ELECTROMAGNETIC CLUTCHES & BRAKES

CLUTCHES & BRAKES

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Electromagnetic Clutch & Brake Models

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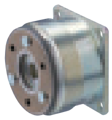

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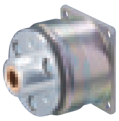

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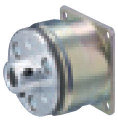

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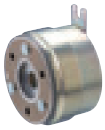

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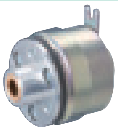

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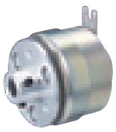

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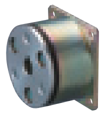

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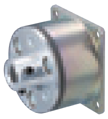

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Series: SPRING-ACTUATED BRAKES

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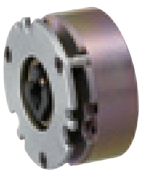

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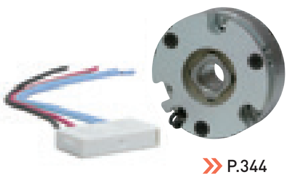

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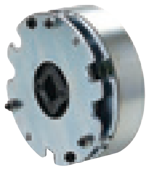

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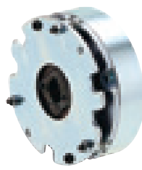

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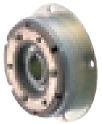
ELECTROMAGNETIC-ACTUATED CLUTCHES & BRAKES

Clutches

101

13G



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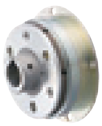

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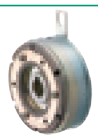
CS

33G



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35G

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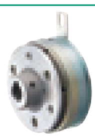
31G



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CSZ

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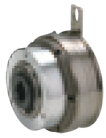

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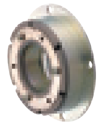
Brakes

111

13G



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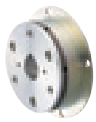
12G



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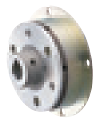
11G



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Series: ELECTROMAGNETIC CLUTCH AND BRAKE UNITS

Device

Clutches & Brakes

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Double clutches

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Double clutches & brakes

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Series: ELECTROMAGNETIC TOOTH CLUTCHES / BRAKE MOTORS

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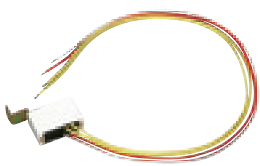

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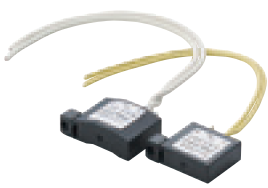

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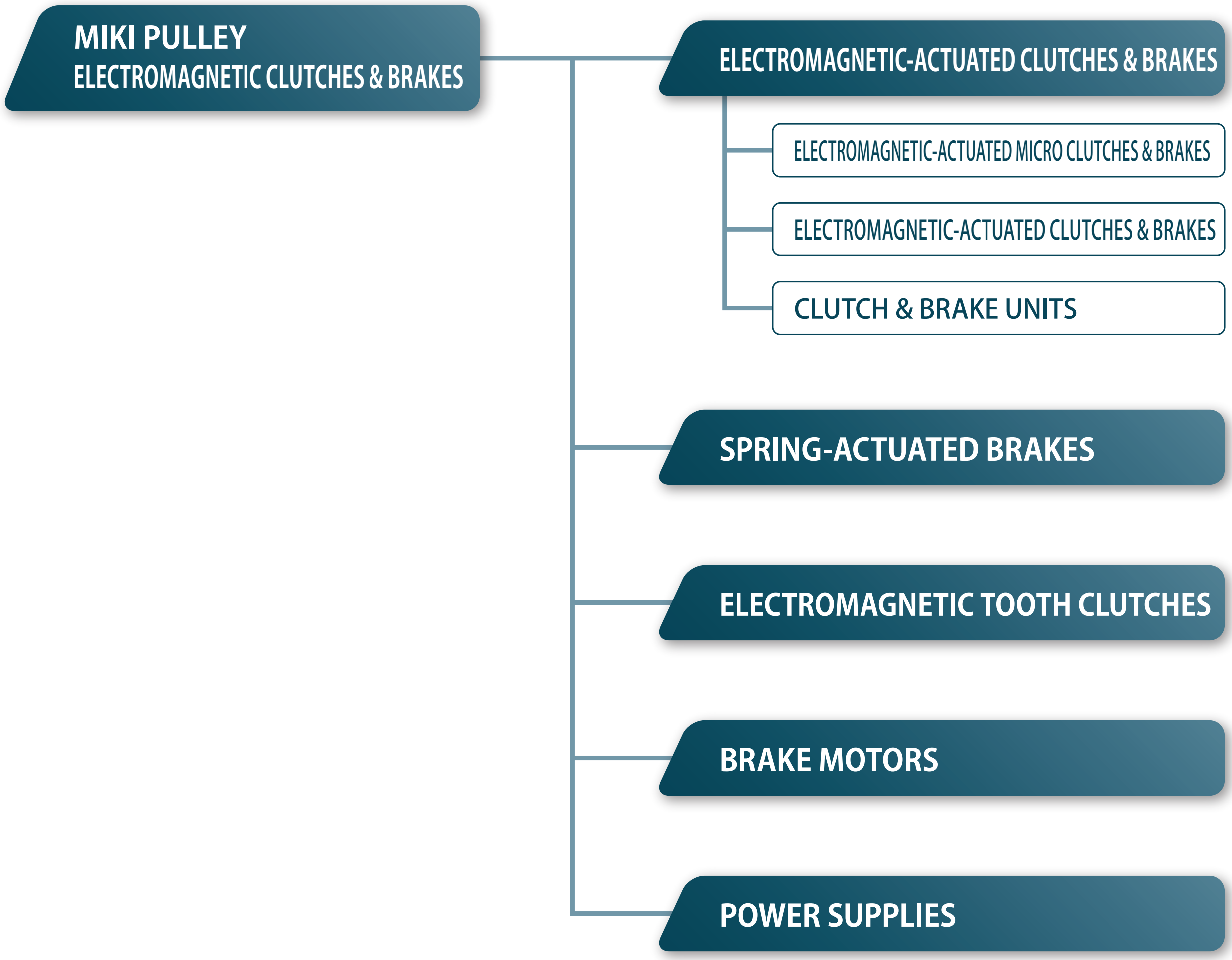
A selection guide for electromagnetic clutches and brakes begins on the next page.

Selection Guide

Miki Pulley divides its electromagnetic clutches & brakes into several major categories: electromagnetic-actuated clutches & brakes, spring-actuated clutches & brakes, electromagnetic tooth clutches, brake motors, and power supplies.

When selecting a product, have information handy on your application, required torque, performance, load properties, drive source and the like, and then use the diagram on the page at right as your guide. Selection details are described in the selection procedures given for each series.

List of Products

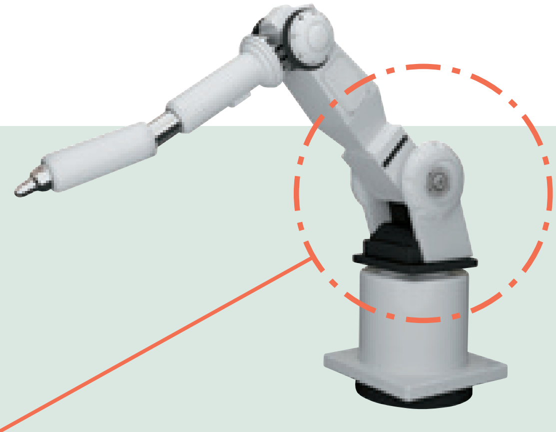


Select by Product Characteristics

Torque (N·m)

ELECTROMAGNETIC-ACTUATED CLUTCHES & BRAKES	Electromagnetic-actuated micro	Clutches	102 [0.4-2.4 N·m]; CYT [0.4-1.0 N·m]
	Electromagnetic-actuated micro	Brakes	112 [0.4-2.4 N·m]
	Electromagnetic-actuated	Clutches	CSZ [2.4-10 N·m]; 101/CS [5-320 N·m]
	Electromagnetic-actuated	Brakes	BSZ [2.4-10 N·m]; 111 [5-320 N·m]
	Clutch & Brake Units	Drip-proof type	125 [2.4-160 N·m]
	Clutch & Brake Units	Open-disc brake system type	121-□-20G [5-320 N·m]
	Clutch & Brake Units	Motor-coupled type	126 [5-80 N·m]
	Clutch & Brake Units	Speed reducer-integrated type	CBW [5-40 N·m]
	Clutch & Brake Units	Motor/speed reducer-integrated type	CMW [5-40 N·m]
	Clutch & Brake Units	Double-clutch units	121-□-10G [5-320 N·m]
	Clutch & Brake Units	Double clutch and brake units	122 [5-160 N·m]
SPRING-ACTUATED BRAKES		Holding use	BXW-R [0.30-2.50 N·m]; BXR [5-55 N·m]; BXW-S [0.36-5.20 N·m]; BXR-LE [0.06-3.20 N·m]
		Holding and braking use	BXW-H [0.24-4.00 N·m]; BXH [4-44 N·m]
		Braking use	BXW-L [0.12-2.00 N·m]; BXL [2-22 N·m]; BXL-N [2-80 N・m]
Tooth clutches			546 [17.5-2200 N·m]
BRAKE MOTORS		Electromagnetic-actuated	BMM [2.5-50 N·m] Motor output 0.2 kW to 3.7 kW
		Spring-actuated	BMS [2-15 N·m] Motor output 0.2 kW to 1.5 kW

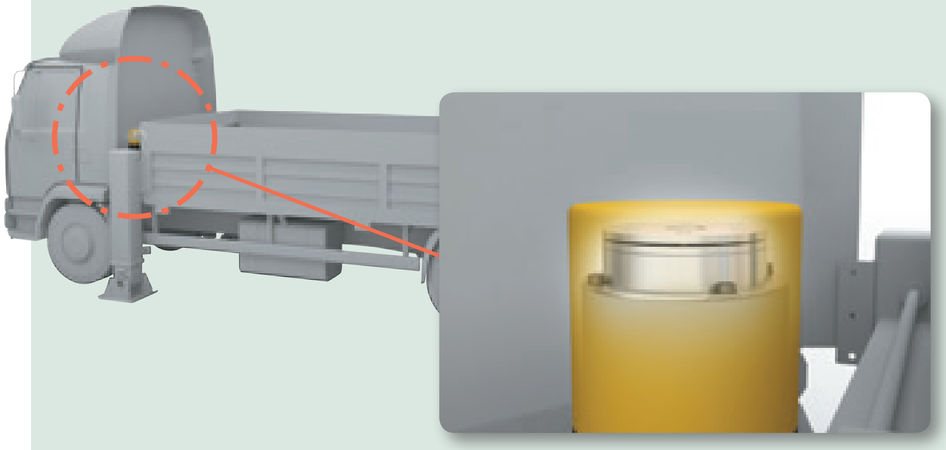
Applications



Product model BXR

Employed device Articulated Robot

BXR spline type for holding arms.
Saves space with slim design and greatly reduces drag wear by using light rotor.



Product model 111

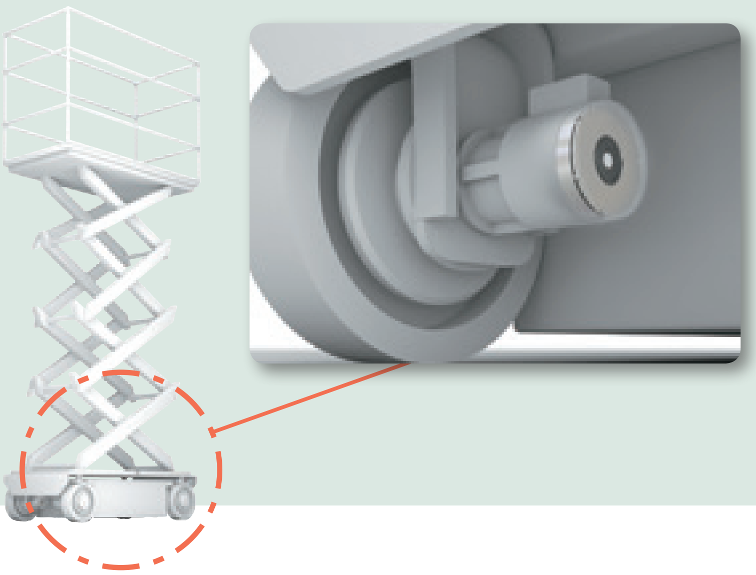
Employed device Special-purpose Vehicles

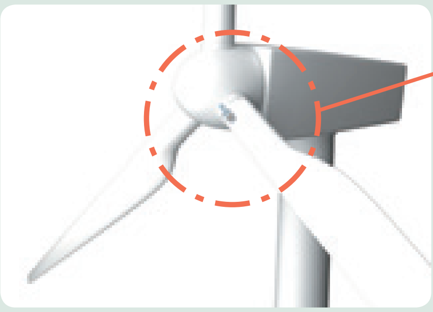
The Electromagnetic-actuated brake 111 model is used in the elevating device for the auxiliary leg.

Product model BXR

Employed device Aerial Vehicle

BXR model as the holding brake for drive motor. Slim design helps save space.

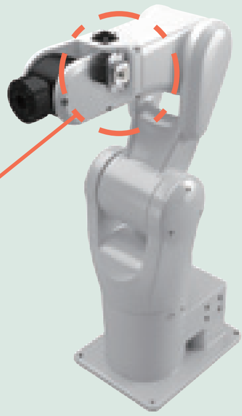


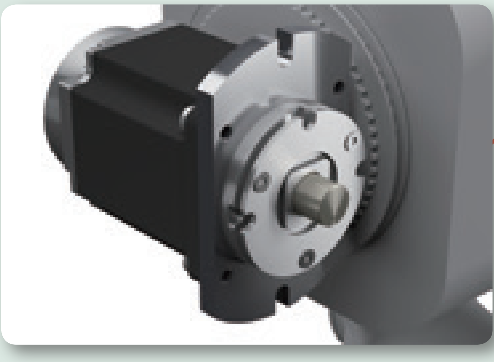


Product model BXW Large Size (Custom Product)

Employed device Wind Turbine Generator

Large BXW as the pitch drive device of a wind turbine generator.

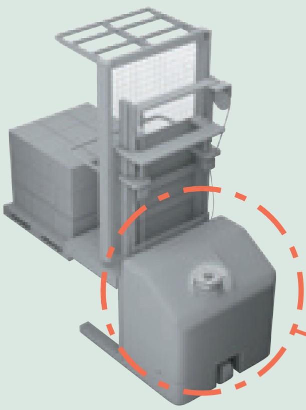




Product model BXR-LE

Employed device Vertically Articulated Robots

The BXR-LE models owes its ultra-thin profile to a dedicated controller. Mounted on the output shaft, it is ideal for applications where space is limited. Its dedicated controller also saves energy.



Product model BXH

Employed device Forklifts

Spring-actuated brake BXH model for electric forklift. Compact, high torque design.

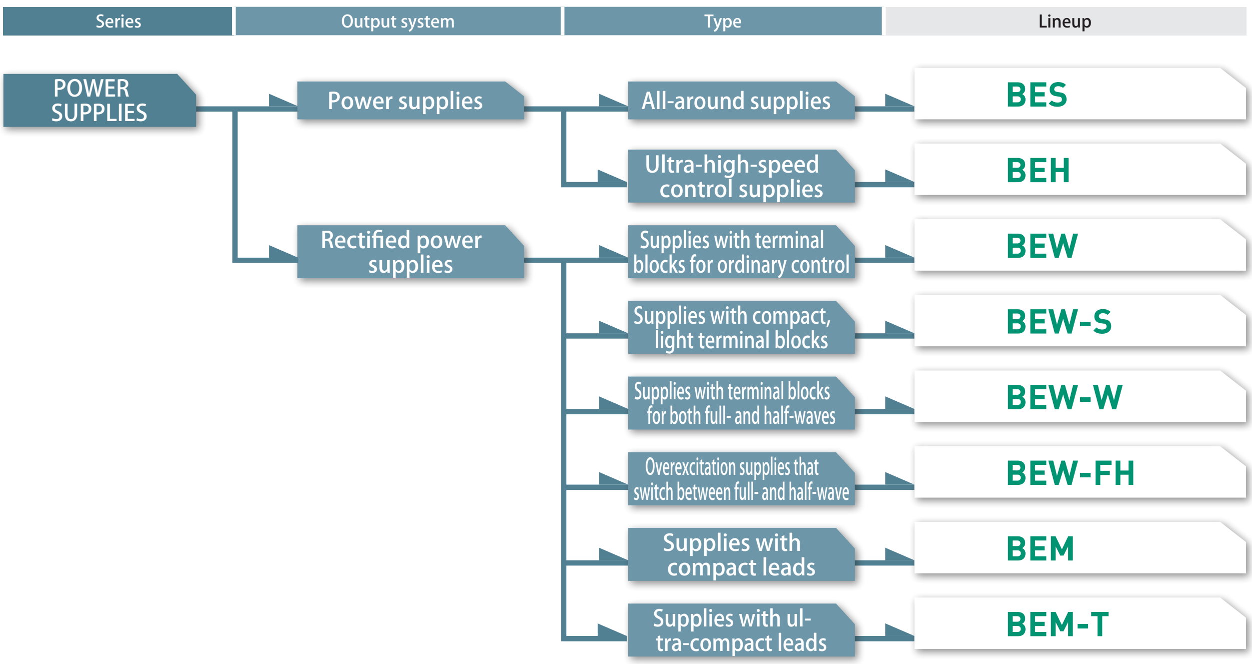
POWER SUPPLIES

Power Supplies to Get the Best Performance from Electromagnetic Clutches and Brakes

Compatible with AC 100, 200, and 400 V input power supplies. Outputs DC 24, 45, 90, and 180 V specifications for electromagnetic clutches and brakes. Broadly divided into power supplies for electromagnetic-actuated devices, which primarily require high-speed and ultra-high-speed control, and rectified power supplies, which are used by spring-actuated brakes and the like. A broad selection of power supplies are available.

RoHS
Some exceptions apply

Available Models



Model Selection

Model/Type	Applicable clutches and brakes			Input voltage			Output voltage				Function		
	Electromagnetic-actuated	Tooth	Spring-actuated	100V	200V	400V	24V	45V	90V	180V	Overexcitation	Reverse excitation	Weak excitation
BES	◎	◎	◎	◎	◎		◎	◎	◎		◎		
BEH	◎	◎		◎	◎		◎				◎	◎	

Model/Type	Applicable clutches and brakes			Input voltage			Output voltage				Function		
	Electromagnetic-actuated	Tooth	Spring-actuated	100V	200V	400V	24V	45V	90V	180V	Overexcitation	Reverse excitation	Weak excitation
BEW			◎	◎	◎	◎		◎	◎	◎			
BEW-S			◎	◎	◎	◎		◎	◎	◎			
BEW-W			◎	◎	◎	◎		◎	◎	◎			
BEW-FH			◎	◎	◎	◎		◎	◎	◎	◎		◎
BEM			◎	◎	◎	◎		◎	◎	◎			
BEM-T			◎	◎	◎	◎		◎	◎	◎			

Product Lineup

BES For ordinary high-speed control

All-around types suitable for the full range of electromagnetic clutches and brakes

Built-in overexcitation function
Can operate at high frequency and high precision.

Zero standby power
When used with one of our spring-actuated brakes, power consumption can be reduced by over 70%.

Light and compact
All terminals are contactless.

Compatible with international standards
UL listed.

Applicable clutches and brakes
Electromagnetic-actuated clutches and brakes
Tooth clutches
Spring-actuated brake

Input voltage
AC100V/200V

Output voltage
DC24V/45V/90V

BEH For ultra-high-speed control

Top-of-the-line ultra-high-speed control, high-precision types with built-in overexcitation/reverse excitation functions

Quiet design
There is no excitation noise while operating.

Combination control is easy
Operations that frequently switch clutches and brakes, such as inching, can be performed using only a single input signal.

An array of operating modes
Compatible with a diverse range of applications.

Auto-tuning function
Easy to set for the optimum operating conditions. Causes of problems can also be easily identified using the alarm displays.

Applicable clutches and brakes
Electromagnetic-actuated clutches and brakes
Tooth clutches

Input voltage
AC100V/200V

Output voltage
DC24V

BEW For ordinary control

Basic power supply device model for electromagnetic clutch and brake control

Diverse array of specifications
Power supplies are available with a variety of specifications, including half-wave rectified and full-wave rectified.

Terminal block type
These are of the terminal block type, which allows easy connection, with a DC switching terminal.

Applicable clutches and brakes
Spring-actuated brake
Electromagnetic-actuated clutches and brakes

Input voltage
AC100V/200V/400V

Output voltage
DC45V/90V/180V

BEW-S Compact, light

Power supplies for ordinary control of spring-actuated brakes

Half-wave rectified
Compact, light models with selected functions.

Terminal block type
These are types with terminal blocks that make connection easy. They are simple power supplies that are set on only the input side and output side.

Applicable clutches and brakes
Spring-actuated brake

Input voltage
AC100V/200V/400V

Output voltage
DC45V/90V/180V

BEW-W For both full- and half-wave rectification

Spring-actuated brakes with different specifications can be handled by a single unit

For both full- and half-wave rectification
Half-wave and full-wave rectified output can be handled by changing the connection method.

Compact, high wattage
Take a wide range of electrical inputs, from low voltage to high.

Terminal block type
These are types with terminal blocks that make connection easy. They are simple power supplies that are set on only the input side and output side.

Applicable clutches and brakes
Spring-actuated brake

Input voltage
AC100V/200V/400V

Output voltage
DC45V/90V/180V

BEW-FH Compact overexcitation power supplies

Can be set for the outcome you desire: higher operating speed, longer service life, and more

Used as overexcitation supplies
These provide benefits such as super-long (roughly double) service lives and shorter (roughly halved) armature pull-in times for electromagnetic clutches and brakes.

Used as weak excitation supplies
These provide benefits such as lower power consumption (roughly one quarter), suppressed heat generation (roughly one quarter) in the stator (electromagnetic coil), and shorter armature release times.

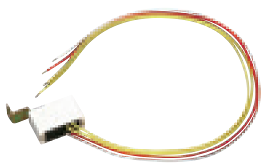
Terminal block type
These are of the terminal block type, which allows easy connection, with a DC switching terminal.

Applicable clutches and brakes
Spring-actuated brake

Input voltage
AC100V/200V/400V

Output voltage
DC45V/90V/180V

BEM Compact, light



Power supplies for ordinary control of spring-actuated brakes

Lead type
These are lead input/output types that are suited to relay connections.

Usable in adverse environments
Since the entire case is molded of resin, they can be used in atmospheres such as dusty locations.

Applicable clutches and brakes
Spring-actuated brake

Input voltage
AC100V/200V/400V

Output voltage
DC45V/90V/180V

BEM-T Ultra-compact, light

Power supplies for ordinary control of spring-actuated brakes

Easy connection
Uses tab terminals on the output side to achieve reductions in connection space and man-hours.

Mounting freedom
These are compact, slim, and can be installed anywhere. The mountings are also movable, so the input/output direction can be set freely.

Usable in adverse environments
Since the entire case is molded of resin, they can be used in atmospheres such as dusty locations.

Applicable clutches and brakes
Spring-actuated brake

Input voltage
AC100V/200V/400V

Output voltage
DC45V/90V/180V

ELECTROMAGNETIC CLUTCH & BRAKE UNITS

BES Models For Ordinary High-speed Control

Specifications

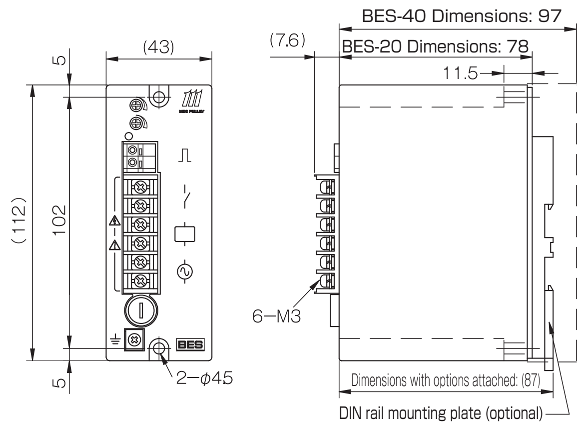
Model	BES-20-□-1	BES-40-□-1	BES-20-□	BES-40-□
Input voltage	AC100V ± 10% 50/60Hz		AC200V ± 10% 50/60Hz	
Output current	2.0A	4.0A	2.0A	4.0A
Voltage control system	PWM control			
Constant excitation voltage	Adjusted for each model and size at the time of shipment			
Overexcitation voltage	DC 90 V Full-wave (with AC 100 V input)		DC 180 V Full-wave (with AC 200 V input)	
Overexcitation time	Adjusted for each model and size at the time of shipment			
Protective functions	Input side Quick-acting fuse (5A)			
Insulating resistance	DC 500 V With Megger 100 M Ω (between terminal and main body)			
Dielectric strength voltage	AC 1000 V 50 Hz 1 min. (between terminal and main body)			
Usage environment	-10 to +50℃ /10 to 90%RH (with no condensation)			
Mass	0.3kg	0.7kg	0.3kg	0.7kg

* The voltage that is output is not insulated from the power supply, so shocks can result if touched.

Terminals and Functions

Terminal symbol	Terminal name	Function description
1-2	Power supply input terminal	Connector for a commercial power supply
3-4	Output terminal	Connector for an electromagnetic clutch or brake
5-6	Control terminal 1	Output is controlled by opening and closing between terminals using a relay or the like.
	Ground terminal	External ground terminal (third class ground or more)
S1-S2	Control terminal 2	Output is controlled by turning the DC 24 V on and off (30 mA, smoothing power supply)

Dimensions



Structure

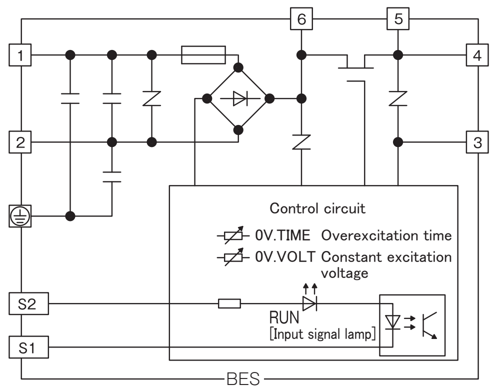


Table of Power Supply/Size Correspondence

MIKI PULLEY electromagnetic-actuated clutch/brake size		02	025	03	04	05	06	08	10	12	16	20	25
Nominal power supply output current		20											40
Power supply size	Excitation voltage For 24 V	05					10			16		20	25

MIKI PULLEY electromagnetic tooth clutch sizes		12	13	15	21	23	25	31	32
Nominal power supply output current		20						40	
Power supply size	Excitation voltage For 24 V	51			52			53	

MIKI PULLEY spring-actuated brake size		01	02	03	04	05	06	08	10	12	14	16	18	20	25
Nominal power supply output current		20													
Power supply size	Excitation voltage 45/90 V	61								62			63		
	Excitation voltage For 24 V	71								72			73		

* The exciting voltages shown in the table above are nominal. Actual output voltages may differ depending on the control method, etc.
* The constant excitation voltage for the 45/90 V excitation voltages of spring-actuated brakes is the DC 45 V specification for an input of AC 100 V and the DC 90 V specification for an input of AC 200 V.

How to Place an Order

BES-20-10-1 DIN

- Output current 20: 2 A / 40: 4 A
- Refer to the power supply size compatibility table
- Input voltage 1: 100 V AC / Blank: 200 V AC
- Mounting method
  DIN: Mounting by DIN mounting rail
  Blank: Direct mounting
  *The DIN mounting rail mounting option can only be set for BES-20.

Options (Noise Reduction Set)

Noise can be reduced if you also order, using the following model number, a noise filter (one) and ferrite cores (two).

BES-20-EMC

Characteristics

Operating Response
All circuits have been made contactless, and response from signal input to output to the electromagnetic-actuated clutch or brake is fast and stable.

Energy Saving
Standby power is "zero." Absolutely no electricity is wastefully consumed.
By combining this power supply with a MIKI PULLEY spring-actuated brake, the electricity consumption and heat generation of the spring-actuated brake is reduced by more than 70%, saving energy.

Noise During Operation
BES models use a quiet design, but electromagnetic clutches and brakes may produce excitation noise when operating under some mounting conditions. This noise is not abnormal and is not cause for concern.

Two Types of Control Systems
You can operate under either PLC control (which uses voltage control via programmable controllers or the like) or contactor control (which controls using relays and the like).
In the case of contactor control, however, a power controller for controlling the power supply line must be used.

Supply Voltage Fluctuations and Output Voltage
BES model power supplies are designed to operate reliably even when supply voltage fluctuates. Characteristically, however, their output voltage will rise or fall along with rises and falls of supply voltage. To fulfill electromagnetic clutch/brake performance, supply voltage fluctuations should be kept within a range of ±10%.

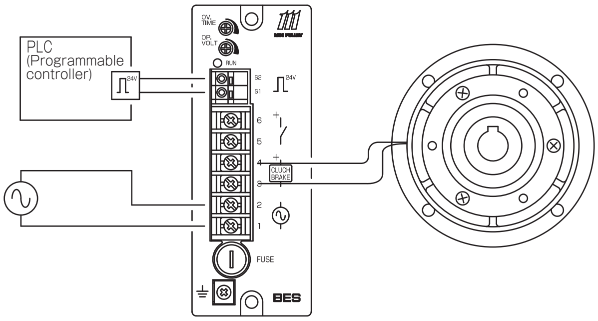
Precautions for Use

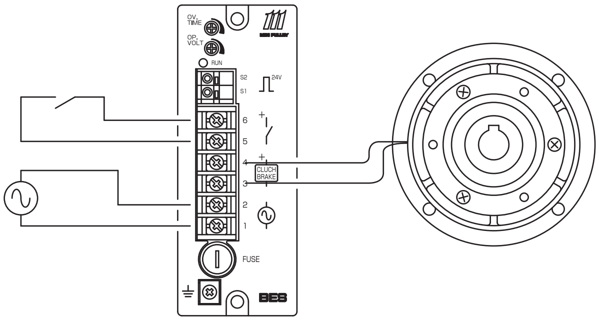
Connection Prohibited — Circuit Protector
BES models incorporate circuit protectors, so there is no need to connect circuit protectors to the output side (between 3 and 4). Also, since voltage is controlled using PWM, the actual voltage output is the same level as the input voltage. This means that connecting the varistor that comes with 24 V-specification clutches and brakes or the like may result in explosion of the varistor or damage to the power supply. Never connect such devices.

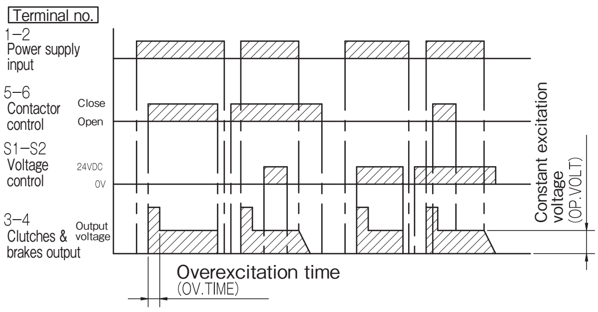
Protective Functions
BES models contain fuses on the input side. When a fuse engages, the likely cause is a malfunction on the output side.
• Short on output side
• Ground fault on output side
• Malfunction on output side (electromagnetic-actuated clutch/brake)
Thoroughly verify that there are no malfunctions on the output side before resuming operation.

How to Check Output Voltage Values
If you are checking the output voltage with a voltage meter, tester or the like, check the value with a load such as an electromagnetic clutch or brake connected to the output side.
If nothing is connected, it shows a value close to the supply voltage.

Wiring Methods and Timing Charts

Wiring 1 (PLC Control)


Wiring 2 (Contactor Control)


Time Chart


BEH Models For Ultra-high-speed Control

Specifications

Model		BEH-10G	BEH-20G	BEH-20G-1
Input voltage		AC200V ± 10%	AC200V ± 10%	AC100V ± 10%
		Single phase, 50/60 Hz		
Output voltage	Overexcitation voltage	Initial value 100 V, 0 to 250 V variable		
	Constant excitation voltage	Initial value 24 V, 0 to 250 V variable		
	Reverse excitation voltage	Initial value 100 V, 0 to 250 V variable		
	Voltage control system	PWM control		
Output current		2A	4A	4A
Applicable clutch/ brake size		02 ～ 16	02 ～ 32	
		MIKI PULLEY electromagnetic-actuated clutches and brakes Rated voltage DC 24 V		
Protective functions		Undervoltage protection, overvoltage protection, overcurrent protection/detection, break detection, element overheating protection, input-side fuse (20 A)		
Usage environment		-10 - +50℃ / 10 - 90%RH		
Mass		0.85kg	0.9kg	0.9kg

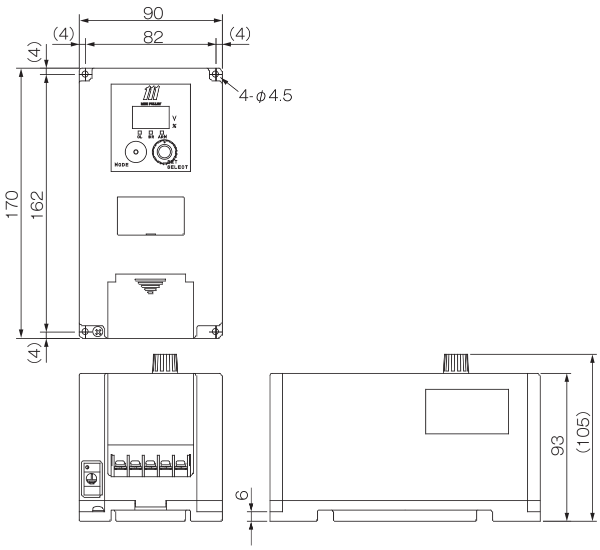
Operating Settings

Operating settings SW (SW3) Switch No.		ON (up)	OFF (down)	Settings when shipped
1	Setup/operating mode	Setup mode	Operation mode	OFF
2	Stand-alone/ interlocked mode	Stand-alone mode	Interlocked mode	OFF
3	Break/overcurrent detection	Enabled	Disabled	OFF
4	Current/voltage control	Current control	Voltage control	OFF
5	Control AUX	Enabled	Disabled	OFF
6	Jog operation	Enabled	Disabled	OFF
7	Slope operation	Enabled	Disabled	OFF
8	One-shot operation	Enabled	Disabled	OFF

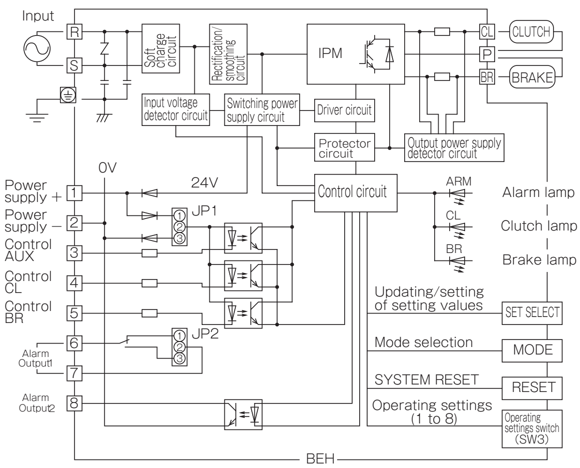
Terminals and Functions

Terminal symbol	Terminal name	Function description
R-S	Power supply input terminal	Connector for a commercial power supply
CL-P	Clutch output terminal	Connector for a clutch
BR-P	Brake output terminal	Connector for a brake
⏚	Ground	External ground terminal (third class ground or more)
1	Power supply terminal +	Positive terminal of control power supply (shared with the internal supply's +24 V)
2	Power supply terminal -	Negative terminal of control power supply (shared with the internal supply's 0 V)
3	Control AUX	When operating switch 5 (AUX operation) is on, executes the operation of the conditions set in the table.
4	Control clutch	Turns output between P and CL on and off.
5	Control brake	Turns output between P and BR on and off.
6・7	Alarm output 1	A relay that operates during an alarm stop (relay output)
8	Alarm output 2	Output operates during an alarm stop (transistor output)

Dimensions



Structure



Characteristics

Operating Response

The circuit construction is completely contactless, and response from signal input to output to the electromagnetic-actuated clutch or brake is fast and stable. The operating speed of the electromagnetic clutch or brake is also increased to the limit speed by the overexcitation and reverse excitation functions.
This is the top-of-the-line model for electromagnetic clutch/brake power supplies. It achieves ultra-high-speed control and high precision.

Noise During Operation

The BEH models are quiet power supplies.
Electromagnetic clutches and brakes normally produce howling sounds during operation. The quiet design of BEH models eliminates such sounds.

Output Control System

You can select either Stand-alone Mode, which controls stand-alone electromagnetic clutches and brakes independently, or Interlocked Mode, which is suited to combination control of electromagnetic clutches and brakes.
There is also a diverse array of other operating modes, such as current control mode and jog mode. These are compatible with a diversity of applications.

Supply Voltage Fluctuations and Output Voltage

BEH models control output voltage to be constant even with a certain amount of supply voltage fluctuation. This ensures stable output even in locations with a bad power supply environment. Variations in electromagnetic clutch/brake response disappear.
However, overly large voltage fluctuations will be sensed as abnormal voltages and set off an alarm. To ensure proper operation, keep supply voltage fluctuation to within a range of ± 10%.

Precautions for Use

Connection Prohibited — Circuit Protector

BEH models incorporate circuit protectors, so there is no need to connect circuit protectors to the output side (between CL, P and BR). When a circuit protector is included, the alarm goes off and operation stops. Also, since voltage is controlled using PWM, the actual voltage output is the same level as the input voltage. This means that connecting the varistor that comes with 24 V-specification clutches and brakes or the like may result in explosion of the varistor or damage to the power supply. Never connect such devices.

Power Supply Protective Functions

These power supplies are equipped with a variety of protective functions.
These functions also alert the user to the cause of the alarm when the various alarms engage. Thoroughly verify that the cause of the alarm has been cleared and that there are no abnormalities before resuming operation.

How to Check Output Voltage Values

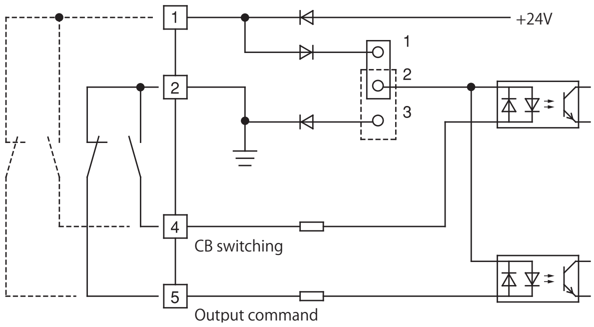
If you are checking the output voltage with a voltage meter, tester or the like, check the value with a load such as an electromagnetic clutch or brake connected to the output side.
If nothing is connected, the protective functions of break detection engage, and a value around the DC 280 V charged in the capacitor is shown, due to the characteristics of this power supply.

Applicable Ranges and Special Adjustments

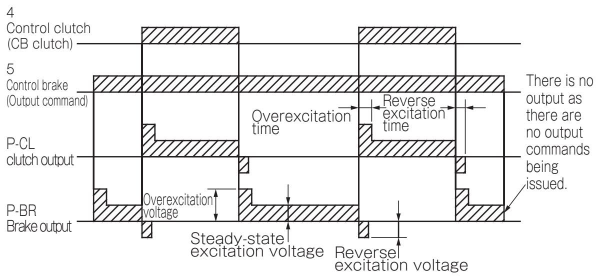
These power supplies can be used as supplies for all electromagnetic coils, not just electromagnetic clutches and brakes. The conducting conditions can be altered freely by changing internal settings. Feel free to consult Miki Pulley regarding settings, operating methods, and the like.

Wiring Methods and Timing Charts

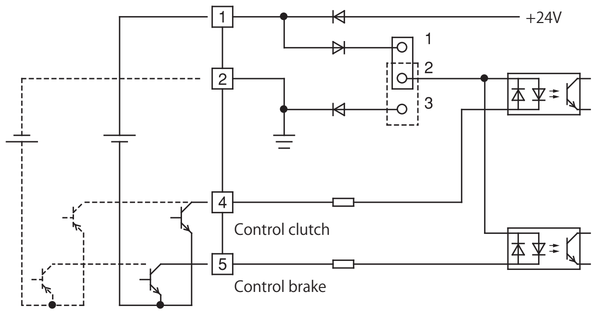
Interlocked Mode (Operating Settings SW-2 Off)



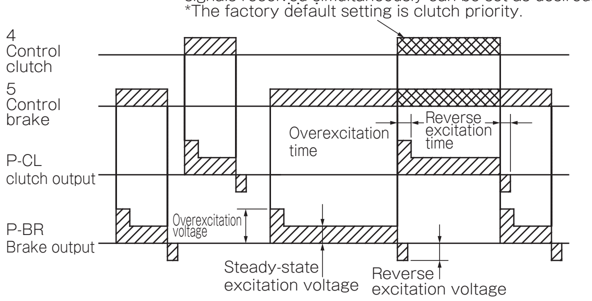
Terminal no. Toggles between the clutch and brake using a single input signal.



Stand-alone Mode (Operating Settings SW-2 On)



Terminal no. The corresponding clutch/brake operates using the signals received by the input terminals.
(Clutches and brakes cannot release output at the same time.)
The priority to determine the order of importance for signals received simultaneously can be set as desired.
*The factory default setting is clutch priority.



How to Place an Order

BEH-20G-1

Output capacity
10: 50 W
20: 100

Input voltage specifications
Blank: 200 V AC
1: 100 V AC

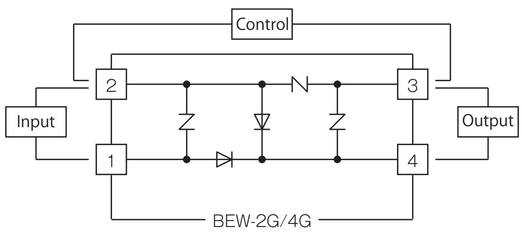
COUPLINGS
ETP BUSHINGS
ELECTROMAGNETIC CLUTCHES & BRAKES
SPEED CHANGERS & REDUCERS
INVERTERS
LINEAR SHAFT DRIVES
TORQUE LIMITERS
ROSTA
SERIES
ELECTROMAGNETIC-ACTUATED CLUTCHES AND BRAKES
ELECTROMAGNETIC-ACTUATED MICRO CLUTCHES & BRAKES
ELECTROMAGNETIC-ACTUATED CLUTCHES & BRAKES
ELECTROMAGNETIC CLUTCH & BRAKE UNITS
SPRING-ACTUATED BRAKE
ELECTROMAGNETIC TOOTH CLUTCHES
BRAKE MOTORS
POWER SUPPLIES
MODELS
BES
BEH
BEW
BEW-S
BEW-W
BEW-FH
BEM
BEM-T

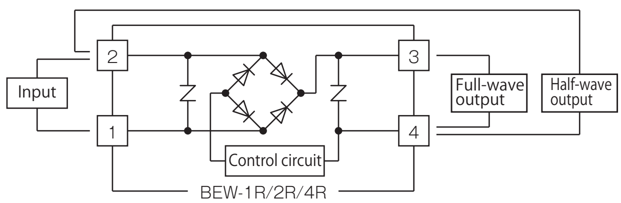
BEW Models Supplies with Terminal Blocks for Ordinary Control

Specifications

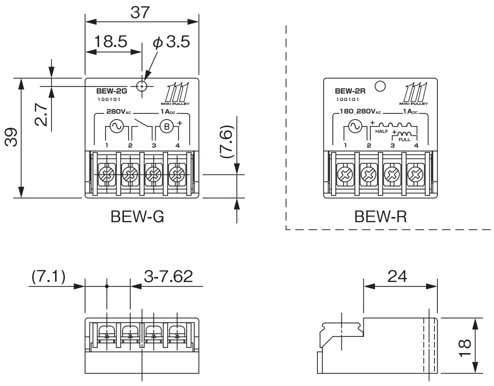
Model			BEW-2G		BEW-4G			BEW-1R		BEW-2R		BEW-4R	
Input voltage	AC100V	± 10% 50/60Hz	●		●			●					
	AC200V			●		●				●			
	AC400V						●					●	
	Input voltage range		AC 280 V max.		AC 480 V max.			AC90 ~ 140V		AC180 ~ 280V		AC360 ~ 480V	
Rectification method			Half-wave rectification					For both half- and full-wave rectification					
								Half-wave	Full-wave	Half-wave	Full-wave	Half-wave	Full-wave
	Output voltage		DC45V	DC90V	DC45V	DC90V	DC180V	DC45V	DC90V	DC90V	DC180V	DC180V	DC360V
Output current	When the ambient temperature is 20℃ Values in () are for an ambient temperature of 60℃		DC1.0A (DC0.7A)		DC1.0A (DC0.7A)			DC2.0A (DC1.5A)		DC1.0A (DC0.7A)		DC0.7A (DC0.5A)	
Output Wattage	When the ambient temperature is 20℃ Values in () are for an ambient temperature of 60℃		45W (25W)	90W (50W)	45W (25W)	90W (50W)	180W (100W)	90W (50W)	180W (100W)	90W (50W)	180W (100W)	126W (90W)	252W (180W)
Size setting	Voltage specification Numbers in parentheses are input voltages		DC45V (AC100V)	DC90V (AC200V)	DC45V (AC100V)	DC90V (AC200V)	DC180V (AC400V)	DC45V (AC100V)	DC90V (AC100V)	DC90V (AC200V)	DC180V (AC200V)	DC180V (AC400V)	DC360V (AC400V)
	● Applicable △: Applicable depending on clutch/brake model	01	●	●	●	●	●	●	●	●	●	●	
		02	●	●	●	●	●	●	●	●	●	●	
		03	●	●	●	●	●	●	●	●	●	●	
		04	●	●	●	●	●	●	●	●	●	●	
		05	●	●	●	●	●	●	●	●	●	●	
		06	●	●	●	●	●	●	●	●	●	●	
		08	●	●	●	●	●	●	●	●	●	●	
		10	●	●	●	●	●	●	●	●	●	●	
		12		●		●	●		●	●	●	●	
		14		●		●	●		●	●	●	●	
		16		●		●	●		●	●	●	●	
		18		△		△	●		●	△	●	●	
		20		△		△	●		●	△	●	●	
		25		△		△	●		●	△	●	●	
Applied clutches/ brakes	MIKI PULLEY electromagnetic-actuated clutches and brakes Rated voltage DC 45/90/180 V DC45/90/180V		Spring-actuated brake					All					
Insulating resistance	Between terminal and body		DC 500 V, 100 M Ω with Megger										
Dielectric strength voltage			1500 V AC, 50 Hz, 1 min.	2000 V AC, 50 Hz, 1 min.				1500 V AC, 50 Hz, 1 min.				2000 V AC, 50 Hz, 1 min.	
Usage environment	With no condensation		-20 - +60℃										
Mass	Per product		0.04kg										

Structure





Dimensions



Terminals and Functions

Model	Terminal symbol	Terminal name	Function description
BEW-G	1-2	Power supply input terminal	Connector for a commercial power supply
	2-3	Control terminal	Output is controlled by opening and closing between terminals with a relay or other contact
	3-4	Output terminal	Connector for an electromagnetic clutch or brake
BEW-R	1-2	Power supply input terminal	Connector for a commercial power supply
	2-4	Output terminal (half-wave)	Connector for an electromagnetic clutch or brake (when half-wave rectified)
	3-4	Output terminal (full-wave)	Connector for an electromagnetic clutch or brake (when full-wave rectified)

Characteristics

Output System

Two systems are available, half-wave rectified and full-wave rectified. Half-wave rectified takes a commercial power supply as the input and generates a half-wave rectified DC voltage on the output side. These power supply devices are known for their very simple construction and low cost, but their voltage pulse is large. They are therefore prone to generating variations in operating response in electromagnetic clutches and brakes, they produce a howling noise when conducting, and they tend to generate more heat from their electromagnetic coils than full-wave rectified supplies or smoothing supplies.
When the above are to be avoided, consider changing to a full-wave rectified supply, smoothing supply, or a DC 24 V specification.
Full-wave rectified power supply devices are known for having smaller voltage pulses than half-wave rectified supplies and tending to have little variation in electromagnetic clutch and brake operating response. They can thus be used not just for spring-actuated brakes but also for electromagnetic-actuated clutches and brakes.
Note that when the rated voltage of the electromagnetic coil does not match the voltage output from the power supply device, you will not be able to obtain the electromagnetic clutch/brake characteristics given in the specifications.

Precautions for Use

Circuit Protector

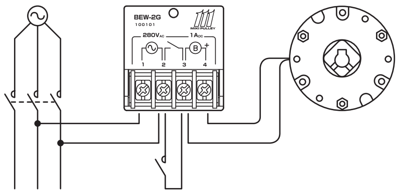
These power supply devices have built-in circuit protectors (varistors) on the input and output sides. There basically is no need, therefore, to install external circuit protectors.

Primary and Secondary Control Methods

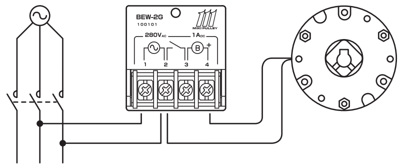
Primary control, which uses on/off of the input voltage to control electromagnetic clutches/brakes, saves wiring, but makes the armature release time extremely long, so the braking time of the brake becomes long. (No surge voltage is generated.)
With secondary control (which controls terminals 2-3 with a relay or other contact), armature release time is shorter, as is the braking time of the brake, but there is more wiring and some surge voltages occur. Select primary or secondary control based on the characteristics you desire.

Wiring Methods and Timing Charts

BEW-G Secondary Control (Basic Wiring)

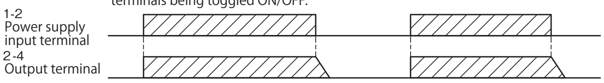


BEW-G Primary Control (Wire Saving)



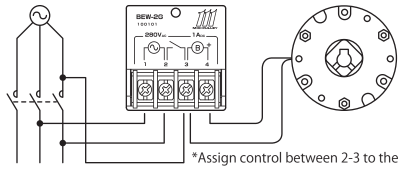
Terminal No.

<Primary side control method>
The output for the 3-4 terminals is controlled by the input power to the 1-2 terminals being toggled ON/OFF.



*Check the above before use as even though the back voltage from the coil will no longer generate when the power supply is toggled ON/OFF, the armature release time will increase.

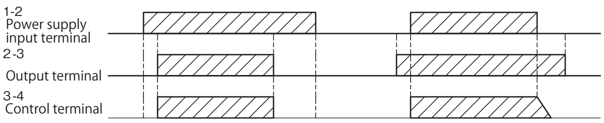
BEW-G Secondary Control (Wire Saving)



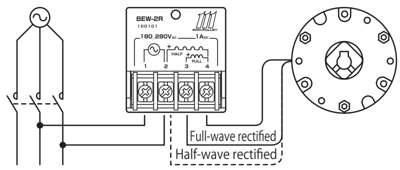
*Assign control between 2-3 to the same phase.

Terminal No.

<Secondary side control method>
The output for the 3-4 terminals is controlled by the input power to the 1-2 terminals being left on and the 2-3 terminals being toggled ON/OFF.

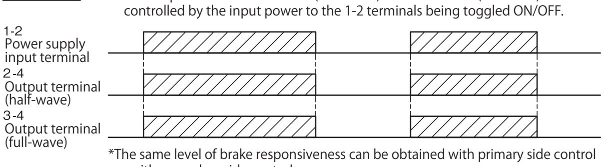


BEW-R Primary Control



Terminal no.

<BEW/R>
The output for the 2-4 terminals(half-wave) or 3-4 terminals(full-wave) is controlled by the input power to the 1-2 terminals being toggled ON/OFF.



*The same level of brake responsiveness can be obtained with primary side control as with secondary side control.

How to Place an Order

BEW-2G

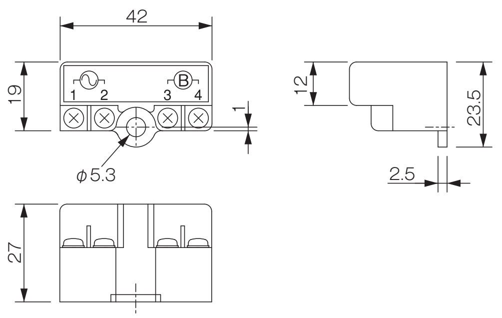
- Specifications — G: Standard, R: Relay included
- Input voltage specifications — Rated input 1: 100 V AC, Rated input 2: 200 V AC, Rated input 4: 400 V AC

BEW-S Types Compact, Light Supplies with Terminal Blocks

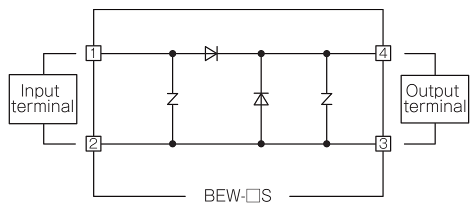
Specifications

Model			BEW-2S		BEW-4S		
Input voltage	AC100V	± 10% 50/60Hz	●		●		
	AC200V			●		●	
	AC400V						●
	Maximum input voltage		AC250V		AC510V		
Rectification method			Half-wave rectification				
	Output voltage		DC45V	DC90V	DC45V	DC90V	DC180V
Output current	When the ambient temperature is 20℃ Values in () are for an ambient temperature of 60℃		DC1.0A (DC0.6A)				
Output Wattage	When the ambient temperature is 20℃ Values in () are for an ambient temperature of 60℃		45W (25W)	90W (50W)	45W (25W)	90W (50W)	180W (100W)
Size setting	Voltage specification Numbers in parentheses are input voltages		DC45V (AC100V)	DC90V (AC200V)	DC45V (AC100V)	DC90V (AC200V)	DC180V (AC400V)
	●: Applicable △: Applicable depending on clutch/ brake model	01	●	●	●	●	●
		02	●	●	●	●	●
		03	●	●	●	●	●
		04	●	●	●	●	●
		05	●	●	●	●	●
		06	●	●	●	●	●
		08	●	●	●	●	●
		10	●	●	●	●	●
		12		●		●	●
		14		●		●	●
		16		●		●	●
		18		△		△	●
		20		△		△	△
		25		△		△	△
Applied clutches/brakes	MIKI PULLEY electromagnetic-actuated clutches and brakes Rated voltage DC 45/90/180 V		Spring-actuated brake				
Insulating resistance	Between terminal and body		DC 500 V, 100 MΩ with Megger				
Dielectric strength voltage			1000 V AC, 50 Hz, 1 min.		2000 V AC, 50 Hz, 1 min.		
Usage environment	With no condensation		-20～+60℃				
Mass	Per product		0.021kg				

Dimensions



Structure



Terminals and functions

Terminal symbol	Terminal name	Function description
1-2	Power supply input terminal	Connector for a commercial power supply
3-4	Output terminal	Connector for an electromagnetic clutch or brake

Characteristics

Output System

BEW-2S/4S types take a commercial power supply as the input and generate a half-wave rectified DC voltage on the output side. These power supply devices are known for their very simple construction and low cost, but their voltage pulse is large. They are therefore prone to generating variations in operating response in electromagnetic clutches and brakes, they produce a howling noise when conducting, and they tend to generate more heat from their electromagnetic coils than full-wave rectified supplies or smoothing supplies.
When the above are to be avoided, consider changing to a full-wave rectified supply (BEW-R types), smoothing supply, or a DC 24 V specification.

How to Calculate Output Voltage
Output voltage = Input voltage × a (a set coefficient)
*** a (set coefficient) = 0.45: half-wave rectification**
(Ex.)
BEW-2S: AC100V × 0.45 = DC45V
BEW-4S: AC400V × 0.45 = DC180V

Note that when the rated voltage of the electromagnetic coil does not match the output voltage calculated above, you will not be able to obtain the electromagnetic clutch/brake characteristics given in the specifications.

Precautions for Use

Circuit Protector

These power supply devices have built-in circuit protectors (varistors) on the input and output sides. There basically is no need, therefore, to install external circuit protectors.

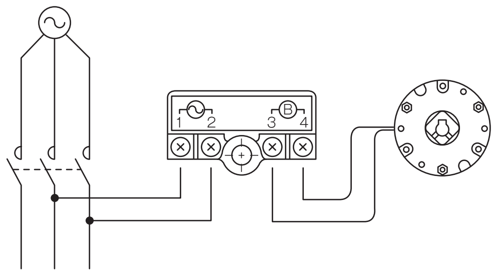
Primary and Secondary Control Methods

These power supply devices use primary control, in which electromagnetic clutches and brakes are controlled by turning input voltage on and off, as their basic control.
This control system saves wiring, but has a longer armature release time than secondary control, extending the braking time of spring-actuated brakes.
This phenomenon becomes more marked the larger the electromagnetic clutch or brake is. Primary control is thus used predominantly on small spring-actuated brakes.
Also, primary control does not generate the surge voltage (counterelectromotive voltage) when the electromagnetic clutch or brake goes off that secondary control does, so it is very effective in machinery when noise must be avoided.

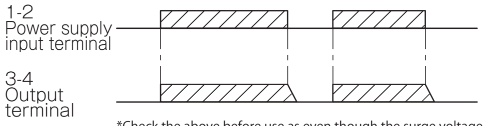
When secondary control is used to improve response, install relay contacts between the output terminals and electromagnetic clutches/brakes as shown in the wiring diagram at right.
At this time, you must install discharge elements such as varistors between relay contacts or in parallel to the electromagnetic clutch/brake.

Wiring Methods and Timing Charts

Primary Control

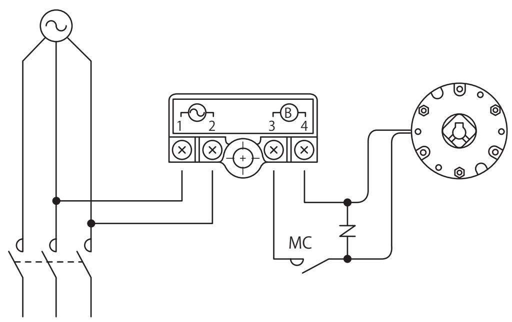


Terminal no. <<Primary side control method>>
The output for the 3-4 terminals is controlled by the input power to the 1-2 terminals being toggled ON/OFF.

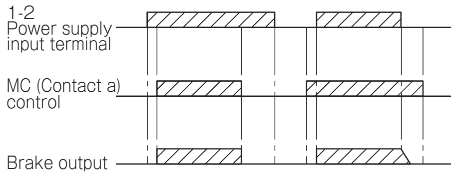


*Check the above before use as even though the surge voltage from the electromagnetic coil will no longer generate when the power supply is toggled ON/OFF, the armature release time will increse.

Secondary Control



Terminal no. <<Secondary side control method>>
The brake output is controlled by the input power being input to the 1-2 terminals and the relay being toggled ON/OFF.



How to Place an Order

BEW-2S
Input voltage specifications
2: Rated input voltage of 200 V AC
4: Rated input voltage of 400 V AC

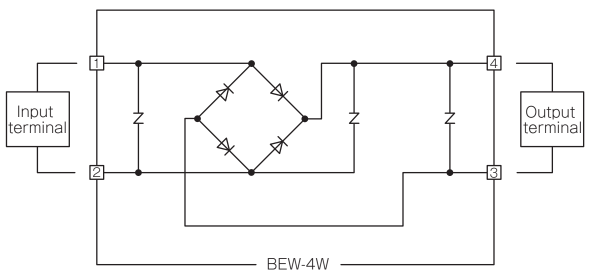
COUPLINGS
ETP BUSHINGS
ELECTROMAGNETIC CLUTCHES & BRAKES
SPEED CHANGERS & REDUCERS
INVERTERS
LINEAR SHAFT DRIVES
TORQUE LIMITERS
ROSTA
SERIES
ELECTROMAGNETIC-ACTUATED CLUTCHES AND BRAKES
ELECTROMAGNETIC-ACTUATED MICRO CLUTCHES & BRAKES
ELECTROMAGNETIC-ACTUATED CLUTCHES & BRAKES
ELECTROMAGNETIC CLUTCH & BRAKE UNITS
SPRING-ACTUATED BRAKE
ELECTROMAGNETIC TOOTH CLUTCHES
BRAKE MOTORS
POWER SUPPLIES
MODELS
BES
BEH
BEW
BEW-S
BEW-W
BEW-FH
BEM
BEM-T

BEW-W Types Supplies with Terminal Blocks for Both Full- and Half-waves

Specifications

Model			BEW-4W					
Input voltage	AC100V	± 10% 50/60Hz	●					
	AC200V				●			
	AC400V						●	
	Maximum input voltage		AC510V					
Rectification method			For both half- and full-wave rectification					
			Half-wave	Full-wave	Half-wave	Full-wave	Half-wave	Full-wave
	Output voltage		DC45V	DC90V	DC90V	DC180V	DC180V	DC360V
Output current	When the ambient temperature is 20℃ Values in () are for an ambient temperature of 60℃		DC3.0A (DC2.5A)					
Output Wattage	When the ambient temperature is 20℃ Values in () are for an ambient temperature of 60℃		135W (112W)	270W (225W)	270W (225W)	540W (540W)	540W (540W)	1080W (900W)
Size Settings	Voltage specification Numbers in parentheses are input voltages		DC45V (AC 100 V half-wave)	DC90V (AC 100 V full-wave)	DC90V (AC 200 V half-wave)	DC180V (AC 200 V full-wave)	DC180V (AC 400 V half-wave)	DC360V (AC 400 V full-wave)
	●: Applicable △: Applicable depending on model of clutch or brake	01	●	●	●	●	●	
		02	●	●	●	●	●	
		03	●	●	●	●	●	
		04	●	●	●	●	●	
		05	●	●	●	●	●	
		06	●	●	●	●	●	
		08	●	●	●	●	●	
		10	△	●	●	●	●	
		12	△	●	●	●	●	
		14	△	●	●	●	●	
		16	△	●	●	●	●	
		18	△	●	●	●	●	
		20	△	●	●	●	●	
		25	△	●	●	●	●	
Applied clutches/brakes	MIKI PULLEY electromagnetic-actuated clutches and brakes Rated voltage DC 45/90/180 V		Spring-actuated brake					
Insulating resistance	Between terminal and body		DC 500 V, 100 M Ω with Megger					
Dielectric strength voltage			2200 V AC, 50 Hz, 1 min.					
Usage environment	With no condensation		-20 ～ +60℃ / 10 ～ 90%RH					
Mass	Per product		0.045kg					

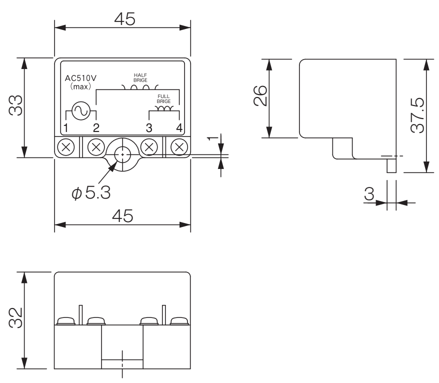
Structure



Terminals and Functions

Terminal symbol	Terminal name	Function description
1 - 2	Power supply input terminal	Connector for a commercial power supply
3 - 4	Output terminal	Connector for an electromagnetic clutch or brake

Dimensions



Characteristics

For Both Half-wave Rectified and Full-wave Rectified

For BEW-4W types, you can select between half-wave rectified and full-wave rectified by changing the connections of the wiring as shown in the figure at right.
These power supply devices are high Wattage and allow a wide range of voltage inputs, from low voltage to high. As a result, a wide variety of electromagnetic clutches and brakes can be handled by a single BEW-4W power supply alone.
You can either focus on the type of brake, assuming you will rewire, or conversely, handle a variety of types of brakes with a BEW-4W power supply alone.

How to Calculate Output Voltage

Output voltage = Input voltage × a (a set coefficient)

*** a (set coefficient) = 0.45: half-wave rectified/0.9: full-wave rectified**

(Ex.)

Half-wave: AC200V × 0.45 = DC90V

Full-wave: AC100V × 0.9 = DC90V

Note that when the rated voltage of the electromagnetic coil does not match the output voltage calculated above, you will not be able to obtain the electromagnetic clutch/brake characteristics given in the specifications.

Precautions for Use

Primary and Secondary Control Methods

These power supply devices use primary control, in which electromagnetic clutches and brakes are controlled by turning input voltage on and off, as their basic control.
This control system saves wiring, but has a longer armature release time than secondary control, extending the braking time of spring-actuated brakes.
This phenomenon becomes more marked the larger the electromagnetic clutch or brake is. Primary control is thus used predominantly on small spring-actuated brakes.
Also, primary control does not generate the surge voltage (counterelectromotive voltage) when the electromagnetic clutch or brake goes off that secondary control does, so it is very effective in machinery when noise must be avoided.

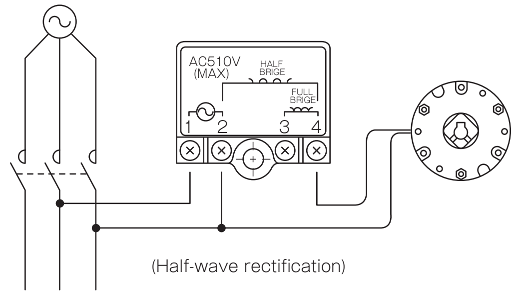
When secondary control is used to improve response, install relay contacts between the output terminals and electromagnetic clutches/brakes as shown in the wiring diagram at right.
At this time, you must install discharge elements such as varistors between relay contacts or in parallel to the electromagnetic clutch/brake.

How to Place an Order

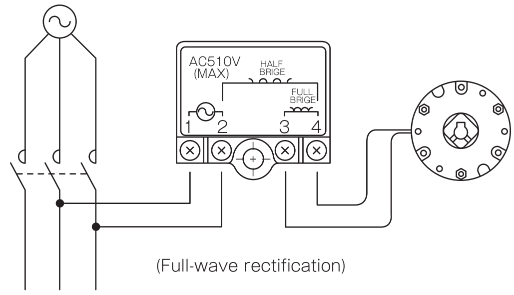
BEW-4W

Wiring Methods and Timing Charts

Primary Control

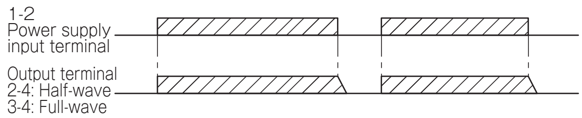


(Half-wave rectification)



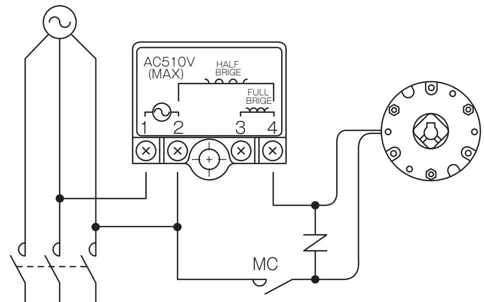
(Full-wave rectification)

Terminal no. <<Primary side control method>>
The output for the 3-4 terminals is controlled by the input power to the 1-2 terminals being toggled ON/OFF.

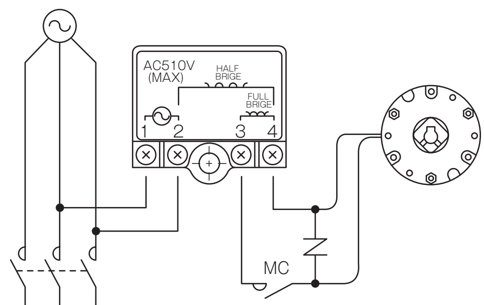


* There is no longer a surge voltage from the electromagnetic coil when power goes on or off, but armature release time is longer, so confirm this prior to use.

Secondary Control

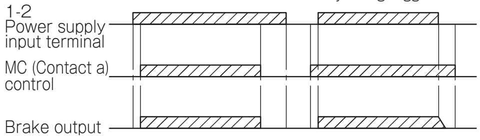


(Half-wave rectification)



(Full-wave rectification)

Terminal no. <<Secondary side control method>>
The brake output is controlled by the input power being input to the 1-2 terminals and the relay being toggled ON/OFF.

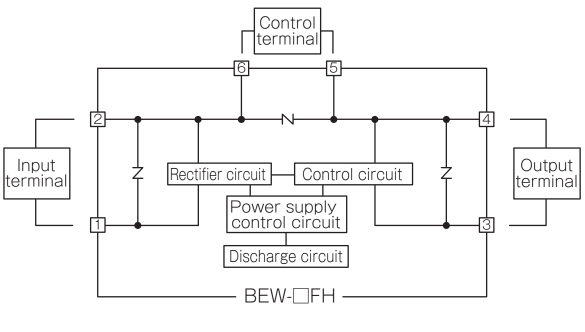


BEW-FH Types Overexcitation Supplies that Switch Between Full- and Half-wave

Specifications

Model			BEW-1FH		BEW-2FH		BEW-4FH	
Input voltage	AC100V	± 10% 50/60Hz	●					
	AC200V				●			
	AC400V						●	
	Input voltage range		AC80 ～ 130V		AC170 ～ 300V		AC80 ～ 480V	
Control method			Overexcitation (full-wave rectified) for 0.5 sec followed by constant excitation (half-wave rectified)					
			Overexcitation	Constant excitation	Overexcitation	Constant excitation	Overexcitation	Constant excitation
Output voltage			DC90V	DC45V	DC180V	DC90V	DC360V	DC180V
Output current	When the ambient temperature is 20℃ Values in () are for an ambient temperature of 60℃		DC1.6A (DC1.3A) Constant excitation		DC1.6A (DC1.3A) Constant excitation		DC1.2A (DC1.0A) Constant excitation	
Output Wattage	When the ambient temperature is 20℃ Values in () are for an ambient temperature of 60℃		72W (58W) Constant excitation		144W (117W) Constant excitation		216W (180W) Constant excitation	
Size Settings	Purpose of use		Using overexcitation	Using weak excitation	Using overexcitation	Using weak excitation	Using overexcitation	Using weak excitation
	Clutch/brake rated voltage		DC45V	DC90V	DC90V	DC180V	DC180V	DC360V
	● Applicable	01	●	●	●	●	●	
		02	●	●	●	●	●	
		03	●	●	●	●	●	
		04	●	●	●	●	●	
		05	●	●	●	●	●	
		06	●	●	●	●	●	
		08	●	●	●	●	●	
		10	●	●	●	●	●	
		12		●	●	●	●	
		14		●	●	●	●	
		16		●	●	●	●	
		18		●	●	●	●	
		20		●	●	●	●	
		25		●	●	●	●	
Applied clutches/brakes	MIKI PULLEY electromagnetic-actuated clutches and brakes Rated voltage DC 45/90/180 V		Spring-actuated brake					
Insulating resistance	Between terminal and body		DC 500 V, 100 M Ω with Megger					
Dielectric strength voltage			2000 V AC, 50 Hz, 1 min.					
Usage environment	With no condensation		-20 ～ +60℃					
Mass	Per product		0.065kg					

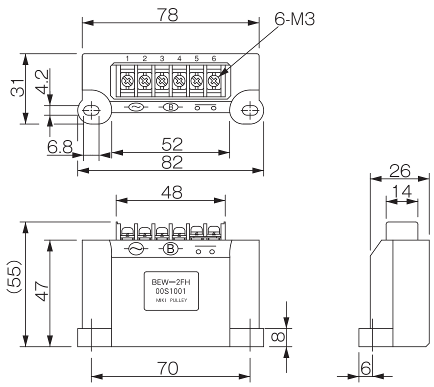
Structure



Terminals and Functions

Terminal symbol	Terminal name	Function description
1-2	Power supply input terminal	Connector for a commercial power supply
3-4	Output terminal	Connector for an electromagnetic clutch or brake
5-6	Control terminal	Output is controlled by opening and closing between terminals with a relay or other contact

Dimensions



Characteristics

Used as Overexcitation Supplies

BEW-FH models go through about 0.5 sec of full-wave rectified output and then transition to half-wave rectified output. BEW-FH power supply devices create an overexcitation state by matching their constant excitation voltage to the rated voltage of the electromagnetic clutch/brake to obtain the following effects.

- Longer electromagnetic clutch/brake service life (about double)
- Shorter armature pull-in time (about half) to achieve high frequency operation
- Reduced startup interference by combined use of a spring-actuated brake and a motor

Also, the following effects can also be obtained by determining the specifications of the spring-actuated brake under the assumption that a BEW-FH power supply will be used.

- Higher torque
- Slimmer and more compact

Used as Weak Excitation Supplies

Conversely, BEW-FH power supply devices create a weak excitation state after armature pull-in by matching their overexcitation voltage to the rated voltage of the electromagnetic clutch/brake to obtain the following effects.

- Lower electricity consumption (about 1/4)
- Lower stator (electromagnetic coil) heat production (about 1/4)
- Shorter armature release time

Precautions for Use

Circuit Protector

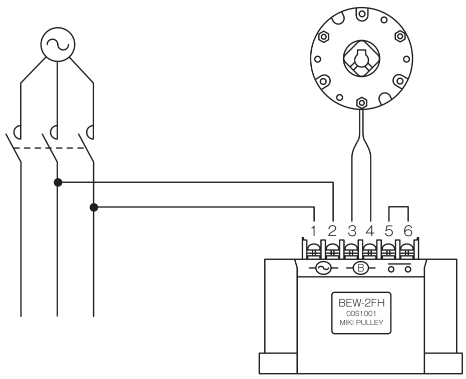
These power supply devices have built-in circuit protectors (varistors) on the input and output sides. There basically is no need, therefore, to install external circuit protectors.

Primary and Secondary Control Methods

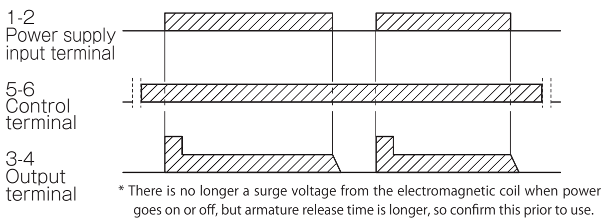
Primary control, which uses on/off of the input voltage to control electromagnetic clutches/brakes (shorting terminals 5-6), saves wiring, but makes the armature release time extremely long, so the braking time of the brake becomes long. (No surge voltage is generated.)
With secondary control (which controls terminals 5-6 with a relay or other contact), armature release time is shorter, as is the braking time of the brake, but there is more wiring and some surge voltages occur.
Select primary or secondary control based on the characteristics you desire.
Terminals 5-6 are part of the circuit that flows into the brake, so add voltage and current to the considerations when you select relay contacts and the like.

Wiring Methods and Timing Charts

Primary Control

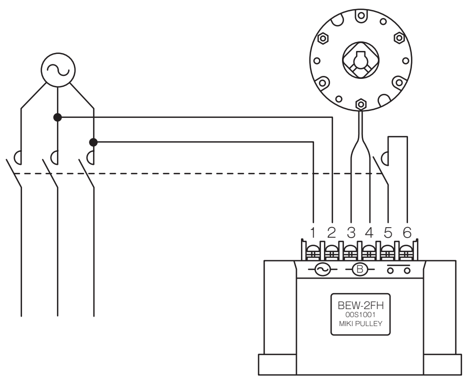


Terminal no. <<Primary side control method>>
5-6 terminals are short-circuited and the output for the 3-4 terminals is controlled by the input power to the 1-2 terminals being toggled ON/OFF.

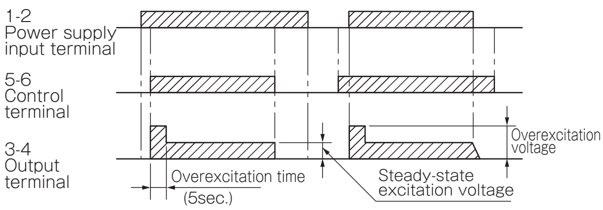


* There is no longer a surge voltage from the electromagnetic coil when power goes on or off, but armature release time is longer, so confirm this prior to use.

Secondary Control



Terminal no. <<Secondary side control methods>>
The output from the 3-4 terminal is controlled by the input power to the 1-2 terminal being left on and the 5-6 terminal being toggled ON/OFF.



How to Place an Order

BEW-1FH

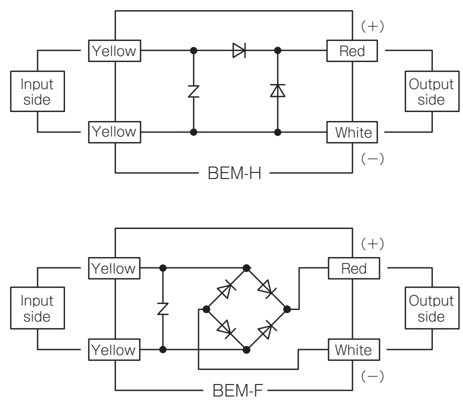
Input voltage specifications
Rated input 1: 100 V AC
Rated input 2: 200 V AC
Rated input 4: 400 V AC

BEM Models Supplies with Compact Leads

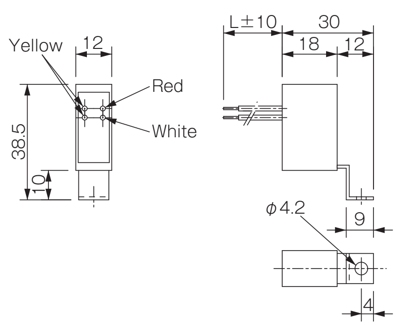
Specifications

Model			BEM-2H		BEM-4H			BEM-2F	
Input voltage	AC100V	±10% 50/60Hz	●		●			●	
	AC200V			●		●			●
	AC400V						●		
	Maximum input voltage		AC250V		AC510V			AC250V	
Rectification method			Half-wave rectification					Full-wave rectification	
Output voltage			DC45V	DC90V	DC45V	DC90V	DC180V	DC90V	DC180V
Output current	When the ambient temperature is 20℃ Values in ( ) are for an ambient temperature of 60℃		DC1.0A (DC0.6A)		DC1.0A (DC0.6A)			DC1.0A (DC0.6A)	
Output Wattage	When the ambient temperature is 20℃ Values in ( ) are for an ambient temperature of 60℃		45W (25W)	90W (50W)	45W (25W)	90W (50W)	180W (100W)	90W (50W)	180W (100W)
Size setting	Voltage specification Numbers in parentheses are input voltages		DC45V (AC100V)	DC90V (AC200V)	DC45V (AC100V)	DC90V (AC200V)	DC180V (AC400V)	DC90V (AC100V)	DC180V (AC200V)
	●: Applicable △: Applicable depending on clutch/brake model	01	●	●	●	●	●	●	●
		02	●	●	●	●	●	●	●
		03	●	●	●	●	●	●	●
		04	●	●	●	●	●	●	●
		05	●	●	●	●	●	●	●
		06	●	●	●	●	●	●	●
		08	●	●	●	●	●	●	●
		10	●	●	●	●	●	●	●
		12		●		●	●	●	●
		14		●		●	●	●	●
		16		●		●	●	●	●
		18		△		△	●	△	●
		20		△		△	△	△	●
		25		△		△	△	△	●
Applied clutches/brakes	MIKI PULLEY electromagnetic-actuated clutches and brakes Rated voltage DC 45/90/180 V		Spring-actuated brake						
Insulating resistance	Between terminal and body		DC 500 V, 100 MΩ with Megger						
Dielectric strength voltage			1500 V AC, 50 Hz, 1 min.		2200 V AC, 50 Hz, 1 min.			1500 V AC, 50 Hz, 1 min.	
Lead wire	UL style/Size		UL3398・AWG22		UL3271・AWG22			UL3398・AWG22	
Usage environment	With no condensation		-15～+60℃						
Mass	Per product		0.020kg		0.021kg			0.023kg	

Structure



Dimensions



Terminals and Functions

Lead color	Function name	Function description
Yellow (two)	Input side	Connector for a commercial power supply
Red/white	Output side	Connector for an electromagnetic clutch or brake

Characteristics

For Both Half-wave Rectified and Full-wave Rectified

BEM-2H/4H types take a commercial power supply as the input and generate a half-wave rectified DC voltage on the output side. These power supply devices are known for their very simple construction and low cost, but their voltage pulse is large.They are therefore prone to generating variations in operating response in electromagnetic clutches and brakes, they produce a howling noise when conducting, and they tend to generate more heat from their electromagnetic coils than full-wave rectified supplies or smoothing supplies.
When the above are to be avoided, consider changing to a full-wave rectified supply (BEM-2F types), smoothing supply, or a DC 24 V specification.

BEM-2F types generate a full-wave rectified DC voltage. These power supply devices are known for having smaller voltage pulses than half-wave rectified supplies and tending to have little variation in electromagnetic clutch and brake operating response.

How to Calculate Output Voltage
Output voltage = Input voltage × a (a set coefficient)
*** a (set coefficient) = 0.45: half-wave rectified/0.9: full-wave rectified**
(Ex.)
BEM-2H, -4H: 200 V AC × 0.45 = 90 V DC
BEM-2F: AC100V × 0.9 = DC90V

Note that when the rated voltage of the electromagnetic coil does not match the output voltage calculated above, you will not be able to obtain the electromagnetic clutch/brake characteristics given in the specifications.

Precautions for Use

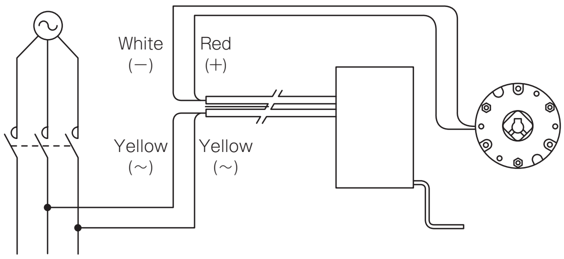
Primary and Secondary Control Methods

These power supply devices use primary control, in which electromagnetic clutches and brakes are controlled by turning input voltage on and off, as their basic control.
This control system saves wiring, but has a longer armature release time than secondary control, extending the braking time of spring-actuated brakes.
This phenomenon becomes more marked the larger the electromagnetic clutch or brake is. Primary control is thus used predominantly on smaller spring-actuated brakes.
Also, primary control does not generate the surge voltage (counterelectromotive voltage) when the electromagnetic clutch or brake goes off that secondary control does, so it is very effective in machinery when noise must be avoided.

When secondary control is used to improve response, install relay contacts between the output terminals and electromagnetic clutches/brakes as shown in the wiring diagram at right.
At this time, you must install discharge elements such as varistors between relay contacts or in parallel to the electromagnetic clutch/brake.

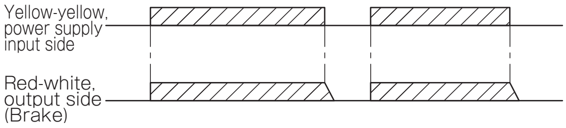
Wiring Methods and Timing Charts

Primary Control



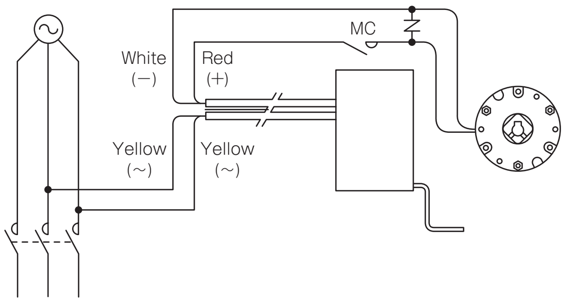
Lead wires

<<Primary side control method>>
The output for the (red/white) output lead wire is controlled by the input power to the (yellow) input lead wire being toggled ON/OFF.



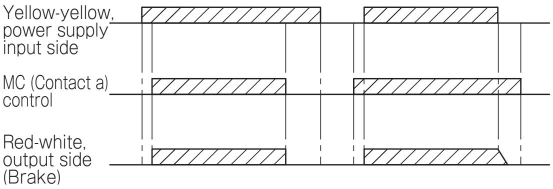
* There is no longer a counterelectromotive voltage from the electromagnetic coil when power goes on or off, but armature release time is longer, so confirm this prior to use.

Secondary Control



Lead wires

<<Secondary side control method>>
The brake output is controlled by the input power being input to the (yellow) input lead wire and the relay being toggled ON/OFF.



How to Place an Order

BEM-2H 120L

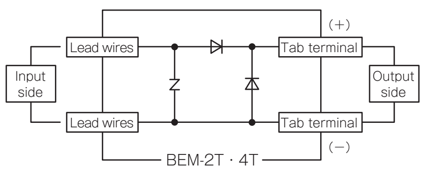
- Input voltage specifications: Rated input 2: 200 V AC; Rated input 4: 400 V AC
- Rectification method: H: Half-wave rectification; F: Full-wave rectification
- Lead wire length, three options available: 120: 120 mm; 240: 240 mm; 360: 360 mm

BEM -T Types Supplies with Ultra-compact Leads

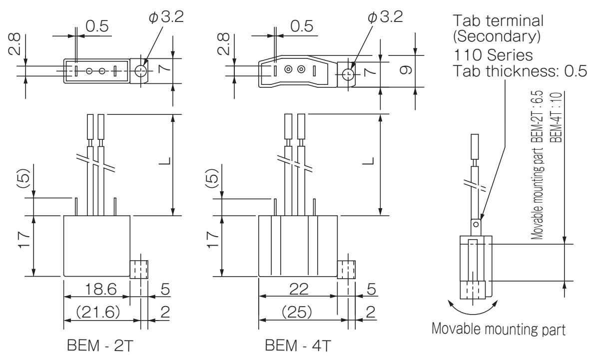
Specifications

Model			BEM-2T		BEM-4T		
Input voltage	AC100V	±10% 50/60Hz	●		●		
	AC200V			●		●	
	AC400V						●
	Maximum input voltage		AC280V		AC480V		
Rectification method			Half-wave rectification				
Output voltage			DC45V	DC90V	DC45V	DC90V	DC180V
Output current	When the ambient temperature is 20℃ Values in parentheses are for an ambient temperature of 60℃		DC1.0A (DC0.6A)		DC0.7A (DC0.5A)		
Output Wattage	When the ambient temperature is 20℃ Values in parentheses are for an ambient temperature of 60℃		45W (25W)	90W (50W)	30W (20W)	60W (40W)	125W (90W)
Size setting	Voltage specifications Figures in parentheses are input voltages		DC45V (AC100V)	DC90V (AC200V)	DC45V (AC100V)	DC90V (AC200V)	DC180V (AC400V)
	●: Applicable △: Applicable depending on clutch or brake model	01	●	●	●	●	●
		02	●	●	●	●	●
		03	●	●	●	●	●
		04	●	●	●	●	●
		05	●	●	●	●	●
		06	●	●	●	●	●
		08	●	●	●	●	●
		10	●	●	●	●	●
		12		●		●	●
		14		●		△	●
		16		●		△	●
		18		△		△	●
		20		△		△	△
		25		△		△	△
Applied clutches/brakes	MIKI PULLEY electromagnetic-actuated clutches and brakes Rated voltage DC 45/90/180 V		Spring-actuated brake				
Insulating resistance	Between terminal and body		DC 500 V, 100 MΩ with Megger				
Dielectric strength voltage			1500 V AC, 50 Hz, 1 min.		2000 V AC, 50 Hz, 1 min.		
Lead wire	UL style/Size		UL3398・AWG22		UL3613・AWG22		
Usage environment	With no condensation		-20～+60℃				
Mass	Per product		0.008kg		0.011kg		

Structure



Dimensions



Terminals and Functions

Terminal	Function name	Function description
Leads (two)	Input side	Connector for a commercial power supply
Tab terminals (two locations)	Output side	Connector for an electromagnetic clutch or brake

Recommended Products for the Tab Terminal Partner Side

- Receptacle 170043-1 (made by AMP)
- Insulation sleeve 170823-1 (made by AMP)
- Flat insertion terminal CSS 62853-F (made by Nichifu)

Design of Mounting Part

The standard mounting feet can not only be moved, they can be removed and a dedicated mount used. Design using the following figure as a guide or consult Miki Pulley.

Recommended mounting dimensions

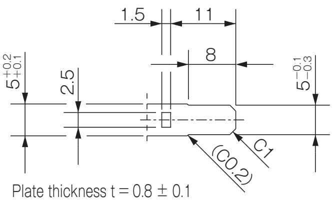


Plate thickness t = 0.8 ± 0.1

Characteristics

Output System

BEM-2T/4T types take a commercial power supply as the input and generate a half-wave rectified DC voltage on the output side. These power supply devices are known for their very simple construction, compact size, and low cost, but their voltage pulse is large. They are therefore prone to generating variations in operating response in electromagnetic clutches and brakes, they produce a howling noise when conducting, and they tend to generate more heat from their electromagnetic coils than full-wave rectified supplies or smoothing supplies.

When the above are to be avoided, consider changing to a full-wave rectified supply (BEM-2F types), smoothing supply, or a DC 24 V specification.

How to Calculate Output Voltage

Output voltage = Input voltage × a (a set coefficient)

*** a (set coefficient) = 0.45: half-wave rectification**

(Ex.)

BEM-2T: AC200V × 0.45 = DC90V

Note that when the rated voltage of the electromagnetic coil does not match the output voltage calculated above, you will not be able to obtain the electromagnetic clutch/brake characteristics given in the specifications.

Precautions for Use

Primary and Secondary Control Methods

These power supply devices use primary control, in which electromagnetic clutches and brakes are controlled by turning input voltage on and off, as their basic control.

This control system saves wiring, but has a longer armature release time than secondary control, extending the braking time of spring-actuated brakes.

This phenomenon becomes more marked the larger the electromagnetic clutch or brake is. Primary control is thus used predominantly on smaller spring-actuated brakes.

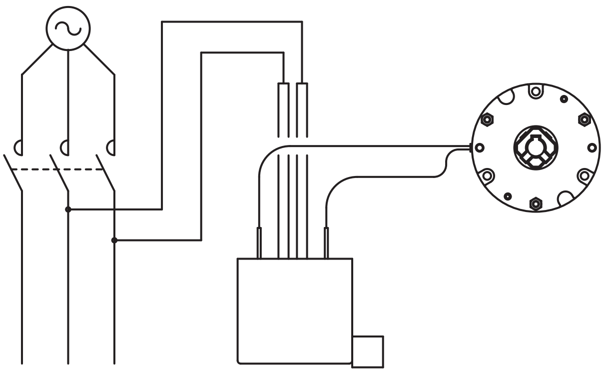
Also, primary control does not generate the surge voltage (counterelectromotive voltage) when the electromagnetic clutch or brake goes off that secondary control does, so it is very effective in machinery when noise must be avoided.

When secondary control is used to improve response, install relay contacts between the output terminals and electromagnetic clutches/brakes as shown in the wiring diagram at right.

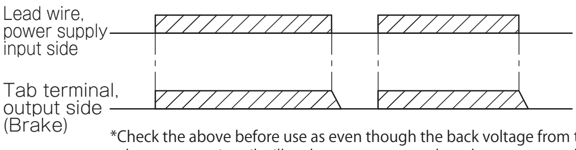
At this time, you must install discharge elements such as varistors between relay contacts or in parallel to the electromagnetic clutch/brake.

Wiring Methods and Timing Charts

Primary Control

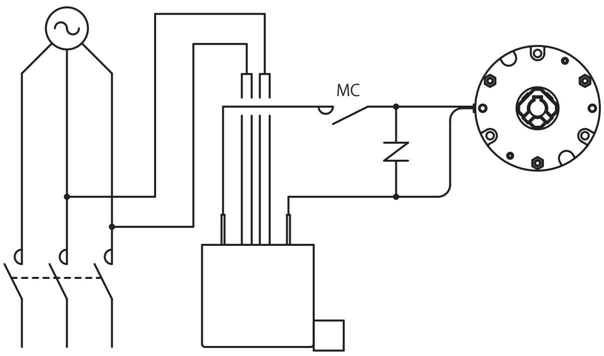


<<Primary side control method>>
The output for the tab terminal on the output side is controlled by the input power to the input lead wire being toggled ON/OFF.

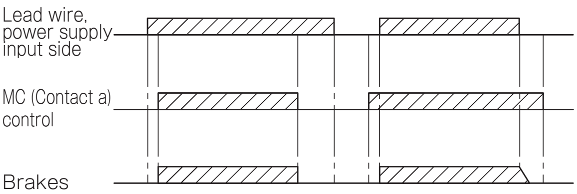


*Check the above before use as even though the back voltage from the electromagnetic coil will no longer generate when the power supply is toggled ON/OFF, the armature release time will increse.

Secondary Control



<<Secondary side control method>>
The brake output is controlled by the input power being input to the input lead wire and the relay being toggled ON/OFF.



How to Place an Order

BEM-2T 120L

Input voltage specifications
2T: 200 V AC
4T: 400 V AC

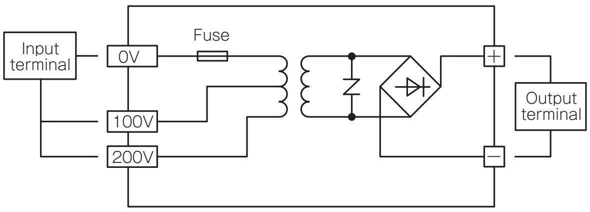
Lead wire length, three options available
120: 120 mm
240: 240 mm
360: 360 mm

Types of Power Supply Devices

Power supply devices are necessary for electromagnetic clutches and brakes to operate. MIKI PULLEY's electromagnetic clutches and brakes all use DC power supply coils, so commercial power supplies must be converted to DC voltages by any one of a variety of methods and that voltage then supplied to the clutch or brake.
There are many ways to create a DC power supply voltage. The operating characteristics of the electromagnetic clutch and brake are greatly affected by the type and specifications of that power supply device.

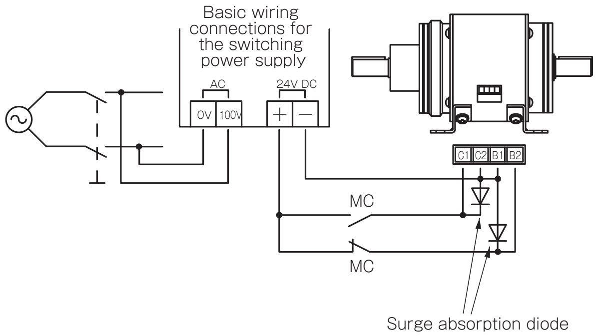
Transformer Stepdown/Single-phase Full-wave Rectified System

This is the most commonly used system for power supplies for electromagnetic clutches/brakes. This system is used with DC 24 V electromagnetic clutches/brakes, has a simple, sturdy construction, and has major resistance to surge voltages (counterelectromotive voltage) that are produced when electromagnetic clutches/brakes are turned on or off, making this a rectification system that is very easy to work with.



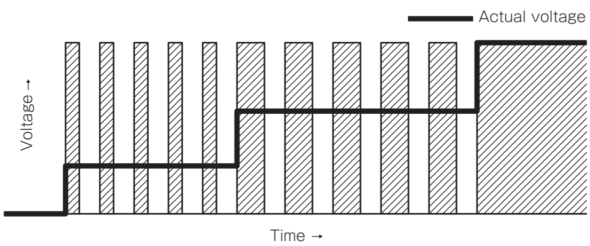
Switching Power Supplies (Off-the-shelf)

These are widely used as power supplies (usually DC 24 V) for relays, timers, programmable controllers, and a variety of other electrical equipment. They are light, compact power supply devices that generate smoothed, stable voltages.
However, these power supplies are characteristically vulnerable to surge voltages generated when electromagnetic coils like those found in electromagnetic clutches and brakes turn on and off. Manufacturers of switching power supplies do not guarantee them for use in such applications.
If you are using a switching power supply as the power supply device for an electromagnetic clutch or brake, you must connect a diode to serve as a surge absorber in parallel to the electromagnetic coil.
Surge absorbing diodes dramatically lengthen the armature release time, so care is advised in their use.



The PWM Control System

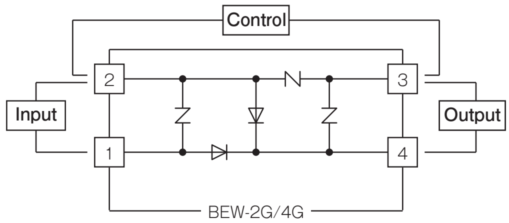
Repeatedly turning energization on and off is a system that creates a simulation of a given voltage as the effective value. Compared to the wasting of surplus electrical energy as heat in resistance control or the like, PWM control saves energy by turning energization on and off at high speed with control elements to get only the power needed, meaning that energy is not wasted as heat.



Half-wave Rectified Supplies (BEW and BEM Models)

Half-wave rectified power supply devices are circuits that contain two diodes, take commercial power supplies as direct input, and generate half-wave rectified DC voltage on the output side.
These power supply devices have very simple circuit structures compared to other power supply devices, and they are compact and low cost.
However, they produce variations of around 10 ms in electromagnetic clutch/brake operation due to the energizing system, which repeatedly starts and stops in a cycle of half of 50/60 Hz, the frequency of commercial power supplies. They are also prone to producing a howling noise when they are energized, and tend to generate more heat from their electromagnetic coils than full-wave rectified supplies or smoothing supplies.
This means they can be used when these trends will not have a major impact, in the event they occur. Miki Pulley recommends the use of half-wave rectified supplies in combination with spring-actuated brakes.
When variations in operation, howling noise when energized, and the like are to be avoided, consider changing to a full-wave rectified supply (BEW-1R/2R/4R types) or a DC 24 V specification.

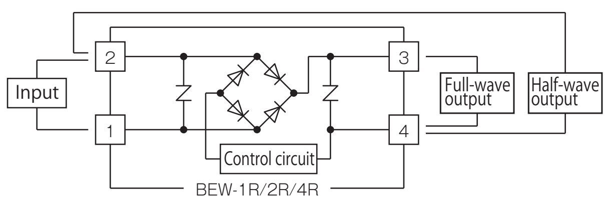
Calculating the Output Voltage from a Half-wave Rectified Power Supply
Output voltage = Input voltage × a (a set coefficient)
*** a (set coefficient) = 0.45: half-wave rectification**
(Ex.)
AC100V × 0.45 = DC45V
AC200V × 0.45 = DC90V
AC400V × 0.45 = DC180V



Full-wave Rectified Supplies (BEW and BEM Models)

Full-wave rectified power supply devices are circuits that contain four diodes, take commercial power supplies as direct input, and generate full-wave rectified DC voltages on the output side.
These power supplies are somewhat more expensive than half-wave rectified supplies, since they use more diodes to construct circuits, but they keep voltage pulses low, so they can suppress variation in electromagnetic clutch/brake operating times.
They can therefore be used as power supply devices for all electromagnetic clutches and brakes.

Calculating the Output Voltage from a Full-wave Rectified Power Supply
Output voltage = Input voltage × a (a set coefficient)
*** a (set coefficient) = 0.9: full-wave rectification**
(Ex.)
AC100V × 0.9 = DC90V
AC200V × 0.9 = DC180V



Overexcitation Supplies (BES, BEH, and BEW-FH Models)

Overexcitation power supplies are power supply devices that apply and control voltage above the rated voltage for a certain set period of time with the goal of speeding up the armature pull-in time of electromagnetic clutches and brakes, boosting the torque generated, and lengthening service life (electromagnetic-actuated clutches/ brakes).

By using these power supplies, the above described electromagnetic clutch and brake characteristics are notably improved.

Caution is advised, however, because if the conducting frequency and time of the electromagnetic clutch/brake are not set appropriately, the coil of the electromagnetic clutch/brake will generate abnormal heat, potentially leading to damage.

Reverse Excitation Function (BEH Models)

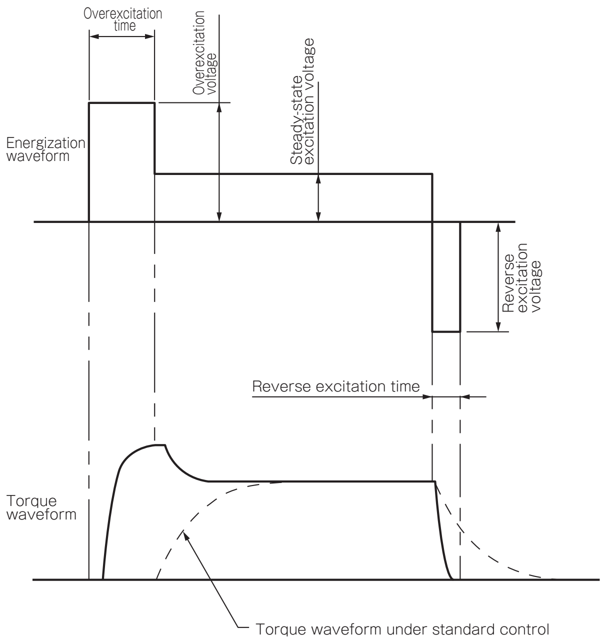
The reverse excitation function is a conductance system that, when energization to the electromagnetic clutch/brake is turned off, applies and controls, for a certain set period of time, a voltage of opposite polarity to the voltage just prior to energization going off, with the goal of shortening the armature release time of electromagnetic clutch/brake.

These power supply devices are more effective the larger the electromagnetic clutch or brake is. With our clutch/brake size 25, it achieves five times the responsiveness of an ordinary transformer stepdown/single-phase full-wave rectified system.

This is a big help in improving high-frequency operation and fighting phenomena.

* MIKI PULLEY overexcitation power supply devices are pre-set to optimal values.
They are pre-set to the optimal value for the given size of MIKI PULLEY electromagnetic clutch or brake, so no special adjustments are needed when installing. If you are not combining the power supply with a MIKI PULLEY electromagnetic clutch/brake, these are not optimal value conditions. Please consultMiki Pulley.

* BEH models are smoothing overexcitation power supply devices.
BEH models, which are smoothing power supplies, have very stable electromagnetic clutch/brake operating response characteristics compared to non-smoothed supplies.



Weak Excitation Supplies (BES and BEW-FH Models)

In recent years, the dimensions of electromagnetic coils and structural components have become more complex and capacities larger to meet demands for spring-actuated brakes that are more compact, slimmer, and provide higher torque.

Directly opposing societal demands for greater energy savings, greater recyclability, and avoidance of toxic materials have meanwhile created a challenging environment for electromagnetic clutches and brakes.

Spring-actuated brakes by their nature require a strong attraction force when the armature is being pulled in, but once they are pulled in, can be held in place with only a tiny amount of power.

Power beyond that required to maintain the spring-actuated brake in a released state can be considered wasted power; spring-actuated brakes waste very large amounts of such power.

Weak excitation power supplies remedy this problem of spring-actuated brakes and achieve the following sorts of effects.

Miki Pulley can design many types of both spring-actuated brakes and power supply devices to resolve such problems. Do not hesitate to consult us.

■ Compact, slim, high torque, high responsiveness, and long service life

A compact, slim, high-torque, and highly responsive spring-actuated brake with a long service life is achieved by designing the brake assuming that it will use a weak excitation power supply.

■ Energy saving

By creating a weak excitation state, they cut ordinary power by more than 90% while similarly reducing heat generated by electromagnetic coils by more than 90%.

■ Reducing the fault rate

They dramatically reduce burning of spring-actuated brakes caused by abnormal heat generation in electromagnetic coils or rises in ambient temperature, as well as burning in the periphery of spring-actuated brakes.

■ Increasing recyclability

They can be broken down into their constituent raw materials, increasing the recyclability of structural components.

Control of Electromagnetic Clutches and Brakes

Power supply devices are what is required to make electromagnetic clutches and brakes work, but control devices are necessary for freely controlling electromagnetic clutches and brakes consistent with machinery operation, so this portion must be installed separately.
Miki Pulley's BEH models, which are high-performance power supplies, get minute control input from programmable controllers or the like and perform high-Wattage energization control.
However, other power supply devices are constructed so that the power applied to the electromagnetic clutches and brakes is applied unaltered to control contacts or the like, meaning that power relays and other power control equipment is needed for control.
Each piece of control equipment has its own features, so those features must be adequately studied and control equipment selected that is matched to the machinery specifications.

Power Relays (Off-the-shelf)

There are relays that can control relatively large currents up to 10 A, which are generally called power relays.
These relays guarantee power control of high voltage and current values for AC power supplies, but in DC power supply control, they must be used within extremely low specification value ranges when the load is a DC inductive load.
This is because relay contacts are heavily worn by surge voltage (counterelectromotive voltage) generated during electromagnetic coil control. Since electromagnetic clutches and brakes have electromagnetic coils, check the catalog specification values at the conditions of the DC inductive load of the power relay you will use.
General guideline values are given below.

For LY series, made by Omron

Primary Control of Electromagnetic Clutches and Brakes

AC voltage: AC 110 V (no more than the maximum AC 250 V)
AC current: AC 4 A max.
Wattage: 100W max.

Secondary Control of Electromagnetic Clutches and Brakes

DC voltage: DC 24 V (no more than the maximum DC 125 V)
DC current: DC 1 A max.
Wattage: 25W max.

* Only 24VDC-specification clutches/brakes can be used with secondary control valves (DC switching). 45 to 180VDC clutches/brakes cannot be used.
* Secondary control values are for when a MIKI PULLEY varistor is used.
* The above values must be within the specification value ranges for all three items.
* For primary and secondary control, see the control wiring of the individual model of power supply.
* When diodes are used as discharge elements, the specification values of primary control are allowed even with secondary control.

Electromagnetic Contactors (Off-the-shelf)

Electromagnetic contactors and electromagnetic switches, which are widely used in control of induction motors and the like, are very effective as control equipment for controlling large electromagnetic clutches and brakes.
These electromagnetic contactors can control several times as much voltage and current as power relays, and are particularly effective in high-voltage control.
Electromagnetic contactors are suited to high-power control, but a discharge element such as a varistor must be added for surge voltages (counterelectromotive voltages) generated when controlling electromagnetic clutches and brakes.
Were one to control a large electromagnetic clutch or brake without using a discharge element, the surge voltage generated might exceed 2000 V. This voltage easily exceeds the rated voltage of the electromagnetic contactor, ultimately greatly wearing the contacts, which is likely to prevent the equipment from having its expected service life.
General guideline values are given below.

For SC series, made by Fuji Electric

Primary Control of Electromagnetic Clutches and Brakes

AC voltage: AC 220 V (no more than the maximum AC 440 V)
AC current: AC 3 A max.
Wattage: 450 W max.

Secondary Control of Electromagnetic Clutches and Brakes

DC voltage: DC 220 V max.
DC current: DC 2 A max.
Wattage: 150W max.

* Secondary control values are for when a MIKI PULLEY varistor is used.
* The above values must be within the specification value ranges for all three items.
* For primary and secondary control, see the control wiring of the individual model of power supply.
* When diodes are used as discharge elements, the specification values of primary control are allowed even with secondary control.

Solid State Relays/SSR (Off-the-shelf)

SSRs used in control of the various load devices are highly suited to control by programmable controller. In recent years, their use has continued to grow. Most SSRs are intended for control of AC supplies; 80% of SSRs on the market are for AC power supply control.
When using an AC control SSR for an electromagnetic clutch/brake, the input voltage (which is the primary side of the power supply device) is controlled.
The "zero cross control" used in SSR control slows response when used with primary control, so be careful when using it with electromagnetic clutches and brakes.

Maximum rated voltage is a very important specification with DC supply control SSRs.
When controlling an electromagnetic clutch or brake with a DC SSR, the surge voltage generated must be kept within the SSR rating. In other words, a discharge element such as a varistor or diode must be used.
If no discharge element is added, the SSR will be damaged in a short time. For details, contact the SSR manufacturer or Miki Pulley.

Contactless Control (Power MOS-FET/Power Transistor)

The major goals of contactless control of electromagnetic clutches and brakes are high-frequency operation and high-precision operation.
Such control is suited to cases in which delay of output vis-a-vis input signals, as happens with control using contacts, is undesirable. It offers major advantages such as the doing away with the need for wear-related maintenance and the ability to make devices smaller by making a control board.
Although contactless control has these many advantages, caution is advisable when selecting elements. Should a selection be made badly, not only will the electromagnetic clutch or brake not deliver the desired characteristics, the elements will be damaged in a short period of time, and peripherals could even be affected.
The following serves as a general guide for selecting elements.

Control of selection example 101-12-13 and an ordinary switching supply

Conditions

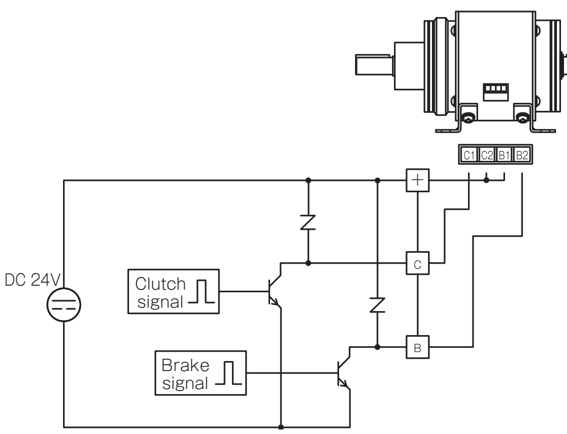
- **Clutch used: 101-12-13**
- **Rated voltage: DC 24 V**
- **Rated current: DC 1.09 A**
- **Varistor used: 82 V varistor (NVD07SCD082)**

Elements selected

- **Rated voltage: 200 V min.**
- **Rated current: 5 A min.**

■ Key selection issues

The rated voltage of the element must be at least the highest voltage applied to the element.
In the above example, the surge voltage generated when the electromagnetic clutch or brake is controlled by on/off is the highest value.
Varistors have variation in clamping voltages due to their operating characteristics, and a maximum clamping voltage is defined. Under these element conditions (82 V elements), that value is 135 V.
A safety factor for this voltage is required for the element. With a minimum safety factor of 1.3, 135 V × 1.3 = 175.5 V. Thus, the rated voltage of the element must be at least 200 V.
The rated current of the element must be at least three times the current value actually flowing. Also, the amount of heat generated by the element varies considerably with the type of element selected, energizing conditions, and ambient environment. In the end, evaluate the heat generation of the element under usage conditions, and check whether the amount of heat generated is within the specified value range of the element.



Other Control

■ Current control (electromagnetic-actuated clutches and brakes)

This control system is intended for torque control of electromagnetic clutches and brakes.
Electromagnetic clutches and brakes generate attraction force using the current flowing into the electromagnetic coil and transmit torque using that attraction force. The value of the current flowing into the electromagnetic coil must therefore be controlled in order to control torque.
Miki Pulley offers power supply devices for performing this current control. Feel free to consult Miki Pulley.

■ Voltage control

There are many different purposes to voltage control, and many different ways to implement that control. All of the following are voltage controls.

- Weak excitation control
  Simple torque control (using voltage regulation)
  Softens shocks upon engagement
  Speeds up armature release
  Suppresses heat generation in electromagnetic coils
- Overexcitation control
  Shortens armature pull-in time
  Boosts torque
- Rapid excitation control
  Shortens armature pull-in time
- Rapid overexcitation control
  Shortens armature pull-in time
  Boosts torque

To implement the control described above, the power supply voltage must be set to a prescribed state and some kind of control performed.

- Switching control, preparing several types of supply voltage
- Control of voltage using knob
- Switching control without using contacts
- Voltage control that inserts resistors in series to divide voltage

■ Rapid excitation control

This is a circuit that makes the time constant smaller to speed up the armature pull-in time of the electromagnetic clutch or brake.
The circuit places resistors in series with the electromagnetic clutch/brake and pre-sets the power supply voltage high. The supply voltage and the resistance values are set according to various conditions so that DC 24 V, which is the rated voltage, is applied to the electromagnetic coil.
This control method requires that a current similar to the current value flowing to the electromagnetic clutch/brake also flow to the resistors and that the resistance Wattage be set high. The heat generated by the resistors must also be considered.

* Time constant
The time constant exhibits the characteristic that the value of the current flowing inward gradually rises as DC voltage is applied, since the electromagnetic clutch or brake is an inductive load.
This characteristic has a value determined by the type and size of the electromagnetic clutch or brake, such that the larger the object, the slower the current movement becomes.

■ Rapid overexcitation control

The armature pull-in time can be made even shorter than with rapid excitation control by adding a large capacitor to the rapid excitation circuit.
An overexcitation voltage is generated by the capacitor, so the on/off times must be set factoring in the heat generated by the electromagnetic coil and the time to charge the capacitor.

Surge Voltages and Discharge Elements

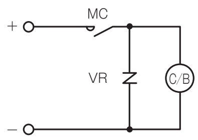
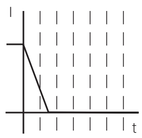
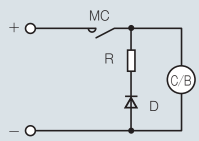
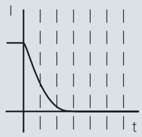
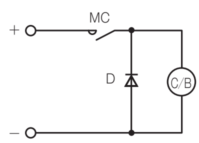
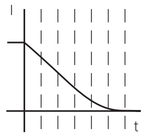
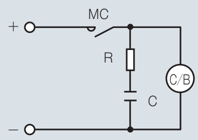
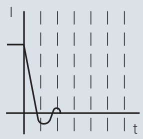
What is Surge Voltage?

When current flows to the electromagnetic coil of an electromagnetic clutch or brake, the coil is excited, the pull-in force required by the clutch or brake is generated, and work is performed.
Energy is accumulated within the coil, which has reached the prescribed current value; the larger the clutch or brake size, the larger is the amount of that energy. At this time, if current is shut off, a surge voltage of only part of the accumulated energy is generated. This is generated by working to keep current flowing, since the electromagnetic clutches and brakes are inductive loads. Surge voltages are larger with larger sizes, as noted above, and voltages easily exceeding 1000 V are generated in control contacts and within electromagnetic coils. This phenomenon can cause contact burning or electromagnetic coil insulation breakdown. It is thus very important to use discharge elements to limit this surge voltage to an appropriate value.
In general, a high surge-limit voltage means a short armature release time; conversely, a low limit voltage tends to mean a longer time. When selecting a circuit protector, it is very important to factor in machinery specifications, power supply device/control circuit conditions, and the like.

The Role of Varistors

We recommend using a varistor for the discharge element.
The reason is that it is easy to set the limit voltage needed for the varistor to appropriately control the electromagnetic clutch/brake; the element is also very small and can adequately handle different amounts of surge energy.
By selecting an appropriate varistor, the electromagnetic clutch/brake can be used without impairing innate characteristics.
When the selection has an inappropriately high limit voltage, control contact may be burned or the power supply device damaged.
Conversely, when the limit voltage is too low, the varistor may be burned by the power supply device or the power supply device may be damaged. Also, even when such phenomena do not occur, the armature release time is prone to becoming long.

Types of Discharge Elements

Element type	Circuit diagram	Current decay	Characteristics	Clutch/brake		Recommended product
				Size	Rated voltage (input voltage specification)	
Varistor			Very effective in keeping surge voltage small without adding delay to the armature release time.	Electromag-netic-actuated #02 to #25	DC24V	NVD07SCD082 or an equivalent (NVD14SCD082 or an equivalent)
				Electromag-netic-actuated #31 or over	DC24V	NVD14SCD082 or an equivalent
				Spring-actuated #01 to #18	DC24V	NVD07SCD082 or an equivalent
					DC 45 V (AC 100 V - half-wave rectified)	NVD07SCD220 or an equivalent
					DC 90 V (AC 100 V - full-wave rectified)	
					DC 90 V (AC 200 V - half-wave rectified)	NVD07SCD470 or an equivalent
					DC 180 V (AC 200 V - full-wave rectified)	
					DC 180 V (AC 400 V - half-wave rectified)	NVD14SCD820 or an equivalent
				Spring-actuated #20 or over	DC24V	NVD14SCD082 or an equivalent
					DC 45 V (AC 100 V - half-wave rectified)	NVD14SCD220 or an equivalent
					DC 90 V (AC 100 V - full-wave rectified)	
					DC 90 V (AC 200 V - half-wave rectified)	NVD14SCD470 or an equivalent
					DC 180 V (AC 200 V - full-wave rectified)	
					DC 180 V (AC 400 V - half-wave rectified)	NVD14SCD820 or an equivalent
Resistor + Diode			Can keep power consumption of the power supply part low and resistor Wattage low. The armature release time becomes somewhat longer, so care is required in high frequency use.	#01 to #25	DC24V DC 45 V (AC 100 V - half-wave) DC 90 V (AC 100 V - full-wave) DC 90 V (AC 200 V - half-wave) DC 180 V (AC 200 V - full-wave)	☐ Rated voltage of diode • DC 24 V: 100 V min. • AC 100 V: 400 V min. • AC 200 V: 800 V min. ☐ Rated current of diode • Specification of excitation current or more ☐ Resistance • About 10 times coil resistance
Diode			While the effect in suppressing surge voltage is very high, the armature release time becomes extremely long. Pay attention to high-frequency specifications and fighting between clutches and brakes.	#01 to #25	DC24V DC 45 V (AC 100 V - half-wave) DC 90 V (AC 100 V - full-wave) DC 90 V (AC 200 V - half-wave) DC 180 V (AC 200 V - full-wave)	☐ Rated voltage of diode • DC 24 V: 100 V min. • AC 100 V: 400 V min. • AC 200 V: 800 V min. ☐ Rated current of diode • Specification of excitation current or more
Resistor + Capacitor			Although armature release time becomes very short, a high-breakdown-voltage capacitor must be used and the device becomes large.	#01 to #25	DC24V DC 45 V (AC 100 V - half-wave) DC 90 V (AC 100 V - full-wave) DC 90 V (AC 200 V - half-wave) DC 180 V (AC 200 V - full-wave)	Capacitor C [μ F]: Ratio to contact current is: $\frac{C[\mu F]}{I[A]} = \frac{0.5 \sim 1}{1}$ Breakdown voltage: 600 [V] Resistance R [Ω]: Ratio to contact current is: $\frac{R[\Omega]}{E[V]} = 1$ Wattage = 1 [W]

* Some spring-actuated brakes come with varistors other than those recommended above, depending on size.
* Recommended varistors with NVD☐ model names are made by KOA. Items in parentheses are the products that can be used.

Symbols Used in Electrical Circuits

Figure Notations

With rapid advances in science and technology, many new codes and symbols have been adopted in drawings. The drawing symbols below have been created based on JIS handbooks and code and on drawing symbol handbooks primarily for machinery and elements that have long been widely used. The IEC standard or commonly used symbol is labeled Symbol 1; previously used symbols are labeled Symbol 2,

Name	Symbol		Name	Symbol	
	Symbol 1 (IEC or equivalent)	Symbol 2 (old symbol)		Symbol 1 (IEC or equivalent)	Symbol 2 (old symbol)
DC power supply			Motor		
AC power supply			Induction motor		
Fuse			Generator		
Relay a-contact			Electromagnetic clutch		
Relay b-contact			Electromagnetic brake		
Pushbutton switch a-contact			Clutch or Brake		
Pushbutton switch b-contact			Transformer		
Limit switch a-contact			Resistor		
Limit switch b-contact			Variable resistor		
Timer (ON delay) a-contact			Capacitor		
Timer (ON delay) b-contact			Varistor		
Knife switch			Diode		
Magnetic contactor			Rectifier (bridge type)		
Lamp			Transistor (NPN type)		
Buzzer			Transistor (PNP type)		
Ground			Photocoupler		
Connect to outer case			Coil		

* This catalog uses the symbols that are currently the most common in its figures.