### Connection and Operation

#### Names and Functions of Driver Parts

- **15 W (1/50 HP), 30 W (1/25 HP), 50 W (1/15 HP)**
- **100 W (1/8 HP)**

#### Speed Potentiometers

<table>
<thead>
<tr>
<th>Indication</th>
<th>Potentiometer Name</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>VR1</td>
<td>Internal Speed Potentiometer</td>
<td>Set and adjust the operating speed of the motor.</td>
</tr>
<tr>
<td>VR2</td>
<td>Acceleration/Deceleration Time Potentiometer</td>
<td>Set a common acceleration/deceleration time in the range of 0.5 to 10 seconds.</td>
</tr>
</tbody>
</table>

#### Connection Diagrams

- **15 W (1/50 HP), 30 W (1/25 HP), 50 W (1/15 HP)**
- **100 W (1/8 HP)**

#### Input/Output Signals

<table>
<thead>
<tr>
<th>Indication</th>
<th>Input/Output</th>
<th>Pin No.</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Output</td>
<td>1</td>
<td>ALARM Output</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
<td>SPEED Output</td>
</tr>
<tr>
<td></td>
<td>i/O Signal Common</td>
<td>3</td>
<td>GND</td>
</tr>
<tr>
<td></td>
<td>Analog Input</td>
<td>4</td>
<td>VRL Input</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5</td>
<td>VRM Input</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6</td>
<td>VRH Input</td>
</tr>
<tr>
<td></td>
<td></td>
<td>7</td>
<td>ALARM-RESET Input</td>
</tr>
<tr>
<td></td>
<td></td>
<td>8</td>
<td>INT.VR/EXT Input</td>
</tr>
<tr>
<td></td>
<td></td>
<td>9</td>
<td>CW/CCW Input</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10</td>
<td>RUN/BRAKE Input</td>
</tr>
<tr>
<td></td>
<td></td>
<td>11</td>
<td>START/STOP Input</td>
</tr>
<tr>
<td></td>
<td></td>
<td>12</td>
<td>NC</td>
</tr>
</tbody>
</table>

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*The connection position is different from the position for the 15 W (1/50 HP), 30 W (1/25 HP) and 50 W (1/15 HP) models.*
Brushless Motors/AC Speed Control Motors

- **Introduction**

  Brushless Motors

  AC Speed Control Motors

- **Accessories Installation**

  - AC Input
  - DC Input

  BHFFE100/
  FE200
  ES01/ES02
  US
  BX/BL-F/BL-E/BL-U
  BL-H/BL-V

- **Timing Chart**

  - 2-Speed Switching/Deceleration Stop
  - Run/Instantaneous Stop
  - Rotation Direction Switching

  **Motor Operation Pattern**

  - CW (Clockwise)
  - CCW (Counterclockwise)

  - **ON**
  - **OFF**

  - **SPEED Output**

  - **ST**
  - **STOP**
  - **RUN/BRAKE**
  - **INT.VR/EXT**

  - **Switch Connection**

  - **Input/Output Signal Circuits**

  - **Input Circuit**

    - The driver’s signal inputs use the C-MOS input method.
    - The signal status indicates a voltage level of 0 to 0.5 VDC when the signal is ON, or 4 to 5 VDC when it is OFF.

  - **5 VDC C-MOS Output from External Control Device**

    - Internal Circuit

    - Switch

    - Internal Circuit

    - Insert a resistor to keep the current to 10 mA or less.

- **All operations of run/stop, instantaneous stop and rotation direction switching operations can be controlled with the START/STOP, RUN/BRAKE and CW/CCW signals.**

- **If both the START/STOP signal and the RUN/BRAKE signal are set to ON, the motor rotates. The motor will accelerate over the time set by the acceleration/deceleration time potentiometer. During this time, if the CW/CCW signal is set to OFF, the motor rotates clockwise as viewed from the shaft end of the motor; if the CW/CCW signal is set to ON, the motor rotates in the counterclockwise direction.**

- **If the RUN/BRAKE signal is set to OFF while the START/STOP signal is ON, the motor stops instantly. If the START/STOP signal is set to OFF while the RUN/BRAKE signal is ON, the motor will stop with deceleration time set by the acceleration/deceleration time potentiometer.**

- **The duration of each input signal must be 10 ms or longer.**

- **Do not operate (turn ON/OFF) two or more input signals simultaneously. There must be a minimum interval of 10 ms before another input signal can be operated after an input signal has been operated.**

- **Use a switch capable of opening/closing the current flow at 5 VDC, 1 mA maximum.**

- **Open-Collector Output from External Control Device**

  - Internal Circuit

  - Insert a resistor to keep the current to 10 mA or less.
**Brushless Motors/BLH Series**

**SPEED Output**
The system outputs pulse signals (with a width of 0.3 ms) at a rate of 30 pulses per rotation of the motor output shaft synchronized with the motor operation. You can measure the SPEED output frequency and calculate the motor speed.

\[
\text{Motor speed (r/min)} = \frac{\text{SPEED output frequency (Hz)}}{30} \times 60
\]

**ALARM Output**
The ALARM output is normally ON and goes OFF when there is an alarm.

**ALARM-RESET**
When the motor is stopped, setting this signal ON, then returning it to OFF resets the alarm. Please return either the START/STOP input or the RUN/BRAKE input to OFF before inputting the ALARM-RESET. The ALARM-RESET is not accepted if both these signals are ON.

**Notes**
- Output signal is open-collector output, so an external power supply (Vcc) is required.
- Use a power supply of no more than 26.4 VDC and connect a limit resistor (R) so that the output current does not exceed 10 mA. When using neither the speed output function nor the alarm output function, this connection is not required.

**Speed Setting Method**

**Internal Speed Potentiometer**
When INT.VR/EXT input is set to ON, the speed can be set with the internal speed potentiometer. There is no need for this connection when the internal speed potentiometer is not used.

**External Speed Potentiometer (Sold separately)**
When separating the motor speed setting from the driver, connect the accessory external speed potentiometer as follows.

![External Speed Potentiometer](image)

**External DC Voltage**
When setting the motor speed with an external DC voltage, do so in the following manner.

![External DC voltage](image)

**Note**
- The speed in the graph represents the speed of a motor alone. The gearhead output shaft speed of the combination type or geared type is calculated by dividing the graph speed by the gear ratio.
**Multi-Motor Control**  
Two or more sets of motors and drivers can be operated at the same speed by using a DC power supply or an external speed potentiometer.

**When External DC Power Supply is Used**  
- Use a DC power supply with current capacity equal to or greater than the value obtained by the following expression.

\[ I = 1 \times N \text{ (mA)} \]

Example: When two drivers are used, current capacity should be at least 2 mA.

- Connect the other input/output lines to each driver individually.
- Motor speed differences can be adjusted by connecting a resistor of 1.5 kΩ, 1/4 W to the M terminal of the first driver, and a 5 kΩ, 1/4 W variable resistor (VRn) to the M terminals of the other drivers.

**When External Speed Potentiometer is Used**  
As shown below, make the power supply line and the speed control line common to set the speed at VRx.

\[ VRx = \frac{20}{N} \text{ (kΩ)}, \frac{N}{4} \text{ (W)} \]

Example: When two drivers are used, the resistance is 10 kΩ, 1/2 W.

- Connect the other input/output lines to each driver individually.
- Motor speed differences can be adjusted by connecting a resistor of 1.5 kΩ, 1/4 W to the M terminal of the first driver, and a 5 kΩ, 1/4 W variable resistor (VRn) to the M terminals of the other drivers.
- No more than five motors should be operated simultaneously when using the external speed potentiometer.

### List of Motor and Driver Combinations

#### Geared Type
The geared type has an integrated motor and gearhead. The combination of motor and gearhead cannot be changed.

<table>
<thead>
<tr>
<th>Output Power</th>
<th>Model</th>
<th>Geared Motor Model</th>
<th>Driver Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>15 W (1/50 HP)</td>
<td>BLH015K- □</td>
<td>BLHM015K- □</td>
<td>BLHD15K</td>
</tr>
</tbody>
</table>

#### Combination Type – Parallel Shaft Gearhead
The combination type comes with the motor and parallel shaft gearhead pre-assembled.

<table>
<thead>
<tr>
<th>Output Power</th>
<th>Model</th>
<th>Motor Model</th>
<th>Gearhead Model</th>
<th>Driver Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>30 W (1/25 HP)</td>
<td>BLH230KC- □</td>
<td>BLHM230KC-GFS</td>
<td>GFS2G- □</td>
<td>BLHD30K</td>
</tr>
<tr>
<td>50 W (1/15 HP)</td>
<td>BLH450KC- □</td>
<td>BLHM450KC-GFS</td>
<td>GFS4G- □</td>
<td>BLHD50K</td>
</tr>
<tr>
<td>100 W (1/8 HP)</td>
<td>BLH5100KC- □</td>
<td>BLHM5100KC-GFS</td>
<td>GFS5G- □</td>
<td>BLHD100K</td>
</tr>
</tbody>
</table>

#### Combination Type – Hollow Shaft Flat Gearhead
The combination type comes with the motor and hollow shaft flat gearhead pre-assembled.

<table>
<thead>
<tr>
<th>Output Power</th>
<th>Model</th>
<th>Motor Model</th>
<th>Gearhead Model</th>
<th>Driver Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>30 W (1/25 HP)</td>
<td>BLH230KC- □ FR</td>
<td>BLHM230KC-GFS</td>
<td>GFS2G- □ FR</td>
<td>BLHD30K</td>
</tr>
<tr>
<td>50 W (1/15 HP)</td>
<td>BLH450KC- □ FR</td>
<td>BLHM450KC-GFS</td>
<td>GFS4G- □ FR</td>
<td>BLHD50K</td>
</tr>
<tr>
<td>100 W (1/8 HP)</td>
<td>BLH5100KC- □ FR</td>
<td>BLHM5100KC-GFS</td>
<td>GFS5G- □ FR</td>
<td>BLHD100K</td>
</tr>
</tbody>
</table>

#### Round Shaft Type

<table>
<thead>
<tr>
<th>Output Power</th>
<th>Model</th>
<th>Motor Model</th>
<th>Driver Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>15 W (1/50 HP)</td>
<td>BLH015K-A</td>
<td>BLHM015K-A</td>
<td>BLHD15K</td>
</tr>
<tr>
<td>30 W (1/25 HP)</td>
<td>BLH230KC-A</td>
<td>BLHM230KC-A</td>
<td>BLHD30K</td>
</tr>
<tr>
<td>50 W (1/15 HP)</td>
<td>BLH450KC-A</td>
<td>BLHM450KC-A</td>
<td>BLHD50K</td>
</tr>
<tr>
<td>100 W (1/8 HP)</td>
<td>BLH5100KC-A</td>
<td>BLHM5100KC-A</td>
<td>BLHD100K</td>
</tr>
</tbody>
</table>

Enter the gear ratio in the box (□) within the model name.