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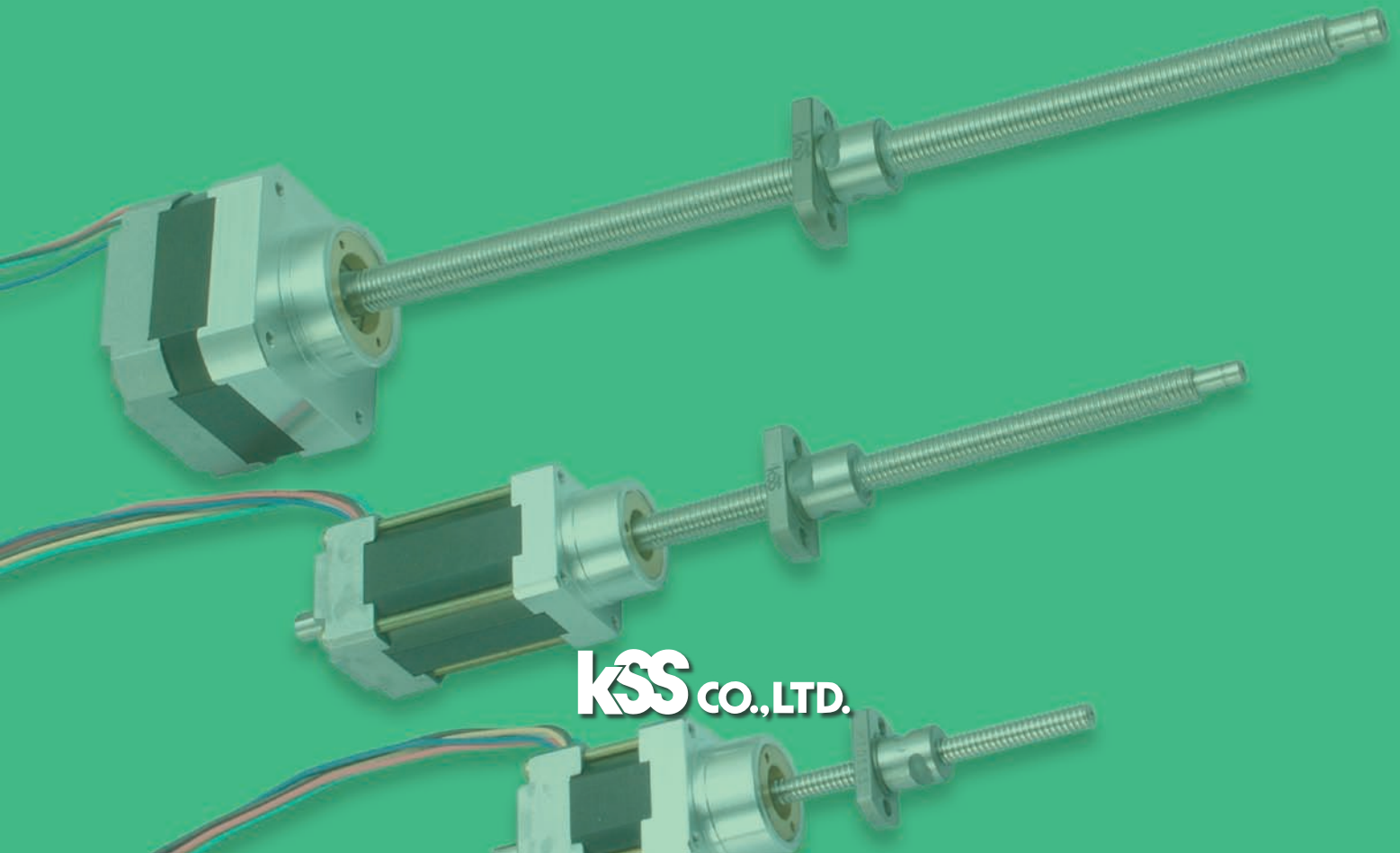
CREATIVE MOTION SYSTEMS

# SUPER DRIVE

Direct Motor Drive Ball Screw  
Vol.38

# M.o.B.o

MB Series



**kss** CO.,LTD.

## Introduction

“The Ultimate in Precision” Since its founding, the basic mindset of **KSS** has been a devotion to continually pursue the micro world of screw products.


For many years, **KSS** has had at its base the development of precision lead screws as well as research and development of ultra precision miniature ball screws as part of our basic screw production technology. Now, we are the world-leading producer of precision miniature ball screws. Over a history of 30 years, **KSS** has penetrated into “The Ultimate in Precision” In addition, we have lowered both the amount of energy and labor employed, which in turn lowers costs while maintaining quality control.

We have standardized miniature ball screws from order-made to half-made, furthermore to ready-made. In 1992, along with employing every re-circulation system in our miniature ball screws, a new product line-up was realized with the development of bi-directional ball screws, the results of a new experiment. We are promoting this new series.

At this time we present to you our “Direct Motor Drive Ball Screw,” a single unit that combines a stepping motor with a ball screw to eliminate the need for coupling.

**KSS** persists in research and development of resin products and units, just as with our precision miniature ball screws. Thank you for your continual support of **KSS**.

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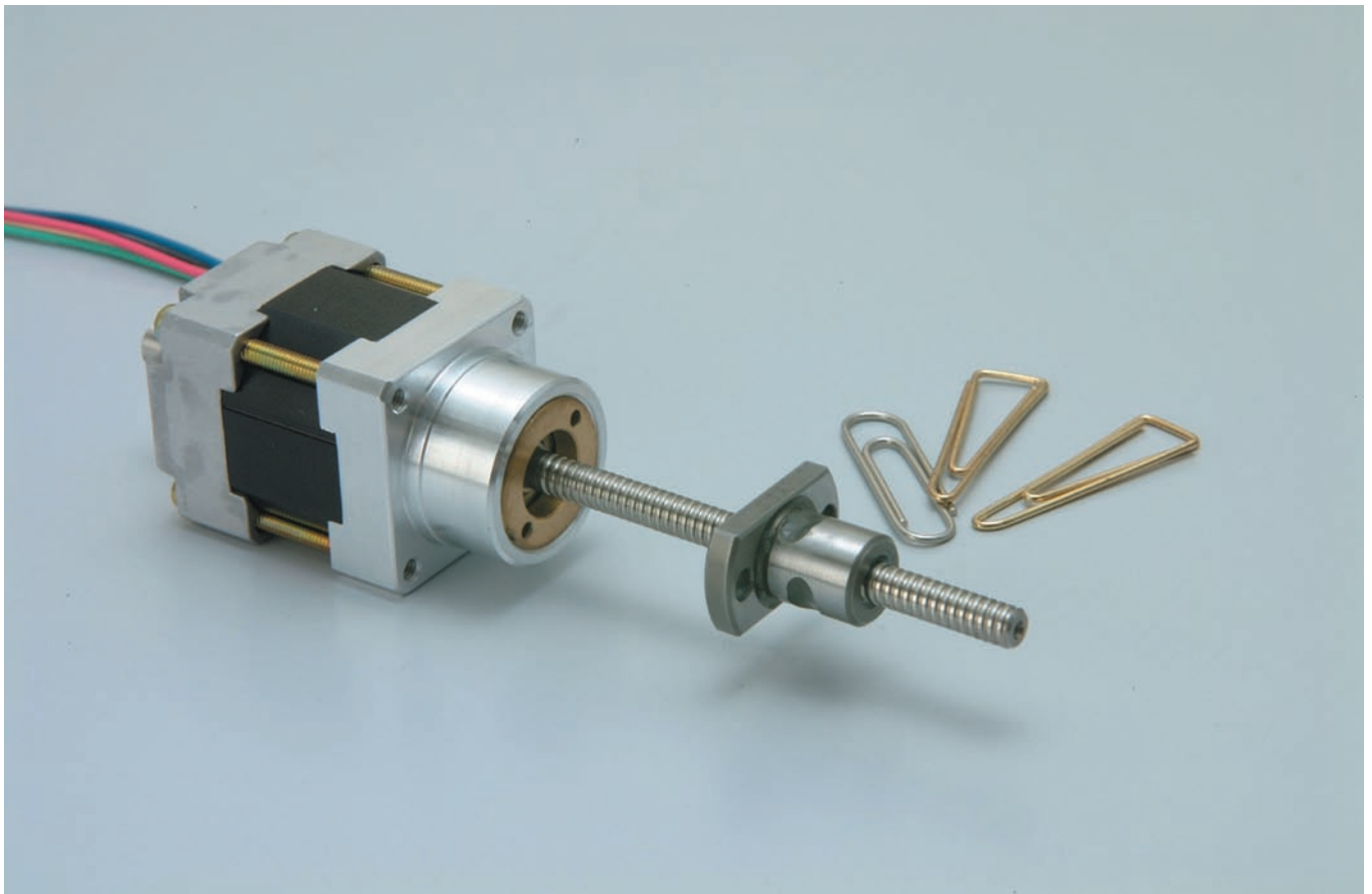
# A new system created to suit

**MoBo**

PAT.P

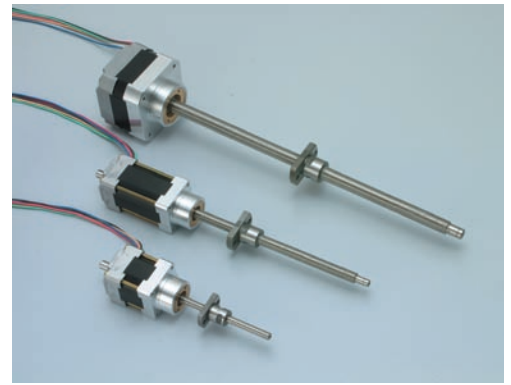
## “MoBo” direct motor drive ball screw

High-performance, compact precision positioning drive unit combines stepping motor with ball screw to eliminate the need for coupling.



USA Patent (No.6791220)  
Korea Patent (No.10-2002-0027825)

# modern needs



## Features

- A 5-phase stepping motor is mounted directly onto the end of a **KSS** ball screw with a diameter of 4 mm, 6 mm, 8mm, or 10 mm, lead of 1 mm, 2 mm, or 4 mm, and a C3 accuracy grade. The KSS-ball screw shaft is ideally constructed to form the motor rotor shaft.
- Precision positioning mechanisms can be achieved without the need to center the motor and screw shaft, reducing labor.
- The direct coupling system eliminates the need for a shaft joint, allowing for reduced axial dimensions and minimizing lost motion.
- This simple yet high-performance positioning unit uses **KSS** ultra-precision miniature ball screws, and makes full use of ball screw performance by precision manufacturing technology based on precision positioning expertise.
- A wide range of series and stroke specifications is available, fitted with a range of **KSS** screw threads starting at an ultra-compact size that fits in the palm of the hand, with 4-mm diameter ball screws, 24-mm external motor dimensions, and a total length of 104 mm.
- Uses high-performance five-phase stepping motors. Provided with drivers and control equipment.

### Core products in electrical actuator range are environmentally friendly, easy-to-use, and labor-saving.

New block unit devices that perform positioning work “straight out of the box” in a variety of fields, such as:

- Lightweight drive work within limited spaces for all types of positioning and drive units
- Small-stroke, high-speed positioning, and drive units
- Ultra-high precision fluid “dose” control mechanisms
- The Z-axis function on XYZ robots or circuit board soldering robots

## Specifications

Screw shaft outside diameter mm	Lead mm	Stroke mm	Travel per pulse (1) $\mu\text{m}$	Accuracy grade Axial gap	Reference thrust N	Motor model	Weight g
4	1	30	2	C3-0	50	TS3664N16E2	100
6	1	75	2		100	TS3664N17E4	170
6	2	75	4		50	TS3664N18E4	180
8	1	150	2		300	TS3667N9E2	310
8	2	150	4		150	TS3667N14E2	320
10	2	200	4		300	TS3667N10E7	530
10	4	200	8		150	TS3667N15E7	600

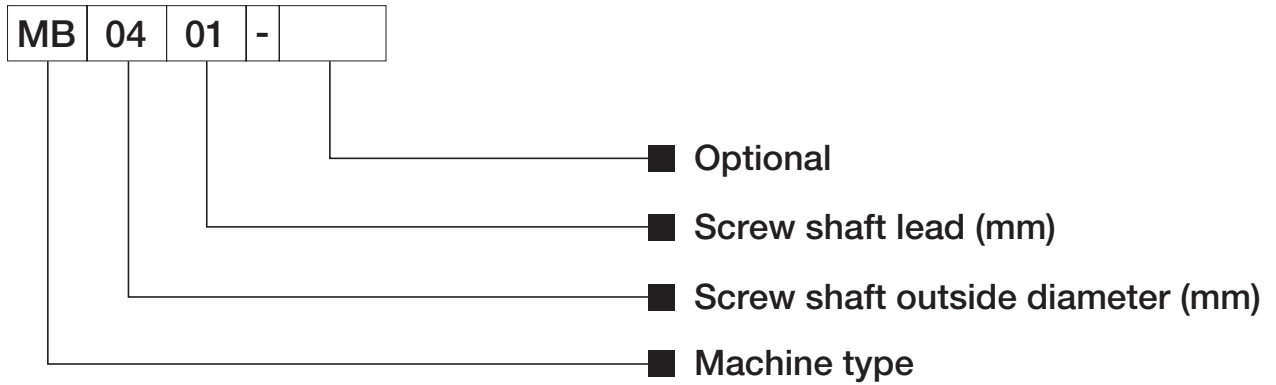
\* (1) represents the values for full step.

\* These catalog specifications are subject to change without notice.

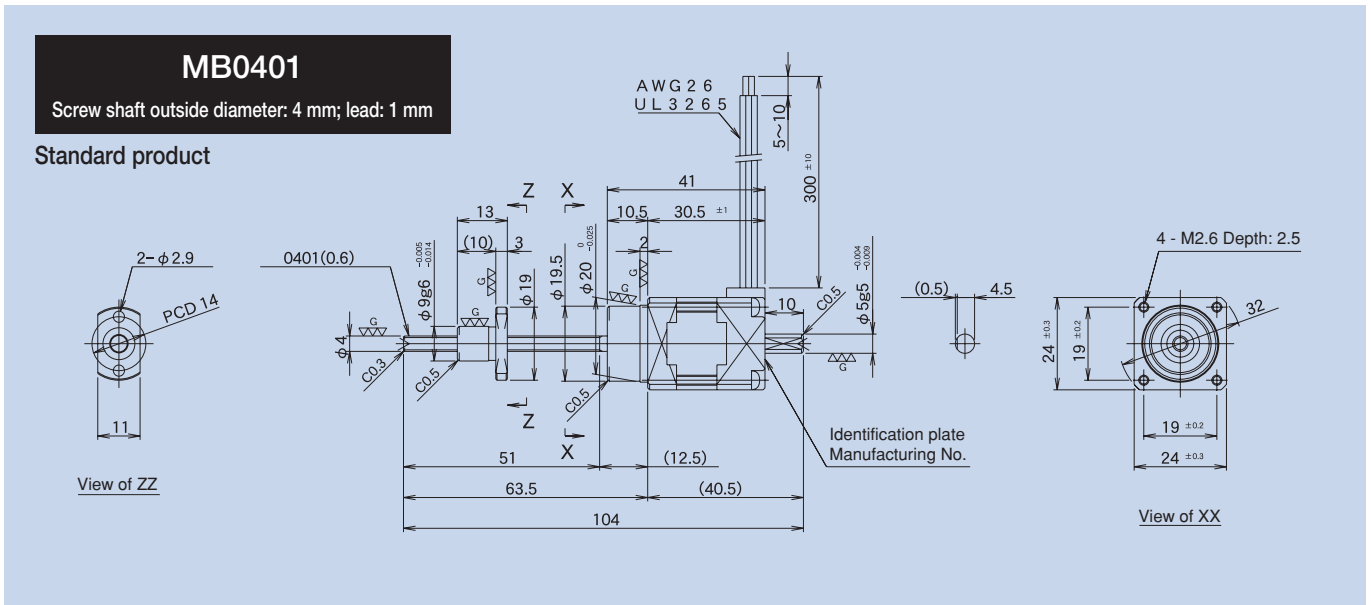
\* The reference thrust may be lower in some cases, depending on operating conditions.

\* Please inquire for details of specifications and for special specifications.

## Model number notation



## External dimensions Unit: mm



## Motor specifications

Model	Motor type	Holding torque gcm	Rated current A / phase	Winding resistance $\Omega$	Rotor inertia gcm <sup>2</sup>	Motor length mm	Weight g
MB0401	TS3664N16E2	180	0.75	1.1	4.2 *1	30.5	70
MB0601	TS3664N17E4	280	0.75	1.7	8.2 *1	46.5	120
MB0602	TS3664N18E4						

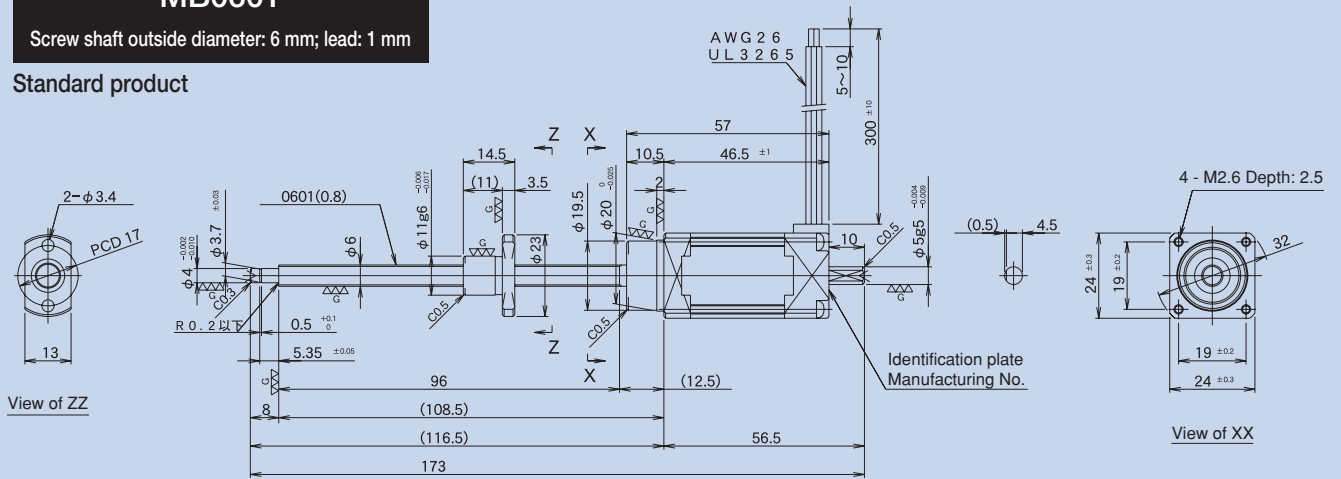
\*1: Excluding thread portion

# External dimensions Unit: mm

## MB0601

Screw shaft outside diameter: 6 mm; lead: 1 mm

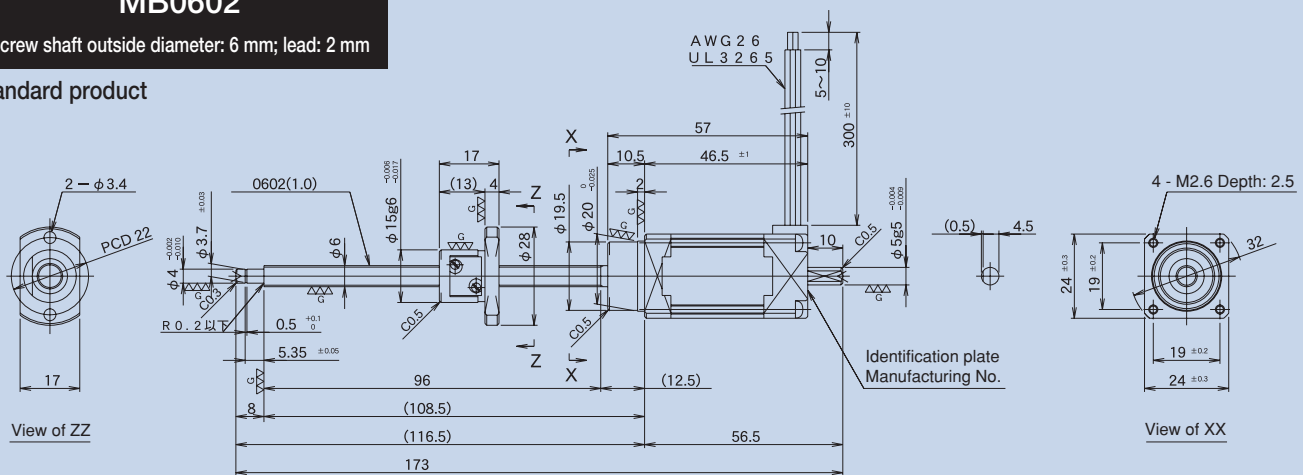
Standard product



## MB0602

Screw shaft outside diameter: 6 mm; lead: 2 mm

Standard product

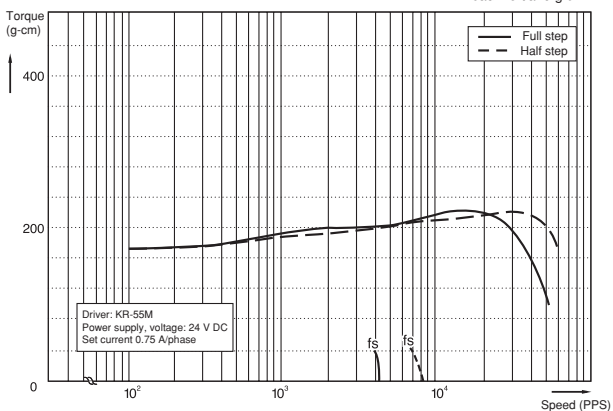


# Motor characteristics

## MB0401

TS3664N16E2

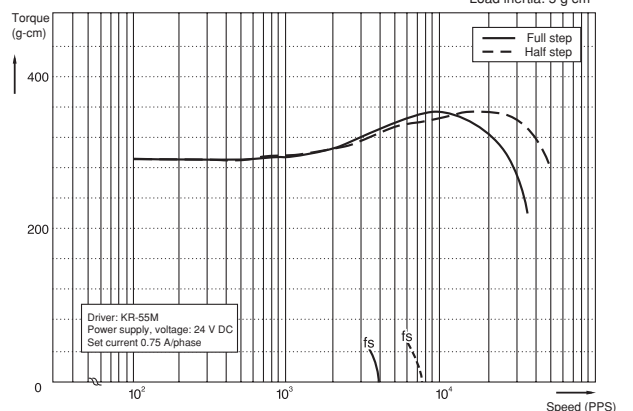
Load inertia: 5 g·cm<sup>2</sup>



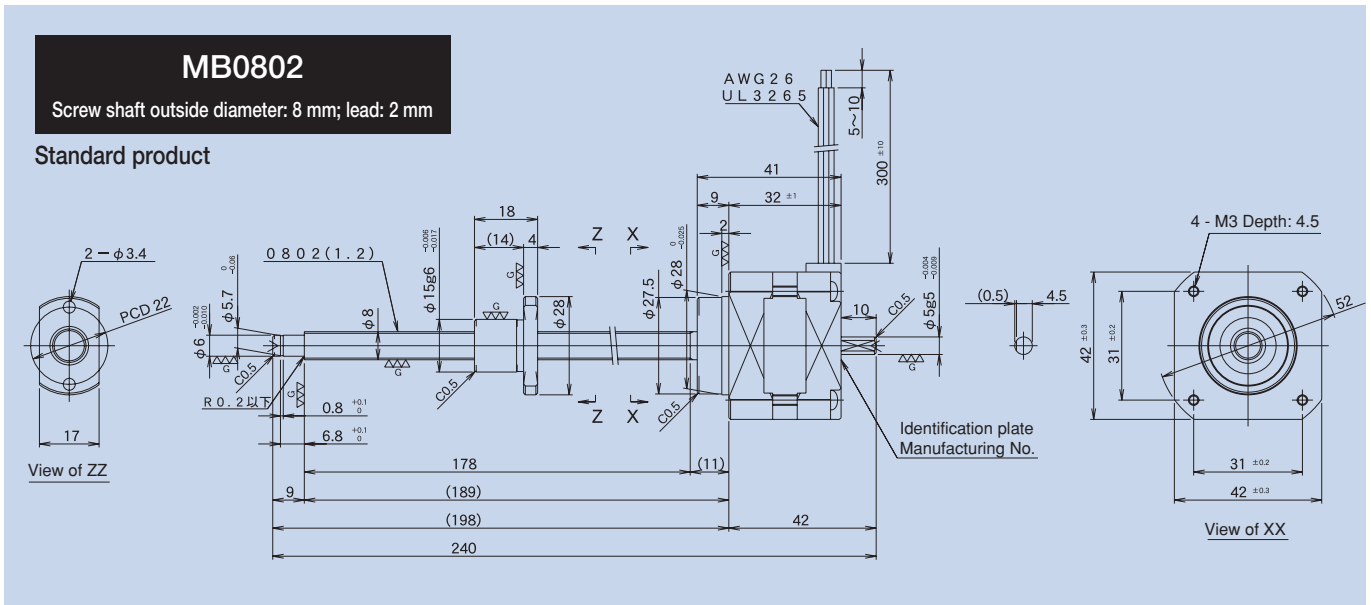
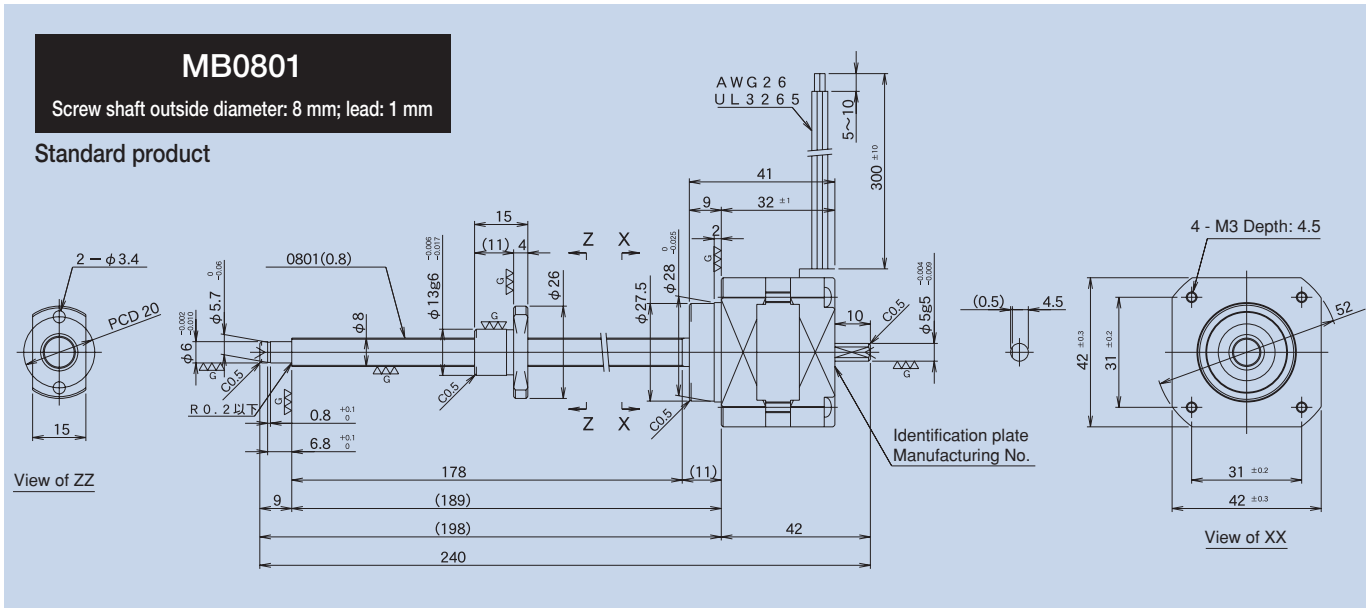
## MB0601 · MB0602

TS3664N17E4/18E4

Load inertia: 5 g·cm<sup>2</sup>



## External dimensions Unit: mm



## Motor specifications

Model	Motor type	Holding torque kgcm	Rated current A / phase	Winding resistance $\Omega$	Rotor inertia gcm <sup>2</sup>	Motor length mm	Weight g
MB0801	TS3667N9E2	1.3	0.75	1.7	35 *1	32	200
MB0802	TS3667N14E2						
MB1002	TS3667N10E7	2.4	0.75	2.2	68 *1	46	310
MB1004	TS3667N15E7						

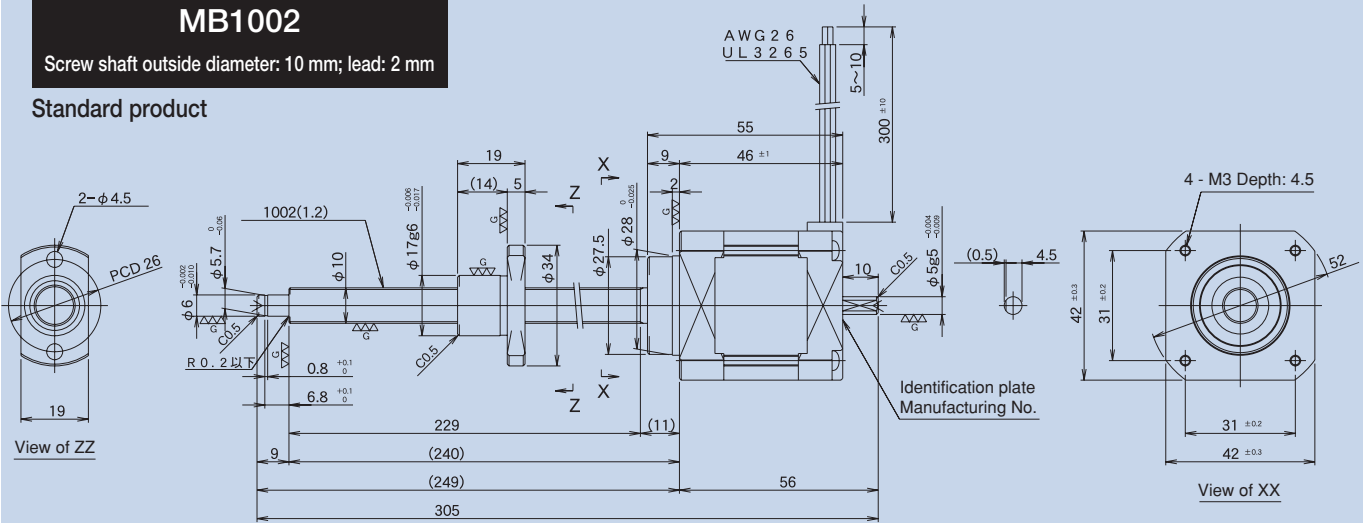
\*1: Excluding thread portion



## MB1002

Screw shaft outside diameter: 10 mm; lead: 2 mm

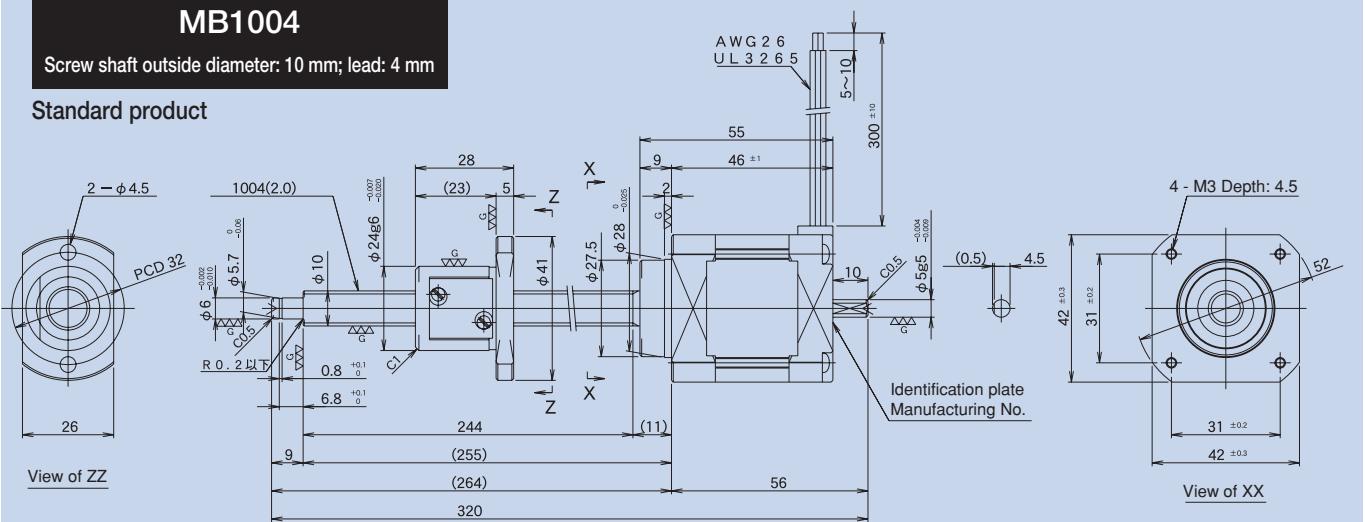
Standard product



## MB1004

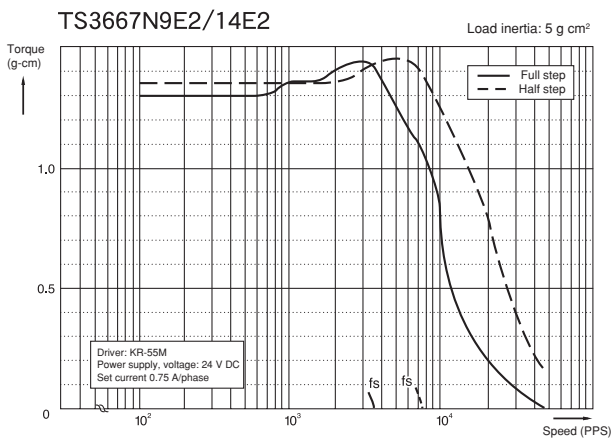
Screw shaft outside diameter: 10 mm; lead: 4 mm

Standard product

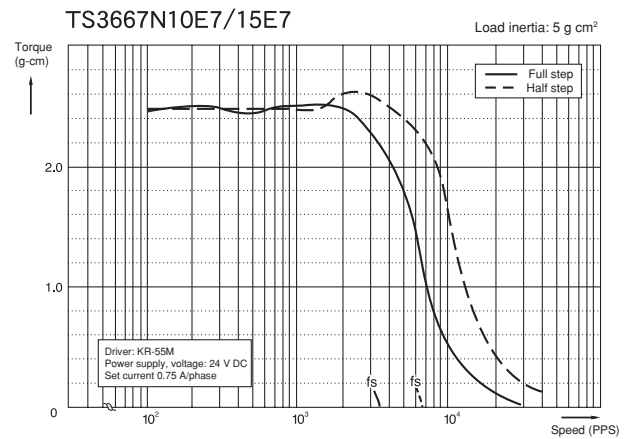


## Motor characteristics

### MB0801 · MB0802

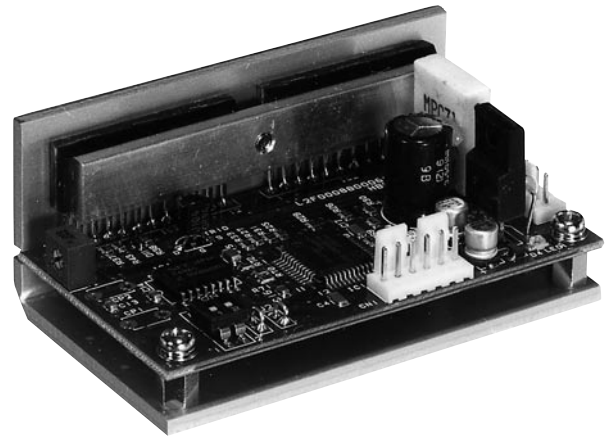


### MB1002 · MB1004



# Five-phase stepping motor driver

# KR-5M-SS



## Features

- Driver for five-phase stepping motor using a single 24 V DC power supply input.
- Incorporates a number of powerful functions despite its compact size, including automatic current reduction circuits to minimize motor heat generation.
- Compact size makes it ideal for incorporation into other equipment.
- New lower price.

## Specifications

Model	KR-5M-SS
Input power supply	DC24 ~ 40V 3A Max
Drive current	0 to about 0.9 A/phase Max
Drive system	Bipolar pentagon drive system FULL step 0.72° HALF step 0.36°
Operating temperature range	0 ~ 40°C
Weight	Approx. 100g

## Wire connection chart

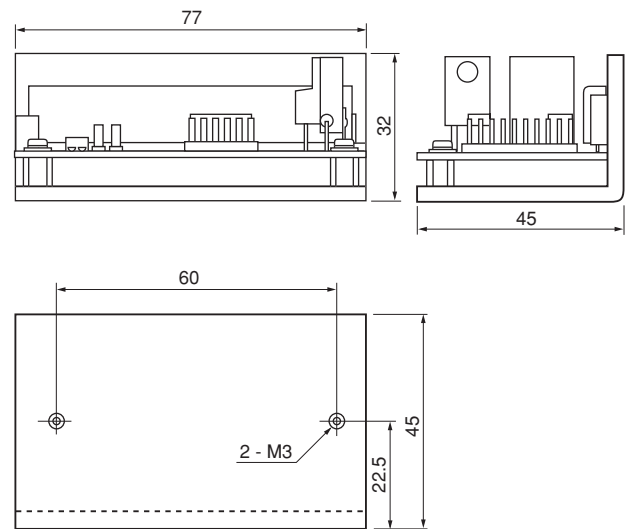
CN1		Details	Signal	Pin No.	Function details
1	Input signal		H.O-	1	"Motor excitation off" control signal
2			H.O+	2	Motor excitation off for "1"
3			R-	3	Reverse signal input for clock 2
4			R+ (for clock 2)	4	Rotation-direction input for clock 1 Normal rotation for "1"; reverse rotation for "0"
5			F-	5	Normal signal input for clock 2 Pulse input for clock 1
6			F+ (for clock 2)	6	

CN2		Details	Signal	Pin No.	Function details
1	Motor lead wire connections			1	Black
2				2	Green
3				3	Orange
4				4	Red
5				5	Blue
6	Power supply		GND	6	Drive power Supply: 0V
7				7	
8			+V	8	Drive power Supply: DC20 ~ 40V
9				9	
10			+5V	10	Maximum supply of 30 mA

Compatible connector: 60-8263-3068-15-000 Kyocera Elco

Compatible connector: 60-8263-3108-15-000 Kyocera Elco

## External dimensions (Unit: mm)

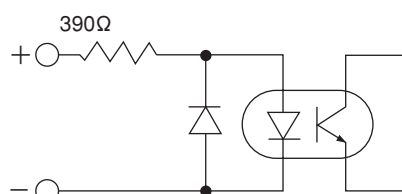


Dimensions do not include protruding items such as screws.

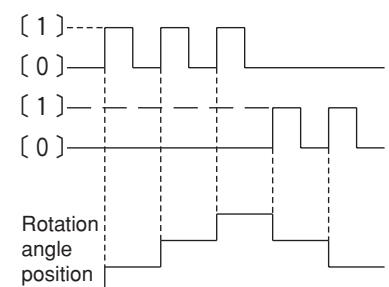
## Input pulse characteristics

- Pulse width 5  $\mu$ s Min
- Pulse interval 5  $\mu$ s Min
- Rise/fall time 1  $\mu$ s Max
- Max pulse frequency 70K pps
- Pulse voltage [1] 4V ~ 8V  
[0] 0.5V ~ -8V
- Internal resistance 390  $\Omega$

## Signal input circuit



## Input time chart

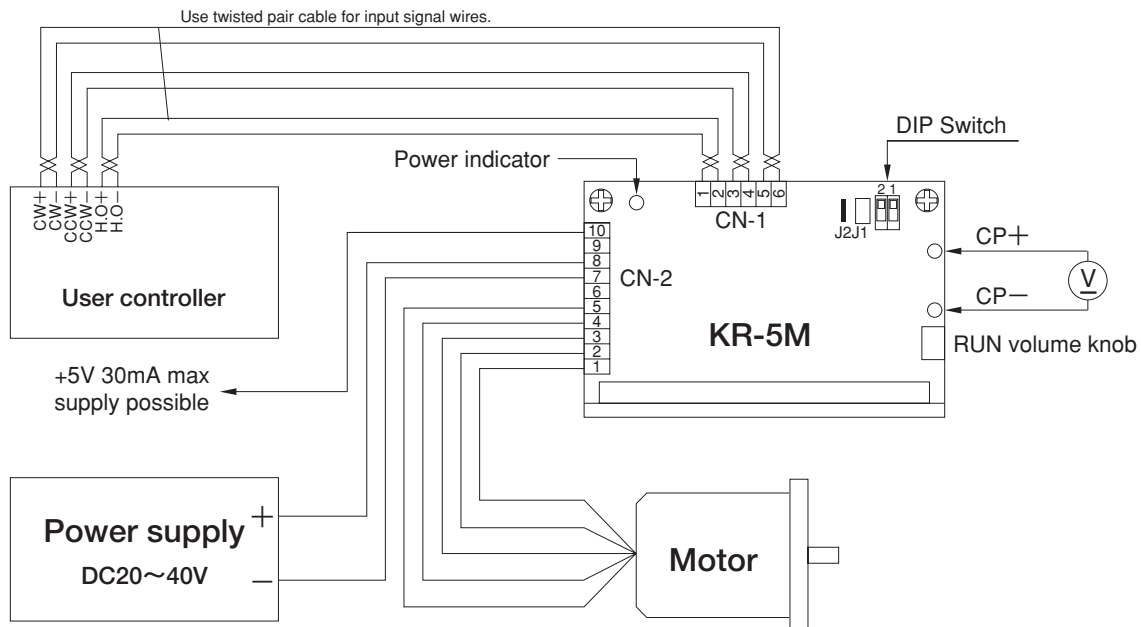


## Explanation of function selector switch



No.	Function	ON	OFF
1	Step angle	0.72° /pulse	0.36° /pulse
2	Clock system	Clock 1	Clock 2

## Wire connection diagram



Note 1: The numbers on CN1 and CN2 should be those shown in the diagram or on the connectors. Do not use the numbers on the printed circuit board.

Note 2: Pins 6 to 7 and 8 to 9 are connected internally on CN2.

## Drive current settings

Connect a voltmeter across CP1+ and CP2- on the board, and turn the RUN volume knob to set the voltage determined as follows.

Check pin voltage (V) = Set current x 4

Set to 0.35 A/phase when shipped

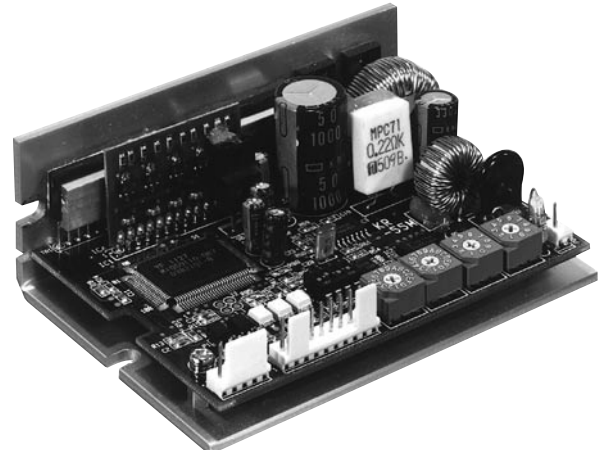
- (1) Turn the RUN volume knob fully counterclockwise before switching on the power.
- (2) Apply a normal or reverse signal with a frequency of at least 10 pps and turn the RUN volume knob slowly to set the calculated voltage value.

Note that the motor will turn when the signal is applied.

- (3) The current setting for automatic current reduction is fixed at approximately 60% of the rated current.
- (4) The motor shaft will be free, both when rotating or when stopped, as long as H.O. is set to "1".

# Five-phase micro-step driver

# KR-55ME-SS



## Features

- Micro-step driver for five-phase stepping motors with a 24V DC power supply input.
- 16 step angle types can be set with up to 250 divisions and 125,000 pulses per revolution.
- A low-vibration function ensures reduced vibration for full-step drive.
- Two types of micro-step angle can be selected as required using a selector signal.

## Specifications

Model	KR-55ME-SS
Input power supply	DC24V ± 10% 3A Max
Drive current	0.23 to 0.75 A/phase Max
Drive system	Micro-step drive system
Operating temperature range	0 ~ 40°C
Weight	Approx. 200g

## Wire connection chart

	Details	Signal	Pin No.	Function details
1	Input signal	F+	1	Pulse signal input for clock 1
2		F-	2	Normal signal input for clock 2
3		R+	3	Rotation direction input for clock 1
4		R-	4	Reverse signal input for clock 2
5		H.O+	5	"Motor excitation off" control signal
6		H.O-	6	Motor excitation off for "1"
7		D.S+	7	Division selector signal
8		D.S-	8	M1 for "0"; M2 for "1"
9	Output signal	Z,P+	9	Origin excitation output signal
10		Z,P-	10	On for origin excitation*

Compatible connector: 5102-10 Molex Japan

	Details	Pin No.	Motor lead wires
1	Motor lead wire connections	1	Blue
2		2	Red
3		3	Orange
4		4	Green
5		5	Black

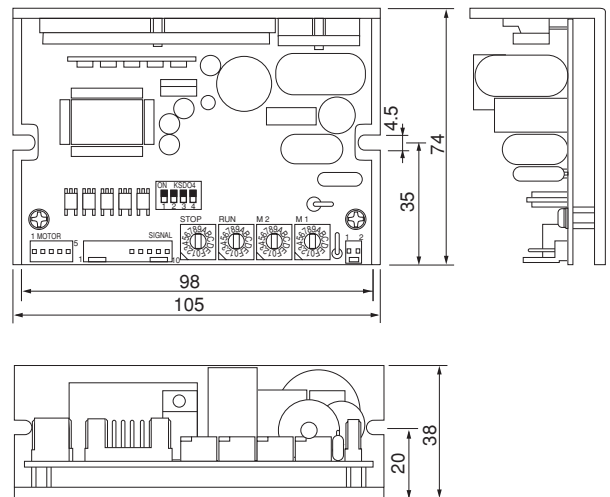
Compatible connector: 5102-5 Molex Japan

	Details	Pin No.	Function details
1	Power supply	1	+DC24V
2		2	0V

Compatible connector: 5102-02 Molex Japan

Note (\*): On when excitation sequence is "0".  
 Will be output at every interval of 7.2° for 0.72° 5-phase motor.  
 However, may not be output if the step angle is switched after power is switched on.

## External dimensions (Unit: mm)

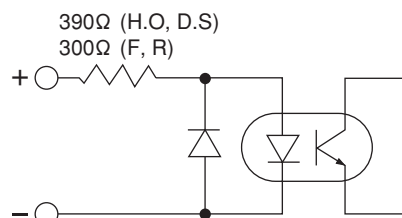


Dimensions do not include protruding items such as screws.

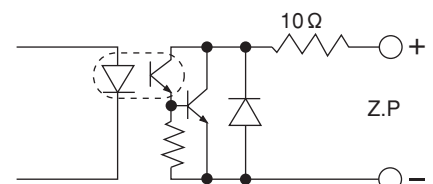
## Input pulse characteristics

- Pulse width: 0.5 μs Min
- Pulse interval: 0.5 μs Min
- Rise/fall time: 1 μs Max
- Max pulse frequency: 500K pps
- Pulse voltage: [1] 4V ~ 8V  
[0] 0.5V ~ -8V
- Internal resistance: 300Ω (F,R)  
390Ω (H.O, D.S)

## Signal input circuit



## Signal output circuit



## Explanation of function selector switch



No.	Label on identification plate	Function	ON	OFF
1	TEST	Self test function	Rotates at approximately 60 pps	Normal
2	2/1CK	Clock system selector	Clock 1	Clock 2
3	C.D	Automatic current reduction	Do not use current reduction	Use current reduction
4	OP	Optional	Off when in use	

Note 1

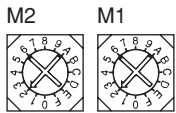
Note 2

Note 1: Rotates at approximately 60 pps regardless of division setting. Rotates clockwise for clock 2, and rotation direction depends on R input for clock 1 (counter-clockwise when R input is "0").

Note 2: The automatic current reduction function reduces the current through the motor when the motor is stopped, to minimize generation of motor heat. Current is reduced approximately 150 ms after the last pulse input.

Holding torque also decreases when current reduction is in operation.

## Micro-step settings



Division setting chart

SW.No.	0	1	2	3	4	5	6	7	8	9
Number of divisions	1	2	4	5	8	10	20	40	80	16

Micro-step angle per pulse = $\frac{\text{Basic step angle}}{\text{Number of divisions}}$		A	B	C	D	E	F
		25	50	100	125	200	250

(1) While driving, if only one micro-step drive is used, set the number of divisions using digital switch M1.

(2) When two micro-step drives are used (to vary the forward and backward speeds for reciprocating motion, for example) set the number of divisions using digital switches M1 and M2.

## Drive current settings

Set the current for motor operation by selecting the digital rotary RUN switch position as shown below.

Drive current setting chart (Digital rotary RUN switch)

SW.No.	0	1	2	3	4	5	6	7	8	9
Current (A)	0.23	0.27	0.30	0.35	0.38	0.41	0.45	0.48	0.52	0.54

RUN		A	B	C	D	E	F
		0.59	0.61	0.66	0.69	0.72	0.75

Example: Motor Settings for Rated Current 0.35A/Phase is adjusting SW to 3.

## Current reduction setting

Set the current for the motor when the motor is stopped by selecting the digital rotary STOP switch position as shown below. The figures in the chart show percentages of the RUN current settings.

Current reduction setting chart (Digital rotary STOP switch)

SW.No.	0	1	2	3	4	5	6	7	8	9
%	27	31	36	40	45	50	54	58	62	66

STOP		A	B	C	D	E	F
		70	74	78	82	86	90

Example: When Drive Current is 0.3A/Phase adjusting SW to 5, 0.15A/Phase of electricity will flow into the motor at the time of stop.

# Five-phase micro-step driver

# KR-535M



## Features

- Micro-step driver for 5-phase stepping motors with a 100 V AC power supply input.
- Connector specification for easy wiring KR-535MW.
- 16 step angle types can be set with up to 250 divisions and a 125,000 pulses per revolution.
- A low vibration function ensures reduced vibration for full-step drive.
- Two types of micro-step angle can be selected as required using a selector signal.

## Wire connection chart

Details	Indication of plate	Pin No.	Function details
Input signal	F+	A1	Pulse signal input for clock 1
	F-	B1	Normal signal input for clock 2
	R+	A2	Rotation direction input for clock 1
	R-	B2	Reverse signal input for clock 2
	C.D+	A3	Automatic current reduction
	C.D-	B3	Current reduction not used for "1" *1
	H.O+	A4	"Motor excitation off" control signal
	H.O-	B4	Motor excitation off for "1"
Output signal	D.S+	A5	Division selector signal
	D.S-	B5	M1 for "0"; M2 for "1"
		A6, B6	Not used
		A7, B7	Not used
	Z.P+	A8	Origin excitation output signal
	Z.P-	B8	On for origin excitation *2

Compatible connector: MC1.5/12-ST/3.81 Phoenix Contact (KR-535MW)  
FCN361-J016-AU Fujitsu (KR-535M)

Details	Indication of plate	Motor lead wires
Motor lead wire connections	1	Blue
	2	Red
	3	Orange
	4	Green
	5	Black

Compatible connector: MKDSA2.5/5-ST5.08 Phoenix Contact (KR-535MW)

Details	Indication of plate	Function details
Power supply	AC	+100 to 115V AC
	AC	
	F.G	Frame ground

Compatible connector: GMKDSA2.5/3-ST7.62 Phoenix Contact (KR-535MW)

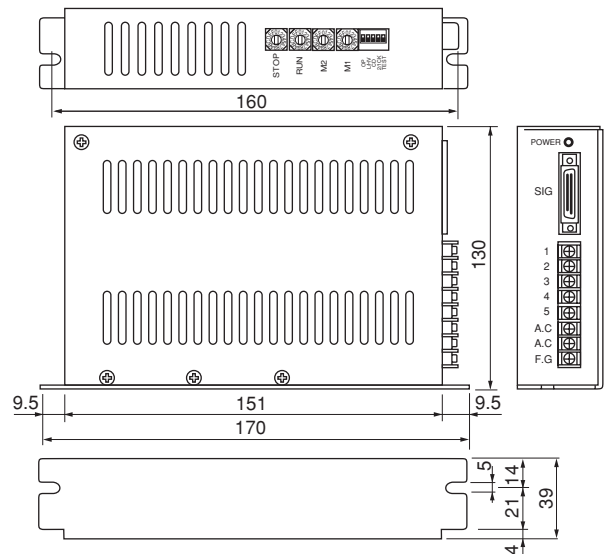
Note \*1: Automatic current reduction is not used if either C.D signal or C.D DIP switch is "On."

Note \*2: Turns on when excitation sequence is "0." Will be output at every interval of 7.2° for 0.72° five-phase motor. However, may not be output if the step angle is switched after power is switched on.

## Specifications

Model	KR-535M,535MW (Connector specifications)
Input power supply	AC100 ~ 115V 3.5A 50/60Hz
Drive current	0.5 to 1.4 A/phase
Drive system	Micro-step drive system
Operating temperature range	0 ~ 40°C
Weight	Approx. 750g

## External dimensions (Unit: mm)

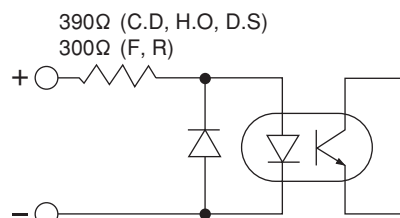


Dimensions do not include protruding items such as screws.

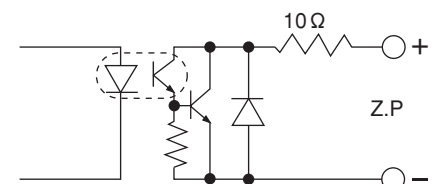
## Input pulse characteristics

- Pulse width: 0.5  $\mu$ s Min
- Pulse interval: 0.5  $\mu$ s Min
- Rise/fall time: 1  $\mu$ s Max
- Max pulse frequency: 500K pps
- Pulse voltage: [1] 4V ~ 8V  
[0] 0.5V ~ -8V
- Internal resistance: 300 $\Omega$  (F,R)  
390 $\Omega$  (C,D,H,O,D,S)

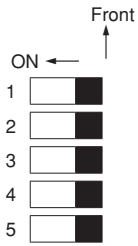
## Signal input circuit



## Signal output circuit



## Explanation of function selector switch



No.	Label on identification plate	Function	ON	OFF
1	TEST	Self test function	Rotates at approximately 60 pps	Normal
2	2/1CK	Clock system selector	Clock 1	Clock 2
3	C.D	Automatic current reduction	Do not use current reduction	Use current reduction
4	L/HV	Drive voltage selector	High speed, high torque	Normal
5	OP	Low vibration	Low-vibration drive	Normal drive

Note 1

Note 2

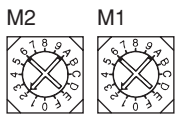
Note 3

Note 1: Rotates at approximately 60 pps regardless of division setting. Rotates clockwise for clock 2, and rotation direction depends on R input for clock 1 (counter-clockwise when R input is "0").

Note 2: The automatic current reduction function reduces the current through the motor when the motor is stopped, to minimize generation of motor heat. Current is reduced approximately 150 ms after the last pulse input. Holding torque also decreases when current reduction is in operation.

Note 3: Note that generation of motor heat will increase when L/HV high-speed high torque is used.

## Micro-step settings



### Division setting chart

SW.No.	0	1	2	3	4	5	6	7	8	9
Number of divisions	1	2	4	5	8	10	20	40	80	16

	A	B	C	D	E	F
Micro-step angle per pulse = $\frac{\text{Basic step angle}}{\text{Number of divisions}}$	25	50	100	125	200	250

(1) While driving, if only one micro-step drive is used, set the number of divisions using digital switch M1.

(2) When two micro-step drives are used (to vary the forward and backward speeds for reciprocating motion, for example) set the number of divisions using digital switches M1 and M2.

## Drive current settings

Set the current for motor operation by selecting the digital rotary RUN switch position as shown below.

### Drive current setting chart (Digital rotary RUN switch)

SW.No.	0	1	2	3	4	5	6	7	8	9
Current (A)	0.5	0.58	0.66	0.75	0.81	0.88	0.96	1.03	1.1	1.15

	A	B	C	D	E	F
RUN	1.25	1.3	1.4	1.47	1.53	1.6

Example: Motor Settings for Rated Current 1.4A/Phase is adjusting SW to C.

## Current reduction setting

Set the current for the motor when the motor is stopped by selecting the digital rotary STOP switch position as shown below. The figures in the chart show percentages of the RUN current settings.

### Current reduction setting chart (Digital rotary STOP switch)

SW.No.	0	1	2	3	4	5	6	7	8	9
%	27	31	36	40	45	50	54	58	62	66

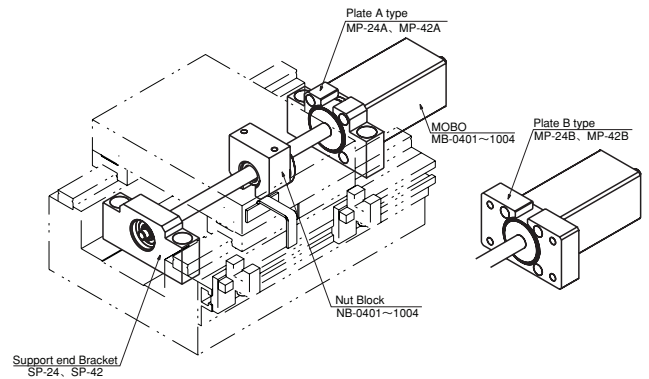
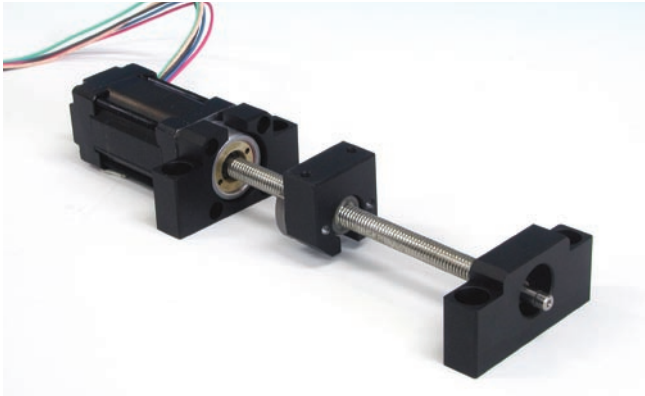
	A	B	C	D	E	F
STOP	70	74	78	82	86	90

Example: When Drive Current is 1.4A/Phase adjusting SW to 5, 0.7A/Phase of electricity will flow into the motor at the time of stop.

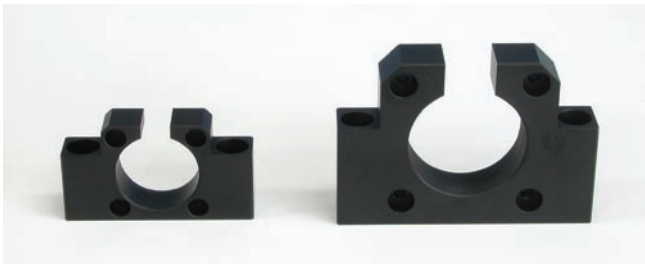
## direct motor drive ball screw

# MoBo Accessories

### Assembling Parts

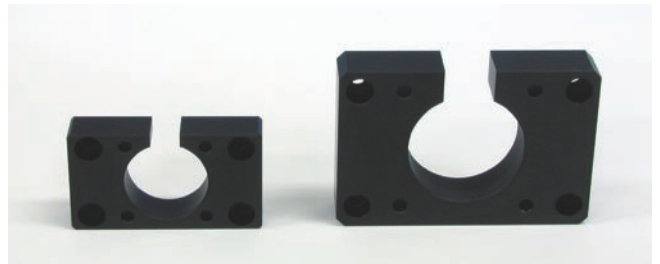


- Assembling parts of “MoBo” direct motor drive ball screw was set up as standard stock.
- Accessories consists of 3 types, No. 1 Supporting plate at the Motor side (A or B type), No. 2 Bracket at the support end and No. 3 Nut Block.



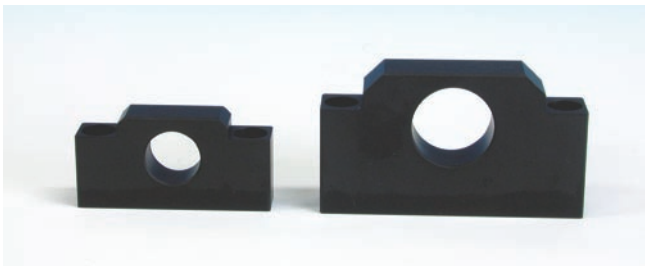
#### Supporting Plate A type

Description: MP-24A (For 24 Square Motor)  
Description: MP-42A (For 42 Square Motor)



#### Supporting Plate B type

Description: MP-24B (For 24 Square Motor)  
Description: MP-42B (For 42 Square Motor)



#### Support end Bracket

Description: SP-24 (For 24 Square Motor)  
SP-42 (For 42 Square Motor)  
Accessories: Bearing Set (Bearing • Stop Ring)  
B624ZZ (For 24 Square),  
B626ZZ (For 42 Square)



#### Nut Block

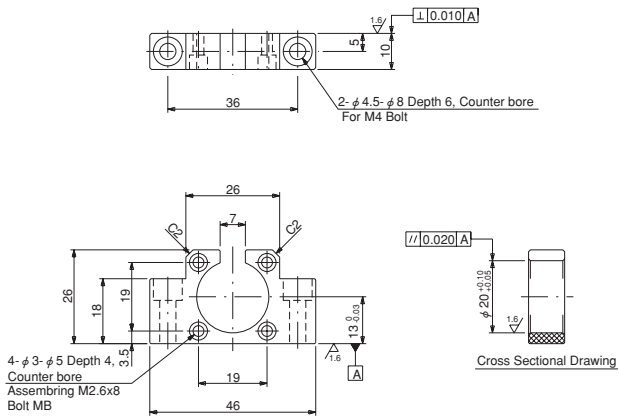
Description: NB-0401, 0601, 0801, 1002  
(2 Mounting Holes)  
Description: NB-0602, 0802, 1004  
(4 Mounting Holes)



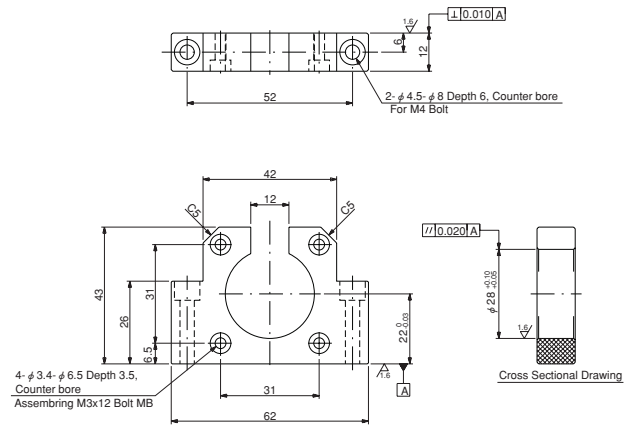
# Specification figure and size

## Supporting Plate

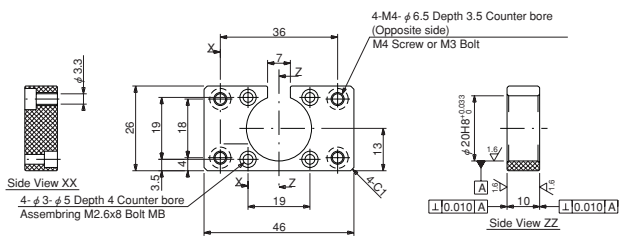
**MP-24A**



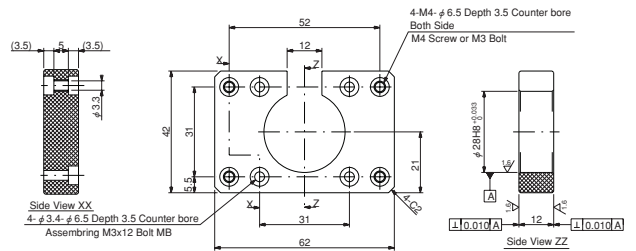
**MP-42A**



**MP-24B**

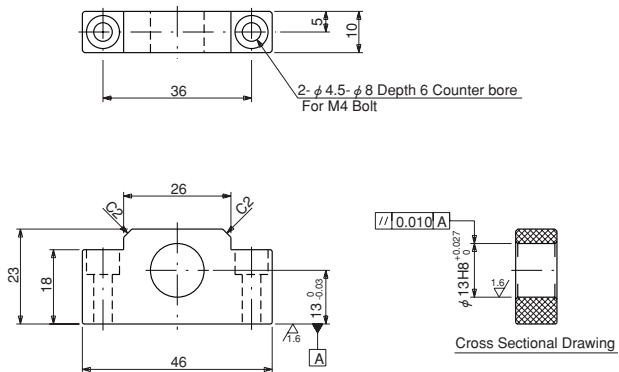


**MP-42B**

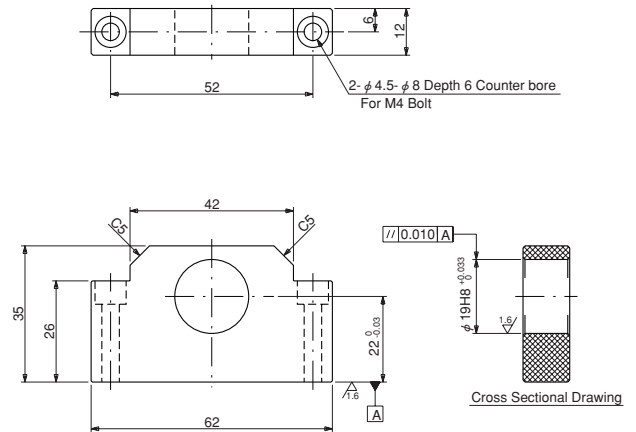


## Support end Bracket

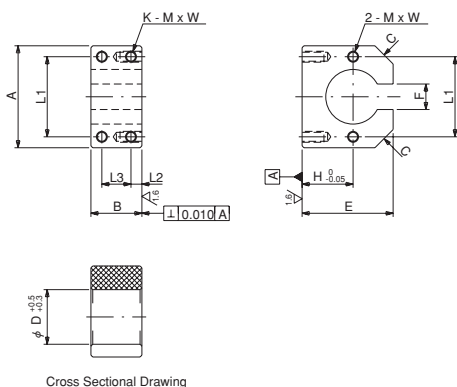
**SP-24**



**SP-42**



## Nut Block



**Size Table**

TYPE	A	B	E	F	D	H	L1	L2	L3	K	M x W	C
NB-0401	19	11	22	5	9	14	14	5.5	-	2	M2.6 x 6	4
NB-0601	23	12	23	7	11	14	17	6	-	2	M3 x 6	5
NB-0602	28	14	25	7	15	14	22	3	8	4	M3 x 6	5
NB-0801	26	12	32	9	13	22	20	6	-	2	M3 x 6	5
NB-0802	28	15	33	9	15	22	22	3.5	8	4	M3 x 6	5
NB-1002	34	15	34	12	17	22	26	7.5	-	2	M4 x 8	5
NB-1004	41	24	37	12	24	22	32	5	14	4	M4 x 8	6

\* Specification may be changed without a preliminary announcement.



# Safety Precautions

To ensure safe and correct operation

## MoBo direct motor drive ball screw

### ★ Ball screw operating precautions

1. Never disassemble the ball screw
2. The ball screw is a precision component. Do not subject to shock.
3. Follow the attached “Ball screw operating precaution”

### ★ Step motor operating precautions

#### 1. Precautions when unpacking

- ① When unpacking, check that the product has no defects.
- ② Check that the product is the same as that ordered.

#### 2. Transportation and installation precautions.

- ① Do not lift by the lead wire or motor shaft. This may result in damage to the device or injury.
- ② Do not strike the shaft, or subject to thrust or radial loads exceeding the specifications. Failure to observe this precaution may result in damage.
- ③ The motor is not waterproof. Do not use in an oil bath or in locations in which it may come into direct with water or oil.
- ④ Do not use in locations subject to toxic gases or liquids, high humidity, or steam. Precautions must be taken against vibration, shock, and humidity.

#### 3. Wiring precautions

- ① Check the wire connection type, drive system, and phase sequence.
- ② A ground connection must be used.
- ③ Disconnect from the controller before performing dielectric withstanding voltage test of the motor or megger test.

#### 4. Operating precautions

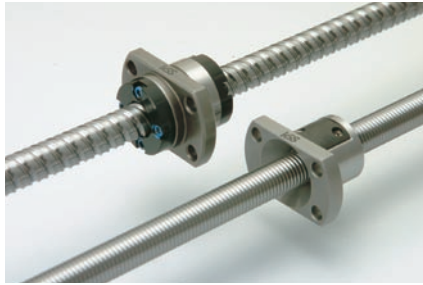
- ① Contact KSS before using currents that exceed the rated current.
- ② The motor may overheat depending on the load conditions or driver used. Make sure that the motor surface temperature does not exceed 80°C when in use.
- ③ The motor possesses a resonant point within the specified values. Avoid the resonant point when in use.
- ④ The motor torque and speed characteristics may vary from the specified values depending on the load conditions or driver used. Please adjust as appropriate.
- ⑤ If abnormal odor, noise, smoke, overheating, or vibration occurs, stop operation immediately and switch off the power.
- ⑥ Do not allow the motor come into contact with water or oil.

# About KSS

## Products



①



②

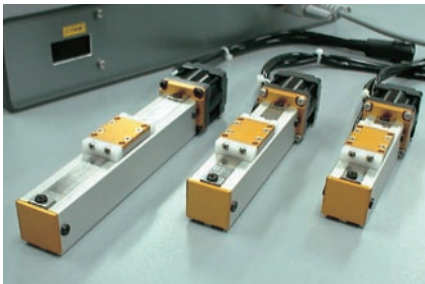


③



④

- ① Ground ball screw standard product series .....“SG”
- ② Roll ball screw standard product series .....“SR”
- ③ Ground bi-directional ball screw standard product series .....“SD”
- ④ Ultra precision lead screw series .....“MG”
- ⑤ General purpose, ultra compact, electrically powered cylinder unit series  
KUMI, KUMIKO, KUMINA, KUMIRI, Custom-made controller KUMICON
- ⑥ Ultra precision positioning: Nano-Stage Unit
- ⑦ Direct motor drive ball screw “MOBO”  
Direct motor drive resin lead screw “Resin MOBO”



⑤



⑥



⑦

## Head Office / Ojiya Plant



Head Office

Ojiya Plant





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