

# **WJ200 Series Inverter Quick Reference Guide**

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- Single-phase Input 200V class
- Three-phase Input 200V class
- Three-phase Input 400V class

Manual Number: NT3251X  
May 2010

**Refer to the user manual for detail**

**Hitachi Industrial Equipment Systems Co., Ltd.**

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**UL® Cautions, Warnings and Instructions**

**Warnings and Cautions for Troubleshooting and Maintenance**

The warnings and instructions in this section summarizes the procedures necessary to ensure an inverter installation complies with Underwriters Laboratories® guidelines.



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**WARNING:** Use 60/75°C Cu wire only. (for models: WJ200-001L, 002L, 004L, 007L, 015S, 022S, 004H, 007H, 015H, 022H, 030H)

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**WARNING:** Use 75°C Cu wire only. (for models: WJ200-001S, -002S, -004S, -007S, -015L, -022L, -037L, -055L, -075L, -110L, -150L, -040H, -055H, -075H, -110H and -150H)

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**WARNING:** Suitable for use on a circuit capable of delivering not more than 100,000 rms Symmetrical Amperes, 240 or 480V maximum.

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**WARNING:** When protected by CC, G, J, or R class Fuses, or when Protected By A Circuit Breaker Having An Interrupting Rating Not Less Than 100,000 rms Symmetrical Amperes, 240 or 480 Volts Maximum.

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**WARNING:** Install device in pollution degree 2 environment.

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**WARNING:** Maximum Surrounding Air Temperature 50°C

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**WARNING:** Solid state motor overload protection is provided in each model

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**WARNING:** Integral solid state short circuit protection does not provide branch circuit protection. Branch circuit protection must be provided in accordance with the National Electric Code and any additional local codes

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## Terminal symbols and Screw size

| Inverter Model                                       | Screw Size | Required Torque (N-m) | Wire range                  |
|--|------------|-----------------------|-----------------------------|
| WJ200-001S<br>WJ200-002S<br>WJ200-004S               | M3.5       | 1.0                   | AWG16 (1.3mm <sup>2</sup> ) |
| WJ200-007S   | M4         | 1.4                   | AWG12 (3.3mm <sup>2</sup> ) |
| WJ200-015S<br>WJ200-022S                             | M4         | 1.4                   | AWG10 (5.3mm <sup>2</sup> ) |
| WJ200-001L<br>WJ200-002L<br>WJ200-004L<br>WJ200-007L | M3.5       | 1.0                   | AWG16 (1.3mm <sup>2</sup> ) |
| WJ200-015L   | M4         | 1.4                   | AWG14 (2.1mm <sup>2</sup> ) |
| WJ200-022L   | M4         | 1.4                   | AWG12 (3.3mm <sup>2</sup> ) |
| WJ200-037L   | M4         | 1.4                   | AWG10 (5.3mm <sup>2</sup> ) |
| WJ200-055L<br>WJ200-075L                             | M5         | 3.0                   | AWG6 (13mm <sup>2</sup> )   |
| WJ200-110L   | M6         | 3.9 to 5.1            | AWG4 (21mm <sup>2</sup> )   |
| WJ200-150L   | M8         | 5.9 to 8.8            | AWG2 (34mm <sup>2</sup> )   |
| WJ200-004H<br>WJ200-007H<br>WJ200-015H               | M4         | 1.4                   | AWG16 (1.3mm <sup>2</sup> ) |
| WJ200-022H<br>WJ200-030H                             | M4         | 1.4                   | AWG14 (2.1mm <sup>2</sup> ) |
| WJ200-040H   | M4         | 1.4                   | AWG12 (3.3mm <sup>2</sup> ) |
| WJ200-055H<br>WJ200-075H                             | M5         | 3.0                   | AWG10 (5.3mm <sup>2</sup> ) |
| WJ200-110H<br>WJ200-150H                             | M6         | 3.9 to 5.1            | AWG6 (13mm <sup>2</sup> )   |

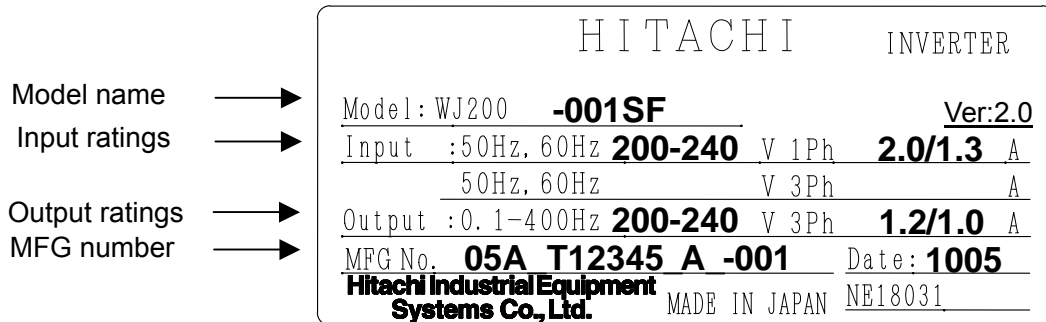
## Fuse Sizes

The inverter shall be connected with a UL Listed Cartridge Nonrenewable fuse, rated 600Vac with the current ratings as shown in the table below.

| Inverter Model                                       | Type    | Rating         |
|--|---------|----------------|
| WJ200-001S<br>WJ200-002S<br>WJ200-004S               | Class J | 10A, AIC 200kA |
| WJ200-007S   |         | 15A, AIC 200kA |
| WJ200-015S<br>WJ200-022S                             |         | 30A, AIC 200kA |
| WJ200-001L<br>WJ200-002L<br>WJ200-004L               |         | 10A, AIC 200kA |
| WJ200-007L<br>WJ200-015L                             |         | 15A, AIC 200kA |
| WJ200-022L   |         | 20A, AIC 200kA |
| WJ200-037L   |         | 30A, AIC 200kA |
| WJ200-055L<br>WJ200-075L                             |         | 40A, AIC 200kA |
| WJ200-110L<br>WJ200-150L                             |         | 80A, AIC 200kA |
| WJ200-004H<br>WJ200-007H<br>WJ200-015H<br>WJ200-022H |         | 10A, AIC 200kA |
| WJ200-030H<br>WJ200-040H                             |         | 15A, AIC 200kA |
| WJ200-055H<br>WJ200-075H                             |         | 20A, AIC 200kA |
| WJ200-110H<br>WJ200-150H                             |         | 40A, AIC 200kA |

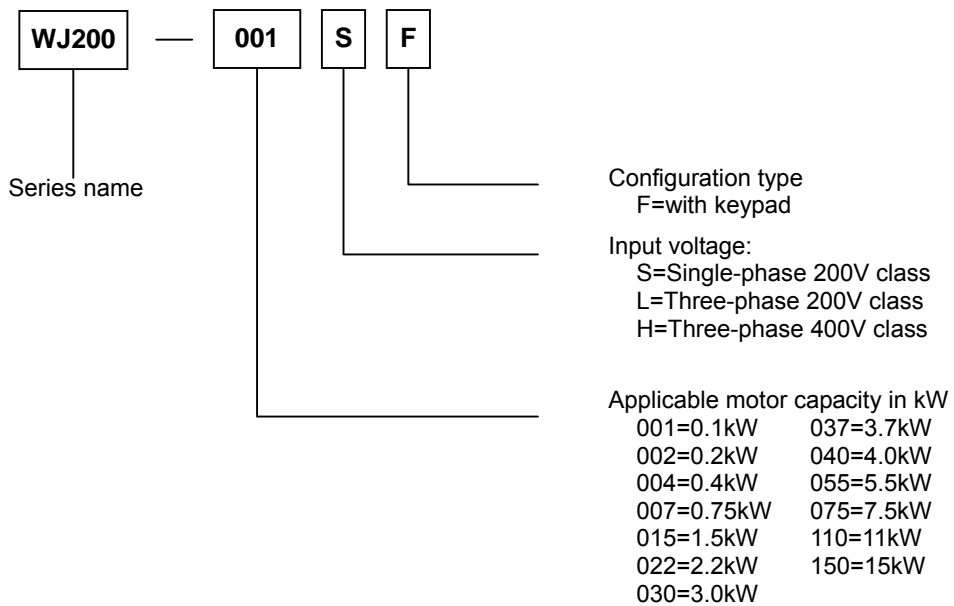
## Inverter Specification Label

The Hitachi WJ200 inverters have product labels located on the right side of the housing, as pictured below. Be sure to verify that the specifications on the labels match your power source, and application safety requirements.



## Inverter Specification Label

The model number for a specific inverter contains useful information about its operating characteristics. Refer to the model number legend below:



# WJ200 Inverter Specifications

## Model-specific tables for 200V and 400V class inverters

The following tables are specific to WJ200 inverters for the 200V and 400V class model groups. Note that “General Specifications” on page in this chapter apply to both voltage class groups. Footnotes for all specification tables follow the table below.

| Item                         |                  | Single-phase 200V class Specifications                |            |            |            |                            |                            |          |
|------------------------------|------------------|---|------------|------------|------------|----------------------------|----------------------------|----------|
| WJ200 inverters, 200V models |                  | 001SF   | 002SF      | 004SF      | 007SF      | 015SF                      | 022SF                      |          |
| Applicable motor size *2     | kW               | VT  | 0.2        | 0.4        | 0.55       | 1.1                        | 2.2                        | 3.0      |
|                              |                  | CT  | 0.1        | 0.2        | 0.4        | 0.75                       | 1.5                        | 2.2      |
|                              | HP               | VT  | <b>1/4</b> | <b>1/2</b> | <b>3/4</b> | <b>1.5</b>                 | <b>3</b>                   | <b>4</b> |
|                              |                  | CT  | <b>1/8</b> | <b>1/4</b> | <b>1/2</b> | <b>1</b>                   | <b>2</b>                   | <b>3</b> |
| Rated capacity (kVA)         | 200V             | VT  | 0.4        | 0.6        | 1.2        | 2.0                        | 3.3                        | 4.1      |
|                              |                  | CT  | 0.2        | 0.5        | 1.0        | 1.7                        | 2.7                        | 3.8      |
|                              | 240V             | VT  | 0.4        | 0.7        | 1.4        | 2.4                        | 3.9                        | 4.9      |
|                              |                  | CT  | 0.3        | 0.6        | 1.2        | 2.0                        | 3.3                        | 4.5      |
| Rated input voltage          |                  | Single-phase: 200V-15% to 240V +10%, 50/60Hz ±5%      |            |            |            |                            |                            |          |
| Rated output voltage *3      |                  | 3-phase: 200 to 240V (proportional to input voltage)  |            |            |            |                            |                            |          |
| Rated output current (A)     | VT               | 1.2   | 1.9        | 3.5        | 6.0        | 9.6                        | 12.0                       |          |
|                              | CT               | 1.0   | 1.6        | 3.0        | 5.0        | 8.0                        | 11.0                       |          |
| Starting torque *6           |                  | 200% at 0.5Hz   |            |            |            |                            |                            |          |
| Braking                      | Without resistor | 100%: ≤ 50Hz<br>50%: ≤ 60Hz                           |            |            |            | 70%: ≤ 50Hz<br>50%: ≤ 60Hz | 20%: ≤ 50Hz<br>20%: ≤ 60Hz |          |
|                              | With resistor    | 150%  |            |            |            |                            | 100%                       |          |
| DC braking                   |                  | Variable operating frequency, time, and braking force |            |            |            |                            |                            |          |
| Weight                       | kg               | 1.0   | 1.0        | 1.1        | 1.6        | 1.8                        | 1.8                        |          |
|                              | lb               | 2.2   | 2.2        | 2.4        | 3.5        | 4.0                        | 4.0                        |          |

WJ200 Inverter Specifications, continued...

| Item                         |                  |               | Three-phase 200V class Specifications                    |            |            |             |             |          |
|------------------------------|------------------|---------------|--|------------|------------|-------------|-------------|----------|
| WJ200 inverters, 200V models |                  |               | 001LF  | 002LF      | 004LF      | 007LF       | 015LF       | 022LF    |
| Applicable motor size *2     | kW               | VT            | 02   | 04         | 0.75       | 1.1         | 22          | 30       |
|                              |                  | CT            | 0.1  | 0.2        | 0.4        | 0.75        | 1.5         | 2.2      |
|                              | HP               | VT            | <b>1/4</b>   | <b>1/2</b> | <b>1</b>   | <b>1.5</b>  | <b>3</b>    | <b>4</b> |
|                              |                  | CT            | <b>1/8</b>   | <b>1/4</b> | <b>1/2</b> | <b>1</b>    | <b>2</b>    | <b>3</b> |
| Rated capacity (kVA)         | 200V             | VT            | 04   | 06         | 12         | 20          | 33          | 41       |
|                              |                  | CT            | 02   | 05         | 10         | 17          | 27          | 38       |
|                              | 240V             | VT            | 04   | 07         | 14         | 24          | 39          | 49       |
|                              |                  | CT            | 03   | 06         | 12         | 20          | 33          | 45       |
| Rated input voltage          |                  |               | Three-phase: 200V-15% to 240V +10%, 50/60Hz ±5%          |            |            |             |             |          |
| Rated output voltage *3      |                  |               | Three-phase: 200 to 240V (proportional to input voltage) |            |            |             |             |          |
| Rated output current (A)     | VT               |               | 12   | 19         | 35         | 60          | 96          | 120      |
|                              | CT               |               | 1.0  | 1.6        | 30         | 50          | 80          | 110      |
| Starting torque *6           |                  |               | 200% at 0.5Hz  |            |            |             |             |          |
| Braking                      | Without resistor |               | 100%: ≤ 50Hz   |            |            | 70%: ≤ 50Hz | 20%: ≤ 50Hz |          |
|                              |                  |               | 50%: ≤ 60Hz  |            |            | 50%: ≤ 60Hz | 20%: ≤ 60Hz |          |
|                              |                  | With resistor |  | 150%       |            |             |             | 100%     |
| DC braking                   |                  |               | Variable operating frequency, time, and braking force    |            |            |             |             |          |
| Weight                       | kg               |               | 1.0  | 1.0        | 1.1        | 1.2         | 1.6         | 1.8      |
|                              | lb               |               | 2.2  | 2.2        | 2.4        | 2.6         | 3.5         | 4.0      |

| Item                         |                  |               | Three-phase 200V class Specifications                 |            |           |             |             |  |
|------------------------------|------------------|---------------|---|------------|-----------|-------------|-------------|--|
| WJ200 inverters, 200V models |                  |               | 037LF   | 055LF      | 075LF     | 110LF       | 150LF       |  |
| Applicable motor size *2     | kW               | VT            | 5.5   | 7.5        | 11        | 15          | 18.5        |  |
|                              |                  | CT            | 3.7   | 5.5        | 7.5       | 11          | 15          |  |
|                              | HP               | VT            | <b>7.5</b>  | <b>10</b>  | <b>15</b> | <b>20</b>   | <b>25</b>   |  |
|                              |                  | CT            | <b>5</b>  | <b>7.5</b> | <b>10</b> | <b>15</b>   | <b>20</b>   |  |
| Rated capacity (kVA)         | 200V             | VT            | 6.7   | 10.3       | 13.8      | 19.3        | 20.7        |  |
|                              |                  | CT            | 6.0   | 8.6        | 11.4      | 16.2        | 20.7        |  |
|                              | 240V             | VT            | 8.1   | 12.4       | 16.6      | 23.2        | 24.9        |  |
|                              |                  | CT            | 7.2   | 10.3       | 13.7      | 19.5        | 24.9        |  |
| Rated input voltage          |                  |               | Single-phase: 200V-15% to 240V +10%, 50/60Hz ±5%      |            |           |             |             |  |
| Rated output voltage *3      |                  |               | 3-phase: 200 to 240V (proportional to input voltage)  |            |           |             |             |  |
| Rated output current (A)     | VT               |               | 19.6  | 30.0       | 40.0      | 56.0        | 69.0        |  |
|                              | CT               |               | 17.5  | 25.0       | 33.0      | 47.0        | 60.0        |  |
| Starting torque *6           |                  |               | 200% at 0.5Hz   |            |           |             |             |  |
| Braking                      | Without resistor |               | 100%: ≤ 50Hz  |            |           | 70%: ≤ 50Hz | 50%: ≤ 60Hz |  |
|                              |                  |               | 50%: ≤ 60Hz   |            |           | 50%: ≤ 60Hz | 20%: ≤ 60Hz |  |
|                              |                  | With resistor |   | 150%       |           |             |             |  |
| DC braking                   |                  |               | Variable operating frequency, time, and braking force |            |           |             |             |  |
| Weight                       | Kg               |               | 2.0   | 3.3        | 3.4       | 5.1         | 7.4         |  |
|                              | lb               |               | 4.4   | 7.3        | 7.5       | 11.2        | 16.3        |  |



WJ200 Inverter Specifications, continued...

| Item                         |                  |     | Three-phase 400V class Specifications                    |       |       |             |       |       |
|------------------------------|------------------|-----|--|-------|-------|-------------|-------|-------|
| WJ200 inverters, 400V models |                  |     | 004HF  | 007HF | 015HF | 022HF       | 030HF | 040HF |
| Applicable motor size *2     | kW               | VT  | 0.75   | 1.5   | 2.2   | 3.0         | 4.0   | 5.5   |
|                              |                  | CT  | 0.4  | 0.75  | 1.5   | 2.2         | 3.0   | 4.0   |
|                              | HP               | VT  | 1  | 2     | 3     | 4           | 5     | 7.5   |
|                              |                  | CT  | 1/2  | 1     | 2     | 3           | 4     | 5     |
| Rated capacity (kVA)         | 380V             | VT  | 1.3  | 2.6   | 3.5   | 4.5         | 5.7   | 7.3   |
|                              |                  | CT  | 1.1  | 2.2   | 3.1   | 3.6         | 4.7   | 6.0   |
|                              | 480V             | VT  | 1.7  | 3.4   | 4.4   | 5.7         | 7.3   | 9.2   |
|                              |                  | CT  | 1.4  | 2.8   | 3.9   | 4.5         | 5.9   | 7.6   |
| Rated input voltage          |                  |     | Three-phase: 200V-15% to 240V +10%, 50/60Hz ±5%          |       |       |             |       |       |
| Rated output voltage *3      |                  |     | Three-phase: 200 to 240V (proportional to input voltage) |       |       |             |       |       |
| Rated output current (A)     | VT               | 21  | 4.1  | 5.4   | 6.9   | 8.8         | 11.1  |       |
|                              | CT               | 1.8 | 3.4  | 4.8   | 5.5   | 7.2         | 9.2   |       |
| Starting torque *6           |                  |     | 200% at 0.5Hz  |       |       |             |       |       |
| Braking                      | Without resistor |     | 100%: ≤ 50Hz   |       |       | 70%: ≤ 50Hz |       |       |
|                              |                  |     | 50%: ≤ 60Hz  |       |       | 50%: ≤ 60Hz |       |       |
|                              | With resistor    |     | 150%   |       |       |             |       |       |
| DC braking                   |                  |     | Variable operating frequency, time, and braking force    |       |       |             |       |       |
| Weight                       | kg               | 1.5 | 1.6  | 1.8   | 1.9   | 1.9         | 2.1   |       |
|                              | lb               | 3.3 | 3.5  | 4.0   | 4.2   | 4.2         | 4.6   |       |

| Item                         |                  |      | Three-phase 400V class Specifications                 |       |       |       |  |  |
|------------------------------|------------------|------|---|-------|-------|-------|--|--|
| WJ200 inverters, 400V models |                  |      | 055HF   | 075HF | 110HF | 150HF |  |  |
| Applicable motor size *2     | kW               | VT   | 7.5   | 11    | 15    | 18.5  |  |  |
|                              |                  | CT   | 5.5   | 7.5   | 11    | 15    |  |  |
|                              | HP               | VT   | 10  | 15    | 20    | 25    |  |  |
|                              |                  | CT   | 7.5   | 10    | 15    | 20    |  |  |
| Rated capacity (kVA)         | 380V             | VT   | 11.5  | 15.1  | 20.4  | 25.0  |  |  |
|                              |                  | CT   | 9.7   | 11.8  | 15.7  | 20.4  |  |  |
|                              | 480V             | VT   | 14.5  | 19.1  | 25.7  | 31.5  |  |  |
|                              |                  | CT   | 12.3  | 14.9  | 19.9  | 25.7  |  |  |
| Rated input voltage          |                  |      | Single-phase: 200V-15% to 240V +10%, 50/60Hz ±5%      |       |       |       |  |  |
| Rated output voltage *3      |                  |      | 3-phase: 200 to 240V (proportional to input voltage)  |       |       |       |  |  |
| Rated output current (A)     | VT               | 17.5 | 23.0  | 31.0  | 38.0  |       |  |  |
|                              | CT               | 14.8 | 18.0  | 24.0  | 31.0  |       |  |  |
| Starting torque *6           |                  |      | 200% at 0.5Hz   |       |       |       |  |  |
| Braking                      | Without resistor |      | 100%: ≤ 50Hz  |       |       |       |  |  |
|                              |                  |      | 50%: ≤ 60Hz   |       |       |       |  |  |
|                              | With resistor    |      | 150%  |       |       |       |  |  |
| DC braking                   |                  |      | Variable operating frequency, time, and braking force |       |       |       |  |  |
| Weight                       | kg               | 3.5  | 3.5   | 4.7   | 5.2   |       |  |  |
|                              | lb               | 7.7  | 7.7   | 10.4  | 11.5  |       |  |  |

The following table shows which models need derating.

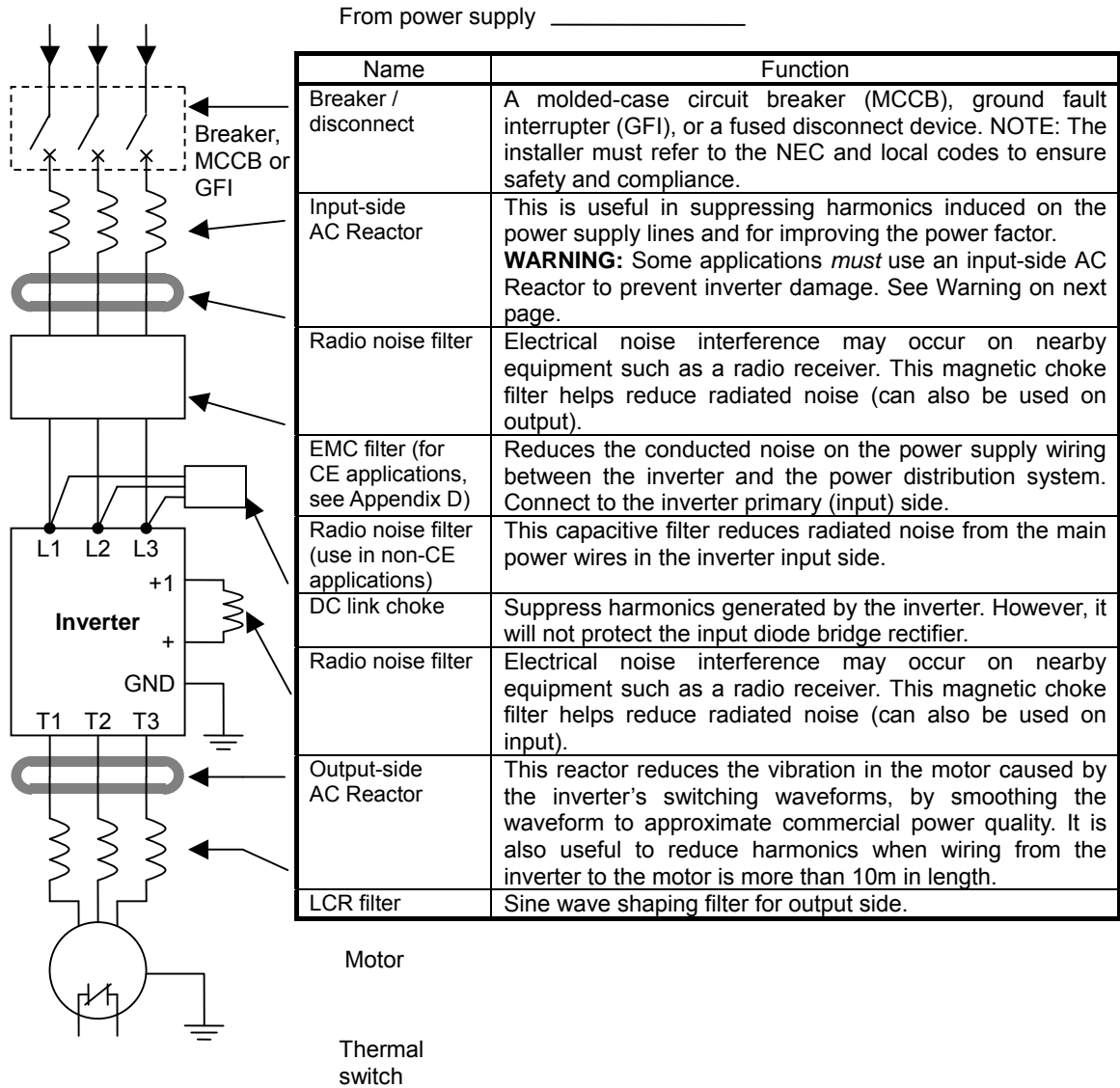
| 1-ph 200V class | Need derating | 3-ph 200V class | Need derating | 3-ph 400V class | Need derating |
|-----------------|---------------|-----------------|---------------|-----------------|---------------|
| WJ200-001S      | -             | WJ200-001L      | -             | WJ200-004H      | ✓             |
| WJ200-002S      | -             | WJ200-002L      | ✓             | WJ200-007H      | ✓             |
| WJ200-004S      | ✓             | WJ200-004L      | ✓             | WJ200-015H      | -             |
| WJ200-007S      | ✓             | WJ200-007L      | -             | WJ200-022H      | -             |
| WJ200-015S      | -             | WJ200-015L      | -             | WJ200-030H      | -             |
| WJ200-022S      | -             | WJ200-022L      | -             | WJ200-040H      | ✓             |
| -               | -             | WJ200-037L      | ✓             | WJ200-055H      | -             |
| -               | -             | WJ200-055L      | -             | WJ200-075H      | ✓             |
| -               | -             | WJ200-075L      | ✓             | WJ200-110H      | ✓             |
| -               | -             | WJ200-110L      | ✓             | WJ200-150H      | ✓             |
| -               | -             | WJ200-150L      | ✓             | -               | -             |

✓ : need derating  
 - : need no derating

Use the following derating curves to help determine the optimal carrier frequency setting for your inverter and find the output current derating. Be sure to use the proper curve for your particular WJ200 inverter model number.

# Basic System Description

A motor control system will obviously include a motor and inverter, as well as a circuit breaker or fuses for safety. If you are connecting a motor to the inverter on a test bench just to get started, that's all you may need for now. But a system can also have a variety of additional components. Some can be for noise suppression, while others may enhance the inverter's braking performance. The figure and table below show a system with all the **optional** components you might need in your finished application.



## Determining Wire and Fuse Sizes

The maximum motor currents in your application determines the recommended wire size. The following table gives the wire size in AWG. The “Power Lines” column applies to the inverter input power, output wires to the motor, the earth ground connection, and any other components shown in the “Basic System Description” on page 2-7. The “Signal Lines” column applies to any wire connecting to the two green connectors just inside the front cover panel.

| Motor Output |      |     |     | Inverter Model | Wiring                                    |  | Applicable equipment                                       |
|--------------|------|-----|-----|----------------|---|--|--|
| kW           |      | HP  |     |                | Power Lines                               | Signal Lines   | Fuse (UL-rated, class J, 600V , Maximum allowable current) |
| VT           | CT   | VT  | CT  |                |   |  |  |
| 0.2          | 0.1  | ¼   | 1/8 | WJ200-001SF    | AWG16 / 1.3mm <sup>2</sup><br>(75°C only) | 18 to 28<br>AWG / 0.14<br>to 0.75 mm <sup>2</sup><br>shielded wire<br>(see Note 4) | 10A  |
| 0.4          | 0.2  | ½   | ¼   | WJ200-002SF    |   |  |  |
| 0.55         | 0.4  | ¾   | ½   | WJ200-004SF    |   |  |  |
| 1.1          | 0.75 | 1.5 | 1   | WJ200-007SF    | AWG12 / 3.3mm <sup>2</sup><br>(75°C only) | 20A  |  |
| 2.2          | 1.5  | 3   | 2   | WJ200-015SF    | AWG10 / 5.3mm <sup>2</sup>                |  |  |
| 3.0          | 2.2  | 4   | 3   | WJ200-022SF    |   |  |  |
| 0.2          | 0.1  | ¼   | 1/8 | WJ200-001LF    | AWG16 / 1.3mm <sup>2</sup>                | 10A  |  |
| 0.4          | 0.2  | ½   | ¼   | WJ200-002LF    |   |  |  |
| 0.75         | 0.4  | 1   | ½   | WJ200-004LF    |   |  |  |
| 1.1          | 0.75 | 1.5 | 1   | WJ200-007LF    |   |  |  |
| 2.2          | 1.5  | 3   | 2   | WJ200-015LF    | AWG14 / 2.1mm <sup>2</sup><br>(75°C only) | 15A  |  |
| 3.0          | 2.2  | 4   | 3   | WJ200-022LF    | AWG12 / 3.3mm <sup>2</sup><br>(75°C only) | 20A  |  |
| 5.5          | 3.7  | 7.5 | 5   | WJ200-037LF    | AWG10 / 5.3mm <sup>2</sup><br>(75°C only) | 30A  |  |
| 7.5          | 5.5  | 10  | 7.5 | WJ200-055LF    | AWG6 / 13mm <sup>2</sup><br>(75°C only)   | 60A  |  |
| 11           | 7.5  | 15  | 10  | WJ200-075LF    |   |  |  |
| 15           | 11   | 20  | 15  | WJ200-110LF    | AWG4 / 21mm <sup>2</sup><br>(75°C only)   | 80A  |  |
| 18.5         | 15   | 25  | 20  | WJ200-150LF    | AWG2 / 34mm <sup>2</sup><br>(75°C only)   | 80A  |  |
| 0.75         | 0.4  | 1   | ½   | WJ200-004HF    | AWG16 / 1.3mm <sup>2</sup>                | 10A  |  |
| 1.5          | 0.75 | 2   | 1   | WJ200-007HF    |   |  |  |
| 2.2          | 1.5  | 3   | 2   | WJ200-015HF    |   |  |  |
| 3.0          | 2.2  | 4   | 3   | WJ200-022HF    | AWG14 / 2.1mm <sup>2</sup>                | 15A  |  |
| 4.0          | 3.0  | 5   | 4   | WJ200-030HF    |   |  |  |
| 5.5          | 4.0  | 7.5 | 5   | WJ200-040HF    | AWG12 / 3.3mm <sup>2</sup><br>(75°C only) | 30A  |  |
| 7.5          | 5.5  | 10  | 7.5 | WJ200-055HF    | AWG10/ 5.3mm <sup>2</sup><br>(75°C only)  |  |  |
| 11           | 7.5  | 15  | 10  | WJ200-075HF    |   |  |  |
| 15           | 11   | 20  | 15  | WJ200-110HF    | AWG6 / 13mm <sup>2</sup><br>(75°C only)   | 50A  |  |
| 18.5         | 15   | 25  | 20  | WJ200-150HF    | AWG6 / 13mm <sup>2</sup><br>(75°C only)   | 50A  |  |

**Note 1:** Field wiring must be made by a UL-Listed and CSA-certified closed-loop terminal connector sized for the wire gauge involved. Connector must be fixed by using the crimping tool specified by the connector manufacturer.

**Note 2:** Be sure to consider the capacity of the circuit breaker to be used.

**Note 3:** Be sure to use a larger wire gauge if power line length exceeds 66ft. (20m).

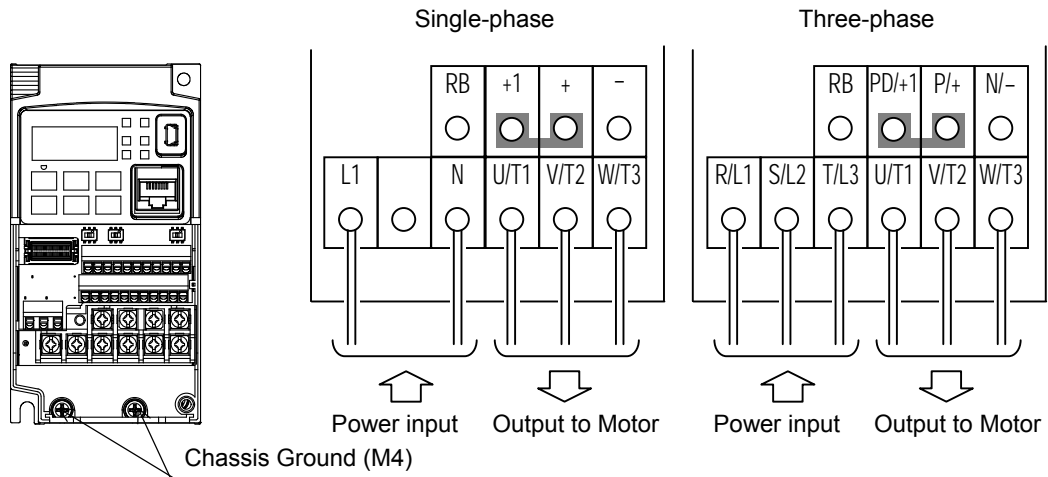
**Note 4:** Use 18 AWG / 0.75mm<sup>2</sup> wire for the alarm signal wire ([AL0], [AL1], [AL2] terminals).

## Wire the Inverter Input to a Supply

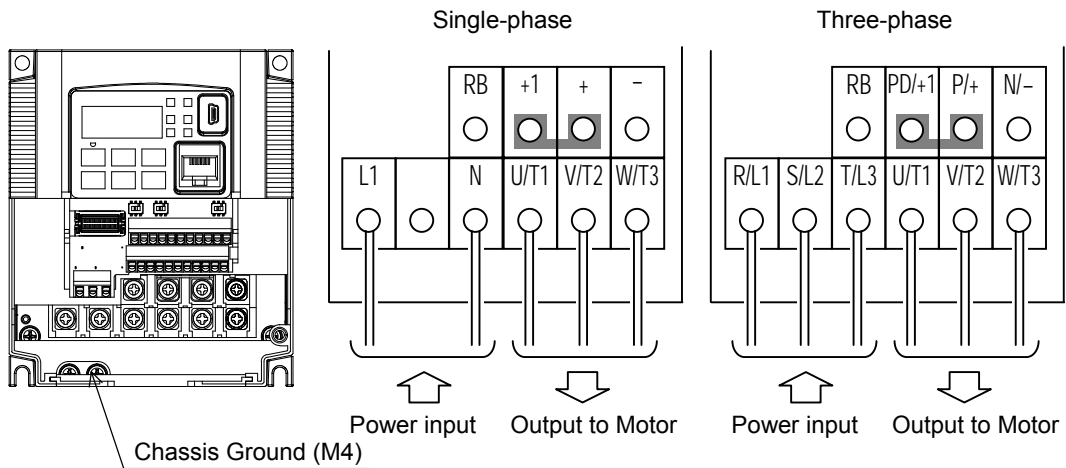
- Step 6:** In this step, you will connect wiring to the input of the inverter. First, you must determine whether the inverter model you have required three-phase power only, or single-phase power only. All models have the same power connection terminals [R/L1], [S/L2], and [T/L3]. So you must refer to the specifications label (on the side of the inverter) for the acceptable power source types! For inverters that can accept single-phase power and are connected that way, terminal [S/L2] will remain unconnected.

Note the use of ring lug connectors for a secure connection.

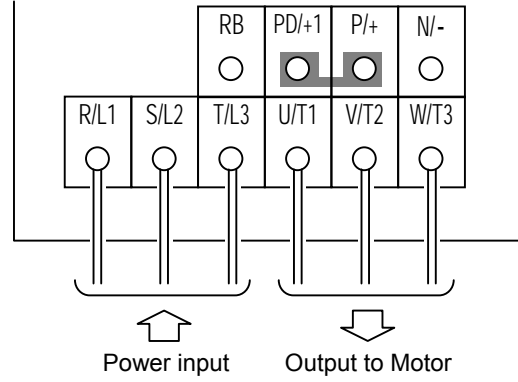
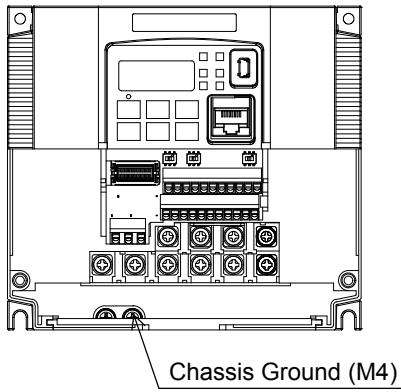
**Single-phase 200V 0.1 to 0.4kW**  
**Three-phase 200V 0.1 to 0.75kW**



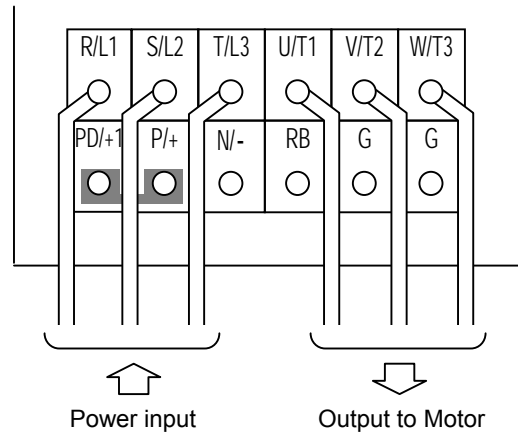
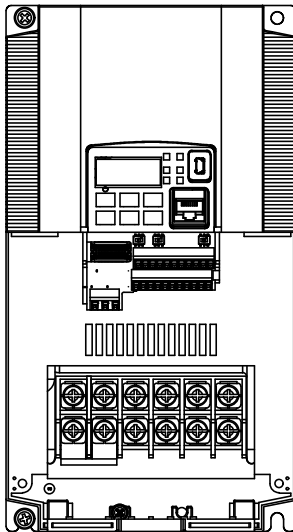
**Single-phase 200V 0.75 to 2.2kW**  
**Three-phase 200V 1.5, 2.2kW**  
**Three-phase 400V 0.4 to 3.0kW**



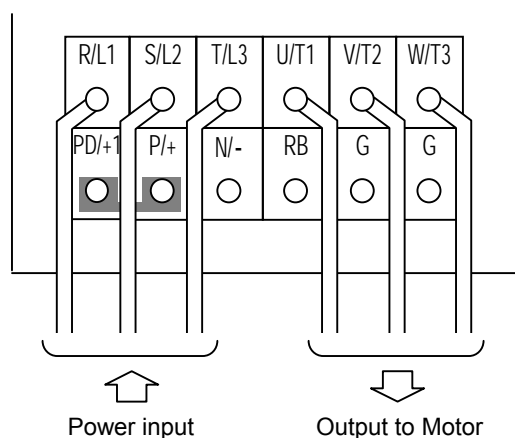
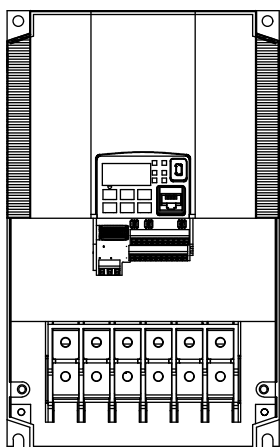
**Three-phase 200V 3.7kW**  
**Three-phase 400V 4.0kW**



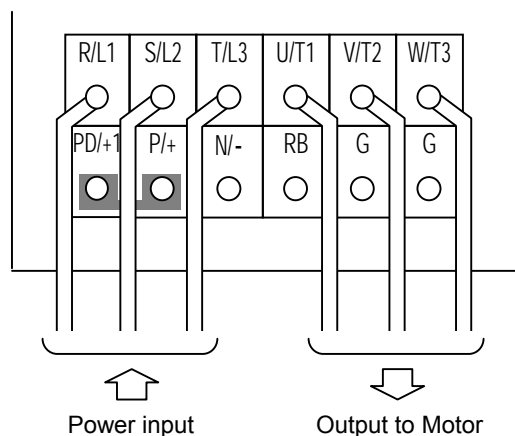
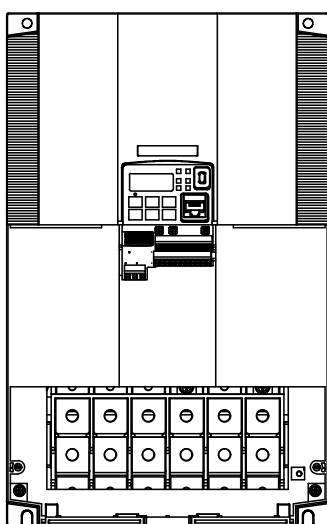
**Three-phase 200V 5.5, 7.5kW**  
**Three-phase 400V 5.5, 7.5kW**



**Three-phase 200V 11kW**  
**Three-phase 400V 11, 15kW**



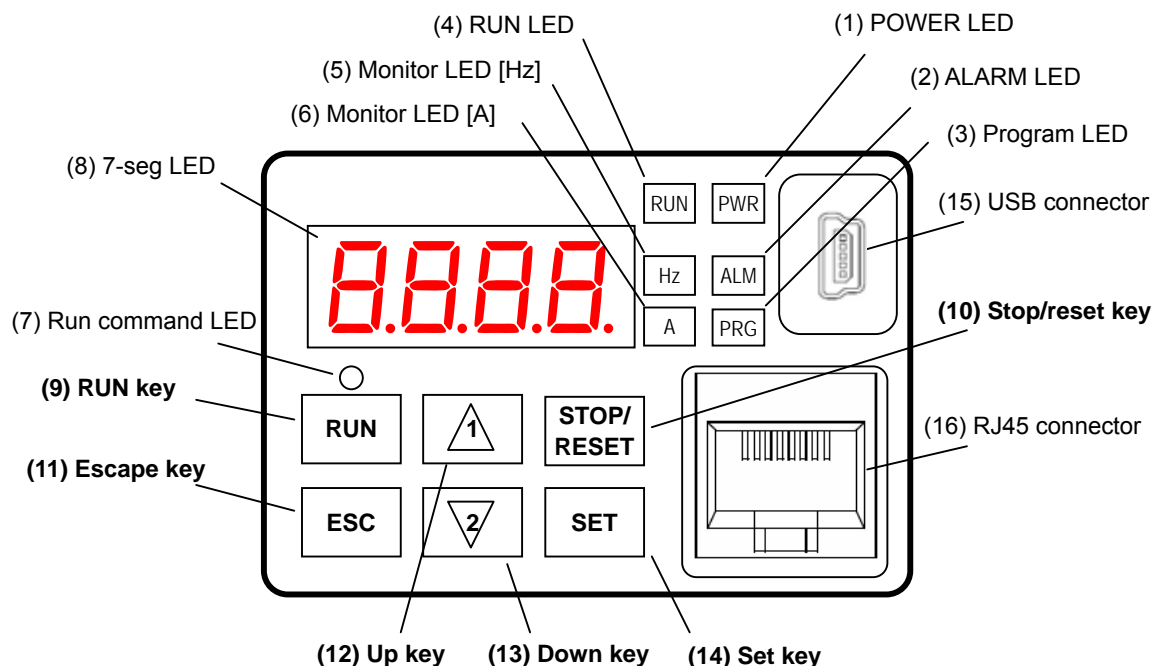
**Three-phase 200V 15kW**



**NOTE:** An inverter powered by a portable power generator may receive a distorted power waveform, overheating the generator. In general, the generator capacity should be five times that of the inverter (kVA).

# Using the Front Panel Keypad

Please take a moment to familiarize yourself with the keypad layout shown in the figure below. The display is used in programming the inverter's parameters, as well as monitoring specific parameter values during operation.



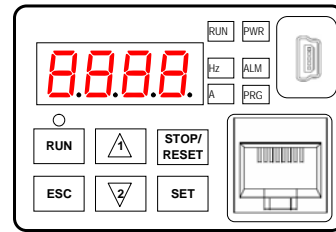
## Key and Indicator Legend

| Items                | Contents  |
|----------------------|---|
| (1) POWER LED        | Turns ON (Green) while the inverter is powered up.  |
| (2) ALARM LED        | Turns ON (Red) when the inverter trips.   |
| (3) Program LED      | <ul style="list-style-type: none"> <li>➢ Turns ON (Green) when the display shows changeable parameter.</li> <li>➢ Blinks when there is a mismatch in setting.</li> </ul>  |
| (4) RUN LED          | Turns ON (Green) when the inverter is driving the motor.  |
| (5) Monitor LED [Hz] | Turns ON (Green) when the displayed data is frequency related.  |
| (6) Monitor LED [A]  | Turns ON (Green) when the displayed data is current related.  |
| (7) Run command LED  | Turns ON (Green) when a Run command is set to the operator. (Run key is effective.)   |
| (8) 7-seg LED        | Shows each parameter, monitors etc.   |
| (9) Run key          | Makes inverter run.   |
| (10) Stop/reset key  | <ul style="list-style-type: none"> <li>➢ Makes inverter decelerates to a stop.</li> <li>➢ Reset the inverter when it is in trip situation</li> </ul>  |
| (11) ESC key         | <ul style="list-style-type: none"> <li>➢ Go to the top of next function group, when a function mode is shown</li> <li>➢ Cancel the setting and return to the function code, when a data is shown</li> <li>➢ Moves the cursor to a digit left, when it is in digit-to-digit setting mode</li> <li>➢ Pressing for 1 second leads to display data of <b>d00 I</b>, regardless of current display.</li> </ul> |
| (12) Up key          | ➢ Increase or decrease the data.  |
| (13) Down key        | ➢ Pressing the both keys at the same time gives you the digit-to-digit edit.  |
| (14) SET key         | <ul style="list-style-type: none"> <li>➢ Go to the data display mode when a function code is shown</li> <li>➢ Stores the data and go back to show the function code, when data is shown.</li> <li>➢ Moves the cursor to a digit right, when it is in digit-to-digit display mode</li> </ul>   |
| (15) USB connector   | Connect USB connector (mini-B) for using PC communication   |
| (16) RJ45 connector  | Connect RJ45 jack for remote operator   |



## Keys, Modes, and Parameters

The purpose of the keypad is to provide a way to change modes and parameters. The term *function* applies to both monitoring modes and parameters. These are all accessible through *function codes* that are primary 4-character codes. The various functions are separated into related groups identifiable by the left-most character, as the table shows.

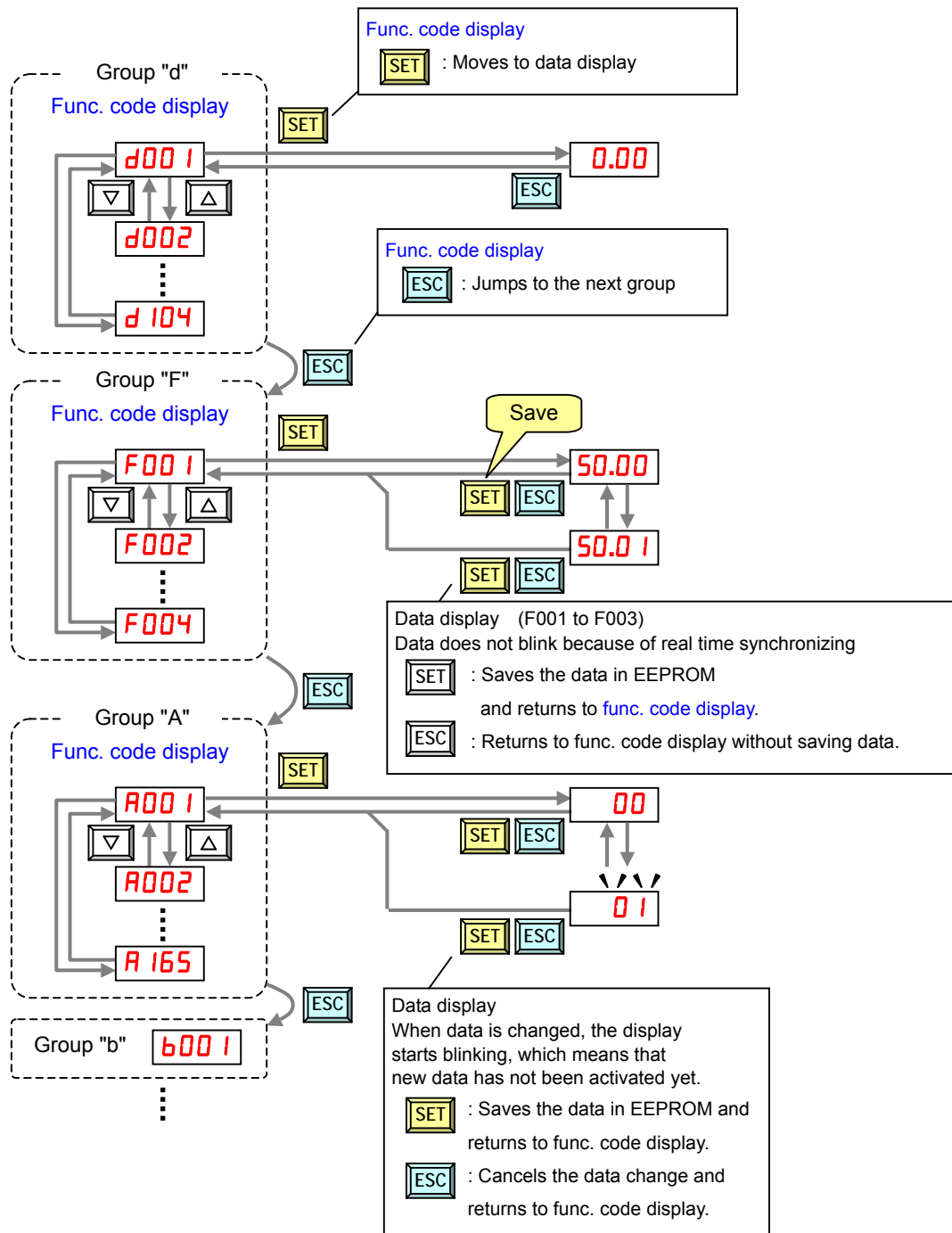



| Function Group | Type (Category) of Function  | Mode to Access | PRG LED Indicator |
|----------------|--|----------------|-------------------|
| "D"            | Monitoring functions   | Monitor        | ○                 |
| "F"            | Main profile parameters  | Program        | ●                 |
| "A"            | Standard functions   | Program        | ●                 |
| "B"            | Fine tuning functions  | Program        | ●                 |
| "C"            | Intelligent terminal functions                                       | Program        | ●                 |
| "H"            | Motor constant related functions                                     | Program        | ●                 |
| "P"            | Pulse train input, torque, EzSQ, and communication related functions | Program        | ●                 |
| "U"            | User selected parameters   | Program        | ●                 |
| "E"            | Error codes  | —              | —                 |

You can see from the following page how to monitor and/or program the parameters.

## Keypad Navigation Map

The WJ200 Series inverter drives have many programmable functions and parameters. Chapter 3 will cover these in detail, but you need to access just a few items to perform the powerup test. The menu structure makes use of function codes and parameter codes to allow programming and monitoring with only a 4-digit display and keys and LEDs. So, it is important to become familiar with the basic navigation map of parameters and functions in the diagram below. You may later use this map as a reference.



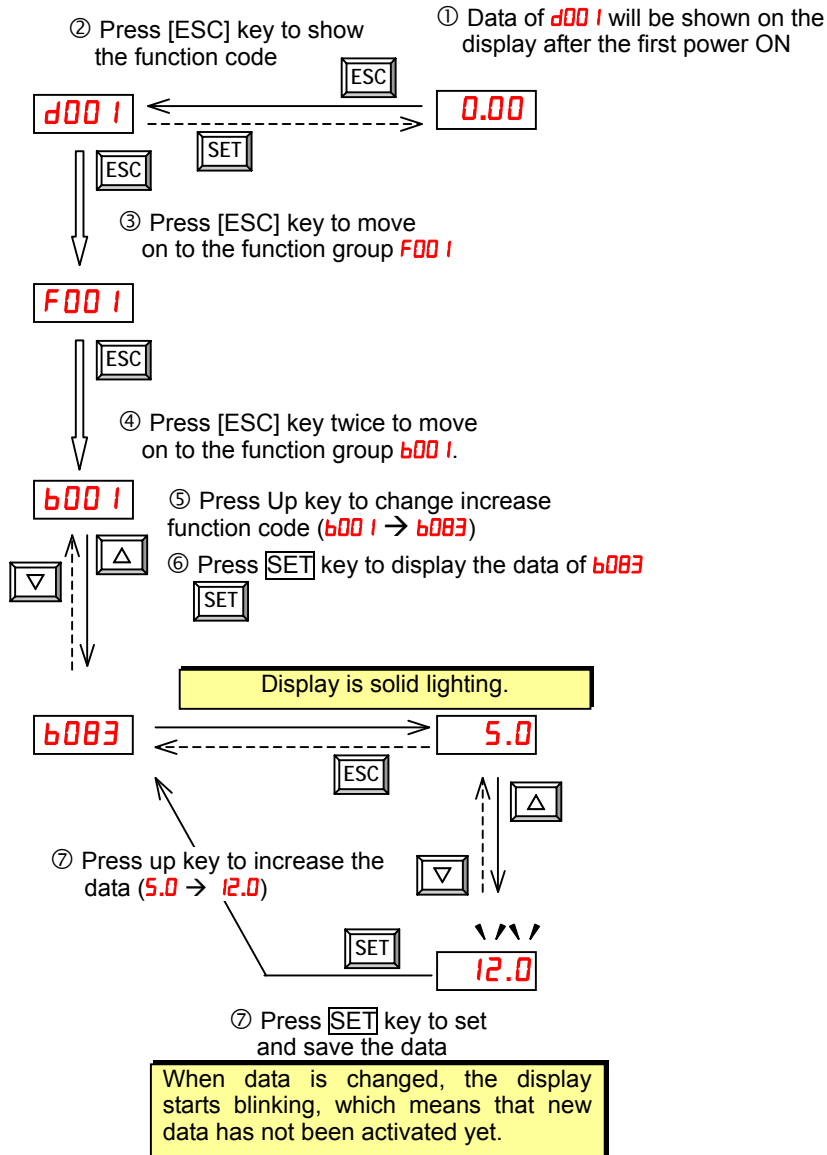

 Press the both up and down key at the same time in func. code or data display, then single-digit edit mode will be enabled. Refer to 2-34 for further information.



**NOTE:** Pressing the [ESC] key will make the display go to the top of next function group, regardless the display contents. (e.g. A02 1 → [ESC] → b00 1)

[Setting example]

After power ON, changing from 0.00 display to change the **b003** (carrier frequency) data.




- :Fix and stores the data and moves back to the function code
- :Cancels the change and moves back to the function code



Function code **dxxx** are for monitor and not possible to change.  
 Function codes **Fxxx** other than **F004** are reflected on the performance just after changing the data (before pressing [SET] key), and there will be no blinking.

|                | When a function code is shown...   | When a data is shown...                                     |
|----------------|------------------------------------|---|
| <b>ESC</b> key | Move on to the next function group | Cancels the change and moves back to the function code      |
| <b>SET</b> key | Move on to the data display        | Fix and stores the data and moves back to the function code |
| <b>△</b> key   | Increase function code             | Increase data value   |
| <b>▽</b> key   | Decrease function code             | Decrease data value   |

 Note

Keep pressing for more than 1 second leads to d001 display, regardless the display situation. But note that the display will circulates while keep pressing the [ESC] key because of the original function of the key.  
(e.g. *F00 1* → *A00 1* → *b00 1* → *C00 1* → ... → displays *50.00* after 1 second)

# Connecting to PLCs and Other Devices

Hitachi inverters (drives) are useful in many types of applications. During installation, the inverter keypad (or other programming device) will facilitate the initial configuration. After installation, the inverter will generally receive its control commands through the control logic connector or serial interface from another controlling device. In a simple application such as single-conveyor speed control, a Run/Stop switch and potentiometer will give the operator all the required control. In a sophisticated application, you may have a *programmable logic controller* (PLC) as the system controller, with several connections to the inverter.

It is not possible to cover all the possible types of application in this manual. It will be necessary for you to know the electrical characteristics of the devices you want to connect to the inverter. Then, this section and the following sections on I/O terminal functions can help you quickly and safely connect those devices to the inverter.



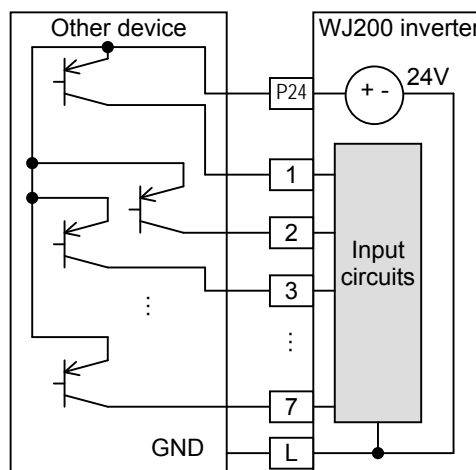
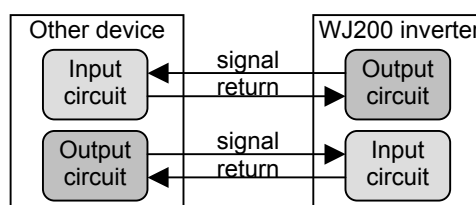
**CAUTION:** It is possible to damage the inverter or other devices if your application exceeds the maximum current or voltage characteristics of a connection point.

The connections between the inverter and other devices rely on the electrical input/output characteristics at both ends of each connection, shown in the diagram to the right. The inverter's configurable inputs accept either a sourcing or sinking output from an external device (such as PLC). This chapter shows the inverter's internal electrical component(s) at each I/O terminal. In some cases, you will need to insert a power source in the interface wiring.

In order to avoid equipment damage and get your application running smoothly, we recommend drawing a schematic of each connection between the inverter and the other device. Include the internal components of each device in the schematic, so that it makes a complete circuit loop.

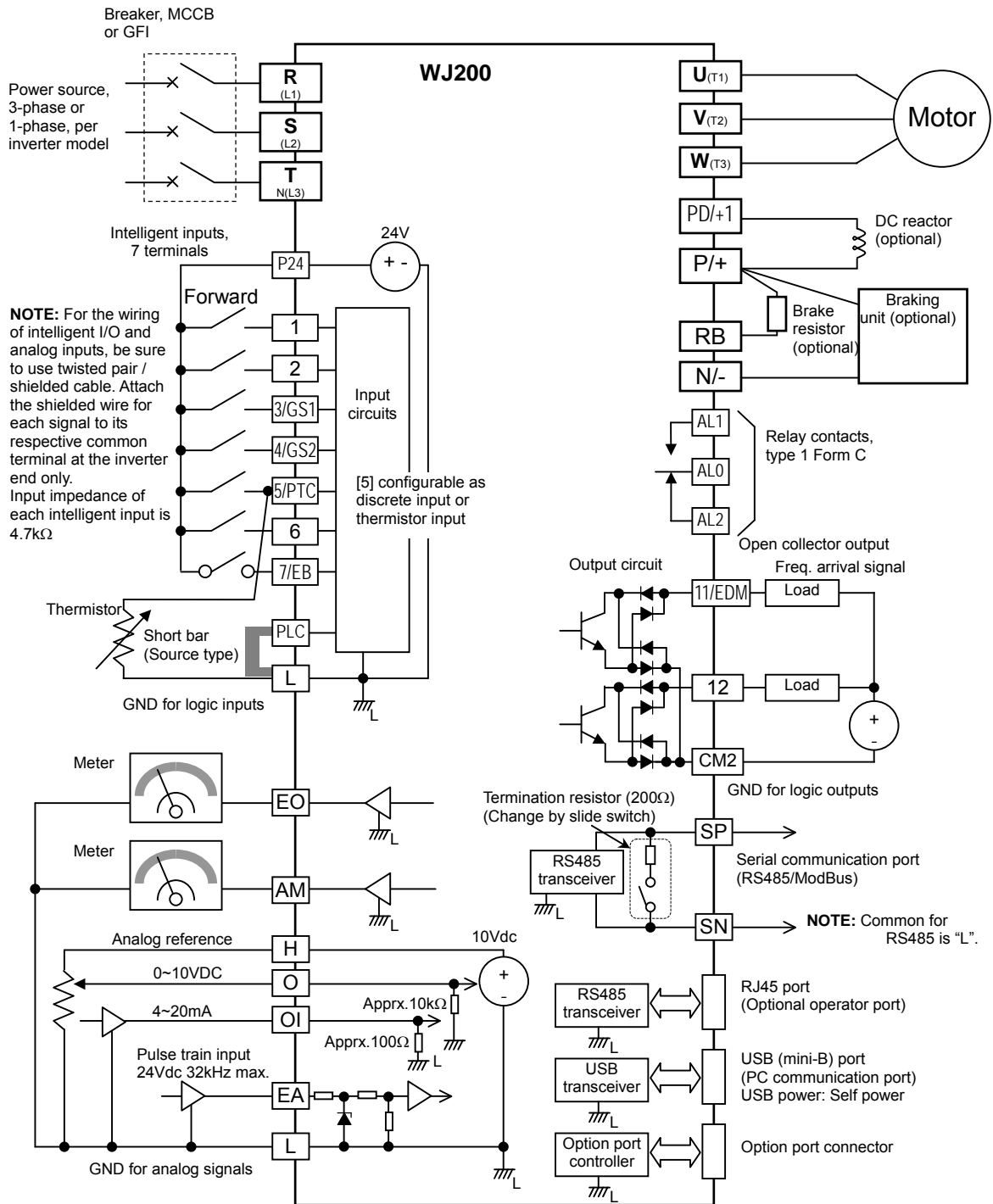
After making the schematic, then:

1. Verify that the current and voltage for each connection is within the operating limits of each device.
2. Make sure that the logic sense (active high or active low) of any ON/OFF connection is correct.
3. Check the zero and span (curve end points) for analog connections, and be sure the scale factor from input to output is correct.
4. Understand what will happen at the system level if any particular device suddenly loses power, or powers up after other devices.



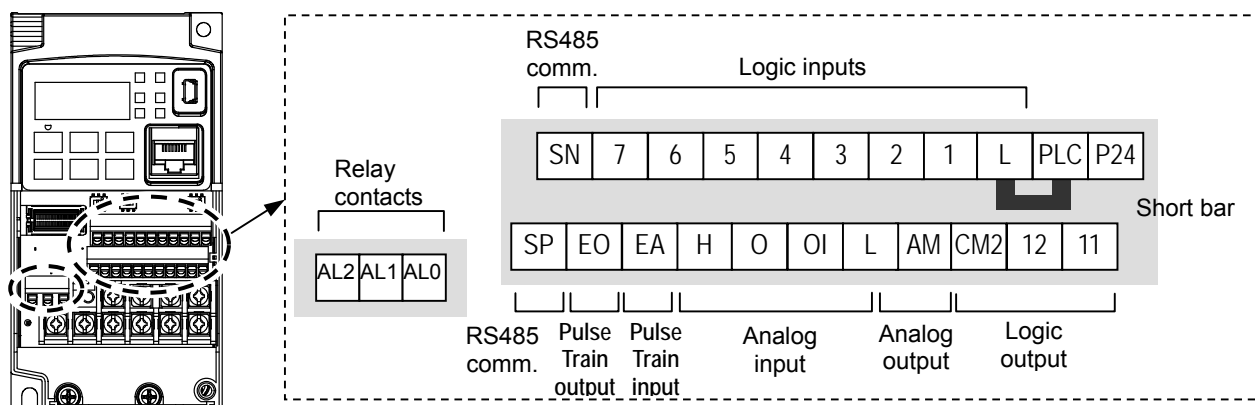
# Example Wiring Diagram

The schematic diagram below provides a general example of logic connector wiring, in addition to basic power and motor wiring converted in Chapter 2. The goal of this chapter is to help you determine the proper connections for the various terminals shown below for your application needs.



# Control Logic Signal Specifications

The control logic connectors are located just behind the front housing cover. The relay contacts are just to the left of the logic connectors. Connector labeling is shown below.

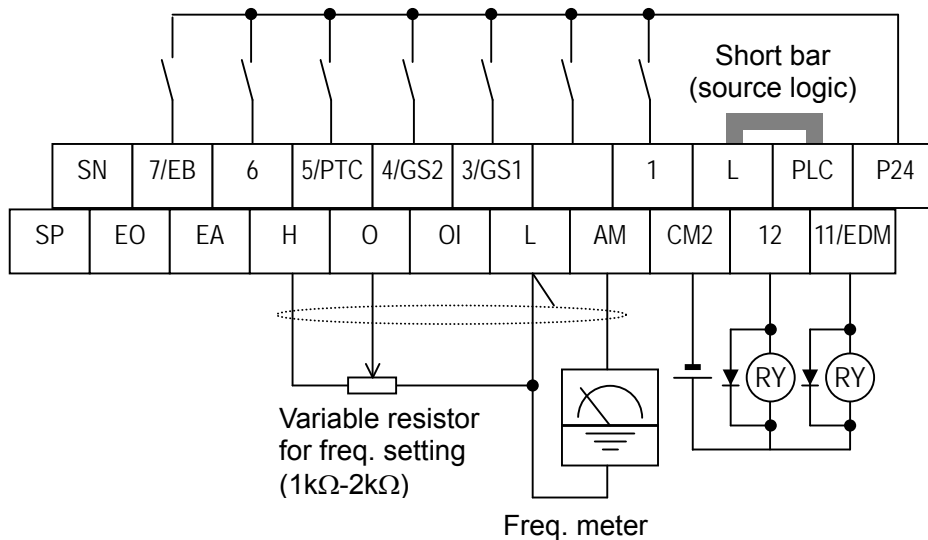


| Terminal Name                                  | Description   | Ratings   |
|--|---|---|
| P24  | +24V for logic inputs   | 24VDC, 100mA. (do not short to terminal L)  |
| PLC  | Intelligent input common  | Factory set: Source type for -FE and -FU models (connecting [P24] to [1]~[7] turns each input ON). To change to sink type, remove the short bar between [PLC] and [L], and connect it between [P24] and [L]. In this case, connecting [L] to [1]~[7] makes each input ON. |
| 1<br>2<br>3/GS1<br>4/GS2<br>5/PTC<br>6<br>7/EB | Discrete logic inputs (Terminal [3],[4],[5] and [7] have dual function. See following description and related pages for the details.) | 27VDC max. (use PLC or an external supply referenced to terminal L)   |
| GS1(3)   | Safe stop input GS1   | Functionality is based on ISO13849-1  |
| GS2(4)   | Safe stop input GS2   | See appendix for the details.   |
| PTC(5)   | Motor thermistor input  | Connect motor thermistor between PTC and L terminal to detect the motor temperature. Set <b>19</b> in <b>C005</b> .   |
| EB(7)  | Pulse train input B   | 2kHz max.<br>Common is [PLC]  |
| EA   | Pulse train input A   | 32kHz max.<br>Common is [L]   |
| L (in upper row) *1                            | GND for logic inputs  | Sum of input [1]~[7] currents (return)  |
| 11/EDM   | Discrete logic outputs [11] (Terminal [11] has dual function. See following description and related pages for the details.)           | 50mA max. ON state current, 27 VDC max. OFF state voltage<br>Common is CM2<br>In case the EDM is selected, the functionality is based on ISO13849-1<br>4VDC max. ON state voltage depression  |
| 12   | Discrete logic outputs [12]   | 50mA max. ON state current, 27 VDC max. OFF state voltage<br>Common is CM2  |
| CM2  | GND for logic output  | 100 mA: [11], [12] current return   |
| AM   | Analog voltage output   | 0~10VDC 2mA maximum   |
| EO   | Pulse train output  | 10VDC 2mA maximum<br>32kHz maximum  |
| L (in bottom row) *2                           | GND for analog signals  | Sum of [OI], [O], and [H] currents (return)   |

| Terminal Name    | Description                   | Ratings   |
|------------------|-------------------------------|---|
| OI               | Analog current input          | 4 to 19.6 mA range, 20 mA nominal, input impedance 100 $\Omega$   |
| O                | Analog voltage input          | 0 to 9.8 VDC range, 10 VDC nominal, input impedance 10 k $\Omega$   |
| H                | +10V analog reference         | 10VDC nominal, 10mA max.  |
| SP, SN           | Serial communication terminal | For RS485 Modbus communication.   |
| AL0, AL1, AL2 *3 | Relay common contact          | 250VAC, 2.5A (R load) max.<br>250VAC, 0.2A (I load, P.F.=0.4) max.<br>100VAC, 10mA min.<br>30VDC, 3.0A (R load) max.<br>30VDC, 0.7A (I load, P.F.=0.4) max.<br>5VDC, 100mA min. |

- Note 1:** The two terminals [L] are electrically connected together inside the inverter.
- Note 2:** We recommend using [L] logic GND (to the right) for logic input circuits and [L] analog GND (to the left) for analog I/O circuits.
- Note 3:** Refer to page 39 for details of trip signals.

### Wiring sample of control logic terminal (source logic)

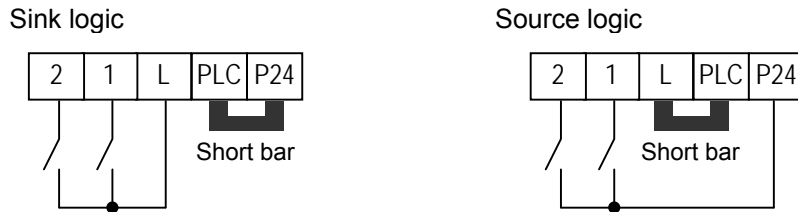


- Note:** If relay is connected to intelligent output, install a diode across the relay coil (reverse-biased) in order to suppress the turn-off spike.



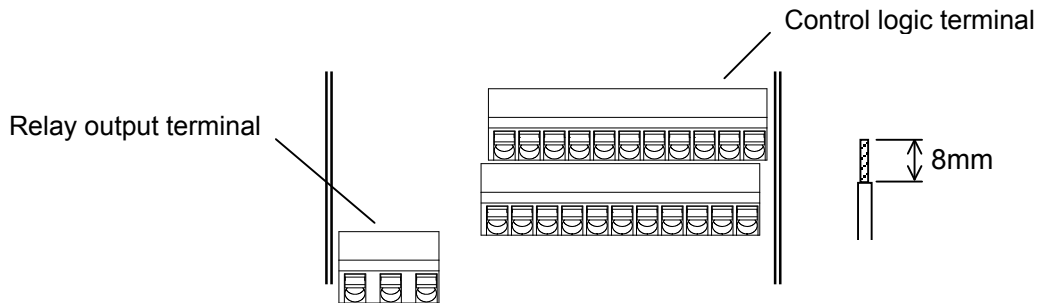
## Sink/source logic of intelligent input terminals

Sink or source logic is switched by a short bar as below.



## Wire size for control and relay terminals

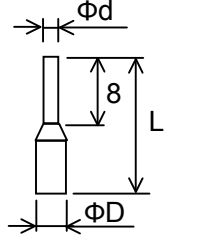
Use wires within the specifications listed below. For safe wiring and reliability, it is recommended to use ferrules, but if solid or stranded wire is used, stripping length should be 8mm.



|                        | Solid<br>mm <sup>2</sup> (AWG) | Stranded<br>mm <sup>2</sup> (AWG) | Ferrule<br>mm <sup>2</sup> (AWG) |
|------------------------|--------------------------------|-----------------------------------|----------------------------------|
| Control logic terminal | 0.2 to 1.5<br>(AWG 24 to 16)   | 0.2 to 1.0<br>(AWG 24 to 17)      | 0.25 to 0.75<br>(AWG 24 to 18)   |
| Relay terminal         | 0.2 to 1.5<br>(AWG 24 to 16)   | 0.2 to 1.0<br>(AWG 24 to 17)      | 0.25 to 0.75<br>(AWG 24 to 18)   |

## Recommended ferrule

For safe wiring and reliability, it is recommended to use following ferrules.

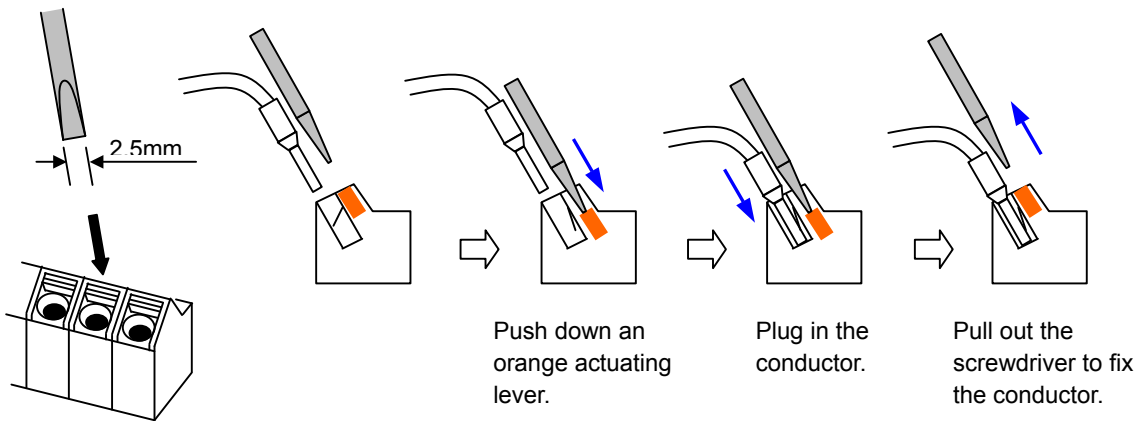
| Wire size<br>mm <sup>2</sup> (AWG) | Model name of<br>ferrule * | L [mm] | Φd [mm] | ΦD [mm] |  |
|------------------------------------|----------------------------|--------|---------|---------|---|
| 0.25 (24)                          | AI 0.25-8YE                | 12.5   | 0.8     | 2.0     |   |
| 0.34 (22)                          | AI 0.34-8TQ                | 12.5   | 0.8     | 2.0     |   |
| 0.5 (20)                           | AI 0.5-8WH                 | 14     | 1.1     | 2.5     |   |
| 0.75 (18)                          | AI 0.75-8GY                | 14     | 1.3     | 2.8     |   |

\* Supplier: Phoenix contact

Crimping pliers: CRIMPFOX UD 6-4 or CRIMPFOX ZA 3

## How to connect?

- (1) Push down an orange actuating lever by a slotted screwdriver (width 2.5mm max.).
- (2) Plug in the conductor.
- (3) Pull out the screwdriver then the conductor is fixed.



# Intelligent Terminal Listing

## Intelligent Inputs

Use the following table to locate pages for intelligent input material in this chapter.

| Input Function Summary Table |       |   |      |
|------------------------------|-------|---|------|
| Symbol                       | Code  | Function Name                             | Page |
| FW                           | 00    | Forward Run/Stop                          |      |
| RV                           | 01    | Reverse Run/Stop                          |      |
| CF1                          | 02    | Multi-speed Select, Bit 0 (LSB)           |      |
| CF2                          | 03    | Multi-speed Select, Bit 1                 |      |
| CF3                          | 04    | Multi-speed Select, Bit 2                 |      |
| CF4                          | 05    | Multi-speed Select, Bit 3 (MSB)           |      |
| JG                           | 06    | Jogging                                   |      |
| DB                           | 07    | External DC braking                       |      |
| SET                          | 08    | Set (select) 2nd Motor Data               |      |
| 2CH                          | 09    | 2-stage Acceleration and Deceleration     |      |
| FRS                          | 11    | Free-run Stop                             |      |
| EXT                          | 12    | External Trip                             |      |
| USP                          | 13    | Unattended Start Protection               |      |
| CS                           | 14    | Commercial power source switchover        |      |
| SFT                          | 15    | Software Lock                             |      |
| AT                           | 16    | Analog Input Voltage/Current Select       |      |
| RS                           | 18    | Reset Inverter                            |      |
| PTC                          | 19    | PTC thermistor Thermal Protection         |      |
| STA                          | 20    | Start (3-wire interface)                  |      |
| STP                          | 21    | Stop (3-wire interface)                   |      |
| F/R                          | 22    | FWD, REV (3-wire interface)               |      |
| PID                          | 23    | PID Disable                               |      |
| PIDC                         | 24    | PID Reset                                 |      |
| UP                           | 27    | Remote Control UP Function                |      |
| DWN                          | 28    | Remote Control Down Function              |      |
| UDC                          | 29    | Remote Control Data Clearing              |      |
| OPE                          | 31    | Operator Control                          |      |
| SF1~SF7                      | 32~38 | Multi-speed Select, Bit operation Bit 1~7 |      |
| OLR                          | 39    | Overload Restriction Source Changeover    |      |
| TL                           | 40    | Torque Limit Selection                    |      |
| TRQ1                         | 41    | Torque limit switch 1                     |      |
| TRQ2                         | 42    | Torque limit switch 2                     |      |
| BOK                          | 44    | Brake confirmation                        |      |
| LAC                          | 46    | LAD cancellation                          |      |
| PCLR                         | 47    | Pulse counter clear                       |      |
| ADD                          | 50    | ADD frequency enable                      |      |
| F-TM                         | 51    | Force Terminal Mode                       |      |
| ATR                          | 52    | Permission for torque command input       |      |
| KHC                          | 53    | Clear watt-hour data                      |      |
| MI1~MI7                      | 56~62 | General purpose input (1)~(7)             |      |
| AHD                          | 65    | Analog command hold                       |      |
| CP1~CP3                      | 66~68 | Multistage-position switch (1)~(3)        |      |
| ORL                          | 69    | Limit signal of zero-return               |      |
| ORG                          | 70    | Trigger signal of zero-return             |      |
| SPD                          | 73    | Speed/position changeover                 |      |
| GS1                          | 77    | STO1 input (Safety related signal)        |      |
| GS2                          | 78    | STO2 input (Safety related signal)        |      |
| 485                          | 81    | Starting communication signal             |      |
| PRG                          | 82    | Executing EzSQ program                    |      |
| HLD                          | 83    | Retain output frequency                   |      |
| ROK                          | 84    | Permission of Run command                 |      |
| EB                           | 85    | Rotation direction detection (phase B)    |      |

Use the following table to locate pages for intelligent input material in this chapter.

| Input Function Summary Table |      |                    |      |
|------------------------------|------|--------------------|------|
| Symbol                       | Code | Function Name      | Page |
| DISP                         | 86   | Display limitation |      |
| NO                           | 255  | No assign          |      |

## Intelligent Outputs

Use the following table to locate pages for intelligent output material in this chapter.

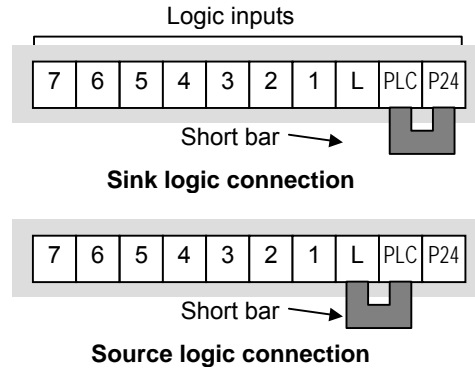
| Input Function Summary Table |       |  |      |
|------------------------------|-------|--|------|
| Symbol                       | Code  | Function Name  | Page |
| RUN                          | 00    | Run Signal   |      |
| FA1                          | 01    | Frequency Arrival Type 1–Constant Speed                                |      |
| FA2                          | 02    | Frequency Arrival Type 2–Over frequency                                |      |
| OL                           | 03    | Overload Advance Notice Signal   |      |
| OD                           | 04    | PID Deviation error signal   |      |
| AL                           | 05    | Alarm Signal   |      |
| FA3                          | 06    | Frequency Arrival Type 3–Set frequency                                 |      |
| OTQ                          | 07    | Over/under Torque Threshold  |      |
| UV                           | 09    | Undervoltage   |      |
| TRQ                          | 10    | Torque Limited Signal  |      |
| RNT                          | 11    | Run Time Expired   |      |
| ONT                          | 12    | Power ON time Expired  |      |
| THM                          | 13    | Thermal Warning  |      |
| BRK                          | 19    | Brake Release Signal   |      |
| BER                          | 20    | Brake Error Signal   |      |
| ZS                           | 21    | Zero Hz Speed Detection Signal   |      |
| DSE                          | 22    | Speed Deviation Excessive  |      |
| POK                          | 23    | Positioning Completion   |      |
| FA4                          | 24    | Frequency Arrival Type 4–Over frequency                                |      |
| FA5                          | 25    | Frequency Arrival Type 5–Set frequency                                 |      |
| OL2                          | 26    | Overload Advance Notice Signal 2                                       |      |
| ODc                          | 27    | Analog Voltage Input Disconnect Detection                              |      |
| OIDc                         | 28    | Analog Voltage Output Disconnect Detection                             |      |
| FBV                          | 31    | PID Second Stage Output  |      |
| NDc                          | 32    | Network Disconnect Detection   |      |
| LOG1~3                       | 33~35 | Logic Output Function 1~3  |      |
| WAC                          | 39    | Capacitor Life Warning Signal  |      |
| WAF                          | 40    | Cooling Fan Warning Signal   |      |
| FR                           | 41    | Starting Contact Signal  |      |
| OHF                          | 42    | Heat Sink Overheat Warning   |      |
| LOC                          | 43    | Low load detection   |      |
| MO1~3                        | 44~46 | General Output 1~3   |      |
| IRDY                         | 50    | Inverter Ready Signal  |      |
| FWR                          | 51    | Forward Operation  |      |
| RVR                          | 52    | Reverse Operation  |      |
| MJA                          | 53    | Major Failure Signal   |      |
| WCO                          | 54    | Window Comparator for Analog Voltage Input                             |      |
| WCOI                         | 55    | Window Comparator for Analog Current Input                             |      |
| FREF                         | 58    | Frequency Command Source   |      |
| REF                          | 59    | Run Command Source   |      |
| SETM                         | 60    | 2 <sup>nd</sup> Motor in operation                                     |      |
| EDM                          | 62    | STO (Safe Torque Off) Performance Monitor<br>(Output terminal 11 only) |      |
| OP                           | 63    | Option control signal  |      |
| no                           | 255   | Not used   |      |

# Using Intelligent Input Terminals

Terminals [1], [2], [3], [4], [5], [6] and [7] are identical, programmable inputs for general use. The input circuits can use the inverter's internal (isolated) +24V field supply or an external power supply. This section describes input circuits operation and how to connect them properly to switches or transistor outputs on field devices.

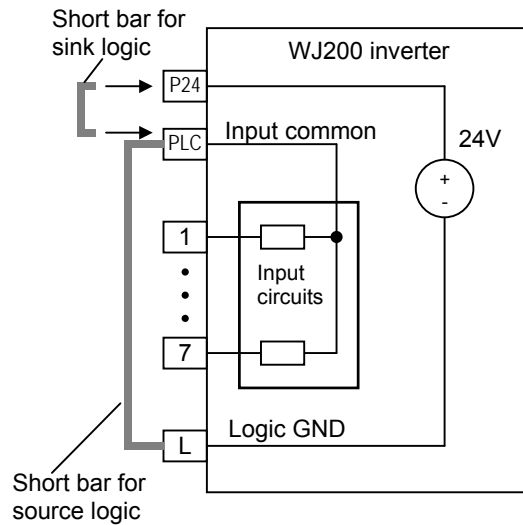
The WJ200 inverter features selectable *sinking* or *sourcing* inputs. These terms refer to the connection to the external switching device—it either *sinks* current (from the input to GND) or *sources* current (from a power source) into the input. Note that the sink/source naming convention may be different in your particular country or industry. In any case, just follow the wiring diagrams in this section for your application.

The inverter has a short bar (jumper) for configuring the choice of sinking or sourcing inputs. To access it, you must remove the front cover of the inverter housing. In the figure to the top right, the short bar is shown as attached to the logic terminal block (connector). For EU and US version (suffix -xFE, and -xFU), it is originally located as source type logic. If you need to change to the sink type connection, remove the short bar and connect it as shown in the figure at the bottom right.



**CAUTION:** Be sure to turn OFF power to the inverter before changing the short circuit bar position. Otherwise, damage to the inverter circuitry may occur.

[PLC] Terminal Wiring – The [PLC] terminal (Programmable Logic Control terminal) is named to include various devices that can connect to the inverter's logic inputs. In the figure to the right, note the [PLC] terminal and the short bar (jumper). Locating the short bar between [PLC] and [L] sets the input logic source type, which is the default setting for EU and US versions. In this case, you connect input terminal to [P24] to make it active. If instead you locate the short bar between [PLC] and [P24], the input logic will be sink type. In this case, you connect the input terminal to [L] to make it active.

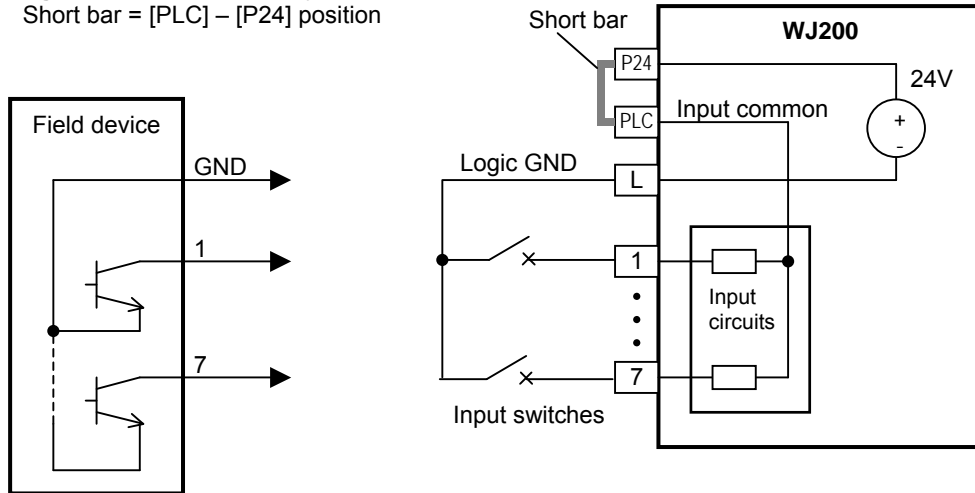


The wiring diagram on the following pages show the four combinations of using sourcing or sinking inputs, and using the internal or an external DC supply.

The two diagrams below input wiring circuits using the inverter's internal +24V supply. Each diagram shows the connection for simple switches, or for a field device with transistor outputs. Note that in the lower diagram, it is necessary to connect terminal [L] only when using the field device with transistors. Be sure to use the correct connection of the short bar shown for each wiring diagram.

**Sinking Inputs, Internal Supply**

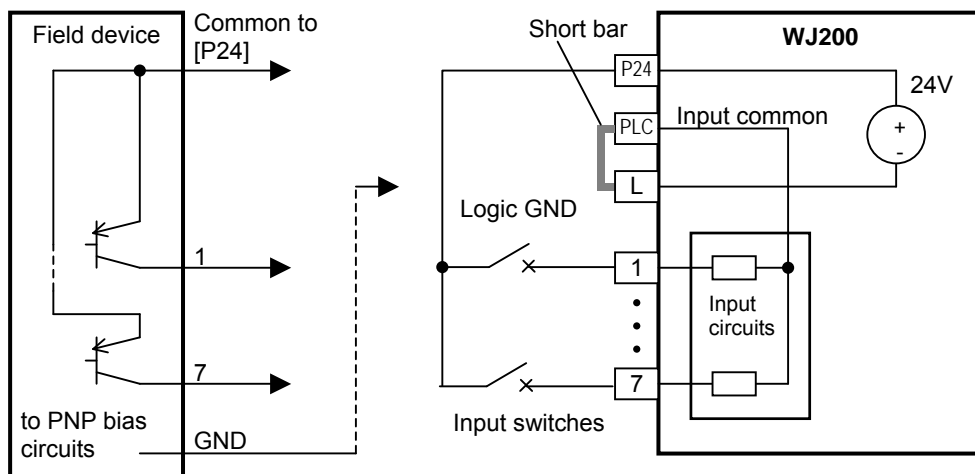
Short bar = [PLC] – [P24] position



Open collector outputs,  
NPN transistors

**Sourcing Inputs, Internal Supply**

Short bar = [PLC] – [L] position

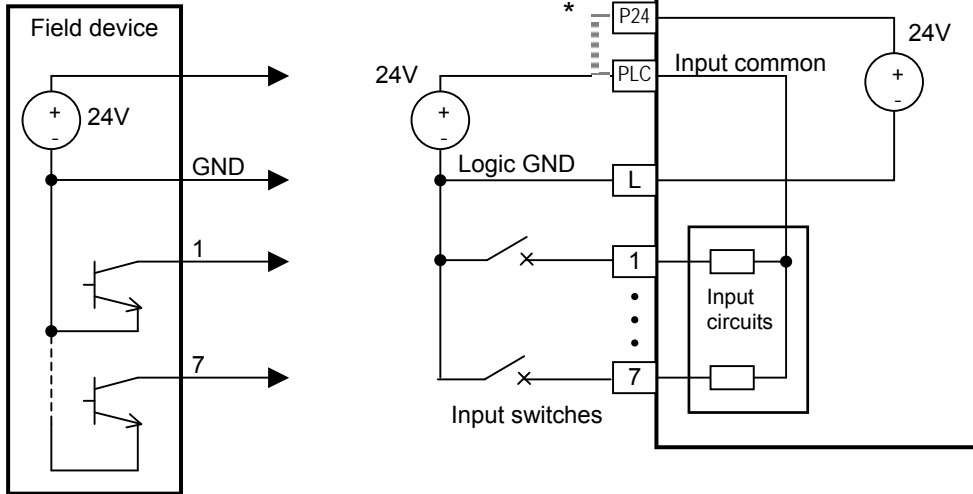


PNP transistor  
sourcing outputs

The two diagrams below show input wiring circuits using an external supply. If using the "Sinking Inputs, External Supply" in below wiring diagram, be sure to remove the short bar, and use a diode (\*) with the external supply. This will prevent a power supply contention in case the short bar is accidentally placed in the incorrect position. For the "Sourcing Inputs, External Supply", please connect the short bar as drawn in the diagram below.

**Sinking Inputs, External Supply**

Short bar = Removed

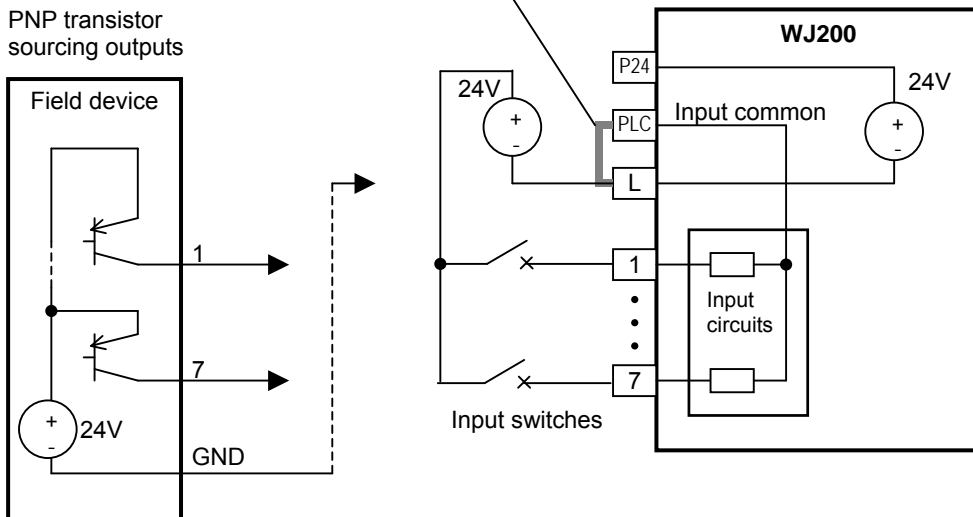


Open collector outputs,  
NPN transistors

\* Note: Make sure to remove the short circuit bar in case of using an external power supply.

**Sourcing Inputs, External Supply**

Short bar = [PLC] – [L]



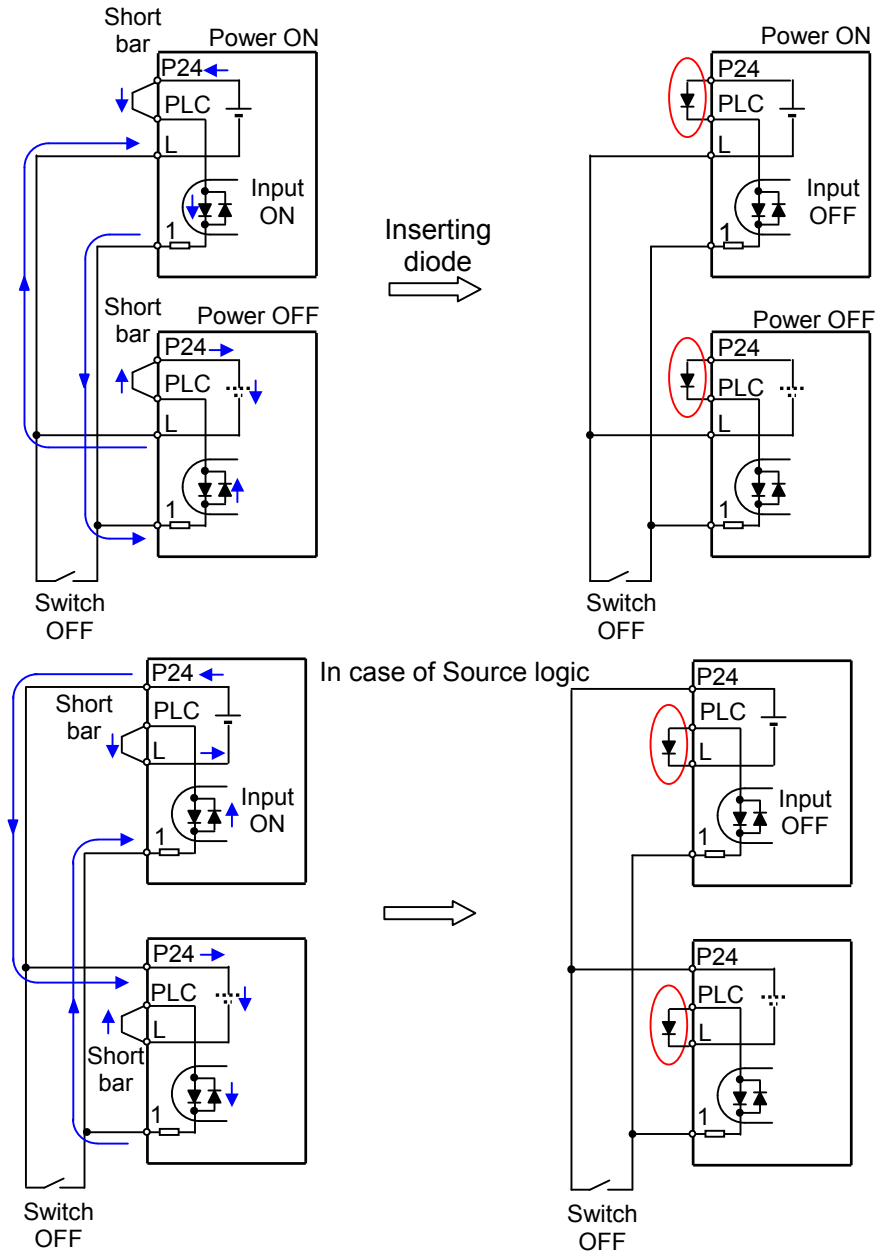
PNP transistor  
sourcing outputs



**CAUTION:** Be sure to diode in between "P24" and "PLC" when connecting plural inverters with digital input wiring in common.

The power to the inverter control part can be supplied externally as shown below. Except driving motor, it is possible read and write the parameters by keypad and via communication even the drive itself is not powered.

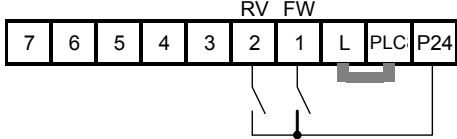
By having ability inverter doesn't block the current flowing into itself when it is not powered. This may cause the closed circuit when two or more inverters are connected to common I/O wiring as shown below to result in unexpected turning the on the input. To avoid this closed circuit, please put the diode (rated:50V/0.1A) in the path as described below.





## Forward Run/Stop and Reverse Run/Stop Commands:

When you input the Run command via the terminal [FW], the inverter executes the Forward Run command (high) or Stop command (low). When you input the Run command via the terminal [RV], the inverter executes the Reverse Run command (high) or Stop command (low).

| Option Code   | Terminal Symbol | Function Name    | State | Description  |
|---|-----------------|------------------|-------|--|
| 00  | FW              | Forward Run/Stop | ON    | Inverter is in Run Mode, motor runs forward  |
|   |                 |                  | OFF   | Inverter is in Stop Mode, motor stops  |
| 01  | RV              | Reverse Run/Stop | ON    | Inverter is in Run Mode, motor runs reverse  |
|   |                 |                  | OFF   | Inverter is in Stop Mode, motor stops  |
| <b>Valid for inputs:</b>  |                 | C00 1~C007       |       | Example (default input configuration shown – see <a href="#">page 3-49</a> )<br><br> |
| <b>Required settings</b>  |                 | A002 = 01        |       |  |
| <b>Notes:</b> <ul style="list-style-type: none"> <li>When the Forward Run and Reverse Run commands are active at the same time, the inverter enters the Stop Mode.</li> <li>When a terminal associated with either [FW] or [RV] function is configured for <i>normally closed</i>, the motor starts rotation when that terminal is disconnected or otherwise has no input voltage.</li> </ul> |                 |                  |       |  |
|   |                 |                  |       | See I/O specs on <a href="#">page 4-6</a> .  |



**NOTE:** The parameter **F004**, Keypad Run Key Routing, determines whether the single Run key issues a Run FWD command or Run REV command. However, it has no effect on the [FW] and [RV] input terminal operation.



**WARNING:** If the power is turned ON and the Run command is already active, the motor starts rotation and is dangerous! Before turning power ON, confirm that the Run command is not active.

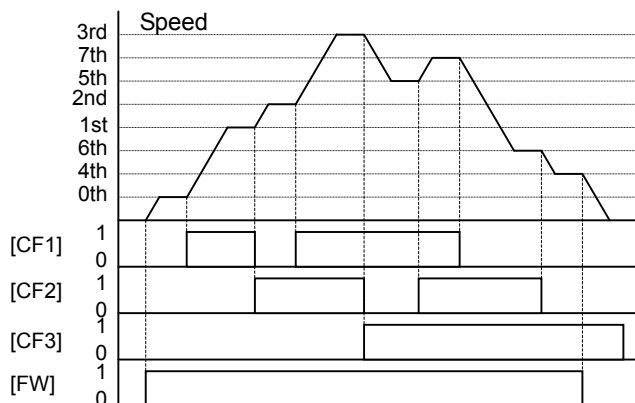
## Multi-Speed Select ~Binary Operation

The inverter can store up to 16 different target frequencies (speeds) that the motor output uses for steady-state run condition. These speeds are accessible through programming four of the intelligent terminals as binary-encoded inputs CF1 to CF4 per the table to the right. These can be any of the six inputs, and in any order. You can use fewer inputs if you need eight or fewer speeds.



**NOTE:** When choosing a subset of speeds to use, always start at the top of the table, and with the least-significant bit: CF1, CF2, etc.

| Multi-speed | Input Function |     |     |     |
|-------------|----------------|-----|-----|-----|
|             | CF4            | CF3 | CF2 | CF1 |
| Speed 0     | 0              | 0   | 0   | 0   |
| Speed 1     | 0              | 0   | 0   | 1   |
| Speed 2     | 0              | 0   | 1   | 0   |
| Speed 3     | 0              | 0   | 1   | 1   |
| Speed 4     | 0              | 1   | 0   | 0   |
| Speed 5     | 0              | 1   | 0   | 1   |
| Speed 6     | 0              | 1   | 1   | 0   |
| Speed 7     | 0              | 1   | 1   | 1   |
| Speed 8     | 1              | 0   | 0   | 0   |
| Speed 9     | 1              | 0   | 0   | 1   |
| Speed 10    | 1              | 0   | 1   | 0   |
| Speed 11    | 1              | 0   | 1   | 1   |
| Speed 12    | 1              | 1   | 0   | 0   |
| Speed 13    | 1              | 1   | 0   | 1   |
| Speed 14    | 1              | 1   | 1   | 0   |
| Speed 15    | 1              | 1   | 1   | 1   |



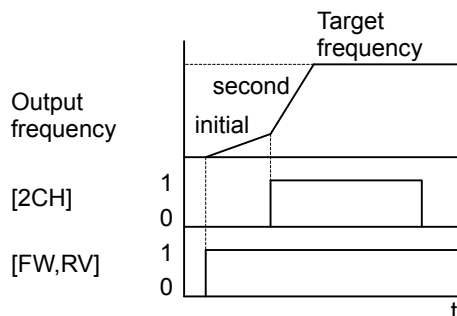
The example with eight speeds in the figure below shows how input switches configured for CF1–CF3 functions can change the motor speed in real time.

**NOTE:** Speed 0 depends on **ADD 1** parameter value.

| Option Code   | Terminal Symbol | Function Name                        | State | Description  |
|---|-----------------|--------------------------------------|-------|--|
| <b>02</b>   | CF1             | Multi-speed Select, Bit 0 (LSB)      | ON    | Binary encoded speed select, Bit 0, logical 1  |
|   |                 |                                      | OFF   | Binary encoded speed select, Bit 0, logical 0  |
| <b>03</b>   | CF2             | Multi-speed Select, Bit 1            | ON    | Binary encoded speed select, Bit 1, logical 1  |
|   |                 |                                      | OFF   | Binary encoded speed select, Bit 1, logical 0  |
| <b>04</b>   | CF3             | Multi-speed Select, Bit 2            | ON    | Binary encoded speed select, Bit 2, logical 1  |
|   |                 |                                      | OFF   | Binary encoded speed select, Bit 2, logical 0  |
| <b>05</b>   | CF4             | Multi-speed Select, Bit 3 (MSB)      | ON    | Binary encoded speed select, Bit 3, logical 1  |
|   |                 |                                      | OFF   | Binary encoded speed select, Bit 3, logical 0  |
| <b>Valid for inputs:</b>  |                 | <b>C00 1~C00 7</b>                   |       | Example (some CF inputs require input configuration; some are default inputs):<br><br> |
| <b>Required settings</b>  |                 | <b>F00 1, ADD 1=02, A020 to A035</b> |       |  |
| <b>Notes:</b> <ul style="list-style-type: none"> <li>When programming the multi-speed settings, be sure to press the SET key each time and then set the next multi-speed setting. Note that when the key is not pressed, no data will be set.</li> <li>When a multi-speed setting more than 50Hz (60Hz) is to be set, it is necessary to program the maximum frequency <b>A004</b> high enough to allow that speed</li> </ul> |                 |                                      |       |  |
|   |                 |                                      |       | See I/O specs on <a href="#">page 4–6</a> .  |

## Two Stage Acceleration and Deceleration

When terminal [2CH] is turned ON, the inverter changes the rate of acceleration and deceleration from the initial settings (**F002** and **F003**) to use the second set of acceleration/ deceleration values. When the terminal is turned OFF, the inverter is returned to the original acceleration and deceleration time (**F002** acceleration time 1, and **F003** deceleration time 1). Use **A092** (acceleration time 2) and **A093** (deceleration time 2) to set the second stage acceleration and deceleration times.



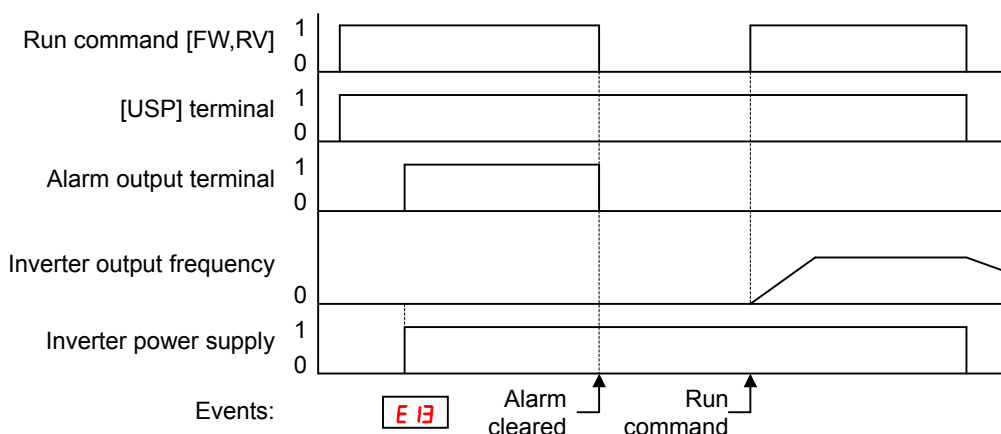
In the graph shown above, the [2CH] becomes active during the initial acceleration. This causes the inverter to switch from using acceleration 1 (**F002**) to acceleration 2 (**A092**).

| Option Code              | Terminal Symbol | Function Name  | State | Description   |
|--------------------------|-----------------|--|-------|---|
| <b>09</b>                | 2CH             | Two-stage Acceleration and Deceleration  | ON    | Frequency output uses 2nd-stage acceleration and deceleration values        |
|                          |                 |  | OFF   | Frequency output uses the initial acceleration 1 and deceleration 1 values  |
| <b>Valid for inputs:</b> |                 | <b>C00 1~C007</b>  |       | Example (default input configuration shown—see <a href="#">page 3-49</a> ): |
| <b>Required settings</b> |                 | <b>A092, A093, A094=00</b>   |       |   |
| <b>Notes:</b>            |                 | <ul style="list-style-type: none"> <li>Function <b>A094</b> selects the method for second stage acceleration. It must be set = <b>00</b> to select the input terminal method in order for the [2CH] terminal assignment to operate.</li> </ul> |       |   |
|                          |                 |  |       | <p>See I/O specs on <a href="#">page 4-6</a>.</p>                           |

## Unattended Start Protection

If the Run command is already set when power is turned ON, the inverter starts running immediately after powerup. The Unattended Start Protection (USP) function prevents that automatic startup, so that the inverter *will not* run without outside intervention. When USP is active and you need to reset an alarm and resume running, either turn the Run command OFF, or perform a reset operation by the terminal [RS] input or the keypad Stop/reset key.

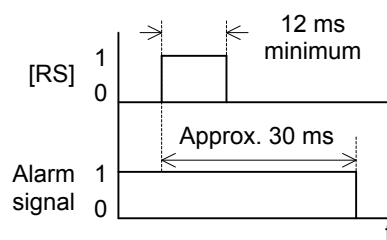
In the figure below, the [USP] feature is enabled. When the inverter power turns ON, the motor does not start, even though the Run command is already active. Instead, it enters the USP trip state, and displays **E 13** error code. This requires outside intervention to reset the alarm by turning OFF the Run command per this example (or applying a reset). Then the Run command can turn ON again and start the inverter output.



| Option Code   | Terminal Symbol | Function Name               | State | Description  |
|---|-----------------|-----------------------------|-------|--|
| <b>E 13</b>   | USP             | Unattended Start Protection | ON    | On powerup, the inverter will not resume a Run command (mostly used in the US)   |
|   |                 |                             | OFF   | On powerup, the inverter will resume a Run command that was active before power loss   |
| <b>Valid for inputs:</b>  |                 | <b>C00 1~C00 7</b>          |       | Example (default input configuration shown for –FE and –FU models; –F models require input configuration—see <a href="#">page 3–49</a> ):  |
| <b>Required settings</b>  |                 | (none)                      |       |  |
| <b>Notes:</b>   |                 |                             |       |  |
| <ul style="list-style-type: none"> <li>Note that when a USP error occurs and it is canceled by a reset from a [RS] terminal input, the inverter restarts running immediately.</li> <li>Even when the trip state is canceled by turning the terminal [RS] ON and OFF after an under voltage protection <b>E 09</b> occurs, the USP function will be performed.</li> <li>When the running command is active immediately after the power is turned ON, a USP error will occur. When this function is used, wait for at least three (3) seconds after the powerup to generate a Run command.</li> </ul> |                 |                             |       | <p>The diagram shows a terminal block with terminals 7, 6, 5, 4, 3, 2, 1, L, PLC, and P24. Terminal 1 is labeled 'USP'. A switch is connected between terminal 1 and terminal L.</p> |
|   |                 |                             |       | See I/O specs on <a href="#">page 4–6</a> .  |

## Reset Inverter

The [RS] terminal causes the inverter to execute the reset operation. If the inverter is in Trip Mode, the reset cancels the Trip state. When the signal [RS] is turned ON and OFF, the inverter executes the reset operation. The minimum pulse width for [RS] must be 12 ms or greater. The alarm output will be cleared within 30 ms after the onset of the Reset command.

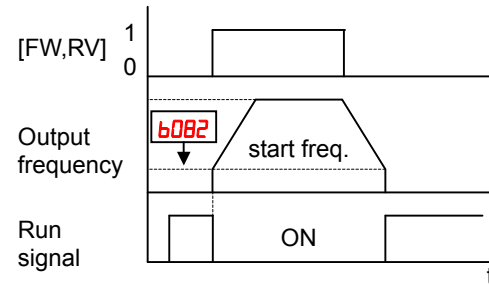


**WARNING:** After the Reset command is given and the alarm reset occurs, the motor will restart suddenly if the Run command is already active. Be sure to set the alarm reset after verifying that the Run command is OFF to prevent injury to personnel.

| Option Code  | Terminal Symbol | Function Name     | State | Description   |
|--|-----------------|-------------------|-------|---|
| <b>I8</b>  | RS              | Reset Inverter    | ON    | The motor output is turned OFF, the Trip Mode is cleared (if it exists), and powerup reset is applied |
|  |                 |                   | OFF   | Normal power ON operation   |
| <b>Valid for inputs:</b>   |                 | <b>C00 1~C007</b> |       | Example (default input configuration shown):  |
| <b>Required settings</b>   |                 | (none)            |       |   |
| <b>Notes:</b> <ul style="list-style-type: none"> <li>While the control terminal [RS] input is ON, the keypad displays alternating segments. After RS turns OFF, the display recovers automatically.</li> <li>Pressing the Stop/Reset key of the digital operator can generate a reset operation only when an alarm occurs.</li> </ul>  |                 |                   |       |   |
| <p>The diagram shows a keypad with 12 segments labeled 7, 6, 5, 4, 3, 2, 1, L, PLC, P24. A switch is connected to the L segment, and the label 'RS' is placed above the switch. The L segment is highlighted with a grey background.</p>   |                 |                   |       |   |
| <ul style="list-style-type: none"> <li>A terminal configured with the [RS] function can only be configured for normally open operation. The terminal cannot be used in the normally closed contact state.</li> <li>When input power is turned ON, the inverter performs the same reset operation as it does when a pulse on the [RS] terminal occurs.</li> <li>The Stop/Reset key on the inverter is only operational for a few seconds after inverter powerup when a hand-held remote operator is connected to the inverter.</li> <li>If the [RS] terminal is turned ON while the motor is running, the motor will be free running (coasting).</li> <li>If you are using the output terminal OFF delay feature (any of <b>C 145</b>, <b>C 147</b>, <b>C 149</b> &gt; 0.0 sec.), the [RS] terminal affects the ON-to-OFF transition slightly. Normally (without using OFF delays), the [RS] input causes the motor output and the logic outputs to turn OFF together, immediately. However, when any output uses an OFF delay, then after the [RS] input turns ON, that output will remain ON for an additional 1 sec. period (approximate) before turning OFF.</li> </ul> |                 |                   |       |   |

## Run Signal

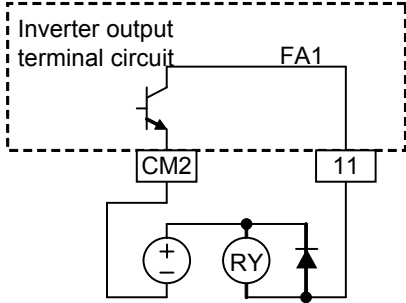
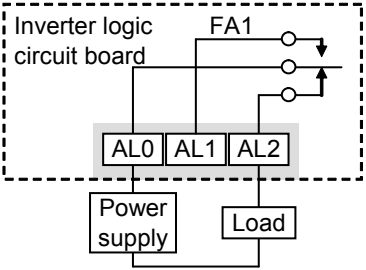
When the [RUN] signal is selected as an intelligent output terminal, the inverter outputs a signal on that terminal when it is in Run Mode. The output logic is active low, and is the open collector type (switch to ground).



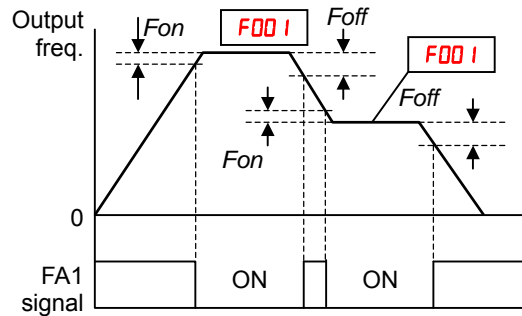
| Option Code   | Terminal Symbol | Function Name     | State | Description  |
|---|-----------------|-------------------|-------|--|
| <b>00</b>   | RUN             | Run Signal        | ON    | when inverter is in Run Mode   |
|   |                 |                   | OFF   | when inverter is in Stop Mode  |
| <b>Valid for inputs:</b>  |                 | 11, 12, AL0 – AL2 |       | Example for terminal [11] (default output configuration shown – see <a href="#">page 3-54</a> ): |
| <b>Required settings</b>  |                 | (none)            |       |  |
| <p><b>Notes:</b></p> <ul style="list-style-type: none"> <li>The inverter outputs the [RUN] signal whenever the inverter output exceeds the start frequency specified by parameter <b>b002</b>. The start frequency is the initial inverter output frequency when it turns ON.</li> <li>The example circuit for terminal [11] drives a relay coil. Note the use of a diode to prevent the negative going turn-off spike generated by the coil from damaging the inverter's output transistor.</li> </ul> |                 |                   |       |  |
| <p>Example for terminal [AL0], [AL1], [AL2] (requires output configuration – see <a href="#">page 4-35 and 3-54</a>):</p> <p>The diagram shows an inverter logic circuit board with three terminals: AL0, AL1, and AL2. A power supply is connected to the board. The RUN signal is shown as a pulse. A load is connected to the output of the logic circuit.</p>   |                 |                   |       |  |
| See I/O specs on <a href="#">page 4-6</a>   |                 |                   |       |  |

## Frequency Arrival Signals

The *Frequency Arrival* group of outputs helps coordinate external systems with the current velocity profile of the inverter. As the name implies, output [FA1] turns ON when the output frequency arrives at the standard set frequency (parameter F001). Output [FA2] relies on programmable accel/ decel thresholds for increased flexibility. For example, you can have an output turn ON at one frequency during acceleration, and have it turn OFF at a different frequency during deceleration. All transitions have hysteresis to avoid output chatter if the output frequency is near one of the thresholds.

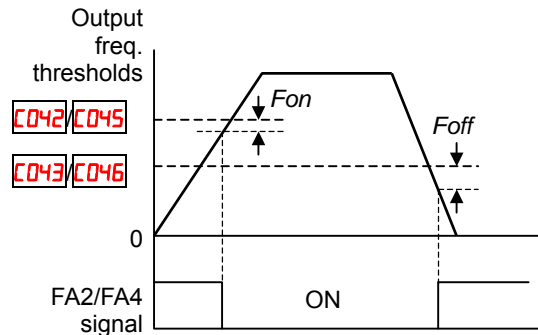
| Option Code  | Terminal Symbol | Function Name                                 | State | Description  |
|--|-----------------|---|-------|--|
| 01   | FA1             | Frequency Arrival Type 1 – Constant Speed     | ON    | when output to motor is at the constant frequency  |
|  |                 |   | OFF   | when output to motor is OFF, or in any acceleration or deceleration ramp                                     |
| 02   | FA2             | Frequency Arrival Type 2 – Over frequency     | ON    | when output to motor is at or above the set frequency thresholds for, even if in acceleration or decel ramps |
|  |                 |   | OFF   | when output to motor is OFF, or during accel or decel before the respective thresholds are crossed           |
| 06   | FA3             | Frequency Arrival Type 3 – Set frequency      | ON    | when output to motor is at the set frequency   |
|  |                 |   | OFF   | when output to motor is OFF, or in any acceleration or deceleration ramp                                     |
| 24   | FA4             | Frequency Arrival Type 4 – Over frequency (2) | ON    | when output to motor is at or above the set frequency thresholds for, even if in acceleration or decel ramps |
|  |                 |   | OFF   | when output to motor is OFF, or during accel or decel before the respective thresholds are crossed           |
| 25   | FA5             | Frequency Arrival Type 5 – Set frequency (2)  | ON    | when output to motor is at the set frequency   |
|  |                 |   | OFF   | when output to motor is OFF, or in any acceleration or deceleration ramp                                     |
| <b>Valid for inputs:</b>   |                 | 11, 12, AL0 – AL2                             |       | Example for terminal [11] (default output configuration shown – see page 3-54):                              |
| <b>Required settings</b>   |                 | C042, C043, C045, C046,                       |       |  |
| <b>Notes:</b> <ul style="list-style-type: none"> <li>For most applications you will need to use only one type of frequency arrival outputs (see examples). However, it is possible assign both output terminals to output functions [FA1] and [FA2]</li> <li>For each frequency arrival threshold, the output anticipates the threshold (turns ON early) by 1.5Hz</li> <li>The output turns OFF as the output frequency moves away from the threshold, delayed by 0.5Hz</li> <li>The example circuit for terminal [11] drives a relay coil. Note the use of a diode to prevent the negative going turn-off spike generated by the coil from damaging the inverter's output transistor</li> </ul> |                 |   |       |  |
| Example for terminal [AL0], [AL1], [AL2] (requires output configuration – see page 54):    |                 |   |       |  |
| Example for terminal [AL0], [AL1], [AL2] (requires output configuration – see page 54):    |                 |   |       |  |
| See I/O specs on <a href="#">page 4-6</a>  |                 |   |       |  |

Frequency arrival output [FA1] uses the standard output frequency (parameter F001) as the threshold for switching. In the figure to the right, Frequency Arrival [FA1] turns ON when the output frequency gets within  $F_{on}$  Hz below or  $F_{on}$  Hz above the target constant frequency, where  $F_{on}$  is 1% of the set maximum frequency and  $F_{off}$  is 2% of the set maximum frequency. This provides hysteresis that prevents output chatter near the threshold value. The hysteresis effect causes the output to turn ON slightly *early* as the speed approaches the threshold. Then the turn-OFF point is slightly *delayed*. Note the active low nature of the signal, due to the open collector output.



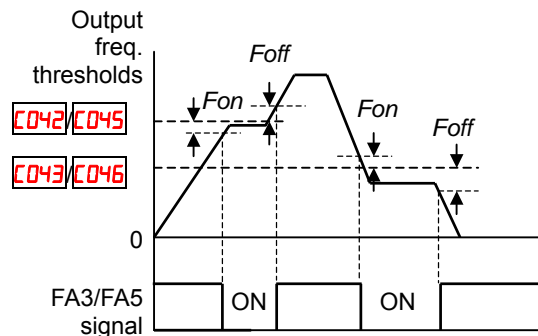
$F_{on}$ =1% of max. frequency  
 $F_{off}$ =2% of max. frequency

Frequency arrival output [FA2/FA4] works the same way; it just uses two separate thresholds as shown in the figure to the right. These provide for separate acceleration and deceleration thresholds to provide more flexibility than for [FA1]. [FA2/FA4] uses C042/C045 during acceleration for the ON threshold, and C043/C046 during deceleration for the OFF threshold. This signal also is active low. Having different accel and decel thresholds provides an asymmetrical output function. However, you can use equal ON and OFF thresholds, if desired.



$F_{on}$ =1% of max. frequency  
 $F_{off}$ =2% of max. frequency

Frequency arrival output [FA3/FA5] works also the same way, only difference is arriving at set frequency.

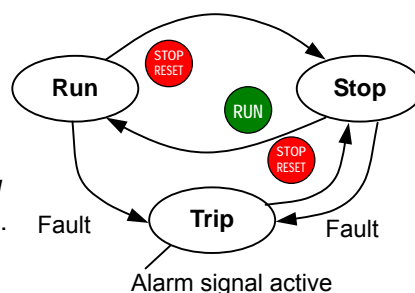


$F_{on}$ =1% of max. frequency  
 $F_{off}$ =2% of max. frequency



## Alarm Signal

The inverter alarm signal is active when a fault has occurred and it is in the Trip Mode (refer to the diagram at right). When the fault is cleared the alarm signal becomes inactive.



We must make a distinction between the alarm *signal* AL and the alarm relay *contacts* [AL0], [AL1] and [AL2]. The signal AL is a logic function, which you can assign to the open collector output terminals [11], [12], or the relay outputs.

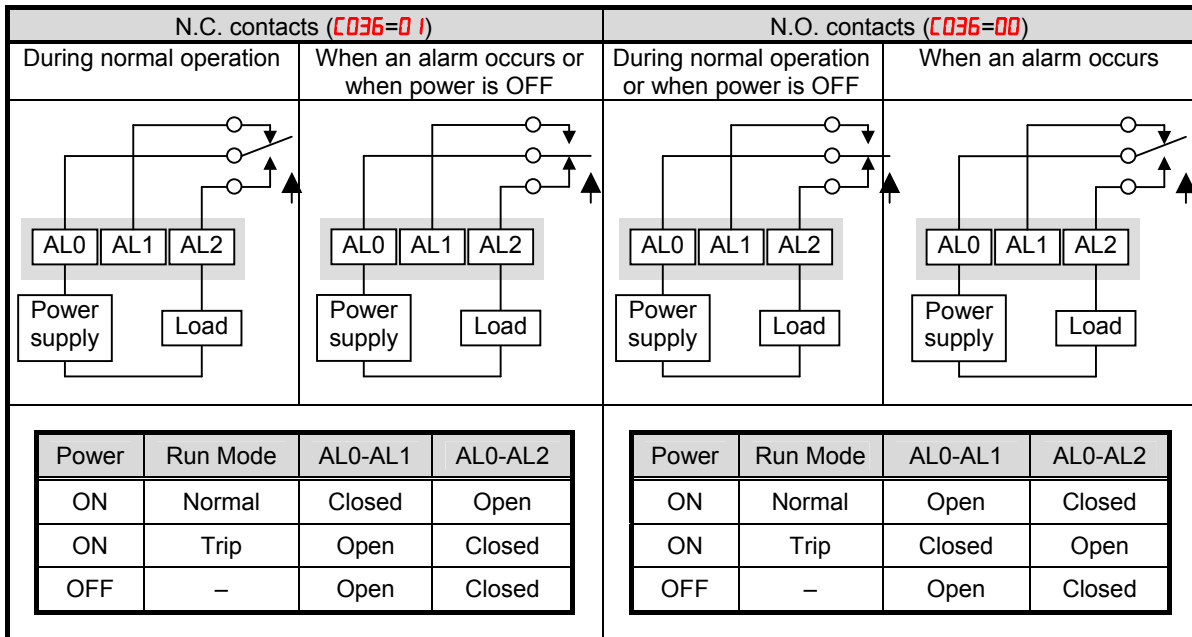
The most common (and default) use of the relay is for AL, thus the labeling of its terminals. Use an open collector output (terminal [11] or [12]) for a low-current logic signal interface or to energize a small relay (50 mA maximum). Use the relay output to interface to higher voltage and current devices (10 mA minimum).

| Option Code   | Terminal Symbol | Function Name           | State  | Description  |
|---|-----------------|-------------------------|--|--|
| 05  | AL              | Alarm Signal            | ON   | when an alarm signal has occurred and has not been cleared     |
|   |                 |                         | OFF  | when no alarm has occurred since the last clearing of alarm(s) |
| <b>Valid for inputs:</b>  |                 | 11, 12, AL0 – AL2       | Example for terminal [11] (default output configuration shown – see <a href="#">page 3-54</a> ): |  |
| <b>Required settings</b>  |                 | <b>C031, C032, C036</b> |  |  |
| <p><b>Notes:</b></p> <ul style="list-style-type: none"> <li>By default, the relay is configured as normally closed (<b>C036=01</b>). Refer to the next page for an explanation.</li> <li>In the default relay configuration, an inverter power loss turns ON the alarm output. the alarm signal remains ON as long as the external control circuit has power.</li> <li>When the relay output is set to normally closed, a time delay of less than 2 seconds occurs after powerup before the contact is closed.</li> <li>Terminals [11] and [12] are open collector outputs, so the electric specifications of [AL] are different from the contact output terminals [AL0], [AL1], [AL2].</li> <li>This signal output has the delay time (300 ms nominal) from the fault alarm output.</li> <li>The relay contact specifications are in <a href="#">“Control Logic Signal Specifications”</a> on <a href="#">page 4-6</a>. The contact diagrams for different conditions are on the next page.</li> </ul> |                 |                         |  |  |
| <p>Example for terminal [AL0], [AL1], [AL2] (requires output configuration – see <a href="#">page 4-35</a> and <a href="#">3-54</a>):</p> <p>See I/O specs on <a href="#">page 4-6</a></p>  |                 |                         |  |  |

The alarm relay output can be configured in two main ways:

- **Trip/Power Loss Alarm** – The alarm relay is configured as normally closed (**C036=0 1**) by default, shown below (left). An external alarm circuit that detects broken wiring also as an alarm connects to [AL0] and [AL1]. After powerup and short delay (< 2 seconds), the relay energizes and the alarm circuit is OFF. Then, either an inverter trip event or an inverter power loss will de-energize the relay and open the alarm circuit
- **Trip Alarm** – Alternatively, you can configure the relay as normally open (**C036=00**), shown below (right). An external alarm circuit that detects broken wiring also as an alarm connects to [AL0] and [AL2]. After powerup, the relay energizes only when an inverter trip event occurs, opening the alarm circuit. However, in this configuration, an inverter power loss does not open the alarm circuit.

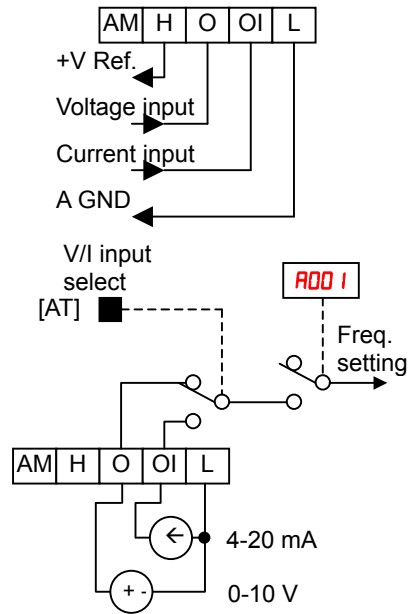
Be sure to use the relay configuration that is appropriate for your system design. Note that the external circuits shown assume that a closed circuit = no alarm condition (so that a broken wire also causes an alarm). However, some systems may require a closed circuit = alarm condition. In that case, then use the opposite terminal [AL1] or [AL2] from the ones shown.



# Analog Input Operation

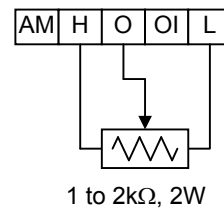
The WJ200 inverters provide for analog input to command the inverter frequency output value. The analog input terminal group includes the [L], [OI], [O], and [H] terminals on the control connector, which provide for Voltage [O] or Current [OI] input. All analog input signals must use the analog ground [L].

If you use either the voltage or current analog input, you must select one of them using the logic input terminal function [AT] analog type. Refer to the table on next page showing the activation of each analog input by combination of **ADD5** set parameter and [AT] terminal condition. The [AT] terminal function is covered in “Analog Input Current/Voltage Select” in section 4. Remember that you must also set **ADD1 = 01** to select analog input as the frequency source.

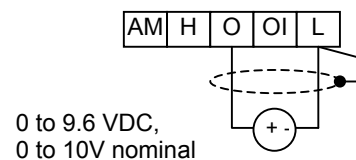


**NOTE:** If no logic input terminal is configured for the [AT] function, then inverter recognizes that [AT]=OFF and MCU recognizes [O]+[OI] as analog input.

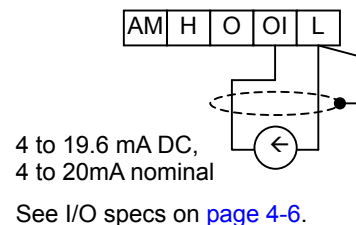
Using an external potentiometer is a common way to control the inverter output frequency (and a good way to learn how to use the analog inputs). The potentiometer uses the built-in 10V reference [H] and the analog ground [L] for excitation, and the voltage input [O] for the signal. By default, the [AT] terminal selects the voltage input when it is OFF. Take care to use the proper resistance for the potentiometer, which is 1~2 k $\Omega$ , 2 Watts.



**Voltage Input** – The voltage input circuit uses terminals [L] and [O]. Attach the signal cable’s shield wire only to terminal [L] on the inverter. Maintain the voltage within specifications (do not apply negative voltage).



**Current Input** – The current input circuit uses terminals [OI] and [L]. The current comes from a *sourcing* type transmitter; a *sinking* type will not work! This means the current must flow into terminal [OI], and terminal [L] is the return back to the transmitter. The input impedance from [OI] to [L] is 100 Ohms. Attach the cable shield wire only to terminal [L] on the inverter.



The following table shows the available analog input settings. Parameter **A005** and the input terminal [AT] determine the External Frequency Command input terminals that are available, and how they function. The analog inputs [O] and [OI] use terminal [L] as the reference (signal return).

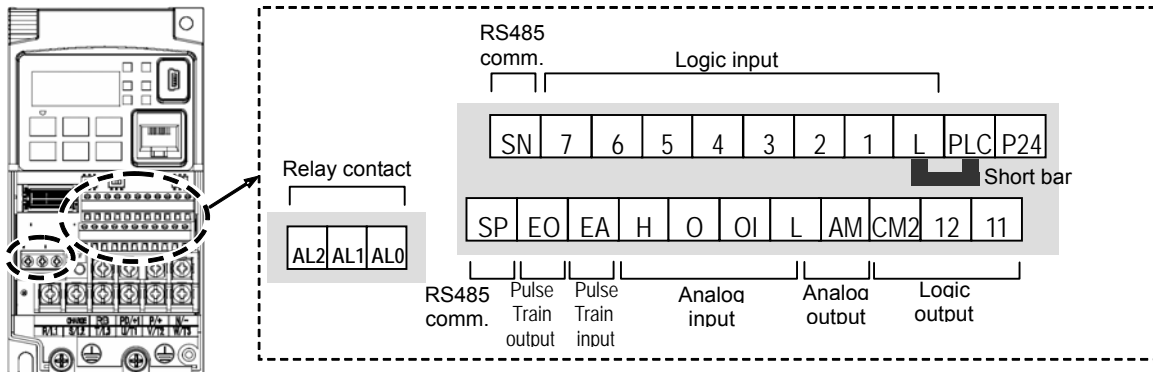
| <b>A005</b> | [AT] Input | Analog Input Configuration       |
|-------------|------------|----------------------------------|
| <b>00</b>   | ON         | [O]                              |
|             | OFF        | [OI]                             |
| <b>02</b>   | ON         | [O]                              |
|             | OFF        | Integrated POT on external panel |
| <b>03</b>   | ON         | [OI]                             |
|             | OFF        | Integrated POT on external panel |

**Other Analog Input-related topics:**

- “Analog Input Settings”
- “Additional Analog Input Settings”
- “Analog Signal Calibration Settings”
- “Analog Input Current/Voltage Select”
- “ADD Frequency Enable”
- “Analog Input Disconnect Detect”

# Pulse Train Input Operation

The WJ200 inverter is capable of accepting pulse train input signals, that are used for frequency command, process variable (feedback) for PID control, and simple positioning. The dedicated terminal is called “EA” and “EB”. Terminal “EA” is a dedicated terminal, and the terminal “EB” is an intelligent terminal, that has to be changed by a parameter setting.



| Terminal Name            | Description  | Ratings  |
|--------------------------|--|--|
| EA                       | Pulse train input A                                    | For frequency command, 32kHz max.<br>Reference voltage: Common is [L]                |
| EB<br>(Input terminal 7) | Pulse train input B<br>(Set <b>C007</b> to <b>B5</b> ) | 27Vdc max.<br>For frequency command, 2kHz max.<br>Reference voltage: Common is [PLC] |

## (1) Frequency Command by pulse train input

When using this mode, you should set **A001** to **05**. In this case the frequency is detected by input-capture, and calculated based on the ratio of designated max. frequency (under 32kHz). Only an input terminal “EA” will be used in this case.

## (2) Using for process variable of PID control

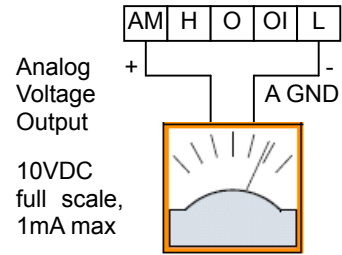
You can use the pulse train input for process variable (feedback) of PID control. In this case you need to set **A076** to **03**. Only “EA” input terminal is to be used.

## (3) Simple positioning by pulse train input

This is to use the pulse train input like an encoder signal. You can select three types of operation.

# Analog Output Operation

In inverter applications it is useful to monitor the inverter operation from a remote location or from the front panel of an inverter enclosure. In some cases, this requires only a panel-mounted volt meter. In other cases, a controller such as a PLC may provide the inverter's frequency command, and require inverter feedback data (such as output frequency or output current) to confirm actual operation. The analog output terminal [AM] serves these purposes.



10VDC  
full scale,  
1mA max

See I/O specs on page 4-6

The inverter provides an analog voltage output on terminal [AM] with terminal [L] as analog GND reference. The [AM] can output inverter frequency or current output value. Note that the voltage range is 0 to +10V (positive-going only), regardless of forward or reverse motor rotation. Use **C02B** to configure terminal [AM] as indicated below.

| Func.       | Code      | Description               |
|-------------|-----------|---------------------------|
| <b>C02B</b> | <b>00</b> | Inverter output frequency |
|             | <b>01</b> | Inverter output current   |
|             | <b>02</b> | Inverter output torque    |
|             | <b>03</b> | Digital output frequency  |
|             | <b>04</b> | Inverter output voltage   |
|             | <b>05</b> | Inverter input power      |
|             | <b>06</b> | Electronic Thermal Load   |
|             | <b>07</b> | LAD frequency             |
|             | <b>08</b> | Digital current monitor   |
|             | <b>10</b> | Cooling fin temperature   |
|             | <b>12</b> | General purpose           |
|             | <b>15</b> | Pulse train               |
|             | <b>16</b> | Option                    |

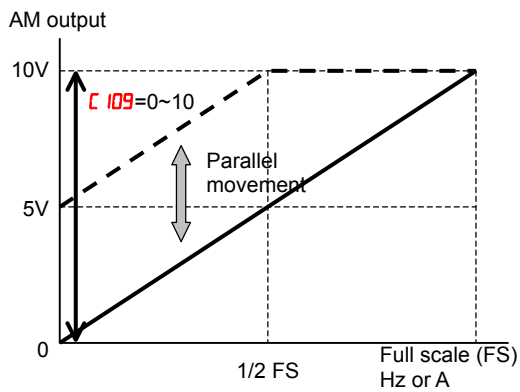
The [AM] signal offset and gain are adjustable, as indicated below.

| Func.        | Description        | Range    | Default |
|--------------|--------------------|----------|---------|
| <b>C 106</b> | [AM] output gain   | 0~255.   | 100.    |
| <b>C 109</b> | [AM] output offset | 0.0~10.0 | 0.0     |

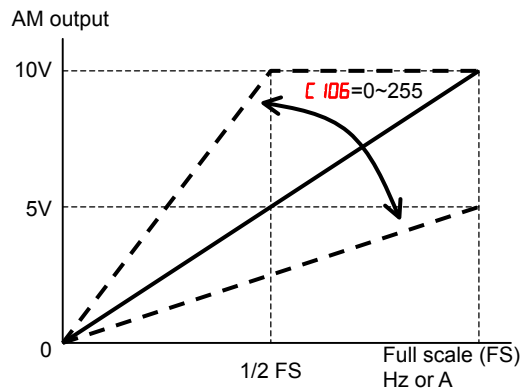
The graph below shows the effect of the gain and offset setting. To calibrate the [AM] output for your application (analog meter), follow the steps below:

1. Run the motor at the full scale speed, or most common operating speed.
  - a. If the analog meter represents output frequency, adjust offset (**C 109**) first, and then use **C 106** to set the voltage for full scale output.
  - b. If [AM] represents motor current, adjust offset (**C 109**) first, and then use **bC 106** to set the voltage for full scale output. Remember to leave room at the upper end of the range for increased current when the motor is under heavier loads.

AM output offset adjustment



AM output gain adjustment

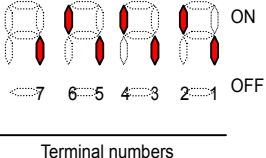
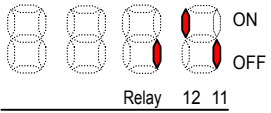


**NOTE:** As mentioned above, first adjust the offset, and then adjust the gain. Otherwise the required performance cannot be obtained because of the parallel movement of the offset adjustment.

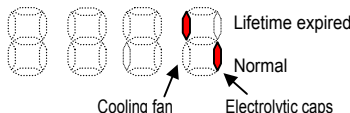
## Monitoring functions



**NOTE:** Mark "✓" in b031=10 shows the accessible parameters when b031 is set "10", high level access.

| "d" Function |   |  | Run Mode Edit | Units            |
|--------------|---|--|---------------|------------------|
| Func. Code   | Name  | Description  |               |                  |
| d001         | Output frequency monitor                    | Real time display of output frequency to motor from 0.0 to 400.0Hz<br>If <b>b163</b> is set high, output frequency ( <b>F001</b> ) can be changed by up/down key with d001 monitoring. | –             | Hz               |
| d002         | Output current monitor                      | Filtered display of output current to motor, range is 0 to 655.3 ampere (~99.9 ampere for 1.5kW and less)  | –             | A                |
| d003         | Rotation direction monitor                  | Three different indications:<br>"F" ...Forward<br>"σ" ...Stop<br>"r" ...Reverse  | –             | –                |
| d004         | Process variable (PV), PID feedback monitor | Displays the scaled PID process variable (feedback) value ( <b>A075</b> is scale factor), 0.00 to 10000  | –             | % times constant |
| d005         | Intelligent input terminal status           | Displays the state of the intelligent input terminals:<br><br>Terminal numbers                     | –             | –                |
| d006         | Intelligent output terminal status          | Displays the state of the intelligent output terminals:<br><br>Relay 12 11                         | –             | –                |



| "d" Function |                                 |   | Run Mode Edit | Units             |
|--------------|---------------------------------|---|---------------|-------------------|
| Func. Code   | Name                            | Description   |               |                   |
| d007         | Scaled output frequency monitor | Displays the output frequency scaled by the constant in <b>b086</b> .<br>Decimal point indicates range: 0 to 3999   | -             | Hz times constant |
| d008         | Actual frequency monitor        | Displays the actual frequency, range is -400 to 400 Hz  | -             | Hz                |
| d009         | Torque command monitor          | Displays the torque command, range is -200 to 200 %   | -             | %                 |
| d010         | Torque bias monitor             | Displays the torque bias value, range is -200 to 200 %  | -             | %                 |
| d012         | Output torque monitor           | Displays the output torque, range is -200 to 200 %  | -             | %                 |
| d013         | Output voltage monitor          | Voltage of output to motor, Range is 0.0 to 600.0V  | -             | V                 |
| d014         | Input power monitor             | Displays the input power, range is 0 to 999.9 kW  | -             | KW                |
| d015         | Watt-hour monitor               | Displays watt-hour of the inverter, range is 0 to 9999000   | -             |                   |
| d016         | Elapsed RUN time monitor        | Displays total time the inverter has been in RUN mode in hours.<br>Range is 0 to 9999 / 1000 to 9999 / $\lceil$ 100 to $\lceil$ 999 (10,000 to 99,900)                        | -             | hours             |
| d017         | Elapsed power-on time monitor   | Displays total time the inverter has been powered up in hours.<br>Range is 0 to 9999 / 1000 to 9999 / $\lceil$ 100 to $\lceil$ 999 (10,000 to 99,900)                         | -             | hours             |
| d018         | Heat sink temperature monitor   | Temperature of the cooling fin, range is -20~150  | -             | °C                |
| d022         | Life check monitor              | Displays the state of lifetime of electrolytic capacitors on the PWB and cooling fan.<br> | -             | -                 |
| d023         | Program counter monitor [EzSQ]  | Range is 0 to 1024  | -             | -                 |
| d024         | Program number monitor [EzSQ]   | Range is 0 to 9999  | -             | -                 |
| d025         | User monitor 0 [EzSQ]           | Result of EzSQ execution, range is -2147483647~2147483647   | -             | -                 |
| d026         | User monitor 1 [EzSQ]           | Result of EzSQ execution, range is -2147483647~2147483647   | -             | -                 |
| d027         | User monitor 2 [EzSQ]           | Result of EzSQ execution, range is -2147483647~2147483647   | -             | -                 |
| d029         | Positioning command monitor     | Displays the positioning command, range is -268435455~+268435455  | -             | -                 |
| d030         | Current position monitor        | Displays the current position, range is -268435455~+268435455   | -             | -                 |
| d050         | Dual monitor                    | Displays two different data configured in <b>b160</b> and <b>b161</b> .   | -             | -                 |
| d060         | Inverter mode monitor           | Displays currently selected inverter mode:<br>I-C:IM CT mode/I-v:IM VT mode/<br>P:PM  | -             | -                 |

| "d" Function |                            |  | Run Mode Edit | Units  |
|--------------|----------------------------|--|---------------|--------|
| Func. Code   | Name                       | Description  |               |        |
| d080         | Trip counter               | Number of trip events,<br>Range is 0. to 65530   | –             | events |
| d081         | Trip monitor 1             | Displays trip event information: <ul style="list-style-type: none"> <li>• Error code</li> <li>• Output frequency at trip point</li> <li>• Motor current at trip point</li> <li>• DC bus voltage at trip point</li> <li>• Cumulative inverter operation time at trip point</li> <li>• Cumulative power-ON time at trip point</li> </ul> | –             | –      |
| d082         | Trip monitor 2             |  | –             | –      |
| d083         | Trip monitor 3             |  | –             | –      |
| d084         | Trip monitor 4             |  | –             | –      |
| d085         | Trip monitor 5             |  | –             | –      |
| d086         | Trip monitor 6             |  | –             | –      |
| d090         | Warning monitor            | Displays the warning code  | –             | –      |
| d102         | DC bus voltage monitor     | Voltage of inverter internal DC bus,<br>Range is 0.0 to 999.9  | –             | V      |
| d103         | BRD load ratio monitor     | Usage ratio of integrated brake chopper, range is 0.0~100.0%   | –             | %      |
| d104         | Electronic thermal monitor | Accumulated value of electronic thermal detection, range is from 0.0~100.0%  | –             | %      |

## Main Profile Parameters



**NOTE:** Mark "✓" in b031=10 shows the accessible parameters when b031 is set "10", high level access.

| Func. Code  | "F" Function                                 |  | Run Mode Edit | Defaults     |       |
|-------------|--|--|---------------|--------------|-------|
|             | Name   | Description  |               | Initial data | Units |
| <b>F001</b> | Output frequency setting                     | Standard default target frequency that determines constant motor speed, range is 0.0 / start frequency to maximum frequency (A004) | ✓             | 0.0          | Hz    |
| <b>F002</b> | Acceleration time (1)                        | Standard default acceleration, range is 0.01 to 3600 sec.  | ✓             | 10.0         | sec.  |
| <b>F202</b> | Acceleration time (1), 2 <sup>nd</sup> motor |  | ✓             | 10.0         | sec.  |
| <b>F003</b> | Deceleration time (1)                        | Standard default deceleration, range is 0.01 to 3600 sec.  | ✓             | 10.0         | sec.  |
| <b>F203</b> | Deceleration time (1), 2 <sup>nd</sup> motor |  | ✓             | 10.0         | sec.  |
| <b>F004</b> | Keypad RUN key routing                       | Two options; select codes:<br><b>00</b> ...Forward<br><b>01</b> ...Reverse   | ✗             | 00           | –     |

## Standard Functions



**NOTE:** Mark “✓” in b031=10 shows the accessible parameters when b031 is set “10”, high level access.

| “A” Function |   |   | Run Mode Edit | Defaults     |       |
|--------------|---|---|---------------|--------------|-------|
| Func. Code   | Name                                      | Description   |               | Initial data | Units |
| <b>R001</b>  | Frequency source                          | Eight options; select codes:<br><b>00</b> ...POT on ext. operator<br><b>01</b> ...Control terminal<br><b>02</b> ...Function F001 setting<br><b>03</b> ...ModBus network input<br><b>04</b> ...Option<br><b>06</b> ...Pulse train input<br><b>07</b> ...via EzSQ<br><b>10</b> ...Calculate function output | ✗             | 02           | –     |
| <b>R201</b>  | Frequency source, 2 <sup>nd</sup> motor   |   | ✗             | 02           | –     |
| <b>R002</b>  | Run command source                        | Five options; select codes:<br><b>01</b> ...Control terminal<br><b>02</b> ...Run key on keypad,   | ✗             | 02           | –     |
| <b>R202</b>  | Run command source, 2 <sup>nd</sup> motor | or digital operator<br><b>03</b> ...ModBus network input<br><b>04</b> ...Option   | ✗             | 02           | –     |
| <b>R003</b>  | Base frequency                            | Settable from 30 Hz to the maximum frequency( <b>R004</b> )   | ✗             | 60.0         | Hz    |
| <b>R203</b>  | Base frequency, 2 <sup>nd</sup> motor     | Settable from 30 Hz to the 2 <sup>nd</sup> maximum frequency( <b>R204</b> )   | ✗             | 60.0         | Hz    |
| <b>R004</b>  | Maximum frequency                         | Settable from the base frequency to 400 Hz  | ✗             | 60.0         | Hz    |
| <b>R204</b>  | Maximum frequency, 2 <sup>nd</sup> motor  | Settable from the 2 <sup>nd</sup> base frequency to 400 Hz  | ✗             | 60.0         | Hz    |
| <b>R005</b>  | [AT] selection                            | Three options; select codes:<br><b>00</b> ...Select between [O] and [OI] at [AT] (ON=OI, OFF=O)<br><b>02</b> ...Select between [O] and external POT at [AT] (ON=POT, OFF=O)<br><b>03</b> ...Select between [OI] and external POT at [AT] (ON=POT, OFF=OI)   | ✗             | 00           | –     |
| <b>R011</b>  | [O] input active range start frequency    | The output frequency corresponding to the analog input range starting point, range is 0.00 to 400.0   | ✗             | 0.00         | Hz    |
| <b>R012</b>  | [O] input active range end frequency      | The output frequency corresponding to the analog input range ending point, range is 0.0 to 400.0  | ✗             | 0.00         | Hz    |
| <b>R013</b>  | [O] input active range start voltage      | The starting point (offset) for the active analog input range, range is 0. to 100.  | ✗             | 0.           | %     |
| <b>R014</b>  | [O] input active range end voltage        | The ending point (offset) for the active analog input range, range is 0. to 100.  | ✗             | 100.         | %     |

| "A" Function        |   |   | Run Mode Edit | Defaults     |       |
|---------------------|---|---|---------------|--------------|-------|
| Func. Code          | Name  | Description   |               | Initial data | Units |
| <b>AD 15</b>        | [O] input start frequency enable            | Two options; select codes:<br><b>00</b> ...Use offset ( <b>AD 11</b> value)<br><b>01</b> ...Use 0Hz   | ✗             | 01           | -     |
| <b>AD 16</b>        | Analog input filter                         | Range n = 1 to 31,<br>1 to 30 : x 2ms filter<br>31: 500ms fixed filter with ± 0.1kHz hys.   | ✗             | 8.           | Spl.  |
| <b>AD 17</b>        |   |   | ✓             | 00           | -     |
| <b>AD 19</b>        | Multi-speed operation selection             | Select codes:<br><b>00</b> ...Binary operation (16 speeds selectable with 4 terminals)<br><b>01</b> ...Bit operation (8 speeds selectable with 7 terminals)   | ✗             | 00           | -     |
| <b>AD20</b>         | Multi-speed freq. 0                         | Defines the first speed of a multi-speed profile, range is 0.0 / start frequency to 400Hz<br><b>AD20</b> = Speed 0 (1st motor)  | ✓             | 0.0          | Hz    |
| <b>AD20</b>         | Multi-speed freq. 0, 2 <sup>nd</sup> motor  | Defines the first speed of a multi-speed profile or a 2nd motor, range is 0.0 / start frequency to 400Hz<br><b>AD20</b> = Speed 0 (2nd motor)   | ✓             | 0.0          | Hz    |
| <b>AD21 to AD35</b> | Multi-speed freq. 1 to 15 (for both motors) | Defines 15 more speeds, range is 0.0 / start frequency to 400 Hz.<br><b>AD21</b> =Speed 1 ~ <b>AD35</b> =Speed15  | ✓             | See next row | Hz    |
|                     |   | <b>AD21 ~ AD35</b>  | ✓             | 0.0          | Hz    |
| <b>AD38</b>         | Jog frequency                               | Defines limited speed for jog, range is from start frequency to 9.99 Hz   | ✓             | 6.00         | Hz    |
| <b>AD39</b>         | Jog stop mode                               | Define how end of jog stops the motor; six options:<br><b>00</b> ...Free-run stop (invalid during run)<br><b>01</b> ...Controlled deceleration (invalid during run)<br><b>02</b> ...DC braking to stop(invalid during run)<br><b>03</b> ...Free-run stop (valid during run)<br><b>04</b> ...Controlled deceleration (valid during run)<br><b>05</b> ...DC braking to stop(valid during run) | ✗             | 04           | -     |
| <b>AD41</b>         | Torque boost select                         | Two options:<br><b>00</b> ...Manual torque boost<br><b>01</b> ...Automatic torque boost   | ✗             | 00           | -     |
| <b>AD41</b>         | Torque boost select, 2 <sup>nd</sup> motor  |   | ✗             | 00           | -     |
| <b>AD42</b>         | Manual torque boost value                   | Can boost starting torque between 0 and 20% above   | ✓             | 1.0          | %     |

| "A" Function |   |  | Run Mode Edit | Defaults     |       |
|--------------|---|--|---------------|--------------|-------|
| Func. Code   | Name  | Description  |               | Initial data | Units |
| A242         | Manual torque boost value, 2 <sup>nd</sup> motor                            | normal V/f curve, range is 0.0 to 20.0%  | ✓             | 1.0          | %     |
| A043         | Manual torque boost frequency   | Sets the frequency of the V/f breakpoint A in graph (top of previous page) for torque boost, range is 0.0 to 50.0%                           | ✓             | 5.0          | %     |
| A243         | Manual torque boost frequency, 2 <sup>nd</sup> motor                        |  | ✓             | 5.0          | %     |
| A044         | V/f characteristic curve  | Six available V/f curves;<br>00...Constant torque<br>01...Reduced torque (1.7)<br>02...Free V/F<br>03...Sensorless vector (SLV)              | ✗             | 00           | –     |
| A244         | V/f characteristic curve, 2 <sup>nd</sup> motor                             |  | ✗             | 00           | –     |
| A045         | V/f gain  | Sets voltage gain of the inverter, range is 20. to 100.%   | ✓             | 100.         | %     |
| A245         | V/f gain, 2 <sup>nd</sup> motor   |  | ✓             | 100.         | %     |
| A046         | Voltage compensation gain for automatic torque boost                        | Sets voltage compensation gain under automatic torque boost, range is 0. to 255.   | ✓             | 100.         | –     |
| A246         | Voltage compensation gain for automatic torque boost, 2 <sup>nd</sup> motor |  | ✓             | 100.         | –     |
| A047         | Slip compensation gain for automatic torque boost                           | Sets slip compensation gain under automatic torque boost, range is 0. to 255.  | ✓             | 100.         | –     |
| A247         | Slip compensation gain for automatic torque boost, 2 <sup>nd</sup> motor    |  | ✓             | 100.         | –     |
| A051         | DC braking enable   | Three options; select codes:<br>00...Disable<br>01...Enable during stop<br>02...Frequency detection  | ✗             | 00           | –     |
| A052         | DC braking frequency  | The frequency at which DC braking begins, range is from the start frequency (b002) to 60Hz   | ✗             | 0.5          | Hz    |
| A053         | DC braking wait time  | The delay from the end of controlled deceleration to start of DC braking (motor free runs until DC braking begins), range is 0.0 to 5.0 sec. | ✗             | 0.0          | sec.  |
| A054         | DC braking force for deceleration   | Level of DC braking force, settable from 0 to 100%   | ✗             | 50.          | %     |
| A055         | DC braking time for deceleration  | Sets the duration for DC braking, range is from 0.0 to 60.0 seconds  | ✗             | 0.5          | sec.  |
| A056         | DC braking / edge or level detection for [DB] input                         | Two options; select codes:<br>00...Edge detection<br>01...Level detection  | ✗             | 01           | –     |
| A057         | DC braking force at start   | Level of DC braking force at start, settable from 0 to 100%  | ✗             | 0.           | %     |

| "A" Function                              |                                      |   | Run Mode Edit | Defaults          |       |
|---|--------------------------------------|---|---------------|-------------------|-------|
| Func. Code                                | Name                                 | Description   |               | Initial data      | Units |
| <b>A058</b>                               | DC braking time at start             | Sets the duration for DC braking, range is from 0.0 to 60.0 seconds   | ✗             | 0.0               | sec.  |
| <b>A059</b>                               | Carrier frequency during DC braking  | Carrier frequency of DC braking performance, range is from 2.0 to 15.0kHz   | ✗             | 5.0               | sec.  |
| <b>A061</b>                               | Frequency upper limit                | Sets a limit on output frequency less than the maximum frequency ( <b>A004</b> ). Range is from frequency lower limit ( <b>A062</b> ) to maximum frequency ( <b>A004</b> ). 0.0 setting is disabled >0.0 setting is enabled | ✗             | 0.00              | Hz    |
| <b>A261</b>                               | Frequency upper limit, 2nd motor     | Sets a limit on output frequency less than the maximum frequency ( <b>A204</b> ). Range is from frequency lower limit ( <b>A262</b> ) to maximum frequency ( <b>A204</b> ). 0.0 setting is disabled >0.0 setting is enabled | ✗             | 0.00              | Hz    |
| <b>A062</b>                               | Frequency lower limit                | Sets a limit on output frequency greater than zero. Range is start frequency ( <b>b082</b> ) to frequency upper limit ( <b>A061</b> ) 0.0 setting is disabled >0.0 setting is enabled                                       | ✗             | 0.00              | Hz    |
| <b>A262</b>                               | Frequency lower limit, 2nd motor     | Sets a limit on output frequency greater than zero. Range is start frequency ( <b>b082</b> ) to frequency upper limit ( <b>A261</b> ) 0.0 setting is disabled >0.0 setting is enabled                                       | ✗             | 0.00              | Hz    |
| <b>A063</b><br><b>A065</b><br><b>A067</b> | Jump freq. (center) 1 to 3           | Up to 3 output frequencies can be defined for the output to jump past to avoid motor resonances (center frequency) Range is 0.0 to 400.0 Hz   | ✗             | 0.0<br>0.0<br>0.0 | Hz    |
| <b>A064</b><br><b>A066</b><br><b>A068</b> | Jump freq. width (hysteresis) 1 to 3 | Defines the distance from the center frequency at which the jump around occurs Range is 0.0 to 10.0 Hz  | ✗             | 0.5<br>0.5<br>0.5 | Hz    |
| <b>A069</b>                               | Acceleration hold frequency          | Sets the frequency to hold acceleration, range is 0.0 to 400.0Hz  | ✗             | 0.00              | Hz    |
| <b>A070</b>                               | Acceleration hold time               | Sets the duration of acceleration hold, range is 0.0 to 60.0 seconds  | ✗             | 0.0               | sec.  |
| <b>A071</b>                               | PID enable                           | Enables PID function, three option codes:<br><b>00</b> ...PID Disable<br><b>01</b> ...PID Enable<br><b>02</b> ...PID Enable with reverse output   | ✗             | 00                | –     |

| "A" Function |  |  | Run Mode Edit | Defaults     |       |
|--------------|--|--|---------------|--------------|-------|
| Func. Code   | Name                                       | Description  |               | Initial data | Units |
| A072         | PID proportional gain                      | Proportional gain has a range of 0.00 to 25.00   | ✓             | 1.0          | –     |
| A073         | PID integral time constant                 | Integral time constant has a range of 0.0 to 3600 seconds  | ✓             | 1.0          | sec   |
| A074         | PID derivative time constant               | Derivative time constant has a range of 0.0 to 100 seconds   | ✓             | 0.00         | sec   |
| A075         | PV scale conversion                        | Process Variable (PV), scale factor (multiplier), range of 0.01 to 99.99   | ✗             | 1.00         | –     |
| A076         | PV source                                  | Selects source of Process Variable (PV), option codes:<br>00...[OI] terminal (current in)<br>01...[O] terminal (voltage in)<br>02...ModBus network<br>03...Pulse train input<br>10...Calculate function output | ✗             | 00           | –     |
| A077         | Reverse PID action                         | Two option codes:<br>00...PID input = SP-PV<br>01...PID input = -(SP-PV)   | ✗             | 00           | –     |
| A078         | PID output limit                           | Sets the limit of PID output as percent of full scale, range is 0.0 to 100.0%  | ✗             | 0.0          | %     |
| A079         | PID feed forward selection                 | Selects source of feed forward gain, option codes:<br>00...Disabled<br>01...[O] terminal (voltage in)<br>02...[OI] terminal (current in)   | ✗             | 00           | –     |
| A081         | AVR function select                        | Automatic (output) voltage regulation, selects from three type of AVR functions, three option codes:   | ✗             | 02           | –     |
| A281         | AVR function select, 2 <sup>nd</sup> motor | 00...AVR enabled<br>01...AVR disabled<br>02...AVR enabled except during deceleration   | ✗             | 02           | –     |
| A082         | AVR voltage select                         | 200V class inverter settings:<br>.....200/215/220/230/240<br>400V class inverter settings:   | ✗             | 200/<br>400  | V     |
| A282         | AVR voltage select, 2 <sup>nd</sup> motor  | .....380/400/415/440/460/480   | ✗             | 200/<br>400  | V     |
| A083         | AVR filter time constant                   | Define the time constant of the AVR filter, range is 0 to 10 sec.  | ✗             | 0.300        | sec   |
| A084         | AVR deceleration gain                      | Gain adjustment of the braking performance, range is 50 to 200%  | ✗             | 100.         | %     |
| A085         | Energy-saving operation mode               | Two option codes:<br>00...Normal operation<br>01...Energy-saving operation   | ✗             | 00           | –     |
| A086         | Energy-saving mode tuning                  | Range is 0.0 to 100 %.   | ✗             | 50.0         | %     |



| "A" Function |   |  | Run Mode Edit | Defaults     |       |
|--------------|---|--|---------------|--------------|-------|
| Func. Code   | Name  | Description  |               | Initial data | Units |
| <b>R092</b>  | Acceleration time (2)   | Duration of 2 <sup>nd</sup> segment of acceleration, range is: 0.01 to 3600 sec.   | ✓             | 10.00        | sec   |
| <b>R292</b>  | Acceleration time (2), 2 <sup>nd</sup> motor                        |  | ✓             | 10.00        | sec   |
| <b>R093</b>  | Deceleration time (2)   | Duration of 2 <sup>nd</sup> segment of deceleration, range is: 0.01 to 3600 sec.   | ✓             | 10.00        | sec   |
| <b>R293</b>  | Deceleration time (2), 2 <sup>nd</sup> motor                        |  | ✓             | 10.00        | sec   |
| <b>R094</b>  | Select method to switch to Acc2/Dec2 profile                        | Three options for switching from 1st to 2nd accel/decel:<br>00...2CH input from terminal<br>01...Transition frequency<br>02...Forward and reverse      | ✗             | 00           | –     |
| <b>R294</b>  | Select method to switch to Acc2/Dec2 profile, 2 <sup>nd</sup> motor |  | ✗             | 00           | –     |
| <b>R095</b>  | Acc1 to Acc2 frequency transition point                             | Output frequency at which Accel1 switches to Accel2, range is 0.0 to 400.0 Hz  | ✗             | 0.0          | Hz    |
| <b>R295</b>  | Acc1 to Acc2 frequency transition point, 2 <sup>nd</sup> motor      |  | ✗             | 0.0          | Hz    |
| <b>R096</b>  | Dec1 to Dec2 frequency transition point                             | Output frequency at which Decel1 switches to Decel2, range is 0.0 to 400.0 Hz  | ✗             | 0.0          | Hz    |
| <b>R296</b>  | Dec1 to Dec2 frequency transition point, 2 <sup>nd</sup> motor      |  | ✗             | 0.0          | Hz    |
| <b>R097</b>  | Acceleration curve selection  | Set the characteristic curve of Acc1 and Acc2, five options:<br>00...linear<br>01...S-curve<br>02...U-curve<br>03...Inverse U-curve<br>04...EL S-curve | ✗             | 00           | –     |
| <b>R098</b>  | Deceleration curve selection  | Set the characteristic curve of Dec1 and Dec2, options are same as above (R097)  | ✗             | 00           | –     |
| <b>R 101</b> | [OI] input active range start frequency                             | The output frequency corresponding to the analog input range starting point, range is 0.0 to 400.0 Hz  | ✗             | 0.00         | Hz    |
| <b>R 102</b> | [OI] input active range end frequency                               | The output frequency corresponding to the current input range ending point, range is 0.0 to 400.0 Hz   | ✗             | 0.0          | Hz    |
| <b>R 103</b> | [OI] input active range start current                               | The starting point (offset) for the current input range, range is 0. to 100.%  | ✗             | 20.          | %     |
| <b>R 104</b> | [OI] input active range end current                                 | The ending point (offset) for the current input range, range is 0. to 100.%  | ✗             | 100.         | %     |
| <b>R 105</b> | [OI] input start frequency select                                   | Two options; select codes:<br>00...Use offset (R 101 value)<br>01...Use 0Hz  | ✗             | 00           | –     |

| "A" Function |  |  | Run Mode Edit | Defaults     |       |
|--------------|--|--|---------------|--------------|-------|
| Func. Code   | Name   | Description  |               | Initial data | Units |
| <b>A 131</b> | Acceleration curve constant                          | Range is 01 to 10.   | ✗             | 02           | –     |
| <b>A 132</b> | Deceleration curve constant                          | Range is 01 to 10.   | ✗             | 02           | –     |
| <b>A 141</b> | A input select for calculate function                | Seven options:<br>00...Operator<br>01...VR<br>02...Terminal [O] input<br>03...Terminal [OI] input<br>04...RS485<br>05...Option<br>07...Pulse train input   | ✗             | 02           | –     |
| <b>A 142</b> | B input select for calculate function                | Seven options:<br>00...Operator<br>01...VR<br>02...Terminal [O] input<br>03...Terminal [OI] input<br>04...RS485<br>05...Option<br>07...Pulse train input   | ✗             | 03           | –     |
| <b>A 143</b> | Calculation symbol                                   | Calculates a value based on the A input source ( <b>A 141</b> selects) and B input source ( <b>A 142</b> selects).<br>Three options:<br>00...ADD (A input + B input)<br>01...SUB (A input - B input)<br>02...MUL (A input * B input) | ✗             | 00           | –     |
| <b>A 145</b> | ADD frequency  | An offset value that is applied to the output frequency when the [ADD] terminal is ON.<br>Range is 0.0 to 400.0 Hz   | ✓             | 0.00         | Hz    |
| <b>A 146</b> | ADD direction select                                 | Two options:<br>00...Plus (adds <b>A 145</b> value to the output frequency setting)<br>01...Minus (subtracts <b>A 145</b> value from the output frequency setting)   | ✗             | 00           | –     |
| <b>A 150</b> | Curvature of EL-S-curve at the start of acceleration | Range is 0 to 50%  | ✗             | 10.          | %     |
| <b>A 151</b> | Curvature of EL-S-curve at the end of acceleration   | Range is 0 to 50%  | ✗             | 10.          | %     |
| <b>A 152</b> | Curvature of EL-S-curve at the start of deceleration | Range is 0 to 50%  | ✗             | 10.          | %     |
| <b>A 153</b> | Curvature of EL-S-curve at the end of deceleration   | Range is 0 to 50%  | ✗             | 10.          | %     |
| <b>A 154</b> | Deceleration hold frequency                          | Sets the frequency to hold deceleration, range is 0.0 to 400.0Hz   | ✗             | 0.0          | Hz    |
| <b>A 155</b> | Deceleration hold time                               | Sets the duration of deceleration hold, range is 0.0 to 60.0 seconds   | ✗             | 0.0          | sec.  |

| "A" Function |   |   | Run Mode Edit | Defaults     |       |
|--------------|---|---|---------------|--------------|-------|
| Func. Code   | Name                                    | Description   |               | Initial data | Units |
| <i>A 156</i> | PID sleep function action threshold     | Sets the threshold for the action, set range 0.0~400.0 Hz   | ✗             | 0.00         | Hz    |
| <i>A 157</i> | PID sleep function action delay time    | Sets the delay time for the action, set range 0.0~25.5 sec  | ✗             | 0.0          | sec   |
| <i>A 161</i> | [VR] input active range start frequency | The output frequency corresponding to the analog input range starting point, range is 0.0 to 400.0 Hz | ✗             | 0.00         | Hz    |
| <i>A 162</i> | [VR] input active range end frequency   | The output frequency corresponding to the current input range ending point, range is 0.0 to 400.0 Hz  | ✗             | 0.00         | Hz    |
| <i>A 163</i> | [VR] input active range start %         | The starting point (offset) for the current input range, range is 0. to 100.%                         | ✗             | 0.           | %     |
| <i>A 164</i> | [VR] input active range end %           | The ending point (offset) for the current input range, range is 0. to 100.%                           | ✗             | 100.         | %     |
| <i>A 165</i> | [VR] input start frequency select       | Two options; select codes:<br>00...Use offset ( <i>A 161</i> value)<br>01...Use 0Hz                   | ✗             | 01           | –     |

## Fine Tuning Functions

| Func. Code  | "b" Function  |   | Run Mode Edit | Defaults     |       |
|-------------|---|---|---------------|--------------|-------|
|             | Name  | Description   |               | Initial data | Units |
| <b>b001</b> | Restart mode on power failure / under-voltage trip              | Select inverter restart method, Five option codes:<br><b>00</b> ...Alarm output after trip, no automatic restart<br><b>01</b> ...Restart at 0Hz<br><b>02</b> ...Resume operation after frequency matching<br><b>03</b> ...Resume previous freq. after freq. matching, then decelerate to stop and display trip info<br><b>04</b> ...Resume operation after active freq. matching        | ✗             | 00           | –     |
| <b>b002</b> | Allowable under-voltage power failure time                      | The amount of time a power input under-voltage can occur without tripping the power failure alarm. Range is 0.3 to 25 sec. If under-voltage exists longer than this time, the inverter trips, even if the restart mode is selected.   | ✗             | 1.0          | sec.  |
| <b>b003</b> | Retry wait time before motor restart                            | Time delay after under-voltage condition goes away, before the inverter runs motor again. Range is 0.3 to 100 seconds.  | ✗             | 1.0          | sec.  |
| <b>b004</b> | Instantaneous power failure / under-voltage trip alarm enable   | Three option codes:<br><b>00</b> ...Disable<br><b>01</b> ...Enable<br><b>02</b> ...Disable during stop and decelerates to a stop  | ✗             | 00           | –     |
| <b>b005</b> | Number of restarts on power failure / under-voltage trip events | Two option codes:<br><b>00</b> ...Restart 16 times<br><b>01</b> ...Always restart   | ✗             | 00           | –     |
| <b>b007</b> | Restart frequency threshold                                     | Restart the motor from 0Hz if the frequency becomes less than this set value during the motor is coasting, range is 0 to 400Hz  | ✗             | 0.00         | Hz    |
| <b>b008</b> | Restart mode on over voltage / over current trip                | Select inverter restart method, Five option codes:<br><b>00</b> ...Alarm output after trip, no automatic restart<br><b>01</b> ...Restart at 0Hz<br><b>02</b> ...Resume operation after frequency matching<br><b>03</b> ...Resume previous freq. after active freq. matching, then decelerate to stop and display trip info<br><b>04</b> ...Resume operation after active freq. matching | ✗             | 00           | –     |
| <b>b010</b> | Number of retry on over voltage / over current trip             | Range is 1 to 3 times   | ✗             | 3            | times |
| <b>b011</b> | Retry wait time on over voltage / over current trip             | Range is 0.3 to 100 sec.  | ✗             | 1.0          | sec   |

| Func. Code | "b" Function   |  | Run Mode Edit | Defaults                                 |       |
|------------|--|--|---------------|--|-------|
|            | Name   | Description  |               | Initial data                             | Units |
| b012       | Level of electronic thermal                                      | Set a level between 20% and 100% for the rated inverter current.   | ✗             | Rated current for each inverter model *1 | A     |
| b212       | Level of electronic thermal, 2 <sup>nd</sup> motor               |  |               |  |       |
| b013       | Electronic thermal characteristic                                | Select from three curves, option codes:  | ✗             | 01                                       | -     |
| b213       | Electronic thermal characteristic, 2 <sup>nd</sup> motor         | 00...Reduced torque<br>01...Constant torque<br>02...Free setting   |               |  |       |
| b015       | Free setting electronic thermal ~freq.1                          | Range is 0 to 400Hz  | ✗             | 0.0                                      | Hz    |
| b016       | Free setting electronic thermal ~current1                        | Range is 0 to inverter rated current Amps  | ✗             | 0.00                                     | Amps  |
| b017       | Free setting electronic thermal ~freq.2                          | Range is 0 to 400Hz  | ✗             | 0.0                                      | Hz    |
| b018       | Free setting electronic thermal ~current2                        | Range is 0 to inverter rated current Amps  | ✗             | 0.00                                     | Amps  |
| b019       | Free setting electronic thermal ~freq.3                          | Range is 0 to 400Hz  | ✗             | 0.0                                      | Hz    |
| b020       | Free setting electronic thermal ~current3                        | Range is 0 to inverter rated current Amps  | ✗             | 0.00                                     | Amps  |
| b021       | Overload restriction operation mode                              | Select the operation mode during overload conditions, four options, option codes:<br>00...Disabled<br>01...Enabled for acceleration and constant speed<br>02...Enabled for constant speed only<br>03...Enabled for acceleration and constant speed, increase speed at regen. | ✗             | 01                                       | -     |
| b221       | Overload restriction operation mode, 2 <sup>nd</sup> motor       |  |               |  |       |
| b022       | Overload restriction level                                       | Sets the level of overload restriction, between 20% and 200% of the rated current of the inverter, setting resolution is 1% of rated current   | ✗             | Rated current x 1.5                      | Amps  |
| b222       | Overload restriction level, 2 <sup>nd</sup> motor                |  |               |  |       |
| b023       | Deceleration rate at overload restriction                        | Sets the deceleration rate when inverter detects overload, range is 0.1 to 3000.0, resolution 0.1  | ✗             | 1.0                                      | sec.  |
| b223       | Deceleration rate at overload restriction, 2 <sup>nd</sup> motor |  |               |  |       |
| b024       | Overload restriction operation mode 2                            | Select the operation mode during overload conditions, four options, option codes:<br>00...Disabled<br>01...Enabled for acceleration and constant speed<br>02...Enabled for constant speed only<br>03...Enabled for acceleration and constant speed, increase speed at regen. | ✗             | 01                                       | -     |

| Func. Code  | "b" Function                                |   | Run Mode Edit | Defaults            |       |
|-------------|---|---|---------------|---------------------|-------|
|             | Name  | Description   |               | Initial data        | Units |
| <b>b025</b> | Overload restriction level 2                | Sets the level of overload restriction, between 20% and 200% of the rated current of the inverter, setting resolution is 1% of rated current  | ✗             | Rated current x 1.5 |       |
| <b>b026</b> | Deceleration rate 2 at overload restriction | Sets the deceleration rate when inverter detects overload, range is 0.1 to 3000.0, resolution 0.1   | ✗             | 1.0                 | sec.  |
| <b>b027</b> | OC suppression selection *                  | Two option codes:<br>00...Disabled<br>01...Enabled  | ✗             | 01                  | -     |
| <b>b028</b> | Current level of active freq. matching      | Sets the current level of active freq. matching restart, range is 0.1*inverter rated current to 2.0*inverter rated current, resolution 0.1  | ✗             | Rated current       | A     |
| <b>b029</b> | Deceleration rate of active freq. matching  | Sets the deceleration rate when active freq. matching restart, range is 0.1 to 3000.0, resolution 0.1   | ✗             | 0.5                 | sec.  |
| <b>b030</b> | Start freq. of active freq. matching        | Three option codes:<br>00...freq at previous shutoff<br>01...start from max. Hz<br>02...start from set frequency  | ✗             | 00                  | -     |
| <b>b031</b> | Software lock mode selection                | Prevents parameter changes, in five options, option codes:<br>00...all parameters except <b>b031</b> are locked when [SFT] terminal is ON<br>01...all parameters except <b>b031</b> and output frequency <b>F001</b> are locked when [SFT] terminal is ON<br>02...all parameters except <b>b031</b> are locked<br>03...all parameters except <b>b031</b> and output frequency <b>F001</b> are locked<br>10...High level access including <b>b031</b><br><i>See appendix C for the accessible parameters in this mode.</i> | ✗             | 01                  | -     |
| <b>b033</b> | Motor cable length parameter                | Set range is 5 to 20.   | ✗             | 10.                 | -     |
| <b>b034</b> | Run/power ON warning time                   | Range is,<br>0.:Warning disabled<br>1. to 9999.:<br>10~99,990 hrs (unit: 10)<br>1000 to 6553:<br>100,000~655,350 hrs (unit: 100)  | ✗             | 0.                  | Hrs.  |
| <b>b035</b> | Rotation direction restriction              | Three option codes:<br>00...No restriction<br>01...Reverse rotation is restricted<br>02...Forward rotation is restricted  | ✗             | 00                  | -     |
| <b>b036</b> | Reduced voltage start selection             | Set range, 0 (disabling the function), 1 (approx. 6ms) to 255 (approx. 1.5s)  | ✗             | 2                   | -     |

| Func. Code  | "b" Function                                 |  | Run Mode Edit | Defaults        |       |
|-------------|--|--|---------------|-----------------|-------|
|             | Name   | Description  |               | Initial data    | Units |
| <b>b037</b> | Function code display restriction            | Seven option codes:<br>00...Full display<br>01...Function-specific display<br>02...User setting (and b037)<br>03...Data comparison display<br>04...Basic display<br>05...Monitor display only          | ✗             | 04              | –     |
| <b>b038</b> | Initial display selection                    | 000...Func. code that SET key pressed last displayed.(*)<br>001~030...d001~d030 displayed<br>201...F001 displayed<br>202...B display of LCD operator   | ✗             | 001             | –     |
| <b>b039</b> | Automatic user parameter registration        | Two option codes:<br>00...Disable<br>01...Enable   | ✗             | 00              |       |
| <b>b040</b> | Torque limit selection                       | Four option codes:<br>00...Quadrant-specific setting mode<br>01...Terminal-switching mode<br>02...Analog voltage input mode(O)   | ✗             | 00              |       |
| <b>b041</b> | Torque limit 1 (fwd/power)                   | Torque limit level in forward powering quadrant, range is 0 to 200%/no(disabled)   | ✗             | 200             | %     |
| <b>b042</b> |  |  |               |                 |       |
| <b>b043</b> | Torque limit 3 (rev/power)                   | Torque limit level in reverse powering quadrant, range is 0 to 200%/no(disabled)   | ✗             | 200             | %     |
| <b>b044</b> | Torque limit 4 (fwd/regen.)                  | Torque limit level in forward regen. quadrant, range is 0 to 200%/no(disabled)   | ✗             | 200             | %     |
| <b>b045</b> | Torque LAD STOP selection                    | Two option codes:<br>00...Disable<br>01...Enable   | ✗             | 00              |       |
| <b>b046</b> | Reverse run protection                       | Two option codes:<br>00...No protection<br>01...Reverse rotation is protected  | ✗             | 01              | –     |
| <b>b049</b> | Dual Rating Selection                        | 00... (CT mode) / 01... (VT mode)  | ✗             | 00              |       |
| <b>b050</b> | Controlled deceleration on power loss        | Four option codes:<br>00...Trips<br>01...Decelerates to a stop<br>02...Decelerates to a stop with DC bus voltage controlled<br>03...Decelerates to a stop with DC bus voltage controlled, then restart | ✗             | 00              | –     |
| <b>b051</b> | DC bus voltage trigger level of ctrl. decel. | Setting of DC bus voltage to start controlled decel. operation. Range is 0.0 to 1000.0   | ✗             | 220.0/<br>440.0 | V     |
| <b>b052</b> | Over-voltage threshold of ctrl. decel.       | Setting the OV-LAD stop level of controlled decel. operation. Range is 0.0 to 1000.0   | ✗             | 360.0/<br>720.0 | V     |
| <b>b053</b> | Deceleration time of ctrl. decel.            | Range is 0.01 to 3600.0  | ✗             | 1.0             | sec   |
| <b>b054</b> | Initial freq. drop of ctrl. decel.           | Setting of initial freq. drop. Range is 0.0 to 10.0 Hz   | ✗             | 0.0             | Hz    |

| Func. Code  | "b" Function                                     |   | Run Mode Edit | Defaults     |       |
|-------------|--|---|---------------|--------------|-------|
|             | Name   | Description   |               | Initial data | Units |
| <b>b060</b> | Maximum-limit level of window comparator (O)     | Set range, {Min.-limit level ( <b>b061</b> ) + hysteresis width ( <b>b062</b> )x2} to 100 % (Minimum of 0%)   | ✗             | 100.         | %     |
| <b>b061</b> | Minimum-limit level of window comparator (O)     | Set range, 0 to {Max.-limit level ( <b>b060</b> ) - hysteresis width ( <b>b062</b> )x2} % (Maximum of 0%)   | ✓             | 0.           | %     |
| <b>b062</b> | Hysteresis width of window comparator (O)        | Set range, 0 to {Max.-limit level ( <b>b060</b> ) - Min.-limit level ( <b>b061</b> )} / 2 % (Maximum of 10%)  | ✓             | 0.           | %     |
| <b>b063</b> | Maximum-limit level of window comparator (OI)    | Set range, {Min.-limit level ( <b>b064</b> ) + hysteresis width ( <b>b065</b> )x2} to 100 % (Minimum of 0%)   | ✓             | 100.         | %     |
| <b>b064</b> | Minimum-limit level of window comparator (OI)    | Set range, 0 to {Max.-limit level ( <b>b063</b> ) - hysteresis width ( <b>b065</b> )x2} % (Maximum of 0%)   | ✓             | 0.           | %     |
| <b>b065</b> | Hysteresis width of window comparator (OI)       | Set range, 0 to {Max.-limit level ( <b>b063</b> ) - Min.-limit level ( <b>b064</b> )} / 2 % (Maximum of 10%)  | ✓             | 0.           | %     |
| <b>b070</b> | Operation level at O disconnection               | Set range, 0 to 100%, or "no" (ignore)  | ✗             | no           | -     |
| <b>b071</b> | Operation level at OI disconnection              | Set range, 0 to 100%, or "no" (ignore)  | ✗             | no           | -     |
| <b>b075</b> | Ambient temperature setting                      | Set range is, -10~50 °C   | ✓             | 40           | °C    |
| <b>b078</b> | Watt-hour clearance                              | Two option codes:<br>00...OFF<br>01...ON (press STR then clear)   | ✓             | 00           | -     |
| <b>b079</b> | Watt-hour display gain                           | Set range is, 1.~1000.  | ✓             | 1.           |       |
| <b>b082</b> | Start frequency                                  | Sets the starting frequency for the inverter output, range is 0.10 to 9.99 Hz   | ✗             | 0.50         | Hz    |
| <b>b083</b> | Carrier frequency                                | Sets the PWM carrier (internal switching frequency), range is 2.0 to 15.0 kHz   | ✗             | 2.0          | kHz   |
| <b>b084</b> | Initialization mode (parameters or trip history) | Select initialized data, five option codes:<br>00...Initialization disabled<br>01...Clears Trip history<br>02...Initializes all Parameters<br>03...Clears Trip history and initializes all parameters<br>04...Clears Trip history and initializes all parameters and EzSQ program | ✗             | 00           | -     |
| <b>b085</b> | Country for initialization                       | Select default parameter values for country on initialization, two option codes:<br>00...area A      01...area B  | ✗             | 00           | -     |
| <b>b086</b> | Frequency scaling conversion factor              | Specify a constant to scale the displayed frequency for <b>d007</b> monitor, range is 0.01 to 99.99   | ✗             | 1.00         | -     |



| Func. Code  | "b" Function                            |  | Run Mode Edit | Defaults     |       |
|-------------|---|--|---------------|--------------|-------|
|             | Name                                    | Description  |               | Initial data | Units |
| <b>b087</b> | STOP key enable                         | Select whether the STOP key on the keypad is enabled, three option codes:<br>00...Enabled<br>01...Disabled always<br>02... Disabled for stop   | ✗             | 00           | -     |
| <b>b088</b> | Restart mode after FRS                  | Selects how the inverter resumes operation when free-run stop (FRS) is cancelled, three options:<br>00...Restart from 0Hz<br>01...Restart from frequency detected from real speed of motor (freq. matching)<br>02...Restart from frequency detected from real speed of motor (active freq. matching) | ✗             | 00           | -     |
| <b>b089</b> | Automatic carrier frequency reduction   | Three option codes:<br>00...Disabled<br>01...Enabled, depending on the output current<br>02...Enabled, depending on the heat-sink temperature  | ✗             | 01           | -     |
| <b>b090</b> | Dynamic braking usage ratio             | Selects the rate of use (in %) of the regenerative braking resistor per 100 sec. intervals, range is 0.0 to 100%.<br>0%: Function disabled<br>>0%: Enabled, per value  | ✗             | 0.0          | %     |
| <b>b091</b> | Stop mode selection                     | Select how the inverter stops the motor, two option codes:<br>00...DEC (decelerate to stop)<br>01...FRS (free-run to stop)   | ✗             | 00           | -     |
| <b>b092</b> | Cooling fan control                     | Selects when the fan is ON during inverter operation, four options:<br>00...Fan is always ON<br>01...Fan is ON during run, OFF during stop (5 minute delay from ON to OFF)<br>02...Fan is temperature controlled   | ✗             | 01           | -     |
| <b>b093</b> | Clear elapsed time of cooling fan       | Two option codes:<br>00...Count<br>01...Clear  | ✗             | 00           | -     |
| <b>b094</b> | Initialization target data              | Select initialized parameters, four option codes:<br>00...All parameters<br>01...All parameters except in/output terminals and communication.<br>02...Only registered parameters in Uxxx.<br>03...All parameters except registered parameters in Uxxx and b037.                                      | ✗             | 00           | -     |
| <b>b095</b> | Dynamic braking control (BRD) selection | Three option codes:<br>00...Disable<br>01...Enable during run only<br>02...Enable always   | ✗             | 01           | -     |

| Func. Code   | "b" Function                                |   | Run Mode Edit | Defaults               |         |
|--------------|---|---|---------------|------------------------|---------|
|              | Name  | Description   |               | Initial data           | Units   |
| <b>b096</b>  | BRD activation level                        | Range is:<br>330 to 380V (200V class)<br>660 to 760V (400V class)                                 | ✗             | 360/<br>720            | V       |
| <b>b097</b>  | BRD resistor value                          | Min.Resistance to 600.0   | ✗             | Min.<br>Resistanc<br>e | Oh<br>m |
| <b>b 100</b> | Free V/F setting, freq.1                    | Set range, 0 ~ value of <b>b 102</b>  | ✗             | 0.                     | Hz      |
| <b>b 101</b> | Free V/F setting, voltage.1                 | Set range, 0 ~ 800V   | ✗             | 0.0                    | V       |
| <b>b 102</b> | Free V/F setting, freq.2                    | Set range, value of <b>b 100</b> ~ <b>b 104</b>   | ✗             | 0.                     | Hz      |
| <b>b 103</b> | Free V/F setting, voltage.2                 | Set range, 0 ~ 800V   | ✗             | 0.0                    | V       |
| <b>b 104</b> | Free V/F setting, freq.3                    | Set range, value of <b>b 102</b> ~ <b>b 106</b>   | ✗             | 0.                     | Hz      |
| <b>b 105</b> | Free V/F setting, voltage.3                 | Set range, 0 ~ 800V   | ✗             | 0.0                    | V       |
| <b>b 106</b> | Free V/F setting, freq.4                    | Set range, value of <b>b 104</b> ~ <b>b 108</b>   | ✗             | 0.                     | Hz      |
| <b>b 107</b> | Free V/F setting, voltage.4                 | Set range, 0 ~ 800V   | ✗             | 0.0                    | V       |
| <b>b 108</b> | Free V/F setting, freq.5                    | Set range, value of <b>b 106</b> ~ <b>b 110</b>   | ✗             | 0.                     | Hz      |
| <b>b 109</b> | Free V/F setting, voltage.5                 | Set range, 0 ~ 800V   | ✗             | 0.0                    | V       |
| <b>b 110</b> | Free V/F setting, freq.6                    | Set range, value of <b>b 108</b> ~ <b>b 112</b>   | ✗             | 0.                     | Hz      |
| <b>b 111</b> | Free V/F setting, voltage.6                 | Set range, 0 ~ 800V   | ✗             | 0.0                    | V       |
| <b>b 112</b> | Free V/F setting, freq.7                    | Set range, <b>b 110</b> ~ 400   | ✗             | 0.                     | Hz      |
| <b>b 113</b> | Free V/F setting, voltage.7                 | Set range, 0 ~ 800V   | ✗             | 0.0                    | V       |
| <b>b 120</b> | Brake control enable                        | Two option codes:<br><b>00</b> ...Disable<br><b>01</b> ...Enable                                  | ✗             | 00                     | -       |
| <b>b 121</b> | Brake Wait Time for Release                 | Set range: 0.00 to 5.00 sec   | ✗             | 0.00                   | Sec     |
| <b>b 122</b> | Brake Wait Time for Acceleration            | Set range: 0.00 to 5.00 sec   | ✗             | 0.00                   | Sec     |
| <b>b 123</b> | Brake Wait Time for Stopping                | Set range: 0.00 to 5.00 sec   | ✗             | 0.00                   | Sec     |
| <b>b 124</b> | Brake Wait Time for Confirmation            | Set range: 0.00 to 5.00 sec   | ✗             | 0.00                   | Sec     |
| <b>b 125</b> | Brake release freq.                         | Set range: 0 to 400Hz   | ✗             | 0.00                   | Sec     |
| <b>b 126</b> | Brake release current                       | Set range: 0~200% of inverter rated current   | ✗             | (rated current)        | A       |
| <b>b 127</b> | Braking freq. setting                       | Set range: 0 to 400Hz   | ✗             | 0.00                   | Hz      |
| <b>b 130</b> | Deceleration overvoltage suppression enable | <b>00</b> ...Disabled<br><b>01</b> ...Enabled<br><b>02</b> ...Enabled with accel.                 | ✗             | 00                     | -       |
| <b>b 131</b> | Decel. overvolt. suppress level             | DC bus voltage of suppression.<br>Range is:<br>200V class...330 to 395<br>400V class...660 to 790 | ✗             | 380<br>/760            | V       |
| <b>b 132</b> | Decel. overvolt. suppress const.            | Accel. rate when b130=02.<br>Set range: 0.10 ~ 30.00 sec.   | ✗             | 1.00                   | sec     |

| Func. Code | "b" Function                                |  | Run Mode Edit | Defaults     |       |
|------------|---|--|---------------|--------------|-------|
|            | Name  | Description  |               | Initial data | Units |
| b 133      | Decel. overvolt. suppress proportional gain | Proportional gain when b130=01. Range is: 0.00 to 5.00   | ✓             | 0.20         | -     |
| b 134      | Decel. overvolt. suppress integral time     | Integration time when b130=01. Range is: 0.00 to 150.0   | ✓             | 1.0          | sec   |
| b 145      | GS input mode                               | Two option codes:<br>00...No trip (Hardware shutoff only)<br>01...Trip   | ✗             | 00           | -     |
| b 150      | Display ex.operator connected               | When an external operator is connected via RS-422 port, the built-in display is locked and shows only one "d" parameter configured in:<br>d001 ~ d030          | ✗             | 001          | -     |
| b 160      | 1st parameter of Dual Monitor               | Set any two "d" parameters in b160 and b161, then they can be monitored in d050. The two parameters are switched by up/down keys.<br>Set range: d001 ~ d030    | ✗             | 001          | -     |
| b 161      | 2nd parameter of Dual Monitor               |  | ✗             | 002          | -     |
| b 163      | Frequency set in monitoring                 | Two option codes:<br>00...Freq. set disabled<br>01...Freq. set enabled   | ✓             | 00           | -     |
| b 164      | Automatic return to the initial display     | 10 min. after the last key operation, display returns to the initial parameter set by b038. Two option codes:<br>00...Disable<br>01...Enable                   | ✓             | 00           | -     |
| b 165      | Ex. operator com. loss action               | Five option codes:<br>00...Trip<br>01...Trip after deceleration to a stop<br>02...Ignore<br>03...Coasting (FRS)<br>04...Decelerates to a stop                  | ✓             | 02           | -     |
| b 166      | Data Read/Write select                      | 00... Read/Write OK<br>01... Protected   | ✗             | 00           | -     |
| b 171      | Inverter mode selection                     | Three option codes:<br>00...No function<br>01...Std. IM (Induction Motor)<br>03...PM(Permanent Magnet Motor)   | ✗             | 00           | -     |
| b 180      | Initialization trigger (*)                  | This is to perform initialization by parameter input with b084, b085 and b094. Two option codes:<br>00...Initialization disable<br>01...Perform initialization | ✗             | 00           | -     |
| b 190      | Password Settings A                         | 0000(Invalid Password)<br>0001-FFFF>Password)  | ✗             | 0000         | -     |
| b 191      | Password authentication A                   | 0000-FFFF  | ✗             | 0000         | -     |
| b 192      | Password Settings B                         | 0000(Invalid Password)<br>0001-FFFF>Password)  | ✗             | 0000         | -     |
| b 193      | Password authentication B                   | 0000-FFFF  | ✗             | 0000         | -     |

## Intelligent Terminal Functions

| Func. Code | "C" Function                               |  | Run Mode Edit | Defaults     |       |
|------------|--|--|---------------|--------------|-------|
|            | Name                                       | Description  |               | Initial data | Units |
| C001       | Input [1] function                         | Select input terminal [1] function, 68 options (see next section)  | X             | 00<br>[FW]   | –     |
| C002       | Input [2] function                         | Select input terminal [2] function, 68 options (see next section)  | X             | 01<br>[RV]   | –     |
| C003       | Input [3] function<br>[GS1 assignable]     | Select input terminal [3] function, 68 options (see next section)  | X             | 02<br>[CF1]  | –     |
| C004       | Input [4] function<br>[GS2 assignable]     | Select input terminal [4] function, 68 options (see next section)  | X             | 03<br>[CF2]  | –     |
| C005       | Input [5] function<br>[PTC assignable]     | Select input terminal [5] function, 68 options (see next section)  | X             | 09<br>[2CH]  | –     |
| C006       | Input [6] function                         | Select input terminal [6] function, 68 options (see next section)  | X             | 18<br>[RS]   | –     |
| C007       | Input [7] function                         | Select input terminal [7] function, 68 options (see next section)  | X             | 13<br>[USP]  | –     |
| C011       | Input [1] active state                     | Select logic conversion, two option codes:<br>00...normally open [NO]<br>01...normally closed [NC]   | X             | 00           | –     |
| C012       | Input [2] active state                     |  | X             | 00           | –     |
| C013       | Input [3] active state                     |  | X             | 00           | –     |
| C014       | Input [4] active state                     |  | X             | 00           | –     |
| C015       | Input [5] active state                     |  | X             | 00           | –     |
| C016       | Input [6] active state                     |  | X             | 00           | –     |
| C017       | Input [7] active state                     |  | X             | 00           | –     |
| C021       | Output [11] function<br>[EDM assignable]   | 48 programmable functions available for logic (discrete) outputs (see next section)  | X             | 01<br>[FA1]  | –     |
| C022       | Output [12] function                       |  | X             | 00<br>[RUN]  | –     |
| C026       | Alarm relay function                       | 48 programmable functions available for logic (discrete) outputs (see next section)  | X             | 05<br>[AL]   | –     |
| C027       | [EO] terminal selection (Pulse/PWM output) | 13 programmable functions:<br>00...Output frequency (PWM)<br>01...Output current (PWM)<br>02...Output torque (PWM)<br>03...Output frequency (Pulse train)<br>04...Output voltage (PWM)<br>05...Input power (PWM)<br>06...Electronic thermal load ratio (PWM)<br>07...LAD frequency (PWM)<br>08...Output current (Pulse train)<br>10...Heat sink temperature (PWM)<br>12...General output (PWM)<br>15...Pulse train input monitor<br>16...Option(PWM) | X             | 07           | –     |

| "C" Function |   |   | Run Mode Edit | Defaults             |       |
|--------------|---|---|---------------|----------------------|-------|
| Func. Code   | Name  | Description   |               | Initial data         | Units |
| C028         | [AM] terminal selection (Analog voltage output 0...10V) | 11 programmable functions:<br>00...Output frequency<br>01...Output current<br>02...Output torque<br>04...Output voltage<br>05...Input power<br>06...Electronic thermal load ratio<br>07...LAD frequency<br>10...Heat sink temperature<br>11...Output torque (with code)<br>13...General output<br>16...Option | X             | 07 [LAD]             | -     |
| C030         | Digital current monitor reference value                 | Current with digital current monitor output at 1,440Hz<br>Range is 20%~200% of rated current  | ✓             | Rated current        | A     |
| C031         | Output [11] active state                                | Select logic conversion, two option codes:<br>00...normally open [NO]<br>01...normally closed [NC]  | X             | 00                   | -     |
| C032         | Output [12] active state                                |   | X             | 00                   | -     |
| C036         | Alarm relay active state                                |   | X             | 01                   | -     |
| C038         | Output mode of low current detection                    | Two option codes:<br>00...During acceleration, deceleration and constant speed<br>01...During constant speed only   | X             | 01                   | -     |
| C039         | Low current detection level                             | Set the level of low load detection, range is 0.0 to 2.0*inverter rated current   | X             | INV rated current    | A     |
| C040         | Output mode of overload warning                         | Two option codes:<br>00...During accel., decel. and constant speed<br>01...During constant speed only   | X             | 01                   | -     |
| C041         | Overload warning level                                  | Sets the overload warning signal level between 0% and 200% (from 0 to two time the rated current of the inverter)   | X             | Rated current x 1.15 | A     |
| C241         | Overload warning level, 2 <sup>nd</sup> motor           | Sets the overload warning signal level between 0% and 200% (from 0 to two time the rated current of the inverter)   | X             | Rated current x 1.15 | A     |
| C042         | Frequency arrival setting for acceleration              | Sets the frequency arrival setting threshold for the output frequency during acceleration, range is 0.0 to 400.0 Hz   | X             | 0.0                  | Hz    |
| C043         | Frequency arrival setting for deceleration              | Sets the frequency arrival setting threshold for the output frequency during deceleration, range is 0.0 to 400.0 Hz   | X             | 0.0                  | Hz    |
| C044         | PID deviation level                                     | Sets the allowable PID loop error magnitude (absolute value), SP-PV, range is 0.0 to 100%   | X             | 3.0                  | %     |
| C045         | Frequency arrival setting 2 for acceleration            | Set range is 0.0 to 400.0 Hz  | X             | 0.00                 | Hz    |
| C046         | Frequency arrival setting 2 for deceleration            | Set range is 0.0 to 400.0 Hz  | X             | 0.00                 | Hz    |

| "C" Function |   |   | Run Mode Edit | Defaults     |       |
|--------------|---|---|---------------|--------------|-------|
| Func. Code   | Name  | Description   |               | Initial data | Units |
| C047         | Pulse train input/output scale conversion       | If EO terminal is configured as pulse train input (C027=15), scale conversion is set in C047.<br>Pulse-out = Pulse-in × (C047)<br>Set range is 0.01 to 99.99              | ✓             | 1.00         |       |
| C052         | PID FBV output high limit                       | When the PV exceeds this value, the PID loop turns OFF the PID second stage output, range is 0.0 to 100%  | ✗             | 100.0        | %     |
| C053         | PID FBV output low limit                        | When the PV goes below this value, the PID loop turns ON the PID second stage output, range is 0.0 to 100%  | ✗             | 0.0          | %     |
| C054         | Over-torque/under-torque selection              | Two option codes:<br>00...Over-torque<br>01...Under-torque  | ✗             | 00           | -     |
| C055         | Over/under-torque level (Forward powering mode) | Set range is 0 to 200%  | ✗             | 100.         | %     |
| C056         | Over/under-torque level (Reverse regen. mode)   | Set range is 0 to 200%  | ✗             | 100.         | %     |
| C057         | Over/under-torque level (Reverse powering mode) | Set range is 0 to 200%  | ✗             | 100.         | %     |
| C058         | Over/under-torque level (Forward regen. mode)   | Set range is 0 to 200%  | ✗             | 100.         | %     |
| C059         | Signal output mode of Over/under-torque         | Two option codes:<br>00...During accel., decel. and constant speed<br>01...During constant speed only   | ✗             | 01           | -     |
| C061         | Electronic thermal warning level                | Set range is 0 to 100%<br>Setting 0 means disabled.   | ✗             | 90           | %     |
| C063         | Zero speed detection level                      | Set range is 0.0 to 100.0Hz   | ✗             | 0.00         | Hz    |
| C064         | Heat sink overheat warning                      | Set range is 0 to 110 °C  | ✗             | 100.         | °C    |
| C071         | Communication speed                             | Eight option codes:<br>03...2,400 bps<br>04...4,800 bps<br>05...9,600 bps<br>06...19,200 bps<br>07...38,400 bps<br>08...57,600 bps<br>09...76,800 bps<br>10...115,200 bps | ✗             | 05           | baud  |
| C072         | Modbus address                                  | Set the address of the inverter on the network. Range is 1 to 247   | ✗             | 1.           | -     |
| C074         | Communication parity                            | Three option codes:<br>00...No parity<br>01...Even parity<br>02...Odd parity  | ✗             | 00           | -     |
| C075         | Communication stop bit                          | Two option codes:<br>1...1 bit<br>2...2 bit   | ✗             | 1            | bit   |

| "C" Function |   |   | Run Mode Edit | Defaults     |       |
|--------------|---|---|---------------|--------------|-------|
| Func. Code   | Name                                    | Description   |               | Initial data | Units |
| C076         | Communication error select              | Selects inverter response to communications error.<br>Five options:<br>00...Trip<br>01...Decelerate to a stop and trip<br>02...Disable<br>03...Free run stop (coasting)<br>04...Decelerates to a stop | X             | 02           | -     |
| C077         | Communication error time-out            | Sets the communications watchdog timer period.<br>Range is 0.00 to 99.99 sec<br>0.0 = disabled  | X             | 0.00         | sec.  |
| C078         | Communication wait time                 | Time the inverter waits after receiving a message before it transmits.<br>Range is 0. to 1000. ms   | X             | 0.           | msec. |
| C081         | O input span calibration                | Scale factor between the external frequency command on terminals L-O (voltage input) and the frequency output, range is 0.0 to 200%   | ✓             | 100.0        | %     |
| C082         | O1 input span calibration               | Scale factor between the external frequency command on terminals L-O1 (voltage input) and the frequency output, range is 0.0 to 200%  | ✓             | 100.0        | %     |
| C085         | Thermistor input (PTC) span calibration | Scale factor of PTC input.<br>Range is 0.0 to 200%  | ✓             | 100.0        | %     |
| C091         | Debug mode enable *                     | Displays debug parameters.<br>Two option codes:<br>00...Disable<br>01...Enable <Do not set> (for factory use)   | ✓             | 00           | -     |
| C096         | Communication selection                 | 00...Modbus-RTU<br>01... EzCOM<br>02... EzCOM<administrator>  | X             | 00           | -     |
| C098         | EzCOM start adr. of master              | 01-08   | X             | 01           | -     |
| C099         | EzCOM end adr. of master                | 01-08   | X             | 01           | -     |
| C100         | EzCOM starting trigger                  | 00... Input terminal<br>01... Always  | X             | 00           | -     |
| C101         | Up/Down memory mode selection           | Controls speed setpoint for the inverter after power cycle.<br>Two option codes:<br>00...Clear last frequency (return to default frequency F001)<br>01...Keep last frequency adjusted by UP/DWN       | X             | 00           | -     |

| "C" Function |                          |   | Run Mode Edit | Defaults             |       |
|--------------|--------------------------|---|---------------|----------------------|-------|
| Func. Code   | Name                     | Description   |               | Initial data         | Units |
| C 102        | Reset selection          | Determines response to Reset input [RS].<br>Four option codes:<br>00...Cancel trip state at input signal ON transition, stops inverter if in Run Mode<br>01...Cancel trip state at signal OFF transition, stops inverter if in Run Mode<br>02...Cancel trip state at input ON transition, no effect if in Run Mode<br>03...Clear the memories only related to trip status | X             | 00                   | -     |
| C 103        | Restart mode after reset | Determines the restart mode after reset is given, three option codes:<br>00...Start with 0 Hz<br>01...Start with freq. matching<br>02...Start with active freq. matching  | X             | 00                   | -     |
| C 104        | UP/DWN clear mode        | Freq. set value when UDC signal is given to the input terminal, two option codes:<br>00...0 Hz<br>01...Original setting (in the EEPROM memory at power on)  | X             | 00                   | -     |
| C 105        | EO gain adjustment       | Set range is 50 to 200%   | ✓             | 100.                 | %     |
| C 106        | AM gain adjustment       | Set range is 50 to 200%   | ✓             | 100.                 | %     |
| C 109        | AM bias adjustment       | Set range is 0 to 100%  | ✓             | 0.                   | %     |
| C 111        | Overload warning level 2 | Sets the overload warning signal level between 0% and 200% (from 0 to two time the rated current of the inverter)   | ✓             | Rated current x 1.15 | A     |
| C 130        | Output [11] on delay     | Set range is 0.0 to 100.0 sec.  | X             | 0.0                  | Sec.  |
| C 131        | Output [11] off delay    |   | X             | 0.0                  | Sec.  |
| C 132        | Output [12] on delay     | Set range is 0.0 to 100.0 sec.  | X             | 0.0                  | Sec.  |
| C 133        | Output [12] off delay    |   | X             | 0.0                  | Sec.  |
| C 140        | Relay output on delay    | Set range is 0.0 to 100.0 sec.  | X             | 0.0                  | Sec.  |
| C 141        | Relay output off delay   |   | X             | 0.0                  | Sec.  |
| C 142        | Logic output 1 operand A | All the programmable functions available for logic (discrete) outputs except LOG1 to LOG3, OPO, no  | X             | 00                   | -     |
| C 143        | Logic output 1 operand B |   | X             | 00                   | -     |
| C 144        | Logic output 1 operator  | Applies a logic function to calculate [LOG] output state,<br>Three options:<br>00...[LOG] = A AND B<br>01...[LOG] = A OR B<br>02...[LOG] = A XOR B  | X             | 00                   | -     |
| C 145        | Logic output 2 operand A | All the programmable functions available for logic (discrete) outputs except LOG1 to LOG3, OPO, no  | X             | 00                   | -     |
| C 146        | Logic output 2 operand B |   | X             | 00                   | -     |



| "C" Function |  |   | Run Mode Edit | Defaults     |       |
|--------------|--|---|---------------|--------------|-------|
| Func. Code   | Name   | Description   |               | Initial data | Units |
| C 147        | Logic output 2 operator                      | Applies a logic function to calculate [LOG] output state, Three options:<br>00...[LOG] = A AND B<br>01...[LOG] = A OR B<br>02...[LOG] = A XOR B | X             | 00           | –     |
| C 148        | Logic output 3 operand A                     | All the programmable functions available for logic (discrete) outputs except LOG1 to LOG3, OPO, no  | X             | 00           | –     |
| C 149        | Logic output 3 operand B                     |   | X             | 01           | –     |
| C 150        | Logic output 3 operator                      | Applies a logic function to calculate [LOG] output state, Three options:<br>00...[LOG] = A AND B<br>01...[LOG] = A OR B<br>02...[LOG] = A XOR B | X             | 00           | –     |
| C 160        | Input [1] response time                      | Sets response time of each input terminal, set range:<br>0 (x 2 [ms]) to 200 (x 2 [ms])<br>(0 to 400 [ms])                                      | X             | 1.           | –     |
| C 161        | Input [2] response time                      |   | X             | 1.           | –     |
| C 162        | Input [3] response time                      |   | X             | 1.           | –     |
| C 163        | Input [4] response time                      |   | X             | 1.           | –     |
| C 164        | Input [5] response time                      |   | X             | 1.           | –     |
| C 165        | Input [6] response time                      |   | X             | 1.           | –     |
| C 166        | Input [7] response time                      |   | X             | 1.           | –     |
| C 169        | Multistage speed/position determination time | Set range is 0. to 200. (x 10ms)  | X             | 0.           | ms    |

**Input Function Summary Table** – This table shows all thirty-one intelligent input functions at a glance. Detailed description of these functions, related parameters and settings, and example wiring diagrams are in "Using Intelligent Input Terminals" on page 4-8.

| Input Function Summary Table |                 |                                 |             |  |
|------------------------------|-----------------|---------------------------------|-------------|--|
| Option Code                  | Terminal Symbol | Function Name                   | Description |  |
| 00                           | FW              | FORWARD Run/Stop                | ON          | Inverter is in Run Mode, motor runs forward  |
|                              |                 |                                 | OFF         | Inverter is in Stop Mode, motor stops  |
| 01                           | RV              | Reverse Run/Stop                | ON          | Inverter is in Run Mode, motor runs reverse  |
|                              |                 |                                 | OFF         | Inverter is in Stop Mode, motor stops  |
| 02                           | CF1 *1          | Multi-speed Select, Bit 0 (LSB) | ON          | Binary encoded speed select, Bit 0, logical 1  |
|                              |                 |                                 | OFF         | Binary encoded speed select, Bit 0, logical 0  |
| 03                           | CF2             | Multi-speed Select, Bit 1       | ON          | Binary encoded speed select, Bit 1, logical 1  |
|                              |                 |                                 | OFF         | Binary encoded speed select, Bit 1, logical 0  |
| 04                           | CF3             | Multi-speed Select, Bit 2       | ON          | Binary encoded speed select, Bit 2, logical 1  |
|                              |                 |                                 | OFF         | Binary encoded speed select, Bit 2, logical 0  |
| 05                           | CF4             | Multi-speed Select, Bit 3 (MSB) | ON          | Binary encoded speed select, Bit 3, logical 1  |
|                              |                 |                                 | OFF         | Binary encoded speed select, Bit 3, logical 0  |
| 06                           | JG              | Jogging                         | ON          | Inverter is in Run Mode, output to motor runs at jog parameter frequency               |
|                              |                 |                                 | OFF         | Inverter is in Stop Mode   |
| 07                           | DB              | External DC braking             | ON          | DC braking will be applied during deceleration   |
|                              |                 |                                 | OFF         | DC braking will not be applied   |
| 08                           | SET             | Set (select) 2nd Motor Data     | ON          | The inverter uses 2nd motor parameters for generating frequency output to motor        |
|                              |                 |                                 | OFF         | The inverter uses 1st (main) motor parameters for generating frequency output to motor |

|    |     |   |      |   |
|----|-----|---|------|---|
| 09 | 2CH | 2-stage Acceleration and Deceleration         | ON   | Frequency output uses 2nd-stage acceleration and deceleration values  |
|    |     |   | OFF  | Frequency output uses standard acceleration and deceleration values   |
| 11 | FRS | Free-run Stop                                 | ON   | Causes output to turn OFF, allowing motor to free run (coast) to stop   |
|    |     |   | OFF  | Output operates normally, so controlled deceleration stop motor   |
| 12 | EXT | External Trip                                 | ON   | When assigned input transitions OFF to ON, inverter latches trip event and displays <b>E 12</b>   |
|    |     |   | OFF  | No trip event for ON to OFF, any recorded trip events remain in history until reset   |
| 13 | USP | Unattended Start Protection                   | ON   | On powerup, the inverter will not resume a Run command (mostly used in the US)  |
|    |     |   | OFF  | On powerup, the inverter will resume a Run command that was active before power loss  |
| 14 | CS  | Commercial power source switchover            | ON   | Motor can be driven by commercial power   |
|    |     |   | OFF  | Motor is driven via the inverter  |
| 15 | SFT | Software Lock                                 | ON   | The keypad and remote programming devices are prevented from changing parameters  |
|    |     |   | OFF  | The parameters may be edited and stored   |
| 16 | AT  | Analog Input Voltage/Current Select           | ON   | Refer to "Analog Input Settings" on page 3-13.  |
|    |     |   | OFF  |   |
| 18 | RS  | Reset Inverter                                | ON   | The trip condition is reset, the motor output is turned OFF, and powerup reset is asserted  |
|    |     |   | OFF  | Normal power-ON operation   |
| 19 | PTC | PTC thermistor Thermal Protection (C005 only) | ANLG | When a thermistor is connected to terminal [5] and [L], the inverter checks for over-temperature and will cause trip event and turn OFF output to motor |
|    |     |   | OPEN | A disconnect of the thermistor causes a trip event, and the inverter turns OFF the motor  |

| Input Function Summary Table |                 |   |             |   |
|------------------------------|-----------------|---|-------------|---|
| Option Code                  | Terminal Symbol | Function Name                                     | Description |   |
| 20                           | STA             | Start (3-wire interface)                          | ON          | Starts the motor rotation   |
|                              |                 |   | OFF         | No change to present motor status   |
| 21                           | STP             | Stop (3-wire interface)                           | ON          | Stops the motor rotation  |
|                              |                 |   | OFF         | No change to present motor status   |
| 22                           | F/R             | FWD, REV (3-wire interface)                       | ON          | Selects the direction of motor rotation: ON = FWD. While the motor is rotating, a change of F/R will start a deceleration, followed by a change in direction  |
|                              |                 |   | OFF         | Selects the direction of motor rotation: OFF = REV. While the motor is rotating, a change of F/R will start a deceleration, followed by a change in direction |
| 23                           | PID             | PID Disable                                       | ON          | Temporarily disables PID loop control. Inverter output turns OFF as long as PID Enable is active ( <b>RD7 I=0 I</b> )   |
|                              |                 |   | OFF         | Has no effect on PID loop operation, which operates normally if PID Enable is active ( <b>RD7 I=0 I</b> )   |
| 24                           | PIDC            | PID Reset   | ON          | Resets the PID loop controller. The main consequence is that the integrator sum is forced to zero   |
|                              |                 |   | OFF         | No effect on PID controller   |
| 27                           | UP              | Remote Control UP Function (motorized speed pot.) | ON          | Accelerates (increases output frequency) motor from current frequency   |
|                              |                 |   | OFF         | Output to motor operates normally   |

| Input Function Summary Table |                 |   |             |  |
|------------------------------|-----------------|---|-------------|--|
| Option Code                  | Terminal Symbol | Function Name                                       | Description |  |
| 28                           | DWN             | Remote Control Down Function (motorized speed pot.) | ON          | Decelerates (decreases output frequency) motor from current frequency  |
|                              |                 |   | OFF         | Output to motor operates normally  |
| 29                           | UDC             | Remote Control Data Clearing                        | ON          | Clears the UP/DWN frequency memory by forcing it to equal the set frequency parameter F001. Setting <b>C 10 I</b> must be set=00 to enable this function to work |
|                              |                 |   | OFF         | UP/DWN frequency memory is not changed   |
| 31                           | OPE             | Operator Control                                    | ON          | Forces the source of the output frequency setting <b>A00 I</b> and the source of the Run command <b>A002</b> to be from the digital operator                     |
|                              |                 |   | OFF         | Source of output frequency set by <b>A00 I</b> and source of Run command set by <b>A002</b> is used  |
| 32                           | SF1             | Multi-speed Select, Bit operation Bit 1             | ON          | Bit encoded speed select, Bit 1, logical 1   |
|                              |                 |   | OFF         | Bit encoded speed select, Bit 1, logical 0   |
| 33                           | SF2             | Multi-speed Select, Bit operation Bit 2             | ON          | Bit encoded speed select, Bit 2, logical 1   |
|                              |                 |   | OFF         | Bit encoded speed select, Bit 2, logical 0   |
| 34                           | SF3             | Multi-speed Select, Bit operation Bit 3             | ON          | Bit encoded speed select, Bit 3, logical 1   |
|                              |                 |   | OFF         | Bit encoded speed select, Bit 3, logical 0   |
| 35                           | SF4             | Multi-speed Select, Bit operation Bit 4             | ON          | Bit encoded speed select, Bit 4, logical 1   |
|                              |                 |   | OFF         | Bit encoded speed select, Bit 4, logical 0   |
| 36                           | SF5             | Multi-speed Select, Bit operation Bit 5             | ON          | Bit encoded speed select, Bit 5, logical 1   |
|                              |                 |   | OFF         | Bit encoded speed select, Bit 5, logical 0   |
| 37                           | SF6             | Multi-speed Select, Bit operation Bit 6             | ON          | Bit encoded speed select, Bit 6, logical 1   |
|                              |                 |   | OFF         | Bit encoded speed select, Bit 6, logical 0   |
| 38                           | SF7             | Multi-speed Select, Bit operation Bit 7             | ON          | Bit encoded speed select, Bit 7, logical 1   |
|                              |                 |   | OFF         | Bit encoded speed select, Bit 7, logical 0   |
| 39                           | OLR             | Overload Restriction Source Changeover              | ON          | Perform overload restriction   |
|                              |                 |   | OFF         | Normal operation   |
| 40                           | TL              | Torque Limit Selection                              | ON          | Setting of <b>b040</b> is enabled  |
|                              |                 |   | OFF         | Max. torque is limited with 200%   |
| 41                           | TRQ1            | Torque limit switch 1                               | ON          | Torque limit related parameters of Powering/regen, and FW/RV modes are selected by the combinations of these inputs.   |
|                              |                 |   | OFF         |  |
| 42                           | TRQ2            | Torque limit switch 2                               | ON          |  |
|                              |                 |   | OFF         |  |

| Input Function Summary Table |                 |                      |             |   |
|------------------------------|-----------------|----------------------|-------------|---|
| Option Code                  | Terminal Symbol | Function Name        | Description |   |
| 44                           | BOK             | Brake confirmation   | ON          | Brake wait time ( <b>b 124</b> ) is valid   |
|                              |                 |                      | OFF         | Brake wait time ( <b>b 124</b> ) is not valid   |
| 46                           | LAC             | LAD cancellation     | ON          | Set ramp times are ignored. Inverter output immediately follows the freq. command.                  |
|                              |                 |                      | OFF         | Accel. and/or decel. is according to the set ramp time  |
| 47                           | PCLR            | Pulse counter clear  | ON          | Clear the position deviation data   |
|                              |                 |                      | OFF         | Maintain the position deviation data  |
| 50                           | ADD             | ADD frequency enable | ON          | Adds the <b>A 145</b> (add frequency) value to the output frequency                                 |
|                              |                 |                      | OFF         | Does not add the <b>A 145</b> value to the output frequency   |
| 51                           | F-TM            | Force Terminal Mode  | ON          | Force inverter to use input terminals for output frequency and Run command sources                  |
|                              |                 |                      | OFF         | Source of output frequency set by <b>A00 I</b> and source of Run command set by <b>A002</b> is used |

| Input Function Summary Table |                 |                                |             |  |
|------------------------------|-----------------|--------------------------------|-------------|--|
| Option Code                  | Terminal Symbol | Function Name                  | Description |  |
| 52                           | ATR             | Enable torque command input    | ON          | Torque control command input is enabled  |
|                              |                 |                                | OFF         | Torque control command input is disabled   |
| 53                           | KHC             | Clear watt-hour data           | ON          | Clear watt-hour data   |
|                              |                 |                                | OFF         | No action  |
| 56                           | MI1             | General purpose input (1)      | ON          | General purpose input (1) is made ON under EzSQ                                      |
|                              |                 |                                | OFF         | General purpose input (1) is made OFF under EzSQ                                     |
| 57                           | MI2             | General purpose input (2)      | ON          | General purpose input (2) is made ON under EzSQ                                      |
|                              |                 |                                | OFF         | General purpose input (2) is made OFF under EzSQ                                     |
| 58                           | MI3             | General purpose input (3)      | ON          | General purpose input (3) is made ON under EzSQ                                      |
|                              |                 |                                | OFF         | General purpose input (3) is made OFF under EzSQ                                     |
| 59                           | MI4             | General purpose input (4)      | ON          | General purpose input (4) is made ON under EzSQ                                      |
|                              |                 |                                | OFF         | General purpose input (4) is made OFF under EzSQ                                     |
| 60                           | MI5             | General purpose input (5)      | ON          | General purpose input (5) is made ON under EzSQ                                      |
|                              |                 |                                | OFF         | General purpose input (5) is made OFF under EzSQ                                     |
| 61                           | MI6             | General purpose input (6)      | ON          | General purpose input (6) is made ON under EzSQ                                      |
|                              |                 |                                | OFF         | General purpose input (6) is made OFF under EzSQ                                     |
| 62                           | MI7             | General purpose input (7)      | ON          | General purpose input (7) is made ON under EzSQ                                      |
|                              |                 |                                | OFF         | General purpose input (7) is made OFF under EzSQ                                     |
| 65                           | AHD             | Analog command hold            | ON          | Analog command is held   |
|                              |                 |                                | OFF         | Analog command is not held   |
| 66                           | CP1             | Multistage-position switch (1) | ON          | Multistage position commands are set according to the combination of these switches. |
|                              |                 |                                | OFF         |  |
| 67                           | CP2             | Multistage-position switch (2) | ON          |  |
|                              |                 |                                | OFF         |  |
| 68                           | CP3             | Multistage-position switch (3) | ON          |  |
|                              |                 |                                | OFF         |  |
| 69                           | ORL             | Limit signal of homing         | ON          | Limit signal of homing is ON   |
|                              |                 |                                | OFF         | Limit signal of homing is OFF  |
| 70                           | ORG             | Trigger signal of homing       | ON          | Starts homing operation  |
|                              |                 |                                | OFF         | No action  |
| 73                           | SPD             | Speed/position changeover      | ON          | Speed control mode   |
|                              |                 |                                | OFF         | Position control mode  |

| Input Function Summary Table |                 |  |             |   |
|------------------------------|-----------------|--|-------------|---|
| Option Code                  | Terminal Symbol | Function Name                            | Description |   |
| 77                           | GS1 *           | GS1 input                                | ON          | EN60204-1 related signals:<br>Signal input of "Safe torque off" function. |
|                              |                 |  | OFF         |   |
| 78                           | GS2 *           | GS2 input                                | ON          |   |
|                              |                 |  | OFF         |   |
| 81                           | 485             | Start EzCOM                              | ON          | Starts EzCOM  |
|                              |                 |  | OFF         | No execution  |
| 82                           | PRG             | Executing EzSQ program                   | ON          | Executing EzSQ program  |
|                              |                 |  | OFF         | No execution  |
| 83                           | HLD             | Retain output frequency                  | ON          | Retain the current output frequency                                       |
|                              |                 |  | OFF         | No retention  |
| 84                           | ROK             | Permission of Run command                | ON          | Run command permitted   |
|                              |                 |  | OFF         | Run command is not permitted  |
| 85                           | EB              | Rotation direction detection (C007 only) | ON          | Forward rotation  |
|                              |                 |  | OFF         | Reverse rotation  |
| 86                           | DISP            | Display limitation                       | ON          | Only a parameter configured in <b>b03B</b> is shown                       |
|                              |                 |  | OFF         | All the monitors can be shown   |
| 255                          | no              | No function                              | ON          | (input ignored)   |
|                              |                 |  | OFF         | (input ignored)   |

**Output Function Summary Table** – This table shows all functions for the logical outputs (terminals [11], [12] and [AL]) at a glance. Detailed descriptions of these functions, related parameters and settings, and example wiring diagrams are in “Using Intelligent Output Terminals” in chapter 4.

| Output Function Summary Table |                 |   |             |   |
|-------------------------------|-----------------|---|-------------|---|
| Option Code                   | Terminal Symbol | Function Name                           | Description |   |
| 00                            | RUN             | Run Signal                              | ON          | When the inverter is in Run Mode  |
|                               |                 |   | OFF         | When the inverter is in Stop Mode   |
| 01                            | FA1             | Frequency Arrival Type 1—Constant Speed | ON          | When output to motor is at the set frequency  |
|                               |                 |   | OFF         | When output to motor is OFF, or in any acceleration or deceleration ramp                        |
| 02                            | FA2             | Frequency Arrival Type 2—Over frequency | ON          | When output to motor is at or above the set freq, even if in accel (C042) or decel (C043) ramps |
|                               |                 |   | OFF         | When output to motor is OFF, or at a level below the set frequency                              |
| 03                            | OL              | Overload Advance Notice Signal 1        | ON          | When output current is more than the set threshold (C041) for the overload signal               |
|                               |                 |   | OFF         | When output current is less than the set threshold for the deviation signal                     |
| 04                            | OD              | Output Deviation for PID Control        | ON          | When PID error is more than the set threshold for the deviation signal                          |
|                               |                 |   | OFF         | When PID error is less than the set threshold for the deviation signal                          |
| 05                            | AL              | Alarm Signal                            | ON          | When an alarm signal has occurred and has not been cleared                                      |
|                               |                 |   | OFF         | When no alarm has occurred since the last cleaning of alarm(s)                                  |
| 06                            | FA3             | Frequency Arrival Type 3—Set frequency  | ON          | When output to motor is at the set frequency, during accel (C042) and decel (C043).             |
|                               |                 |   | OFF         | When output to motor is OFF, or is not at a level of the set frequency                          |
| 07                            | OTQ             | Over/under Torque Signal                | ON          | Estimated motor torque exceeds the specified level  |
|                               |                 |   | OFF         | Estimated motor torque is lower than the specified level  |
| 09                            | UV              | Undervoltage                            | ON          | Inverter is in Undervoltage   |
|                               |                 |   | OFF         | Inverter is not in Undervoltage   |
| 10                            | TRQ             | Torque Limited Signal                   | ON          | Torque limit function is executing  |
|                               |                 |   | OFF         | Torque limit function is not executing  |
| 11                            | RNT             | Run Time Expired                        | ON          | Total running time of the inverter exceeds the specified value                                  |
|                               |                 |   | OFF         | Total running time of the inverter does not exceed the specified value                          |
| 12                            | ONT             | Power ON time Expired                   | ON          | Total power ON time of the inverter exceeds the specified value                                 |
|                               |                 |   | OFF         | Total power ON time of the inverter does not exceed the specified value                         |
| 13                            | THM             | Thermal Warning                         | ON          | Accumulated thermal count exceeds the C061 set value  |
|                               |                 |   | OFF         | Accumulated thermal count does not exceed the C061 set value                                    |
| 19                            | BRK             | Brake Release Signal                    | ON          | Output for brake release  |
|                               |                 |   | OFF         | No action for brake   |
| 20                            | BER             | Brake Error Signal                      | ON          | Brake error has occurred  |
|                               |                 |   | OFF         | Brake performance is normal   |
| 21                            | ZS              | Zero Hz Speed Detection Signal          | ON          | Output frequency falls below the threshold specified in C063                                    |

| Output Function Summary Table |                 |   |             |  |
|-------------------------------|-----------------|---|-------------|--|
| Option Code                   | Terminal Symbol | Function Name                             | Description |  |
|                               |                 |   | OFF         | Output frequency is higher than the threshold specified in <b>C063</b>   |
| 22                            | DSE             | Speed Deviation Excessive                 | ON          | Deviation of speed command and actual speed exceeds the specified value <b>P027</b> .  |
|                               |                 |   | OFF         | Deviation of speed command and actual speed does not exceed the specified value <b>P027</b> .  |
| 23                            | POK             | Positioning Completion                    | ON          | Positioning is completed   |
|                               |                 |   | OFF         | Positioning is not completed   |
| 24                            | FA4             | Frequency Arrival Type 4—Over frequency   | ON          | When output to motor is at or above the set freq., even if in accel ( <b>C045</b> ) or decel ( <b>C046</b> ) ramps   |
|                               |                 |   | OFF         | When output to motor is OFF, or at a level below the set frequency   |
| 25                            | FA5             | Frequency Arrival Type 5—Set frequency    | ON          | When output to motor is at the set frequency, during accel ( <b>C045</b> ) and decel ( <b>C046</b> ).  |
|                               |                 |   | OFF         | When output to motor is OFF, or is not at a level of the set frequency   |
| 26                            | OL2             | Overload Advance Notice Signal 2          | ON          | When output current is more than the set threshold ( <b>L111</b> ) for the overload signal   |
|                               |                 |   | OFF         | When output current is less than the set threshold for the deviation signal  |
| 27                            | ODc             | Analog Voltage Input Disconnect Detection | ON          | When the [O] input value < <b>b070</b> setting (signal loss detected)  |
|                               |                 |   | OFF         | When no signal loss is detected  |
| 28                            | OIDc            | Analog Current input Disconnect Detection | ON          | When the [OI] input value < <b>b071</b> setting (signal loss detected)   |
|                               |                 |   | OFF         | When no signal loss is detected  |
| 31                            | FBV             | PID Second Stage Output                   | ON          | Transitions to ON when the inverter is in RUN Mode and the PID Process Variable (PV) is less than the Feedback Low Limit ( <b>C053</b> )                                   |
|                               |                 |   | OFF         | Transitions to OFF when the PID Process Variable (PV) exceeds the PID High Limit ( <b>C052</b> ), and transitions to OFF when the inverter goes from Run Mode to Stop Mode |
| 32                            | NDc             | Network Disconnect Detection              | ON          | When the communications watchdog timer (period specified by <b>C077</b> ) has time out   |
|                               |                 |   | OFF         | When the communications watchdog timer is satisfied by regular communications activity   |
| 33                            | LOG1            | Logic Output Function 1                   | ON          | When the Boolean operation specified by <b>L143</b> has a logical "1" result   |
|                               |                 |   | OFF         | When the Boolean operation specified by <b>L143</b> has a logical "0" result   |
| 34                            | LOG2            | Logic Output Function 2                   | ON          | When the Boolean operation specified by <b>L146</b> has a logical "1" result   |
|                               |                 |   | OFF         | When the Boolean operation specified by <b>L146</b> has a logical "0" result   |
| 35                            | LOG3            | Logic Output Function 3                   | ON          | When the Boolean operation specified by <b>L149</b> has a logical "1" result   |
|                               |                 |   | OFF         | When the Boolean operation specified by <b>L149</b> has a logical "0" result   |
| 39                            | WAC             | Capacitor Life Warning Signal             | ON          | Lifetime of internal capacitor has expired.  |
|                               |                 |   | OFF         | Lifetime of internal capacitor has not expired.  |
| 40                            | WAF             | Cooling Fan Warning Signal                | ON          | Lifetime of cooling fan has expired.   |

| Output Function Summary Table |                 |   |             |   |
|-------------------------------|-----------------|---|-------------|---|
| Option Code                   | Terminal Symbol | Function Name   | Description |   |
|                               |                 |   | OFF         | Lifetime of cooling fan has not expired.  |
| 41                            | FR              | Starting Contact Signal   | ON          | Either FW or RV command is given to the inverter                                |
|                               |                 |   | OFF         | No FW or RV command is given to the inverter, or both are given to the inverter |
| 42                            | OHF             | Heat Sink Overheat Warning  | ON          | Temperature of the heat sink exceeds a specified value (C064)                   |
|                               |                 |   | OFF         | Temperature of the heat sink does not exceed a specified value (C064)           |
| 43                            | LOC             | Low load detection  | ON          | Motor current is less than the specified value (C039)                           |
|                               |                 |   | OFF         | Motor current is not less than the specified value (C039)                       |
| 44                            | MO1             | General Output 1  | ON          | General output 1 is ON  |
|                               |                 |   | OFF         | General output 1 is OFF   |
| 45                            | MO2             | General Output 2  | ON          | General output 2 is ON  |
|                               |                 |   | OFF         | General output 2 is OFF   |
| 46                            | MO3             | General Output 3  | ON          | General output 3 is ON  |
|                               |                 |   | OFF         | General output 3 is OFF   |
| 50                            | IRDY            | Inverter Ready Signal   | ON          | Inverter can receive a run command  |
|                               |                 |   | OFF         | Inverter cannot receive a run command   |
| 51                            | FWR             | Forward Rotation  | ON          | Inverter is driving the motor in forward direction                              |
|                               |                 |   | OFF         | Inverter is not driving the motor in forward direction                          |
| 52                            | RVR             | Reverse Rotation  | ON          | Inverter is driving the motor in reverse direction                              |
|                               |                 |   | OFF         | Inverter is not driving the motor in reverse direction                          |
| 53                            | MJA             | Major Failure Signal  | ON          | Inverter is tripping with major failure   |
|                               |                 |   | OFF         | Inverter is normal, or is not tripping with major failure                       |
| 54                            | WCO             | Window Comparator for Analog Voltage Input                          | ON          | Analog voltage input value is inside of the window comparator                   |
|                               |                 |   | OFF         | Analog voltage input value is outside of the window comparator                  |
| 55                            | WCOI            | Window Comparator for Analog Current Input                          | ON          | Analog current input value is inside of the window comparator                   |
|                               |                 |   | OFF         | Analog current input value is outside of the window comparator                  |
| 58                            | FREF            | Frequency Command Source  | ON          | Frequency command is given from the operator                                    |
|                               |                 |   | OFF         | Frequency command is not given from the operator                                |
| 59                            | REF             | Run Command Source  | ON          | Run command is given from the operator  |
|                               |                 |   | OFF         | Run command is not given from the operator                                      |
| 60                            | SETM            | 2 <sup>nd</sup> Motor Selection                                     | ON          | 2 <sup>nd</sup> motor is being selected   |
|                               |                 |   | OFF         | 2 <sup>nd</sup> motor is not being selected                                     |
| 62                            | EDM             | STO (Safe Torque Off) Performance Monitor (Output terminal 11 only) | ON          | STO is being performed  |
|                               |                 |   | OFF         | STO is not being performed  |
| 63                            | OPO             | Option card output  | ON          | (output terminal for option card)   |
|                               |                 |   | OFF         | (output terminal for option card)   |
| 255                           | no              | Not used  | ON          | -   |
|                               |                 |   | OFF         | -   |

## Motor Constants Functions

| Func. Code | "H" Function   |  | Run Mode Edit | Defaults   |                  |
|------------|--|--|---------------|--|------------------|
|            | Name   | Description  |               | Initial data                                     | Units            |
| H001       | Auto-tuning selection                                      | Three option codes:<br>00...Disabled<br>01...Enabled with motor stop<br>02...Enabled with motor rotation | ✗             | 00   | -                |
| H002       | Motor constant selection                                   | Four option codes:<br>00...Hitachi standard motor<br>02...Auto tuned data                                | ✗             | 00   | -                |
| H202       | Motor constant selection, 2 <sup>nd</sup> motor            |  | ✗             | 00   | -                |
| H003       | Motor capacity   | Eleven selections:<br>0.1/0.2/0.4/0.75/1.5/2.2/3.7/<br>5.5/7.5/11/15/18.5                                | ✗             | Specified by the capacity of each inverter model | kW               |
| H203       | Motor capacity, 2 <sup>nd</sup> motor                      |  | ✗             |  | kW               |
| H004       | Motor poles setting  | Four selections:<br>2 / 4 / 6 / 8 / 10   | ✗             | 4  | poles            |
| H204       | Motor poles setting, 2 <sup>nd</sup> motor                 |  | ✗             | 4  | poles            |
| H005       | Motor speed response constant                              | Set range is 1 to 1000   | ✓             | 100.   | -                |
| H205       | Motor speed response constant, 2 <sup>nd</sup> motor       |  | ✓             | 100.   | -                |
| H006       | Motor stabilization constant                               | Motor constant (factory set), range is 0 to 255  | ✓             | 100.   | -                |
| H206       | Motor stabilization constant, 2 <sup>nd</sup> motor        |  | ✓             | 100.   | -                |
| H020       | Motor constant R1 (Hitachi motor)                          | 0.001~65.535 ohms  | ✗             | Specified by the capacity of each inverter mode  | Ohm              |
| H220       | Motor constant R1, 2 <sup>nd</sup> motor (Hitachi motor)   |  | ✗             |  | Ohm              |
| H021       | Motor constant R2 (Hitachi motor)                          | 0.001~65.535 ohms  | ✗             |  | Ohm              |
| H221       | Motor constant R2, 2 <sup>nd</sup> motor (Hitachi motor)   |  | ✗             |  | Ohm              |
| H022       | Motor constant L (Hitachi motor)                           | 0.01~655.35mH  | ✗             |  | mH               |
| H222       | Motor constant L, 2 <sup>nd</sup> motor (Hitachi motor)    |  | ✗             |  | mH               |
| H023       | Motor constant I0 (Hitachi motor)                          | 0.01~655.35A   | ✗             |  | A                |
| H223       | Motor constant I0, 2 <sup>nd</sup> motor (Hitachi motor)   |  | ✗             |  | A                |
| H024       | Motor constant J (Hitachi motor)                           | 0.001~9999 kgm <sup>2</sup>  | ✗             |  | kgm <sup>2</sup> |
| H224       | Motor constant J, 2 <sup>nd</sup> motor (Hitachi motor)    |  | ✗             |  | kgm <sup>2</sup> |
| H030       | Motor constant R1 (Auto tuned data)                        | 0.001~65.535 ohms  | ✗             | Specified by the capacity of each inverter mode  | ohm              |
| H230       | Motor constant R1, 2 <sup>nd</sup> motor (Auto tuned data) |  | ✗             |  | ohm              |
| H031       | Motor constant R2 (Auto tuned data)                        | 0.001~65.535 ohms  | ✗             |  | ohm              |



| "H" Function |  |                             |               | Defaults     |                  |
|--------------|--|-----------------------------|---------------|--------------|------------------|
| Func. Code   | Name   | Description                 | Run Mode Edit | Initial data | Units            |
| H231         | Motor constant R2, 2 <sup>nd</sup> motor (Auto tuned data) |                             | ✗             |              | ohm              |
| H032         | Motor constant L (Auto tuned data)                         | 0.01~655.35mH               | ✗             |              | mH               |
| H232         | Motor constant L, 2 <sup>nd</sup> motor (Auto tuned data)  |                             | ✗             |              | mH               |
| H033         | Motor constant I0 (Auto tuned data)                        | 0.01~655.35A                | ✗             |              | A                |
| H233         | Motor constant I0, 2 <sup>nd</sup> motor (Auto tuned data) |                             | ✗             |              | A                |
| H034         | Motor constant J (Auto tuned data)                         | 0.001~9999 kgm <sup>2</sup> | ✗             |              | kgm <sup>2</sup> |
| H234         | Motor constant J, 2 <sup>nd</sup> motor (Auto tuned data)  |                             | ✗             |              | kgm <sup>2</sup> |
| H050         | Slip compensation P gain for V/f control with FB           | 0.00-10.00                  | ✗             | 0.2          | Times            |
| H051         | Slip compensation I gain for V/f control with FB           | 0.-1000.                    | ✗             | 2.           | (s)              |

### PM Motor Constants Functions

| "H" Function |   |  |               | Defaults     |                  |
|--------------|---|--|---------------|--------------|------------------|
| Func. Code   | Name                                    | Description  | Run Mode Edit | Initial data | Units            |
| H102         | PM motor code setting                   | 00...Hitachi standard<br>(Use H106-H110 at motor constants)<br>01...Auto-Tuning<br>(Use H109-H110, H111-H113 at motor constants) | ✗             | 00           | -                |
| H103         | PM motor capacity                       | 0.1/0.2/0.4/0.55/0.75/1.1/1.5/2.2/3.0/3.7/4.0/5.5/7.5/11.0/15.0/18.5   | ✗             | kW dependent | kW               |
| H104         | PM motor pole setting                   | 2/4/6/8/10/12/14/16/18/20/22/24/26/28/30/32/34/36/38/40/42/44/46/48  | ✗             | kW dependent | Poles            |
| H105         | PM Rated Current                        | (0.00-1.00) × Rated current of the inverter [A]  | ✗             | kW dependent | A                |
| H106         | PM const R(Resistance)                  | 0.001-65.535 [Ω]   | ✗             | kW dependent | Ohm              |
| H107         | PM const Ld(d-axis inductance)          | 0.01-655.35 [mH]   | ✗             | kW dependent | mH               |
| H108         | PM const Lq(q-axis inductance)          | 0.01-655.35 [mH]   | ✗             | kW dependent | mH               |
| H109         | PM const Ke(Induction voltage constant) | 0.0001-6.5535 [V/(rad/s)]  | ✗             | kW dependent | V/(rad/s)        |
| H110         | PM const J(Moment of inertia)           | 0.001-9999.000 [kgm <sup>2</sup> ]   | ✗             | kW dependent | kgm <sup>2</sup> |
| H111         | PM const R (Resistance, Auto)           | 0.001-65.535 [Ω]   | ✗             | kW dependent | Ohm              |

| "H" Function  |   |  |              | Run<br>Mode<br>Edit | Defaults |  |
|---------------|---|--|--------------|---------------------|----------|--|
| Func.<br>Code | Name  | Description  | Initial data |                     | Units    |  |
| H 112         | PM const Ld(d-axis inductance, Auto)                    | 0.01-655.35 [mH]   | ✗            | kW dependent        | mH       |  |
| H 113         | PM const Lq(q-axis inductance, Auto)                    | 0.01-655.35 [mH]   | ✗            | kW dependent        | mH       |  |
| H 116         | PM Speed Response                                       | 1-1000 [%]   | ✗            | 100                 | %        |  |
| H 117         | PM Starting Current                                     | 20.00-100.00 [%]   | ✗            | 70.00[%]            | %        |  |
| H 118         | PM Starting Time  | 0.01-60.00 [s]   | ✗            | 1.00[s]             | s        |  |
| H 119         | PM Stabilization Constant                               | 0-120 [%]  | ✗            | 100[%]              | %        |  |
| H 121         | PM Minimum Frequency                                    | 0.0-25.5 [%]   | ✓            | 8.0 [%]             | %        |  |
| H 122         | PM No-Load Current                                      | 0.00-100.00 [%]  | ✓            | 10.00 [%]           | %        |  |
| H 123         | PM Starting Method Select                               | 00... Normal<br>01... Initial Magnet Position Estimation | ✗            | 0                   | -        |  |
| H 131         | PM Initial Magnet Position Estimation 0V Wait Times     | 0-255  | ✗            | 10                  | -        |  |
| H 132         | PM Initial Magnet Position Estimation Detect Wait Times | 0-255  | ✗            | 10                  | -        |  |
| H 133         | PM Initial Magnet Position Estimation Detect Times      | 0-255  | ✗            | 30                  | -        |  |
| H 134         | PM Initial Magnet Position Estimation Voltage Gain      | 0-200  | ✗            | 100                 | -        |  |

## Expansion Card Functions

“P” parameters will be appeared when the expansion option is connected.

| Func. Code | “P” Function                                     |  | Run Mode Edit | Defaults     |       |
|------------|--|--|---------------|--------------|-------|
|            | Name   | Description  |               | Initial data | Jnits |
| P001       | Reaction when option card error occurs           | Two option codes:<br>00... Inverter trips<br>01... Ignores the error (Inverter continues operation)  | ✗             | 00           | -     |
| P003       | [EA] terminal selection                          | Three option codes:<br>00... Speed reference (incl. PID)<br>01... For control with encoder feedback<br>02... Extended terminal for EzSQ  | ✗             | 00           | -     |
| P004       | Pulse train input mode selection for feedback    | Four option codes:<br>00... Single-phase pulse [EA]<br>01... 2-phase pulse (90° difference) 1 ([EA] and [EB])<br>02... 2-phase pulse (90° difference) 2 ([EA] and [EB])<br>03... Single-phase pulse [EA] and direction signal [EB] | ✗             | 00           | -     |
| P011       | Encoder pulse setting                            | Sets the pulse number (ppr) of the encoder, set range is 32~1024 pulses  | ✗             | 512.         | -     |
| P012       | Simple positioning selection                     | Two option codes:<br>00... simple positioning deactivated<br>01... simple positioning activated  | ✗             | 00           | -     |
| P015       | Creep Speed                                      | Set range is start frequency (b002) ~10.00 Hz  | ✗             | 5.00         | Hz    |
| P026       | Over-speed error detection level                 | Set range is 0~150%  | ✗             | 115.0        | %     |
| P027       | Speed deviation error detection level            | Set range is 0~120 Hz  | ✗             | 10.00        | Hz    |
| P031       |  |  |               |              |       |
| P033       | Torque command input selection                   | Six option codes:<br>00... Analog voltage input [O]<br>01... Analog current input [OI]<br>03... Operator, 05... Option   | ✗             | 00           | -     |
| P034       | Torque command level input                       | Set range is 0~200%  | ✓             | 0.           | %     |
| P036       | Torque bias mode selection                       | Five option codes:<br>00... No bias      01... Operator  | ✗             | 00           | -     |
| P037       | Torque bias value setting                        | Range is -200~200%   | ✓             | 0.           | %     |
| P038       | Torque bias polar selection                      | Two option codes:<br>00... According to the sign<br>01... According to the rotation direction<br>05... Option  | ✗             | 00           | -     |
| P039       | Speed limit of Torque control (Forward rotation) | Set range is 0.00~120.00Hz   | ✓             | 0.00         | Hz    |
| P040       | Speed limit of Torque control (Forward rotation) | Set range is 0.00~120.00Hz   | ✓             | 0.00         | Hz    |

| Func. Code | “P” Function   |  | Run Mode Edit | Defaults     |         |
|------------|--|--|---------------|--------------|---------|
|            | Name   | Description  |               | Initial data | Units   |
| P041       | Speed / Torque control switching time                    | Set range is 0 to 1000 ms  | ✗             | 0.           | ms      |
| P044       | Communication watchdog timer (for option)                | Set range is 0.00 to 99.99s  | ✗             | 1.00         | s       |
| P045       | Inverter action on communication error (for option)      | 00 (tripping),<br>01 (tripping after decelerating and stopping the motor),<br>02 (ignoring errors),<br>03 (stopping the motor after free-running),<br>04 (decelerating and stopping the motor) | ✗             | 00           | -       |
| P046       | DeviceNet polled I/O: Output instance number             | 0-20   | ✗             | 1            | -       |
| P048       | Inverter action on communication idle mode               | 00 (tripping),<br>01 (tripping after decelerating and stopping the motor),<br>02 (ignoring errors),<br>03 (stopping the motor after free-running),<br>04 (decelerating and stopping the motor) | ✗             | 00           | -       |
| P049       | Motor poles setting for RPM                              | 0/2/4/6/8/10/12/14/16/18/20/22/24/26/28/<br>30/32/34/36/38/40/42/44/46/48  | ✗             | 0            | Poles   |
| P055       | Pulse train input frequency scale setting                | Sets the pulse numbers at max. frequency, set range is 1.0~32.0 kHz  | ✗             | 25.0         | kHz     |
| P056       | Pulse train input frequency filter time constant setting | Set range is 0.01~2.00 sec.  | ✗             | 0.10         | sec     |
| P057       | Pulse train input bias setting                           | Set range is -100~100 %  | ✗             | 0.           | %       |
| P058       | Limitation of the pulse train input setting              | Set range is 0~100 %   | ✗             | 100.         | %       |
| P060       | Multistage position 0                                    | P073 to P072<br>(Displayed higher 4-digits only)   | ✓             | 0            | Pulse s |
| P061       | Multistage position 1                                    |  | ✓             | 0            | Pulse s |
| P062       | Multistage position 2                                    |  | ✓             | 0            | Pulse s |
| P063       | Multistage position 3                                    |  | ✓             | 0            | Pulse s |
| P064       | Multistage position 4                                    |  | ✓             | 0            | Pulse s |
| P065       | Multistage position 5                                    |  | ✓             | 0            | Pulse s |
| P066       | Multistage position 6                                    |  | ✓             | 0            | Pulse s |
| P067       | Multistage position 7                                    |  | ✓             | 0            | Pulse s |
| P068       | Homing mode selection                                    | 00...Low speed mode<br>01...High speed mode  | ✓             | 00           | -       |
| P069       | Homing direction   | 00...Forward rotation side<br>01...Reverse rotation side   | ✓             | 01           | -       |
| P070       | Low speed homing freq.                                   | 0 to 10Hz  | ✓             | 5.00         | Hz      |
| P071       | High speed homing freq.                                  | 0 to 400Hz   | ✓             | 5.00         | Hz      |

| "P" Function |                                   |  | Run Mode Edit | Defaults     |        |
|--------------|-----------------------------------|--|---------------|--------------|--------|
| Func. Code   | Name                              | Description  |               | Initial data | Units  |
| P072         | Position range (Forward)          | 0 to +268435455(Higher 4-digits displayed)   | ✓             | +268435455   | Pulses |
| P073         | Position range (Reverse)          | -268435455 to 0(Higher 4-digits displayed)   | ✓             | -268435455   | Pulses |
| P075         | Positioning mode selection        | 00...With limitation<br>01...No limitation (shorter route)<br>P004 is to be set 00 or 01 | ✗             | 00           | -      |
| P077         | Encoder disconnection timeout     | 0.0 to 10.0 s  | ✓             | 1.0          | s      |
| P100 ~ P131  | EzSQ user parameter U(00) ~ U(31) | Each set range is 0~65535  | ✓             | 0.           | -      |
| P140         | EzCOM number of data              | 1 to 5   | ✓             | 5            | -      |
| P141         | EzCOM destination 1 address       | 1 to 247   | ✓             | 1            | -      |
| P142         | EzCOM destination 1 register      | 0000 to FFFF   | ✓             | 0000         | -      |
| P143         | EzCOM source 1 register           | 0000 to FFFF   | ✓             | 0000         | -      |
| P144         | EzCOM destination 2 address       | 1 to 247   | ✓             | 2            | -      |
| P145         | EzCOM destination 2 register      | 0000 to FFFF   | ✓             | 0000         | -      |
| P146         | EzCOM source 2 register           | 0000 to FFFF   | ✓             | 0000         | -      |
| P147         | EzCOM destination 3 address       | 1 to 247   | ✓             | 3            | -      |
| P148         | EzCOM destination 3 register      | 0000 to FFFF   | ✓             | 0000         | -      |
| P149         | EzCOM source 3 register           | 0000 to FFFF   | ✓             | 0000         | -      |
| P150         | EzCOM destination 4 address       | 1 to 247   | ✓             | 4            | -      |
| P151         | EzCOM destination 4 register      | 0000 to FFFF   | ✓             | 0000         | -      |
| P152         | EzCOM source 4 register           | 0000 to FFFF   | ✓             | 0000         | -      |
| P153         | EzCOM destination 5 address       | 1 to 247   | ✓             | 5            | -      |
| P154         | EzCOM destination 5 register      | 0000 to FFFF   | ✓             | 0000         | -      |
| P155         | EzCOM source 5 register           | 0000 to FFFF   | ✓             | 0000         | -      |

# CE-EMC Installation Guidelines

You are required to satisfy the EMC directive (2004/108/EC) when using an WJ200 inverter in an EU country.

To satisfy the EMC directive and to comply with standard, you need to use a dedicated EMC filter suitable for each model, and follow the guidelines in this section. Following table shows the compliance condition for reference.

Table 1. Condition for the compliance

| Model            | Cat. | Carrier f | Motor cable    |
|------------------|------|-----------|----------------|
| All WJ200 series | C1   | 2kHz      | 20m (Shielded) |

Table 2. Applicable EMC filter

| Input class      | Inverter model | Filter model (Schaffner) |
|------------------|----------------|--------------------------|
| 1-ph. 200V class | WJ200-001SFE   | FS24828-8-07             |
|                  | WJ200-002SFE   |                          |
|                  | WJ200-004SFE   |                          |
|                  | WJ200-007SFE   | FS24828-27-07            |
|                  | WJ200-015SFE   |                          |
|                  | WJ200-022SFE   |                          |
| 3-ph. 200V class | WJ200-001LFU   | FS24829-8-07             |
|                  | WJ200-002LFU   |                          |
|                  | WJ200-004LFU   |                          |
|                  | WJ200-007LFU   |                          |
|                  | WJ200-015LFU   | FS24829-16-07            |
|                  | WJ200-022LFU   |                          |
|                  | WJ200-037LFU   | FS24829-25-07            |
|                  | WJ200-055LFU   | FS24829-50-07            |
|                  | WJ200-075LFU   |                          |
|                  | WJ200-110LFU   | FS24829-70-07            |
|                  | WJ200-150LFU   | FS24829-75-07            |
| 3-ph. 400V class | WJ200-004HFE   | FS24830-6-07             |
|                  | WJ200-007HFE   |                          |
|                  | WJ200-015HFE   | FS24830-12-07            |
|                  | WJ200-022HFE   |                          |
|                  | WJ200-030HFE   |                          |
|                  | WJ200-040HFE   | FS24830-15-07            |
|                  | WJ200-055HFE   | FS24830-29-07            |
|                  | WJ200-075HFE   |                          |
|                  | WJ200-110HFE   | FS24830-48-07            |
| WJ200-150HFE     |                |                          |

WJ200-110L and 150H needs to be installed in a metal cabinet and add ferrite core at the input cable to meet category C1. Unless otherwise category C2.

## Important notes

1. Input choke or other equipment is required if necessary to comply with EMC directive from the harmonic distortion point of view (IEC 61000-3-2 and 4).
2. If the motor cable length exceeds 20m, use output choke to avoid unexpected problem due to the leakage current from the motor cable (such as malfunction of the thermal relay, vibration of the motor, etc..).
3. As user you must ensure that the HF (high frequency) impedance between adjustable frequency inverter, filter, and ground is as small as possible.
  - Ensure that the connections are metallic and have the largest possible contact

- areas (zinc-plated mounting plates).
4. Avoid conductor loops that act like antennas, especially loops that encompass large areas.
    - Avoid unnecessary conductor loops.
    - Avoid parallel arrangement of low-level signal wiring and power-carrying or noise-prone conductors.
  5. Use shielded wiring for the motor cable and all analog and digital control lines.
    - Allow the effective shield area of these lines to remain as large as possible; i.e., do not strip away the shield (screen) further away from the cable end than absolutely necessary.
    - With integrated systems (for example, when the adjustable frequency inverter is communicating with some type of supervisory controller or host computer in the same control cabinet and they are connected at the same ground + PE-potential), connect the shields of the control lines to ground + PE (protective earth) at both ends. With distributed systems (for example the communicating supervisory controller or host computer is not in the same control cabinet and there is a distance between the systems), we recommend connecting the shield of the control lines only at the end connecting to the adjustable frequency inverter. If possible, route the other end of the control lines directly to the cable entry section of the supervisory controller or host computer. The shield conductor of the motor cables always must be connected to ground + PE at both ends.
    - To achieve a large area contact between shield and ground + PE-potential, use a PG screw with a metallic shell, or use a metallic mounting clip.
    - Use only cable with braided, tinned copper mesh shield (type "CY") with 85% coverage.
    - The shielding continuity should not be broken at any point in the cable. If the use of reactors, contactors, terminals, or safety switches in the motor output is necessary, the unshielded section should be kept as short as possible.
    - Some motors have a rubber gasket between terminal box and motor housing. Very often, the terminal boxes, and particularly the threads for the metal PG screw connections, are painted. Make sure there is always a good metallic connection between the shielding of the motor cable, the metal PG screw connection, the terminal box, and the motor housing. If necessary, carefully remove paint between conducting surfaces.
  6. Take measures to minimize interference that is frequently coupled in through installation cables.
    - Separate interfering cables with 0.25m minimum from cables susceptible to interference. A particularly critical point is laying parallel cables over longer distances. If two cables intersect (one crosses over the other), the interference is smallest if they intersect at an angle of 90°. Cables susceptible to interference should therefore only intersect motor cables, intermediate circuit cables, or the wiring of a rheostat at right angles and never be laid parallel to them over longer distances.
  7. Minimize the distance between an interference source and an interference sink (interference- threatened device), thereby decreasing the effect of the emitted interference on the interference sink.
    - You should use only interference-free devices and maintain a minimum distance of 0.25 m from the adjustable frequency inverter.
  8. Follow safety measures in the filter installation.
    - If using external EMC filter, ensure that the ground terminal (PE) of the filter is properly connected to the ground terminal of the adjustable frequency inverter. An HF ground connection via metal contact between the housings of the filter and the adjustable frequency inverter, or solely via cable shield, is not permitted as a protective conductor connection. The filter must be solidly and permanently
-

connected with the ground potential so as to preclude the danger of electric shock upon touching the filter if a fault occurs.

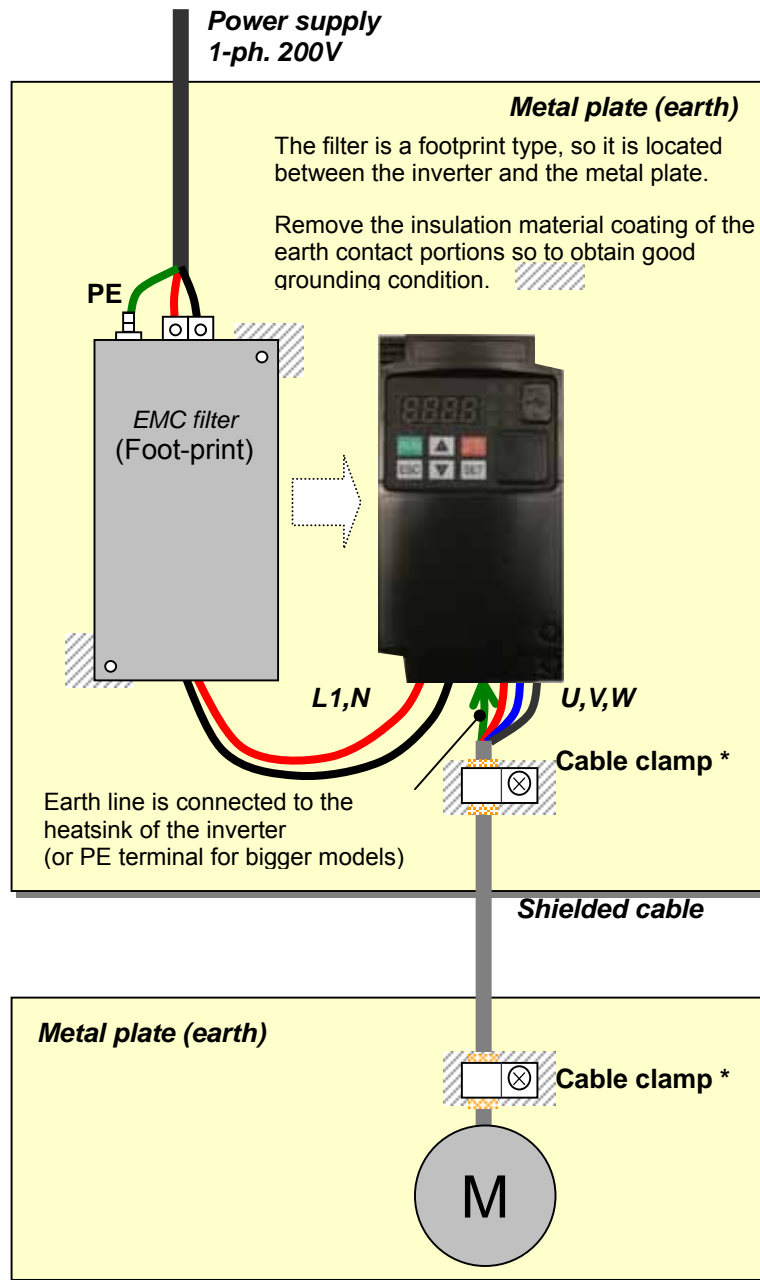
To achieve a protective ground connection for the filter:

- Ground the filter with a conductor of at least 10 mm<sup>2</sup> cross-sectional area.
- Connect a second grounding conductor, using a separate grounding terminal parallel to the protective conductor. (The cross section of each single protective conductor terminal must be sized for the required nominal load.)



## Installation for WJ200 series (example of SFE models)

Model LFx (3-ph. 200V class) and HFx (3-ph. 400V class) are the same concept for the installation.



\*) Both earth portions of the shielded cable must be connected to the earth point by cable clamps.

Input choke or equipment to reduce harmonic current is necessary for CE marking (IEC 61000-3-2 and IEC61000-3-3) from the harmonic current point of view, even conducted emission and radiated emission passed without the input choke.

## Hitachi EMC Recommendations



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**WARNING:** This equipment should be installed, adjusted, and serviced by qualified personal familiar with construction and operation of the equipment and the hazards involved. Failure to observe this precaution could result in bodily injury.

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Use the following checklist to ensure the inverter is within proper operating ranges and conditions.

1. The power supply to WJ200 inverters must meet these specifications:
  - Voltage fluctuation  $\pm 10\%$  or less
  - Voltage imbalance  $\pm 3\%$  or less
  - Frequency variation  $\pm 4\%$  or less
  - Voltage distortion THD = 10% or less
2. Installation measure:
  - Use a filter designed for WJ200 inverter. Refer to the instruction of the applicable external EMC filter.
3. Wiring:
  - Shielded wire (screened cable) is required for motor wiring, and the length must be 20 meter or less.
  - If the motor cable length exceeds the value shown above, use output choke to avoid unexpected problem due to the leakage current from the motor cable.
  - The carrier frequency setting must be 2 kHz to satisfy EMC requirements.
  - Separate the power input and motor wiring from the signal/process circuit wiring.
4. Environmental conditions—when using a filter, follow these guidelines:
  - Ambient temperature:  $-10$  to  $50$  °C (Derating is required when the ambient temperature exceeds  $40$  °C)
  - Humidity: 20 to 90% RH (non-condensing)
  - Vibration:  $5.9$  m/sec<sup>2</sup> (0.6 G) 10 ~ 55Hz
  - Location: 1000 meters or less altitude, indoors (no corrosive gas or dust)

# Functional Safety (Certification in Progress)

## Introduction

The Gate Suppress function can be utilized to perform a safe stop according to the EN60204-1, stop category 0 (Uncontrolled stop by power removal). It is designed to meet the requirements of the ISO13849-1, PL=d only in a system in which EDM signal is monitored by an “external device monitor”.

## Stop Category defined in EN60204-1

Category 0 : Uncontrolled stop by immediate (< 200 ms) shut-down of the power supply to the actuators

Category 1 : Controlled stop by interrupting the power supply to the actuator level if, for example, the hazardous movement has been brought to a standstill (time-delayed shut-down of the power supply).

Category 2 : Controlled stop. The power supply to the drive element is not interrupted. Additional measures to EN 1037 (protection from unexpected restart) are necessary.

## How it works

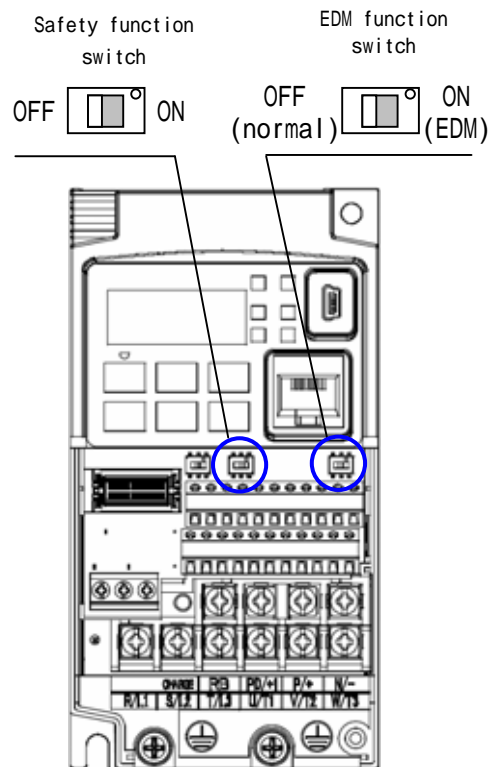
Interrupting the current to GS1 or GS2, for example removing the link between either GS1 or GS2 and PLC or both GS1/GS2 and PLC disables the drive output, i.e. the power supply to the motor is cut by stopping the switching of the output transistors in a safe way. EDM output is activated when GS1 and GS2 are given to the drive.

Always use both inputs to disable the drive. If for any reason only one channel is opened, the drive output is stopped but the EDM output is not activated. In this case the Safe Disable input wiring must be checked.

## Activation

Turning on the safety switch automatically assign the GS1 input and GS2 input automatically.

To assign EDM (external device monitor) output, please turn the EDM function switch on. EDM output is automatically assigned on intelligent output terminal 11.



(When safety switch or EDM switch is turned off, the intelligent input and output terminal assigned on will be set as "no" function, and contact will remain normally off.)

Always use both inputs to disable the drive. If for any reason only one channel is opened, the drive output is stopped but the EDM output is not activated. In this case the Safe Disable input wiring must be checked.

## Installation

According to the safety standard listed above, please install referring to the example. Please be sure to use the both GS1 and GS2, and construct the system that GS1 and GS2 are both turned off when safety input is given to the inverter.

When the Gate Suppress function is utilized, connect the drive to a safety certified interrupting device utilizing EDM output signal to reconfirm both safety inputs GS1 and GS2.

| item                           | Function code | data | description   |
|--------------------------------|---------------|------|---|
| Input [3] and [4] function     | C003          | 77   | GS1: Safety input 1 (note 1)                                    |
|                                | C004          | 78   | GS2 : Safety input 2 (note 1)                                   |
| Input [3] and [4] active state | C013          | 01   | NC: Normally Closed (note 1)                                    |
|                                | C014          | 01   | NC: Normally Closed (note 1)                                    |
| Output [11] function           | C021          | 62   | EDM : External Device Monitor(note2)                            |
| Output [11] active state       | C031          | 00   | NO: Normally Open (note 2)                                      |
| GS input mode                  | b145          | 00   | Output is shut off by hardware. No trip.                        |
|                                |               | 01   | Output is shut off by hardware, and then, trip. (note3) (note4) |

Note 1) They are automatically set when safety switch is turned ON, cannot be changed.

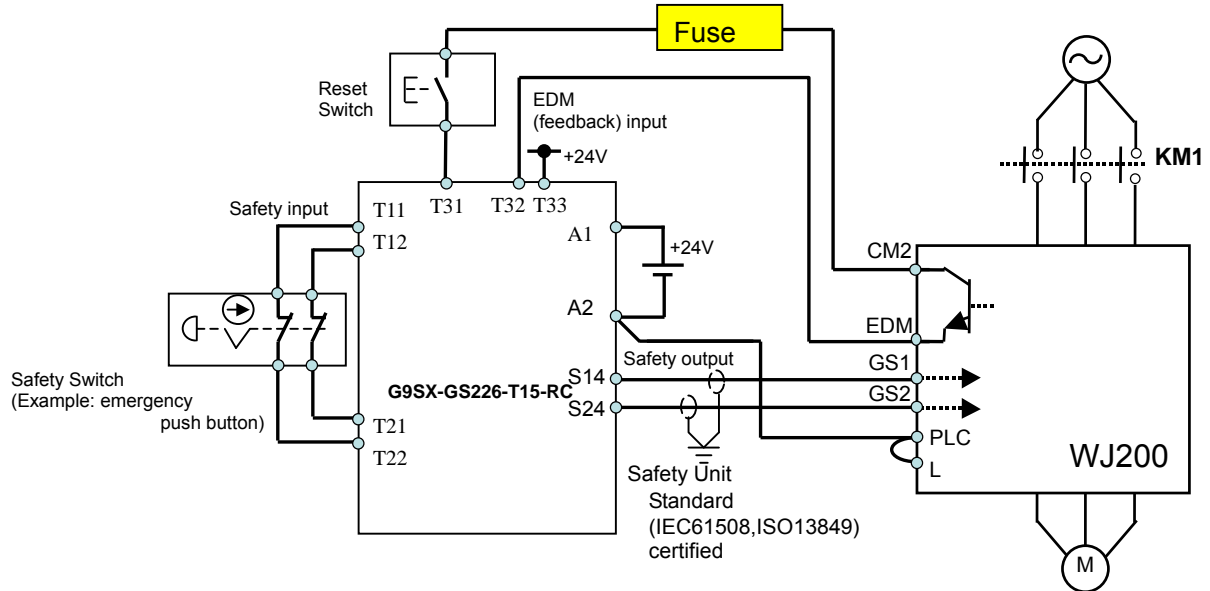
Note 2) Those are automatically assigned when EDM switch is turned ON, cannot be changed.

Note 3) Inverter trips with "E37". When competing with external trip (E12), E37 has priority.

Note 4) While the drive is the trip status "E037" and either GS1 or GS2 is activated, on the safety by is not guaranteed.

## Wiring example

When the Gate Suppress function is utilized, connect the drive to a safety certified interrupting device utilizing EDM output signal to reconfirm both safety inputs GS1 and GS2.



By pressing the emergency stop button, the current to GS1 and GS2 is shut off, and the inverter output is shut off. By this, motor is free-running. This behavior is according to the stop category 0 defined in EN60204.

Note 1: Above is the example to use the intelligent input terminal with source logic. When it is used with sink logic, the wiring is to be modified.

Note 2: The wire for safety relay and emergency input signal are to be shielded coaxial cable for example RS174/U (produced by LAPP) by MIL-C17, or KX2B by NF C 93-550 with diameter 2.9mm with less than 2 meters. Please be sure to ground the shielding.

Note 3: All the inductance related parts such as relay and contactor are required to contain the over-voltage protection circuit.



The arch extinguishing fuse with rated voltage AC250V, rated current 100mA complies to either IEC6127 -2/-3/-4

Example)

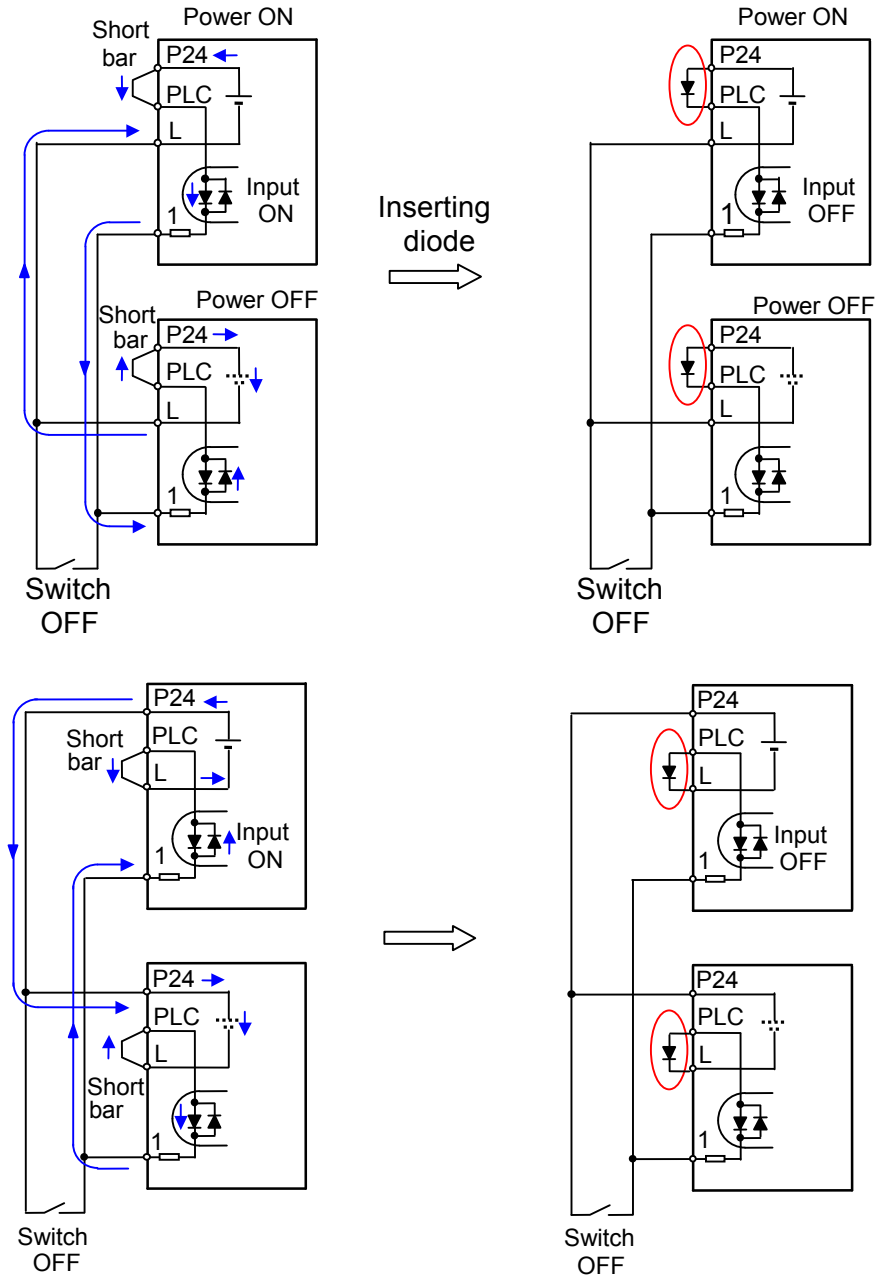
SOC EQ series AC250V, 100mA (UL, SEMKO, BSI)

Little 216 series AC250V, 100mA (CCC, UL, CSA, SEMKO, CE, VDE)



As described on page 4-14 of this manual, inverter doesn't block the current flowing into itself when it is not powered. This may cause the closed circuit when two or more inverters are connected to common I/O wiring as shown below to result in unexpected turning the on the input. This may lead to dangerous situation. To avoid this closed circuit, please put the diode (rated:50V/0.1A) in the path as described below.

In case of Source logic



## Components to be combined

Followings are the example of the safety devices to be combined.

| Series | Model        | Norms to comply       | Certification date |
|--------|--------------|-----------------------|--------------------|
| GS9A   | 301          | ISO13849-2 cat4, SIL3 | 06.06.2007         |
| G9SX   | GS226-T15-RC | IEC61508 SIL1-3       | 04.11.2004         |
| NE1A   | SCPU01-V1    | IEC61508 SIL3         | 27.09.2006         |

The configuration of and components used in any circuit other than an appropriately pre approved safety module that interfaces with the WJ200 GS1/GS2 and EDM ports MUST be at least equivalent to CAT 3 PLd under ISO 13849-1:2006 in order to be able to claim an overall CAT 3 PLd for the WJ200 and external circuit combination.

The EMI level that the external module has been assessed to must be at least equivalent to that of Appendix E IEC 62061.

## Periodical check (proof test)

Proof test is essential to be able to reveal any dangerous undetected failures after a period of time, in this case 1 year. Carrying out this proof test at least one a year is the condition to comply the ISO13849-1 PLd.

- To activate (give current to) GS1 and GS2 simultaneously and separately to see output is allowed and EDM is conducting

| Terminal | Status      |               |               |               |
|----------|-------------|---------------|---------------|---------------|
|          | current OFF | current ON    | current OFF   | current ON    |
| GS1      | current OFF | current ON    | current OFF   | current ON    |
| GS2      | current OFF | current OFF   | current ON    | current ON    |
| EDM      | conducted   | not conducted | Not conducted | not conducted |
| (output) | forbidden   | forbidden     | forbidden     | Allowed       |

- To activate (give current to) both GS1 and GS2 to see output is allowed and EDM is not conducting

- To activate (give current to) GS1, not to activate GS2 and see output is forbidden and EDM is not conducting

- To activate (give current to) GS2, not to activate GS1 and see output is forbidden and EDM is not conducting

- To deactivate (interrupt current to) both GS1 and GS2 to see output is forbidden and EDM is conducting

## Precautions

1. To assure, that the Safe Disable function appropriately fulfills the safety requirements of the application, a throughout risk assessment for the whole safety system has to be carried out.



2. The Safe Disable function does not cut the power supply to the drive and does not provide electrical isolation. Before any installation or maintenance work is done, the drives power supply must be switched off and place a tag/lock-out.

3. The wiring distance for the Safe Disable inputs should be shorter than 30 m.
4. The time from opening the Safe Disable input until the drive output is switched off is less than 10 ms.