Standard AC Motors

Brake Pack
The **SB50W** provides instantaneous stop, bi-directional operation and electromagnetic brake control functions integrated into one unit. This brake pack can sense when the thermal protector is opened, further ensuring the safety of your equipment. For greater convenience, a function has been added to reset alarms using an external signal.

### Features

**Four Functions in One Integrated Unit**
The **SB50W** provides instantaneous stop, bi-directional operation, electromagnetic brake control and thermal protector open detection functions.

**Thermal protector open detection function** (Available only when combined with a motor having a built-in thermal protector)
When the motor's thermal protector (overheat protection device) is activated, the **SB50W** outputs an alarm signal and automatically cuts the power supply to the motor. The motor will not restart by itself, even after the temperature drops and the thermal protector closes. The alarm can be reset with external signals.

**Wide Voltage Range of 100 to 230 VAC**
The **SB50W** covers a single-phase voltage range of 100 to 230 VAC ±10%, accommodating major voltages used throughout the world. Use this product according to the power supply voltage of applicable motors.

**Conforms to Safety Standards**
The **SB50W** is recognized by UL and CSA, and the CE Marking is used in accordance with the EMC Directive and Low Voltage Directive.

**Supports Motors with 1 W to 90 W (1/750 HP to 1/8 HP)**

**Output**
The **SB50W** can be used with induction motors, reversible motors, electromagnetic brake motors and watertight, dust-resistant motors with an output power of 1 W to 90 W (1/750 HP to 1/8 HP).

**Switchable Sink/Source Logic**
Select sink logic or source logic for the input/output circuit. You can change the setting at any time.

**Instantaneous Stop**
The electronic brake stops the motor instantaneously. A large braking force causes the motor to stop in approximately 0.1 second, allowing for an overrun of 1 to 1.5 rotations. The braking current flows through the motor for approximately 0.4 seconds, after which the power supply to the motor is cut off automatically (The motor will have no holding torque).

**Long Life, Simple Wiring and Maintenance-Free**
The electronic brake operates on current flow, so it lasts longer than the mechanically operated electromagnetic brake that is subject to wear. This makes the **SB50W** ideal for indexing applications. The electronic-input type brake pack doesn’t use a power relay, so no maintenance is required. Wiring is easy as well.

**Link Electronic Brake and Electromagnetic Brake**
By combining the **SB50W** with a motor equipped with an electromagnetic brake, you can link the electronic brake with the electromagnetic brake to allow the load to be held automatically following an instantaneous stop. This configuration is ideal for vertical applications in which the load must be held following the instantaneous stop of the motor.
■ Characteristics of the Brake Pack

○ How to Read Braking Characteristics (Reference values)
The brake pack provides stable braking characteristics for the instantaneous stop of the motor. The braking characteristics are illustrated by the braking curve, which indicates the amount of overrun corresponding to the load inertia.

The braking time is $4n/f$ seconds or less.

Where, $n$: overrun, $f$: power supply frequency.

For example, if the 4IK25GN-AW2U [single-phase 115 VAC, 25 W (1/30 HP)] and SB50W are used together to stop a load with an inertia of $J = 0.25 \times 10^{-4}$ kg·m² (1.37 oz-in²), the overrun and braking time required will be approximately 1.4 rotations and 0.1 seconds, respectively, at a power supply frequency of 60 Hz.

In the case of deceleration using a gearhead, refer to the braking characteristics curve after converting the load inertia at the gearhead shaft to its corresponding value at the motor shaft.

Use the following formula to convert the load inertia at the gearhead shaft to its corresponding value at the motor shaft:

$$J_M = \frac{J_G i^2}{kg·m^2}$$

$J_M$: Load inertia converted to corresponding value at the motor shaft
$J_G$: Load inertia at the gearhead shaft
$i$: Gear ratio of gearhead

○ Stopping Accuracy
The figure to the right shows the stopping position error (variation in stopping position) when braking force is applied to the motor using the brake pack. The diagram shows an overrun distribution when braking is repeated 500 times under the same conditions. Varying stopping positions are caused by the power-supply phase when the switch is operated to apply the brake, which could generate a maximum delay of one cycle (power supply frequency) and variation in initial braking force. The sagging at the center reflects the slot-position relationship between the stator and rotor. Refer to the braking characteristics curve representing the average overrun.

■ Other Motor Braking Options
In addition to the brake pack, various other brake options are available to suit a variety of applications.

○ How to Select a Brake Motor

△ Selecting Based on Stopping Accuracy

<table>
<thead>
<tr>
<th>Overrun</th>
<th>Brake Pack</th>
<th>C-179</th>
<th>C-107</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Rotation</td>
<td>C-B Motors</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2–3 Rotations</td>
<td>Electromagnetic Brake Motors</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The values for overrun apply to the motor only.

△ For low-speed synchronous motors, the motor can be stopped instantly within ±10° of stopping accuracy by turning off the power supply. Refer to page C-191 for details.

△ Selecting Based on Frequency of Use

<table>
<thead>
<tr>
<th>Holding Brake Force</th>
<th>Operating Cycles</th>
<th>C-179</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not necessary</td>
<td>60 cycles/minute or less</td>
<td></td>
</tr>
<tr>
<td>Necessary</td>
<td>100 cycles/minute or less</td>
<td></td>
</tr>
<tr>
<td>Electromagnetic Brake Motors</td>
<td>50 cycles/minute or less</td>
<td></td>
</tr>
</tbody>
</table>

Notes:
△ The operating cycles are based merely on brake response. The value specified above is the maximum, so it may not be possible to repeat braking operation at this frequency.
△ In an actual application, be certain the surface temperature of the motor case remains at 90°C (194°F) or less.
△ For low-speed synchronous motors, if operated within the permissible load inertia, the motor can start, stop and reverse within 1.5 cycles of power supply frequency. Refer to page C-191 for details.
Brake Pack

System Configuration

- **Gearheads and Linear Heads (Sold separately)**
  - **Parallel Shaft Gearheads** (Page C-21)
  - **Right-Angle Gearheads** (Page C-227)
  - **Linear Heads** (Page C-247)

  ![Gearheads and Linear Heads](image)

- **World K Series Electromagnetic Brake Motors (Sold separately)**
  - Electromagnetic Brake Motor (Pinion shaft)
  - Long Life, Low Noise Gearhead

- **Brake Pack SB50W**
  - Programmable Controller
  - AC Power Supply (Main power supply)
  - 24 VDC Power Supply

- **Accessories (Sold separately)**
  - Mounting Brackets (Page C-264)
  - Flexible Couplings (Page C-269)

- **Example of System Configuration**

<table>
<thead>
<tr>
<th>Brake PACK</th>
<th>Electromagnetic Brake Motor (Pinion shaft)</th>
<th>Long Life, Low Noise Gearhead</th>
<th>Sold Separately</th>
</tr>
</thead>
<tbody>
<tr>
<td>SB50W</td>
<td>4RK25GN-AW2MU</td>
<td>4GN25SA</td>
<td></td>
</tr>
</tbody>
</table>

- **Sold Separately**
  - **Mounting Bracket**
  - **Flexible Coupling**

  - SOL4U10
  - MCL30F06F06

*The system configuration shown above is an example. Other combinations are available.*

*Not supplied*
### Specifications (RoHS)

<table>
<thead>
<tr>
<th>Model</th>
<th>Power Supply Voltage</th>
<th>Frequency</th>
<th>Applicable Motor Output Power</th>
<th>Functions</th>
<th>Power Source for Control</th>
<th>Input Signals</th>
<th>Output Signals</th>
<th>Braking Current Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>SB50W</td>
<td>Single-Phase 100-230 VAC ±10%</td>
<td>50/60 Hz</td>
<td>1 W–90 W (1/750 HP–1/8 HP)</td>
<td>Instantaneous stop, Bi-directional operation, Electromagnetic brake control (only for electromagnetic brake motors), Thermal protector open detection (Alarm output), Sink/Source logic switch</td>
<td>24 VDC ±10%</td>
<td>CW, CCW, FREE/ALARM-RESET</td>
<td>Input specifications Photocoupler input, Input resistance 4.7 kΩ, 24 VDC ±10%</td>
<td>Approximately 0.2–0.4 seconds</td>
</tr>
</tbody>
</table>

### General Specifications

- **Insulation Resistance**: 100 MΩ or more when 500 VDC megger is applied between the power supply input terminal and the signal input terminal after rated operation under normal ambient temperature and humidity.
- **Dielectric Strength**: Sufficient to withstand 3.0 kVAC at 50 Hz or 60 Hz applied between the power supply input terminal and the signal input terminal for 1 minute after rated operation under normal ambient temperature and humidity.
- **Ambient Temperature**: 0–+40°C (32–+104°F) (non-freezing)
- **Ambient Humidity**: 85% or less (non-condensing)
- **Degree of Protection**: IP10

### World K Series

- **1 W–90 W (1/750 HP–1/8 HP)**
  - Induction Motors
  - Reversible Motors
  - Electromagnetic Brake Motors

### V Series

- **6 W–90 W (1/125 HP–1/8 HP)**
  - Induction Motors
  - Reversible Motors
  - Electromagnetic Brake Motors

### FPW Series

- **25 W–90 W (1/30 HP–1/8 HP)**
  - Induction Motors

- **Note**: Except for 2-pole type
  - Three-phase motors cannot be used in combination.

### Braking Current

When a motor is stopped instantaneously, a large half-wave rectified current flows through the motor for approximately 0.2 to 0.4 seconds. When connecting a circuit breaker, fuse or transformer, refer to the table below for the braking current (peak value) and select its current capacity.

<table>
<thead>
<tr>
<th>Motor Output Power</th>
<th>110/115 VAC</th>
<th>220/230 VAC</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 W (1/750 HP)</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>6 W (1/125 HP)</td>
<td>1.5</td>
<td>1.0</td>
</tr>
<tr>
<td>15 W (1/50 HP)</td>
<td>4.5</td>
<td>2.5</td>
</tr>
<tr>
<td>25 W (1/30 HP)</td>
<td>7.5</td>
<td>4.0</td>
</tr>
<tr>
<td>40 W (1/19 HP)</td>
<td>12</td>
<td>7.0</td>
</tr>
<tr>
<td>60 W (1/12 HP)</td>
<td>18</td>
<td>8.5</td>
</tr>
<tr>
<td>90 W (1/8 HP)</td>
<td>26</td>
<td>17</td>
</tr>
</tbody>
</table>

### Dimensions

- **SB50W**: Mass: 0.1 kg (0.22 lb.)
  - Unit = mm (in.)

- **Flush Mounting Socket (Included)**
  - 2×4.5 (1/8") Mounting Holes
  - 50 max. (1.97"")
  - 31.2 (1.23"") max.

- **Flush Mounting Socket Panel Cut-Out**
  - 40×0.2 (1.575×0.008) Mounting Holes
Braking Characteristics (Reference values)

- World K Series, V Series
- Induction Motors

1 W (1/750 HP)

6 W (1/125 HP)

15 W (1/50 HP)

25 W (1/30 HP)

40 W (1/19 HP)

60 W (1/12 HP)

Reversible Motors

1 W (1/750 HP)

6 W (1/125 HP)

15 W (1/50 HP)

25 W (1/30 HP)

40 W (1/19 HP)

60 W (1/12 HP)
Brake Pack

Connection and Operation

Names and Functions of Brake Pack Parts

- **Power Indicator** (Green): Lights when 24 VDC is supplied.
- **Alarm Indicator** (Red): Lights when the Alarm is activated. (The Alarm output is "OFF").
- **Motor Output Select Switch**: 60 - 90 W (1/12 - 1/8 HP) Set to the motor output.
- **Sink/Source Select Switch**: Sink Used to switch between Sink/Source for the control signal input/output.

Connection Diagrams

The wiring diagram is for when the Sink/Source select switch is set to "Sink".

World K Series, V Series

- **Induction Motors/Reversible Motors**

Electromagnetic Brake Motors

- **Electromagnetic Brake Motor**
  - **Terminal Arrangement for Flush Mounting Socket**

FPW Series

Terminal Arrangement for Flush Mounting Socket

- **Motor/Generator**: Connect the motor and generator.
- **AC Power Supply Input (L)**: Single-phase 100-115 VAC or Single-phase 200-230 VAC
- **NC**: Not used. Leave this terminal unconnected.
- **Brake Release Input** (Not an instantaneous stop but coast to a stop).
- **ALARM-RESET Input**: Reset ALARM Output.
- **CCW Operation Input**: Motor rotates in the CCW direction during “ON”.
- **DC Power Supply Input**: +24 VDC input
- **GND**: GND
- **CW Operation Input**: Motor rotates in the CW direction during “ON”.
- **ALARM Output**: Turns OFF when the motor’s thermal protector is open.
- **Electromagnetic Brake**: Connect to the electromagnetic brake.
- **Motor/Generator**: Connect to the motor and generator.

Notes

- The input signal voltage is 24 VDC ±10%, 0.1 A min.
- Minimize the length of the motor cable and the input/output signal cable.
- Use a cable of AWG18 or more in diameter for the motor cable and power supply cable.
- Be sure to connect the GND terminal to GND (negative side) of the external control device or the motor will not operate.

Connection Diagrams

- **Single-phase 110/115 VAC, single-phase 220/230 VAC**

![Connection Diagrams](image)
**Input/Output Signal Circuit**
The factory setting is sink logic for both input and output circuits. Select sink logic or source logic according to the external control device you will be using.

- **Sink Logic**
  - **Input Circuit**
    - [Diagram](#)
    - 24 VDC
    - Brake Pack
    - Input
    - 4.7 kΩ
    - 5
    - 4
    - 6
    - 9
    - DC Power Input
    - CW Operation Input
    - CCW Operation Input
    - Brake Release Input
    - 8
    - 5
    - 4

- **Source Logic**
  - **Input Circuit**
    - [Diagram](#)
    - 24 VDC
    - Brake Pack
    - Input
    - 4.7 kΩ
    - 5
    - 4
    - 6
    - 9
    - GND
    - 0 V
    - DC Power Input
    - CW Operation Input
    - CCW Operation Input
    - Brake Release Input

- **Output Circuit**
  - [Diagram](#)
    - 24 VDC
    - Brake Pack
    - ALARM Output
    - 3
    - 7
    - 9
    - 6
    - 4.7 kΩ
    - 560 Ω
    - CW Operation Input
    - CCW Operation Input
    - Brake Release Input
    - 8
    - 5
    - 4
    - 24 VDC
    - Brake Pack
    - 4.7 kΩ
    - 0 V
    - 9
    - ALARM Output

**Timing Chart**

- AC Power Supply
- DC Power Supply
- CW Operation Input
- CCW Operation Input
- Brake Release Input

<table>
<thead>
<tr>
<th>Action</th>
<th>Motor</th>
<th>Clockwise Rotation</th>
<th>Swing</th>
<th>CCW Holding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brake Release</td>
<td>Electronic Brake Release</td>
<td>Off</td>
<td>CW Operation Signal</td>
<td>CCW Operation Signal</td>
</tr>
<tr>
<td></td>
<td>Electromagnetic Brake</td>
<td>On</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. Turn on CW operation input, CCW operation input and brake release input after turning on AC power.
2. The brake release input becomes ALARM-RESET input when the ALARM output is OFF.
3. Only for electromagnetic brake motors.
4. The induction motor will not accommodate instantaneous bi-directional switching.

- **CW Operation Input**
  - Turning the CW operation signal to “ON” causes the motor’s output shaft to turn in the CW direction. Turning it to “OFF” triggers an instantaneous stop.

- **CCW Operation Input**
  - Turning the CCW operation signal to “ON” causes the motor’s output shaft to turn in the CCW direction. Turning it to “OFF” triggers an instantaneous stop.

- **Brake Release Input [ALARM-RESET Input]**
  - Functions as a brake release input during normal operation and as an ALARM-RESET input when the ALARM is activated.

- **When Normal Operation: Brake Release Input**
  - Turning the brake release signal to “ON” disables both the electronic brake and electromagnetic brake. When the CW and CCW operation signals are turned “OFF,” the motor operates by inertial force before coasting to a stop. When the motor is stationary, the electromagnetic brake is not activated, so the motor’s output shaft can be moved freely.
  - Turning the brake release signal to “OFF” (or leaving the signal unconnected) and turning both CW and CCW operation signals to “OFF” will activate the electronic brake and electromagnetic brake, bringing the motor to an instantaneous stop. Once the motor stops, the electronic brake will be cut off automatically. However, the electromagnetic brake will continue to operate and hold the load.
Brake Pack

- When an Alarm is Activated (When the ALARM output turns "OFF"): ALARM-RESET Input

When an alarm is activated, the ALARM output will turn "OFF." In this case, turn all input signals "OFF," and then input the ALARM-RESET signal for at least 0.5 seconds.

Wait at least 0.5 seconds after turning the ALARM-RESET input OFF before restarting operation.

<table>
<thead>
<tr>
<th>Brake Release Input</th>
<th>ALARM-RESET Input</th>
<th>Brake Release Input</th>
</tr>
</thead>
<tbody>
<tr>
<td>ON or OFF</td>
<td>ON</td>
<td>ON or OFF</td>
</tr>
</tbody>
</table>

0.5 s min.

ALARM Activation

ALARM Output (Thermal Protector Open Detection)

Since the SB50W ALARM output function detects the action of the thermal protector, the current flowing in the motor is monitored. ALARM output is activated under the following conditions:

- When the motor’s built-in thermal protector is activated (OPEN)
- When there is improper connection/disconnection of the power supply cable and motor cable
- When an input signal is turned "ON" before the AC power supply is turned on
- When the AC power supply is turned off while the motor is in operation or while it is stopped

In the above conditions, the SB50W ALARM function is activated and ALARM output is "OFF." Also, the ALARM indicator lamp (red) on the panel lights up, and power to the motor is cut off.

With electromagnetic brake motors, the brake is activated in order to hold the load in position.

<table>
<thead>
<tr>
<th>External Control Device</th>
<th>Brake Pack</th>
</tr>
</thead>
<tbody>
<tr>
<td>Limiting Resistor 2.7 kΩ or more</td>
<td>24 VDC</td>
</tr>
<tr>
<td>Photocoupler 7 or 9</td>
<td>GND</td>
</tr>
<tr>
<td>ALARM Output</td>
<td></td>
</tr>
</tbody>
</table>

Note

- When the DC power supply is turned on, the alarm indicator lamp (red) lights up briefly, but this is normal.

Operating/Braking Repetition Cycle

Repeated operating and braking of a motor will cause a temperature rise in the motor and brake pack, thereby limiting the continuous operating time.

Observe the repetition cycle given in the table below for the operation and braking of the motor. The motor may generate heat depending on the conditions in which it is driven. Ensure that the temperature of the motor case does not exceed 90˚C (194˚F).

<table>
<thead>
<tr>
<th>Motor Output Power</th>
<th>Repetition Cycle</th>
</tr>
</thead>
<tbody>
<tr>
<td>1–25 W (1/750–1/30 HP)</td>
<td>2 seconds min.</td>
</tr>
<tr>
<td>40–90 W (1/19–1/8 HP)</td>
<td>4 seconds min.</td>
</tr>
</tbody>
</table>

(A repetition cycle of two seconds represents operation for one second and stopping for one second.)