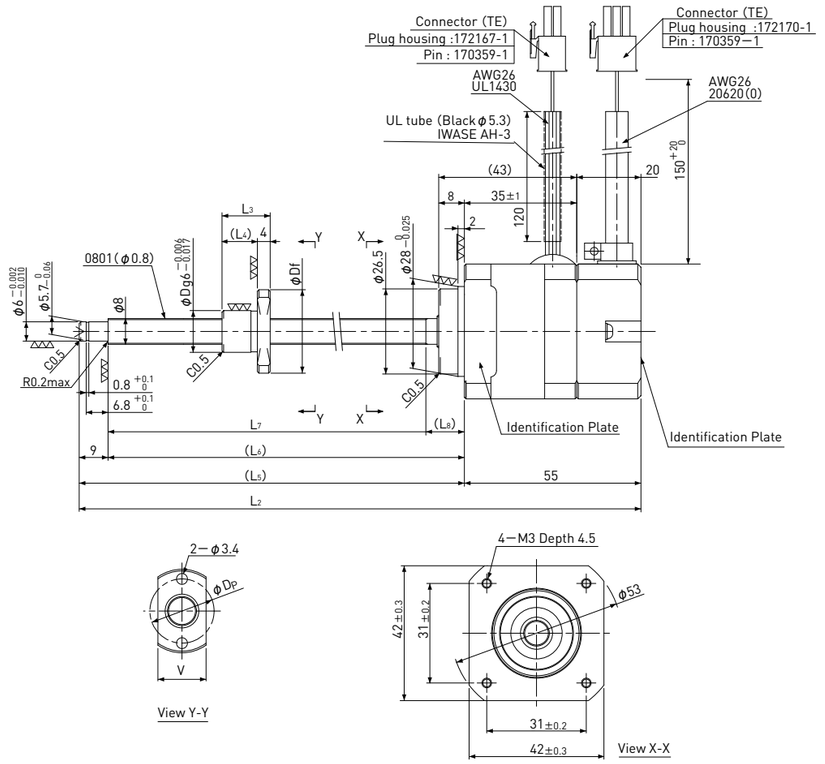
Motor Specifications	
Basic step angle	1.8°
Driving method	2-phase Bi-polar
Rated Voltage	DC 3.0 V
Rated current	DC 0.35 A/phase
Winding resistance	8.5Ω
Holding Torque	0.017Nm
Rotor inertia	1.9g·cm²
Operating temperature	−20℃～50℃
Encoder	Incremental 200ppr

Note1) Exclusive Driver(Si-02LDE)is required this type.
Note2) Only shaft end cutting is available. Other than that, it would be customized order.

Precision Ball Screw + Stepping Servo Motor

SiMB □42 / NEMA 17

Shaft dia.ϕ8



Unit:mm

Model	Lead	Travel	Reference Thrust (N)	L_2	L_5	L_6	L_7	L_8	D	Df	L_3	L_4	V	Dp	Mass (g)
SiMB0801	1	100	300	215	160	151	139	12	13	26	15	11	15	20	130
SiMB0802	2	160	150	265	210	201	189	12	15	28	18	14	17	22	165
SiMB0805	5	150	80	265	210	201	188	13	18	31	28	24	20	25	200

Ball Screw Specifications	
Accuracy grade	JIS C3
Thread direction	Right
Axial play	0
Shaft material	Stainless steel
Nut material	Chrome-molybdenum steel
Surface hardness	Min. HRC55 (Thread area)
Lubricant	Multemp PS-2

Motor Specifications	
Basic step angle	1.8°
Driving method	2-phase Bi-polar
Rated Voltage	DC 2.2 V
Rated current	DC 2.0 A/phase
Winding resistance	1.1Ω
Holding Torque	0.24Nm
Rotor inertia	35g·cm²
Operating temperature	−20℃～50℃
Encoder	Incremental 400ppr

Note1) Exclusive Driver(Si-02DE)is required this type.
Note2) Only shaft end cutting is available. Other than that, it would be customized order.